GEOCHANGE:
Problems of Global Changes of the Geological Environment

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EDITORIAL STAFF:

C O N T E N T S   *P.*

INTRODUCTION

The international scientific journal "GEOCHANGE: Problems of Global Changes of the Geological Environment" is an official scientific and informational publication of the International Committee on issues of Global Changes of the Geological Environment GEOCHANGE (IC GGEC).

The main purpose of the journal's *to present the most complete information about the global geological and environmental changes.*

We are planning to continue publishing in the next issues of the journal regular IC GGEC reports on the problems: desertification, melting of Arctic glaciers, depletion of the ozone layer, land degradation, global changes of the Earth's ecosystem, the impact of global cataclysms on the loss of biodiversity, etc.

The journal will be publishing scientific articles of IC GGEC members and other scientists and experts, on the following issues:

Global Changes of the Environment:

- Core, mantle and lithosphere of the Earth;
- Hydrosphere;
- Atmosphere;
- Near-earth space;
- Solar-terrestrial relations;
- Effect of cosmic processes on the Earth;
- Problems of global desertification;
- Land degradation;
- Melting of glaciers;
- Natural causes of ozone layer depletion;
- Anthropogenous influences on the global environmental changes;
- Global changes of the geological environment contributing to disturbance of the natural ecosystem.

The journal is published once in six months in English.

*Electronic versions of this international scientific journal are available on the journal's website with free access (**www.geochangemag.org**).*

ANNOUNCEMENT: In the third volume of the GEOCHANGE journal (V.3, 2013), it is planned to publish the second IC GGEC report "Global changes of the environment: threatening the progress of civilization".

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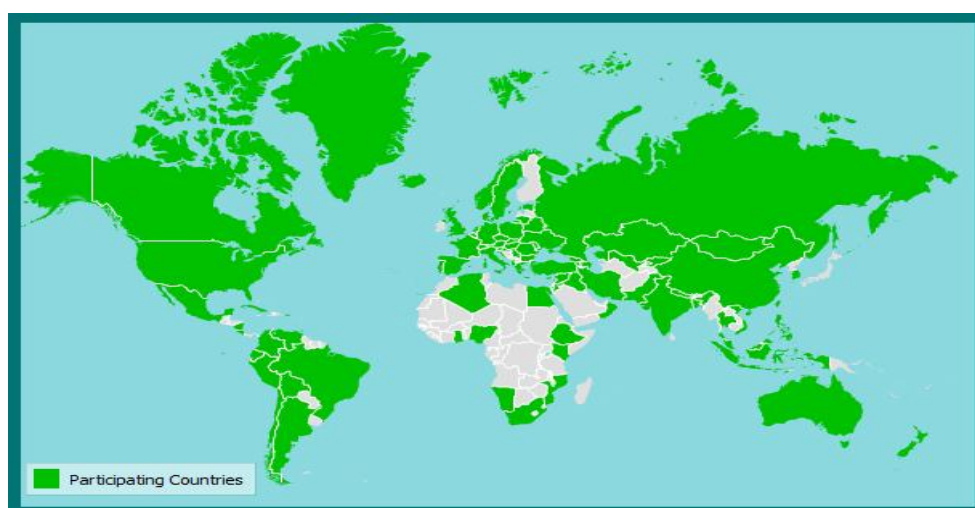
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OUR MOTTOS:

– SCIENCE IS FREE
– SCIENCE WITHOUT BORDERS
– SCIENCE WITHOUT POLITICS
– SCIENCE MUST SERVE PEOPLE

We, scientists from different countries, have teamed up to bring to the attention of leaders of the UN, EU and other international organizations, heads of states, social activists and the international community some objective information about global environmental changes, including global climate change.

We are beyond politics, beyond state borders, beyond religion.

Our mission *is to improve human security in an era of natural disasters.*

Our objectives *are as follows:*

- to identify the true causes, possible extent and implications of global environmental changes;
- to impartially assess the actual role and proportion of natural and anthropogenic factors in global climate change;
- to create equal conditions for scientists from different countries to express their opinion and present scientific results;
- to provide a platform for any alternative views of world scientists.

We invite scientists from all over the world to join our initiative.

Prof. Dr. Elchin Khalilov
Chairman of IC GGEC "GEOCHANGE"

Earth Sciences
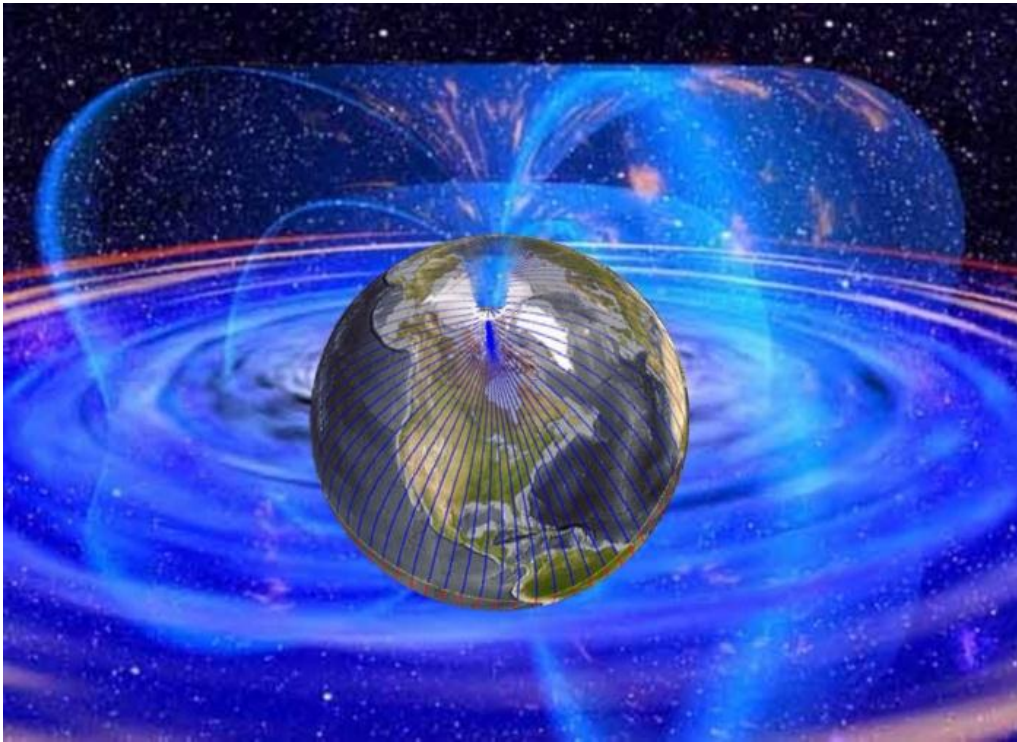
ASSESSMENT OF SO$_2$ EMISSIONS FROM THREE COLOMBIAN ACTIVE VOLCANOES (2007-2012)

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Abstract

Thermodynamic and kinetic properties of magmas are central goal in volcanology researches. Gases play an important role to explain and understand volcanic activity. Relatively recent use of a novel optical remote sensor are a key to have gas data in real time for the surveillance of real state of volcanic activity and to take administrative and political decisions for mitigation and preparation to an eventual volcanic eruption. Examples of temporary sulphur dioxide emissions from three active Colombian volcanoes are presented, together with all cases of activity showed by each volcano since 2007 till 2012. As andesite volcanoes, they show properties to seal volcanic chimney and facilitate pressurization within final stages of explosive eruptions.

Introduction

Faster and easier gases may transfer energy, compared to the other classical states of matter. Transport of gases from the Earth´s interior play an important role in geodynamic processes, including volcanic eruptions, plate tectonic motions and earthquakes.

All around the world, volcano surveillance includes systematic evaluation of various types of geophysical, physicochemical and geological data from processes taking place in the interior and surface of studied volcanic edifice. All data have to be interpreted and synthesized in a report as a guide to anticipate what may happen next, given this way useful information to local authorities for preparation and mitigation purposes.

Instruments and networks used for volcano surveillance are of different types, costs, effectiveness and sophistications: some instruments are of digital type transmitting data in near real time to observatory toolbox, some have to be installed as temporary networks, whereas some others have to be used as portable instruments in the volcanic edifice to make *in situ* measurements.

Volcano surveillance in Colombia was formally initiated just after reactivation of Nevado del Ruiz volcano was recognized in 1985. On November 13th, 1985 at 21:09 Nevado del Ruiz volcano erupted dacitic tephra more than 30 kilometers into the atmosphere (Naranjo et al., 1986). This eruption produced pyroclastic flows that melted summit glaciers and snow, generating four thick lahars that raced down river valleys on the volcano's flanks. Lahars, formed of water, ice, pumice, and other rocks, mixed with clay as they travelled down the volcano's flanks. One of the lahars virtually erased the small Armero town (Tolima department), which lay in Lagunilla river valley. Only one quarter of its 28,700 inhabitants survived.

A second lahar, which descended through the valley of Chinchina river, killed about 1,800 people and destroyed about 400 homes in Chinchina town (Caldas department). In total, over 23,000 people were killed and approximately 5,000 were injured. More than 5,000 homes were destroyed. Armero tragedy, as the event came to be known, was the second-deadliest volcanic disaster in the 20th century, being surpassed only by the 1902 eruption of Mount Pelée, and is the fourth-deadliest volcanic eruption in recorded history (Huggel et al., 2007).

As of 2012 the Colombian Geological Survey (former INGEOMINAS, www.ingeominas.gov.co) has three volcanological observatories, looking for the internal processes of fourteen igneous active volcanoes in Colombian territory (Figure 1a). Seismic, ground deformation, gas and electromagnetic monitoring are the main activities carried out in Colombian observatories. Permanent networks are installed at Colombian volcanoes including three NOVAC gas stations installed in 2007 at Galeras, two NOVAC stations at Nevado del Huila and two NOVAC stations in 2009 at Nevado del Ruiz volcanoes, from which data are transmitted to each volcanological observatory.
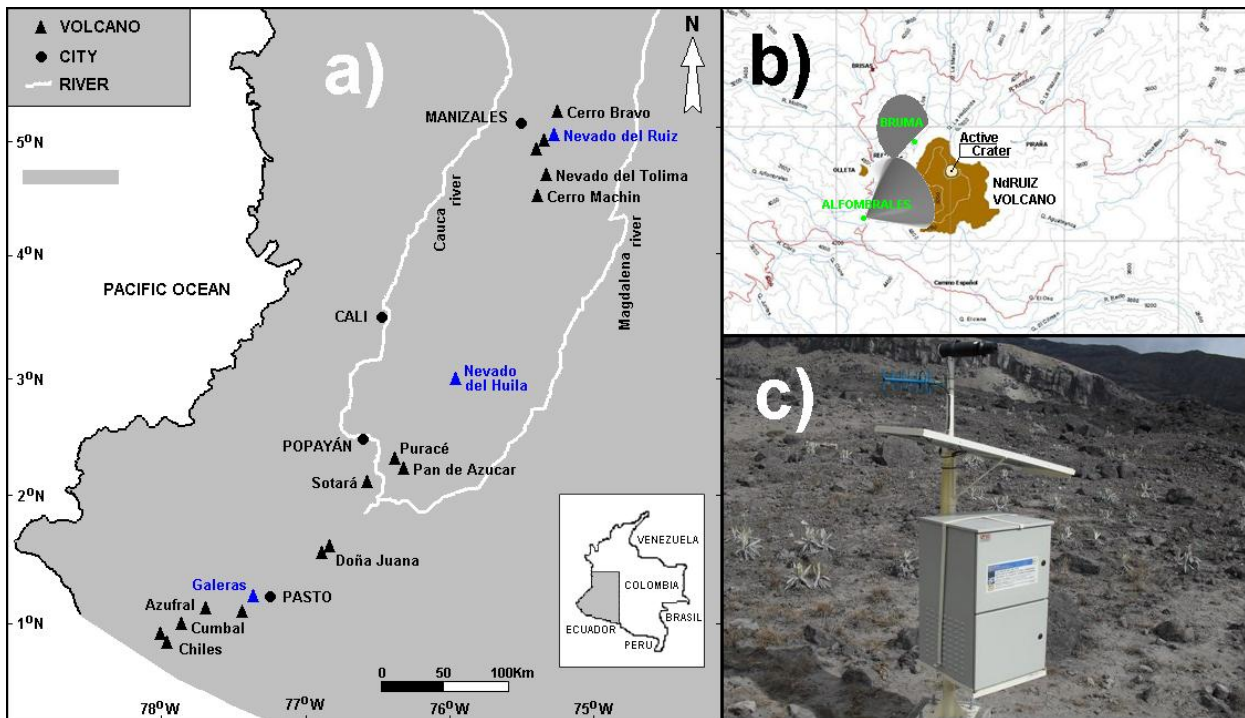
Fig. 1. a) Location of colombian active volcanoes (Northern Andes); b) Scandoas configuration at Nevado del Ruiz volcano; c) Scandoas system installed at Nevado del Ruiz volcano.

Novac project

NOVAC (www.novac-project.eu) is the *Network for Observation of Volcanic and Atmospheric Change* with stations in four continents for the quantitative measurement of volcanic gas emissions by UV absorption spectroscopy making use of a novel type of instrument, the scanning dual-beam miniature – Differential Optical Absorption Spectrometer (mini-DOAS) developed within the EU-project DORSIVA (Galle et al., 2006).

NOVAC was conceived with the purpose to measure gases in real time from natural environments like volcanoes with an optical remote sensor (Galle et al., 2002), as an important attempt to apply these gas data to validate satellite data and specially to evaluate their impact to atmosphere and climate change.

In particular, instruments are providing new parameters in the toolbox of the observatories for: 1) volcano hazard evaluation; 2) gas emission estimates; and, 3) physicochemical research on the local scale. Data are exploited for other scientific purposes, such like: 1) regional and global estimates of volcanic gas emissions; 2) large scale volcanic correlations; 3) studies of climate change; 4) studies of stratospheric ozone depletion; and, 5) validation of gas data from satellites.

As of 2012 NOVAC encompasses 24 volcanoes in four continents, including some of the most active and strongest degassing volcanoes in the world. Five universities and 10 institutes of Europa, Africa and the Americas are partners of the NOVAC consortium. Generated NOVAC data is now available for global and regional networks, such as: 1) Association of Latin-American Volcano Observatories - ALVO; 2) Network for the Detection of Stratospheric Changes – NDSC; and, 3) Inter-American Network for Atmospheric and Biospheric Studies – IANABIS.

Instruments and networks

Measurements of SO$_2$ molecules flying in the volcanic plume from fumaroles at three colombian volcanoes are made using an ultraviolet spectrometer and differential optical absorption spectroscopy – DOAS (Platt, U., 1994) retrieval methods. DOAS is a technique used for continuous measurements of atmospheric gases, based on the spectral analysis of the differential absorption by molecules in the ultraviolet and visible part of the spectrum. The broader extinction of ultraviolet light due to other processes such as scattering on air molecules and aerosol particles is cancelled during DOAS retrieval and thus not taken into account (Grutter et al., 2008). Measurements of volcanic plumes around colombian active volcanoes are carried out in a car or helicopter in motion in a weekly periodicity using a NOVAC mobiledoas system; and, each five minutes during the day from NOVAC scandoas networks located at distances of 5 to 8 Km from active craters of Galeras, Nevado del Huila and Nevado del Ruiz volcanoes (Garzon et al., 2008). All spectra is transmitted using antennas and freewave radios, from stations to the observatory toolbox for later processing, evaluation and comparison with seismic, ground deformation and electromagnetic data.

At Galeras volcano (01° 13´ N, 77° 21´ W, 4276 m.a.s.l.) in 2007 was configured a network of three scandoas type I NOVAC instruments; around Nevado del Huila volcano (02° 55' N, 76° 03´W, 5364 m.a.s.l.) were installed two permanent stations; and, in November 2009 were installed two stations close the main crater of Nevado del Ruiz volcano (04° 53´N, 75° 19´W, 5321 m.a.s.l.) as is shown instruments configuration in Figure 01b. Each scandoas system (Figure 01c) consist of a pointing telescope fiber-coupled to a S2000 spectrometer from Ocean Optics Inc. Ultraviolet light from the sun, scattered by aerosols and molecules in the atmosphere, is collected by means of a telescope with a quartz lens defining a field of view of 8 mrad. The telescope is attached to a scanning device consisting of a mirror mounted on a computer-controlled stepper-motor, providing a means to scan the field of view of the instrument over 180°. The collected light is transferred from the telescope to the spectrometer through an optical quartz fiber. The spectrometer uses a 2400 lines/mm grating, which combined with a 50 μm slit provides an optical resolution of approximately 0.6 nm over the wavelength range of 280-420 nm. A band-pass filter (Hoya U330), blocking visible light with wavelength longer than 360 nm, is installed in the telescope, approximately 2 mm behind the lens, with the purpose of reducing spectrometer stray light. In an ideal measurement, the instrument is located under the volcanic plume, and scans are made from horizon to horizon, in a vertical plane or along a conical surface approximately perpendicular to the wind direction. Typically a 3 seconds integration time is used, with a spectrum collected every 3.6^o, providing a full flux measurement every 5 minutes (Galle et al., 2010).

Results and discussions

Galeras volcano

Galeras last activity cycle started with a first episode on August 11th 2004 at 23:49 followed by a second event after less than one hour on August 12th 2004 at 00:02 erupting ash volumen of about 1.2 million cubic meters. *Pasto Volcanological and Seismological Observatory* reported (http://intranet.ingeominas.gov.co/pasto/Boletines_mensuales) an emplaced dome in the main crater at Galeras volcano with a volumen of 700,000 cubic meters, which was observed from helicopter on January 13th 2006.

Figure 02 shows sulphur dioxide fluxes measured at Galeras volcano since November 2007 till July 2012, where as a red square is indicated an ash eruption registered on January 17th 2008

followed by an SO$_2$ increase started the second semester of 2008 reaching values up to of 13,600 tonnes per day. Increases of sulphur dioxide fluxes from fumaroles at Galeras volcano in 2008 can be explained as a magma intrusion based on the relative high solubility of sulphur gases in the volume of Galeras magmas. Movement from the depth to the surface of relative high volume of Galeras magma will facilitate sulphur dioxide exsolution with decrease of lithostatic pressure reaching the surface with more and more open fractured conditions. Since February 14th till January 2nd 2010 ten explosive eruptions destroyed the dome. Just after the high SO$_2$ emissions in 2008, was followed a sealing process in Galeras, which reduced gas flows into the atmosphere and therefore increased the internal pressurization of the volcanic chimney. Product of this high pressurization in the Galeras conduits, were the consecutive eruptions since 2009.

Nevado del Huila volcano

Nevado del Huila volcano after centuries of dormant state, started its activity on February 2007. Figure 03 shows sulphur dioxide emissions calculated using vertical column densities measured with a NOVAC mobile-DOAS system together with WRF (Weather Research & Forecasting) wind speed model. Since October 1st 2008 till September 30th 2009 wind speed at the top of Nevado del Huila volcano was nearly 10 m/s; whereas SO$_2$ emissions from Nevado del Huila volcano varied from 12,760 tonnes per day on October 28th 2008 to 416 tonnes per day on July 28th 2009. Higher sulphur dioxide emission was measured when magma intrusion process finished with a first dome extruded, and lowest sulphur dioxide was measured just when a second dome extruded on the SW side of the crater as was reported by *Popayan Volcanological Observatory* (http://www.ingeominas.gov.co/Popayan/Publicaciones/Informes-tecnicos.aspx). First three months of 2010 was characterized by a relative relaxation of the system with SO$_2$ emissions close to 2,000 tonnes per day with wind speed at the top of Nevado del Huila volcano of around 8.0 m/s.
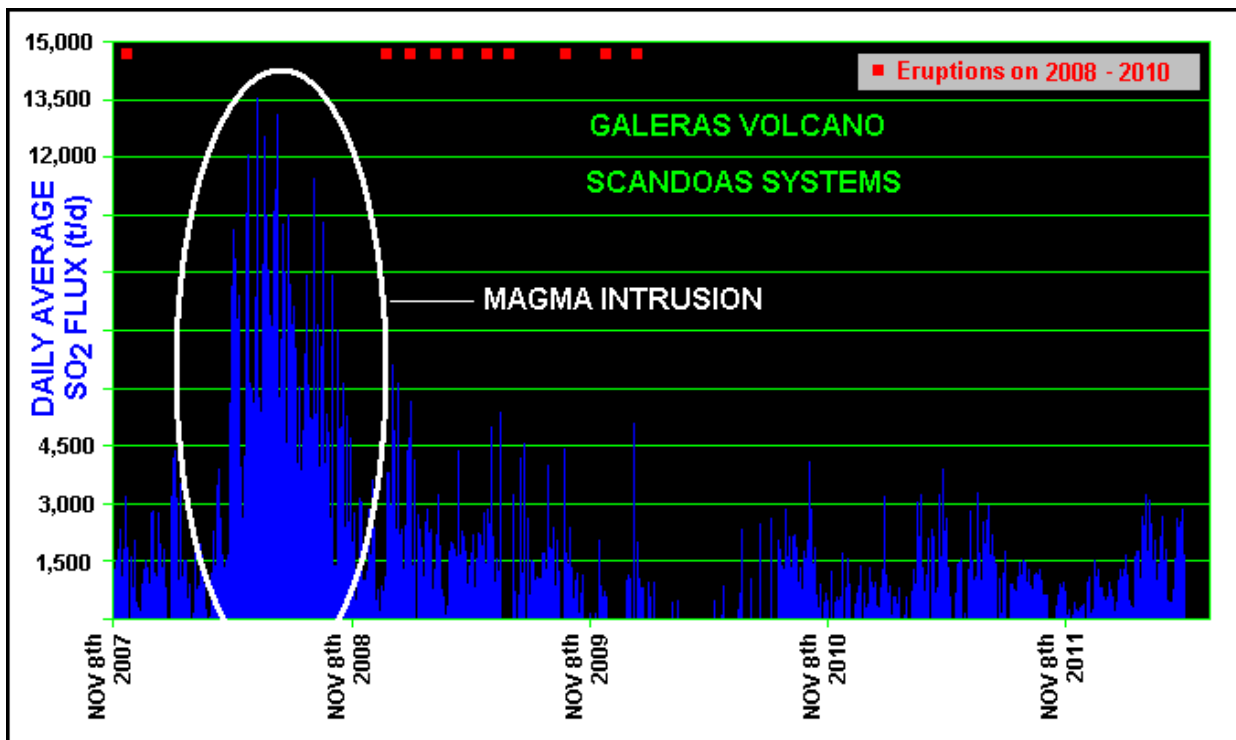
Fig. 2. Sulphur dioxide fluxes and eruptions at Galeras volcano (2005-2012).
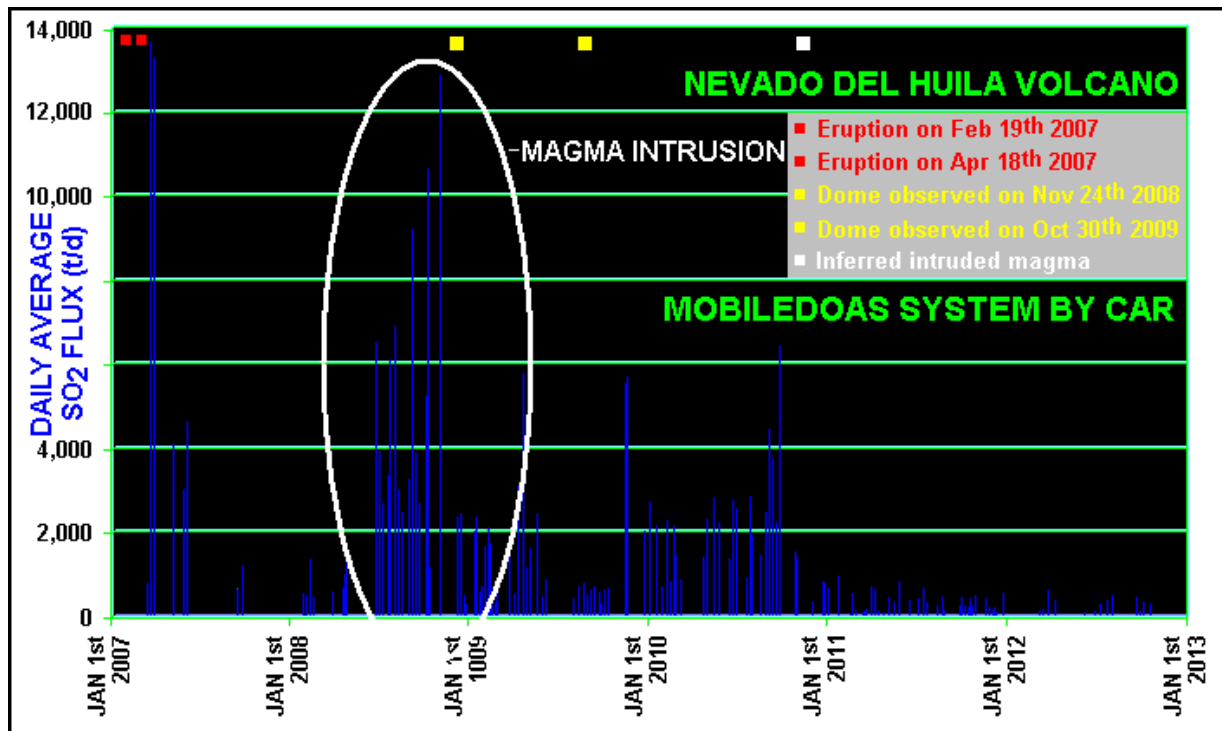
Fig. 3. Sulphur dioxide fluxes from Nevado del Huila volcano (2007-2012).

Nevado del Ruiz volcano

First gas data from Nevado del Ruiz volcano using NOVAC technology were telemetered to the toolbox of *Manizales Volcanological Observatory* on November 30th 2009. As is seen in Figure 04, sulphur dioxide fluxes from Nevado del Ruiz volcano were below 250 tonnes per day since the installations of scandoas systems till finishing second semester of 2010. On October 8th 2010 were registered a daily flux of 462 tonnes of sulphur dioxide and this behaviour was conservative with fluxes below 668 tonnes per day for more than one year. Nevado del Ruiz volcano began to show signs of increased activity in February 2012. A larger than normal steam plume was seen issuing on many days from Nevado del Ruiz´s main crater, while instruments began to show increased gas flux and seismicity. Scientists flying over the volcano noted fresh ash on the east flank of the volcano near the crater. The deposits were likely from an eruption on February 22th 2012 (probably phreatic). On February 23th 2012 a small ash plume was seen rising from the Nevado del Ruiz´s crater (http://www.ingeominas.gov.co/Manizales/Publicaciones/Informes-tecnicos.aspx). On March 31st 2012 the Nevado´s National Natural Park authority decided to shut the reserve to all visitors, following the increment of the threat level from yellow to orange. Sulphur dioxide emissions increases were recorded by scientific instruments until the June 30th 2012 ash eruption, which literally blocked access of sunlight to the solar panels that feed electronics at gas stations. No more contiuous gas data were transmitted to the Manizales Observatory.
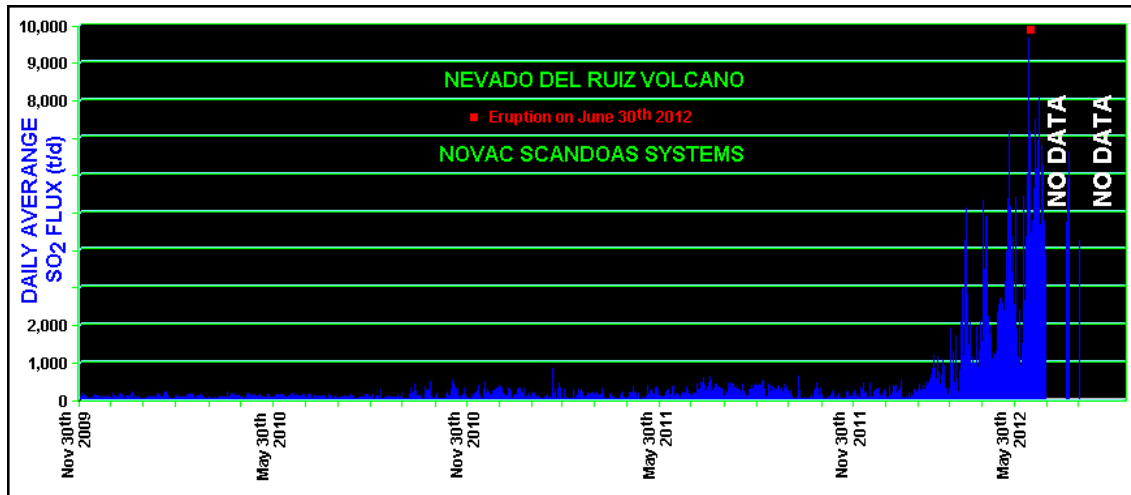
Fig. 4. Sulphur dioxide fluxes from Nevado del Ruiz volcano (2009-2012)
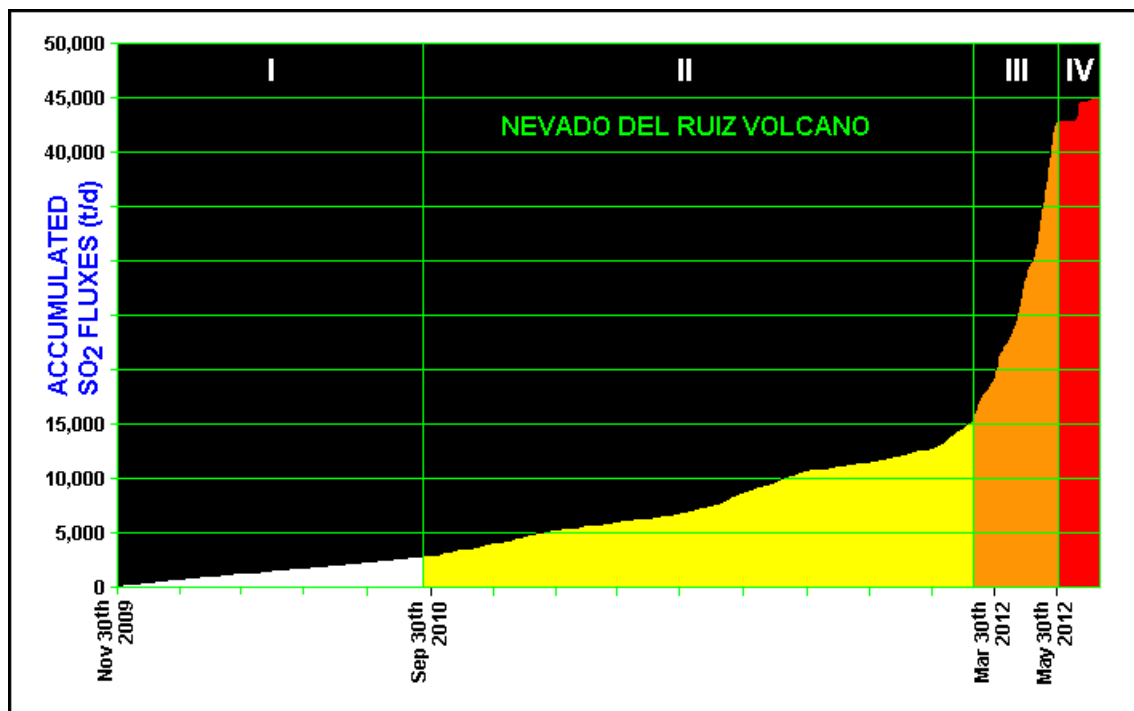
Fig. 5. Summary of sulphur dioxide fluxes from Nevado del Ruiz volcano (2009-2012)

Figure 05 was built by adding SO₂ fluxes emitting from Nevado del Ruiz volcano, where four slopes were observed: 1) Since November 2009 till September 2010; 2) Since September 2010 till March 2012; 3) Since March 2012 till May 2012; 4) Since May 2012.

A first temporary stage (I) was characterized by a relative constant gas emission. Notable in this period was changes as up to 400 µrad registered by electronic tiltmeters installed in the Nevado del Ruiz´s flanks (Ordoñez, M. personal communication) by the Ground Deformation group of Manizales Volcanological Observatory. A second temporal stage (II) was accompanied by increases as about 400 tonnes per day of sulphur dioxide gas emissions from the volcano, and increases of volcano-tectonic seismicity as was reported by the *Manizales Observatory*. High increases as about 2,400 tonnes per day of suphur dioxide fluxes was observed in the third temporal stage (III), which was characterized by the first ash emissions in February-March 2012.

Increases in sulphur dioxide fluxes above 6,000 tonnes per day, accompanied by explosive eruption on June 30th 2012 started the four activity stage (IV) of Nevado del Ruiz volcano.

Activity stage (I) at Nevado del Ruiz volcano was perhaps characterized by ground inflation of the edifice as the most important process for more than one year, which partially fractured conduit rocks observed by volcano-tectonic seismic signals and started increases of gas fluxes in the activity stage (II). Activity stage (III) was dominated by magma intrusion processes, accompanied by high sulphur dioxide fluxes and a first ash emissions into atmosphere. Activity stage (IV) is the present activity characterized with frequent ash eruptions since June 2012.

From Galeras, Nevado del Huila and Nevado del Ruiz´s SO$_2$ fluxes in the period since 2007 till 2012, increases of more than 6,000 tonnes per day have been accompanied by magma intrusion. Later extruded domes in the craters were observed and explosive eruptions were registered. Processes in which magma is transported by depressurization close the surface below active crater, but never cristallyze as a dome in the crater is a possibility, playing a role as a plug.

From cited examples, decrease of sulphur dioxide fluxes can be responsible of two different processes: a pressurization process as a result of sealing of chimney´s conduits which may finalize with an explosive eruption or a relaxation process as is observed in the present activity stage of Nevado del Huila volcano after 2010.

Conclusions

Since 2007 till 2012 fourteen Colombian volcanoes are active, at which three have highest activity, including dome formation as magma flow from the depth, and dome destruction producing explosive eruptions.

Optical remote sensors are playing a key role for sulphur dioxide monitoring in real time.

Increases in sulphur dioxide fluxes positively correlate with magma intrusion at Galeras, Nevado del Huila and Nevado del Ruiz volcanoes.

Decreases in sulphur dioxide fluxes can take place during pressurization or relaxation processes at Galeras, Nevado del Huila and Nevado del Ruiz volcanoes.

Special protection for instruments installed close active volcanoes must be developed, in order to ensure complete data transport to volcanological observatories during volcanic crisis.

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GLOBAL CHANGES OF THE SEISMICITY OF THE EARTH

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Introduction

Beginning in 2010 was marked by a number of natural disasters on a global scale. One after another powerful earthquake in the Solomon Islands (January 3), Haiti (January 12), off the coast of Chile (27 February), on the border of California and Mexico (April 4), China (April 13). Apogee were two very powerful volcanic eruptions. The largest over the past half-century eruption in Chile. Giant eruptions in Iceland suspended for several days, the aviation industry in many countries.

A powerful earthquake struck Haiti on Jan. 12, 2010. His moment magnitude of $Mw = 7.1$. Almost completely destroyed the city of Port-au-Prince - the capital and main port of Haiti. Under the ruins of the city literally disappeared into densely populated neighborhoods. Killed over 270,000 people. Millions of people were left homeless.

One of the largest earthquakes in the past half century occurred off the coast of Chile on Feb. 27, 2010. It had a magnitude of $Mw = 8.8$, accompanied by a tsunami and led to numerous casualties and destruction. Its epicenter was 90 kilometers from the capital of the Bio-Bio Concepcion, the second largest city in the country after Santiago. Magnitude of the strongest aftershocks reached $Mw = 8.0$. The death toll from the tsunami was minimal, since most of the inhabitants managed to escape the coast in the mountains. The earthquake on Feb. 27, 2010 was the largest after the Chilean earthquake of May 22, 1960 with $Mw = 9.5$, occurred at 230 km to the south.

Extremely strong earthquakes continue as at present. This article shows that this global geological activation is not accidental.

Global Seismogeodynamics

The results obtained in this work are based on the new methodological approach to the study of the Earth's seismogeodynamic regime according to which the flow of seismic events is analyzed not integrally but in magnitude intervals reflecting the geodynamics of the hierarchical fault–block structure of the geological medium [1, 2].

In this article sequences of large earthquakes that occurred throughout the Earth in the period from January 1996 to May 2010 were the subject of study. These earthquakes were differentiated in the magnitude intervals $M = 8.5 \pm 0.2$, $M = 8.0 \pm 0.2$, $M = 7.5 \pm 0.2$, and $M = 7.0 \pm 0.2$, completely overlapping a wide energy range, from $M = 6.8$ to $M = 8.7$. The last interval also included several large earthquakes of $M \geq 8.8$.

Figure 1 shows the position of all seismic sources. . Light gray painted sources, located at the depth of 70 km or less; dark gray color shows the sources deeper 70 km. These earthquake sources coincide with zones of subduction (sinking lithosphere in the mantle of the Earth). Date of show only those earthquakes that are cited in the text. Circles delineated foci of earthquakes in Alaska (1964) and Chile (1960). Thin gray lines - the boundaries between lithospheric plates.
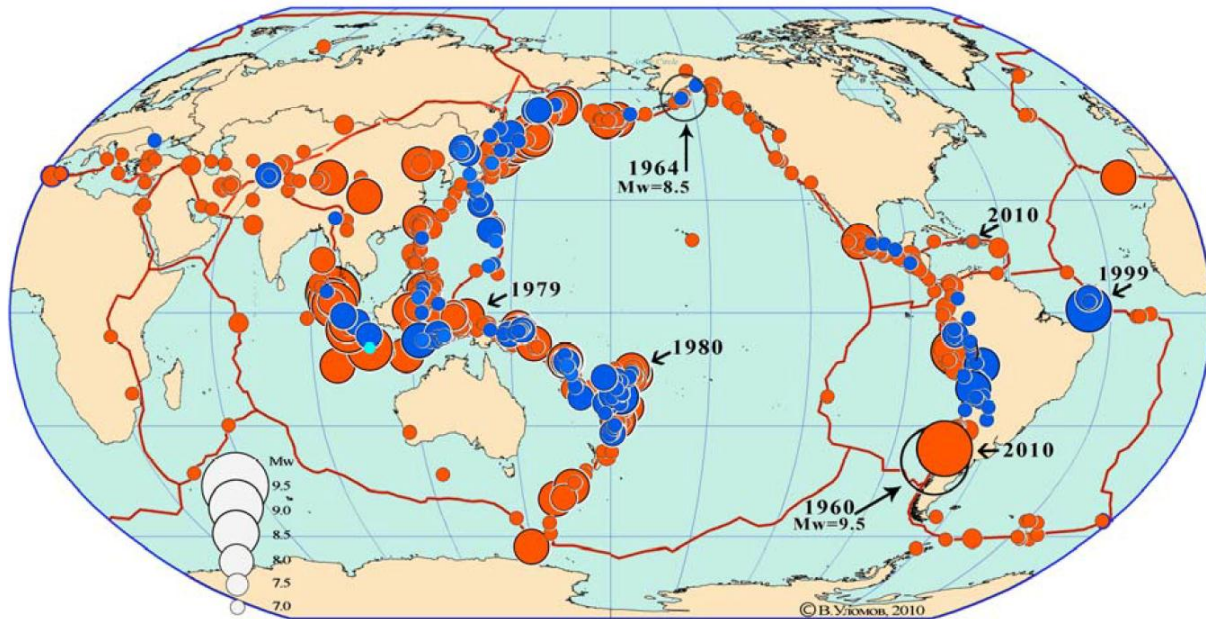
Fig. 1. The epicenters of major earthquakes of the Earth for the period from January 1996 to May 2010. Scale of earthquake magnitude is shown at the bottom left For the territory of Russia shows the state border.

Cumulative plots characterizing the accumulation rate of seismic events all over the Earth in the studied magnitude intervals are presented in Fig. 2. It should be noted that this figure, as in Fig. 1, borrowed from the paper [2], which was submitted for publication in the middle of September 2006, and in this article is completed until May 2010.

In Fig. 2, the cumulative number of earthquakes and the years of their occurrence are plotted on the abscissa and ordinate axes, respectively. Events with hypocenters in the depth ranges $h \leq 70$ km (shallow events) and $h > 70$ km (deep events) are shown by light gray and dark color circles, respectively. The linear approximations (dotted lines) are actually everywhere characterized by the high correlation coefficient (0.9 or higher).

Because of a very large number of shallow earthquakes with M = 7.0 ± 0.2, only the fragment of the corresponding plot is presented in the inset in Fig. 2 (line 4).
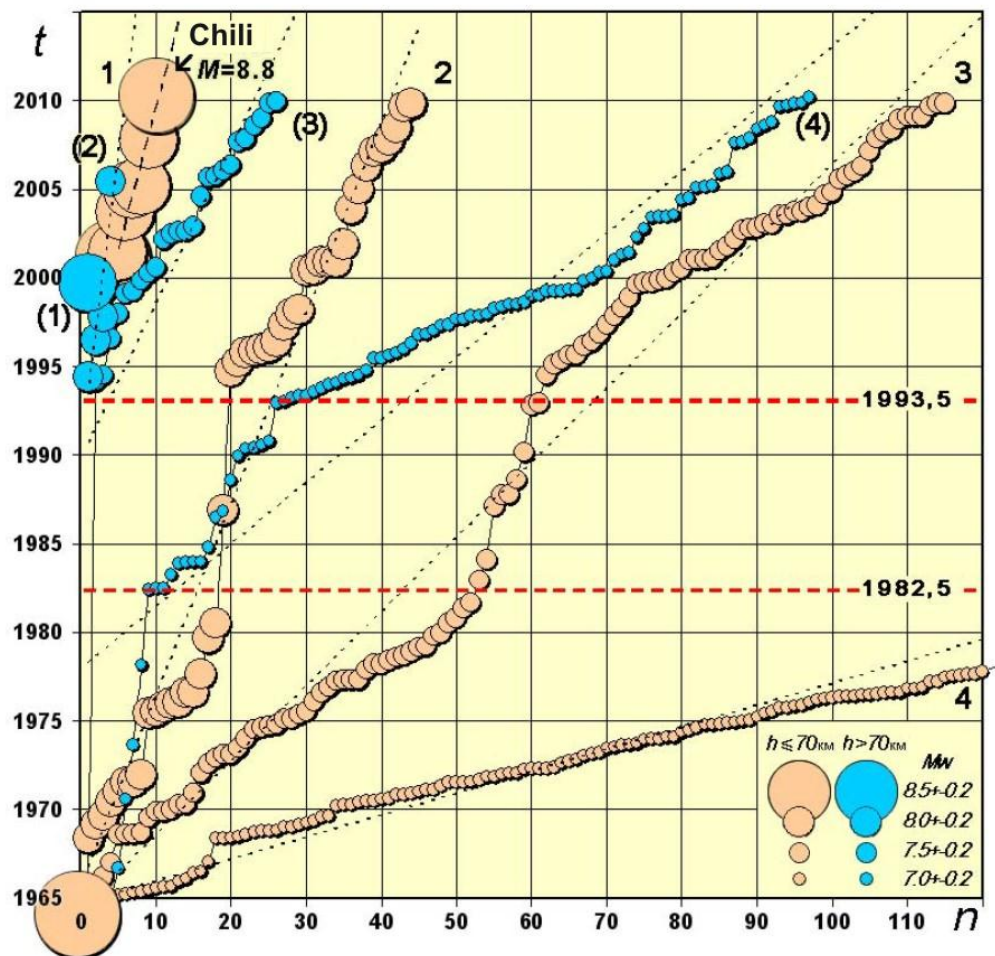
Fig. 2. Cumulative plots of the accumulation of global seismic events with the magnitudes 8.5 ± 0.2, 8.0 ± 0.2, 7.5 ± 0.2 , and 7.0 ± 0.2 that occurred in the period from January 1996 to May 2010: 1 – 4 - linear approximation of the occurrence times of earthquakes with hypocenters no deeper than h = 70 km ; the epicenter of the November 13, 2006, earthquake with M = 8.3 is encircled by a dotted line; (1) – (4) the same for seismic events with hypocenters at depths h > 70 km.

The slopes of the approximating lines characterize the accumulation rates of seismic events of the corresponding magnitudes: the smaller the slope of a line, the higher the rate. A steepness increase reflects a decrease in the recurrence rate of earthquakes. If earthquakes occurred rhythmically, i.e., with the same frequency in each sequence, all their occurrence times, in particular, during the entire period under consideration, would lie exactly on straight lines. However, in reality, deviations from this pattern are caused by a nonlinear development of geodynamic processes affecting the stress–strain state of the medium and, accordingly, seismicity manifestations. Analysis of the configurations of the cumulative plots revealed an interesting phenomenon reflecting specific features of the temporal evolution of global seismogeodynamic processes. First of all, we mean a substantial slowdown in the recurrence of all shallow earthquakes during the approximately 11-yr time interval (from the middle of 1982 through the middle of1993) bounded by the horizontal dashed lines in Fig. 2. As is seen from the figure, the accumulation rates of events in the considered magnitude intervals change rather rapidly, which is expressed in abrupt bends in all plots at the ends of the anomalous interval (1982.5–1993.5). However, before and after there veiled relative seismic quiescence, the occurrence frequency of shallow earthquakes not only was substantially higher but also was characterized by virtually the same accumulation rate of seismic events. In order to compare the

occurrence frequencies of earthquakes within the magnitude ranges under consideration, the numbers of events in 11-yr time intervals before (1971.5–1982.5), during (1982.5–1993.5), and after (1993.5–2005.5) the seismic quiescence are given in the table.

Numbers of earthquakes of various magnitudes in the regular intervals before, during, and after the anomalous seismicity

Hypocentral depths h ≤ 70 km				
Y, годы	M=7.0±0.2	M=7.5±0.2	M=8.0±0.2	M=8.5±0.2
1993.5–2005.5	141	39	17	4
1982.5–1993.5	40	9	1	0
1971.5–1982.5	111	36	12	0
Average	97	28	10	~1
Hypocentral depths h > 70 km				
1993.5–2005.5	53	12	4	1
1982.5–1993.5	22	0	0	0
1971.5–1982.5	2	0	0	0
Average	26	4	~1	~ 0

The average recurrence rates of shallow and deep earthquakes in the corresponding magnitude intervals are also presented in the table. They virtually coincide with the values taken from the generally accepted integral recurrence plots of earthquakes of the Earth. This fact and the aforementioned completeness of the analyzed earthquake catalog confirm the realistic nature of the results obtained.

In all cases, the time is measured from the middle of the year, as in the anomalous period of seismic quiescence. It is seen that, in the interval 1982.5–1993.5, earthquakes with M = 7.0 ± 0.2 and 7.5 ± 0.2occurred three to four times, and earthquakes with M =8.0 ± 0.2 ten or more times, less frequently than in the preceding and subsequent 11-yr periods. The largest seismic events with M = 8.5 ± 0.2 and more, which were altogether absent during the first two intervals, started to occur nearly annually from 2001 through 2006. They included the catastrophic earthquakes of December 26, 2004, with M = 8.8 and March 28, 2005, with M = 8.5, which occurred off the Sumatra coast and were accompanied by gigantic tsunamis that caused numerous victims. The previous 1964 Alaska earthquake with M =8.5 was equally large, and the time interval under consideration began actually from this earthquake.

The fact that deep seismic activity began immediately after the general quiescence of the shallow seismicity is no less important (see Fig. 2). No earthquakes with magnitudes M = 7.5 ± 0.2 and higher were observed before this period, whereas twelve earthquakes with M = 7.5 ±0.2, four earthquakes with M = 8.0 ± 0.2, and one earthquake with M = 8.8 occurred in the conclusive time interval. The last earthquake was unique in its magnitude and occurred in the Atlantic Ocean at a depth of about 90 km off the eastern coast of South America (see Fig. 1). However, earthquakes with M = 7.0 ± 0.2 occurred very seldom up to their conclusive active stage. Thus, while five such earthquakes occurred annually from the middle of 1993 and later, their recurrence rate in the period of seismic quiescence was lower by a factor of 2.5 (and before, even by a factor of 26.5).

The extremely high global seismic activity will continue on today.

The nature of planetary changes in the seismic regime can be interpreted in terms of contemporary ideas of the global dynamics of lithospheric plates (seismicity is its most impressive manifestation). Thus, events with h > 70 km associated with the subsidence of lithospheric plates into the upper mantle in subduction zones, island arcs at the periphery of oceans, and relics of such zones on continents (for example, the eastern Carpathians; at the NW and SE terminations of the Himalayas; Crimea-Caucasus-Central Caspian region). Shallow sources are widespread mainly on continents and in oceanic rift zones. However, both types of sources are undoubtedly caused by a coherent seismogeodynamic process encompassing the entire Earth as a whole.

In order to explain the observed pattern of global seismogeodynamics in the period under consideration, we cannot exclude at least the two following scenarios.

Thus, it may be assumed that the general seismic quiescence in this period was caused by a slow (creep like) and virtually aseismic subsidence of the lithosphere in subduction zones, weakening the total stress state in the lithosphere and decreasing the number of seismic movements in it. Due to the temporary absence of significant hooks (barriers) on sliding planes, no large earthquakes occur in subduction zones (see Fig. 3).

According to another scenario, the observed general seismic quiescence is, on the contrary, associated with the accumulation of geodynamic stresses in the lithosphere of continents and oceans, due to, among other factors, the slowdown of lithosphere subsidence processes in subduction zones. After active subduction is resumed, a general release of lithospheric stresses begins and the entire depth range becomes active.

Other explanations are also possible. Nevertheless, the observed clearly expressed quiescence and other changes in the seismic regime in the entire depth range of seismic sources are an indisputable fact, and the nature of this phenomenon is associated with specific features of the Earth's geodynamic development. It is also possible that both scenarios took place simultaneously but were realized differently innumerous subduction zones.
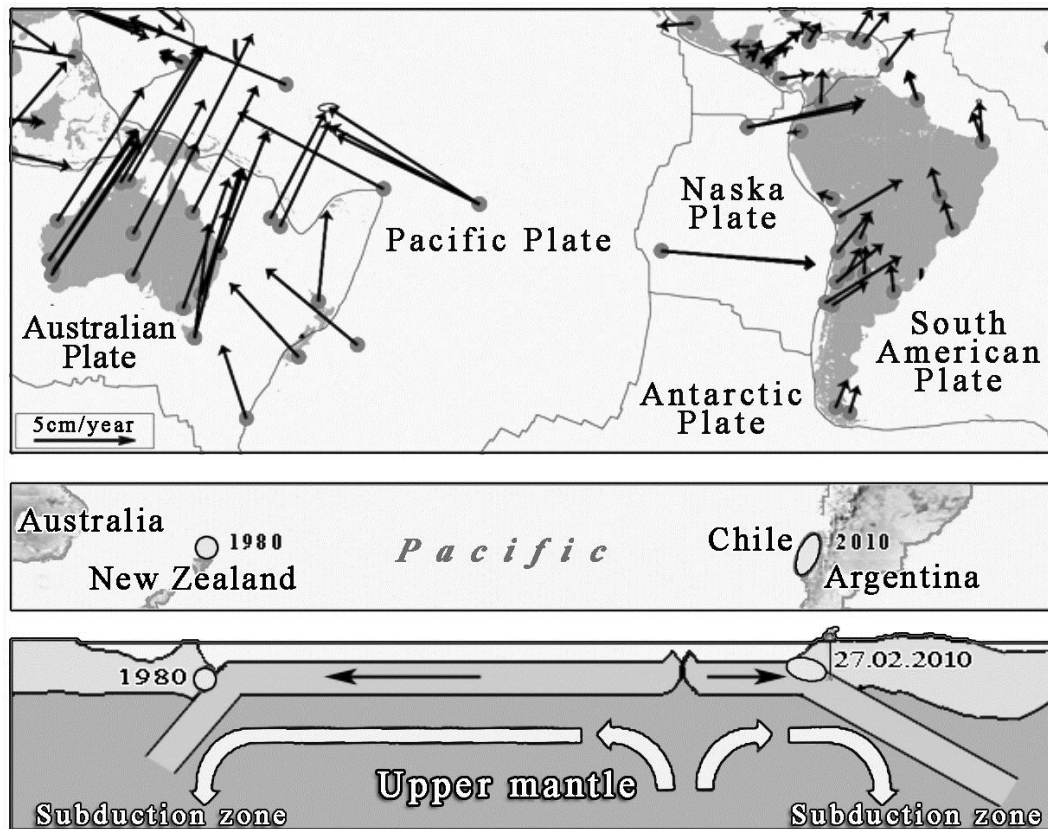
Fig. 3. Directions and velocities of motions of lithospheric plates on the territory between Australia and South America.

Figure 3 illustrates the directions and velocities of contemporary horizontal motions of lithospheric plates determined from GPS (by NASA) measurements at sites on continents and islands (above). Boundaries between plates are shown by thin lines. In the center - a fragment of territory from Australia to South America, along which made the vertical section of the lithosphere and upper mantle (below). At the bottom of the large arrows show the convection in the Upper mantle of the Earth, and thin black arrows show the movement of the Pacific and Naska plates. The New Zealand earthquake 1980 and earthquake 1979 (see Fig. 1) were the last events of which came after nearly 15-year period of anomalous seismic lull.

Joint investigations of seismogeodynamic and hydrogeodynamic processes allowed us to reveal a certain synchronism between changes in the seismic regime of the Earth and the ocean water surface level. In this respect, the joint analysis of seismogeodynamic and hydrodynamic processes performed in seismicity studies of the Caspian Sea has an important advantage, because the only short subduction zone in the central Caspian Sea was considered in [3]. The Caspian Sea and the ocean are similar in that both are closed water basins and can be regarded as indicators actively responding to global and regional seismogeodynamic processes.

As distinct from the Caspian Sea with its single subduction zone, the hydrologic regime of the ocean can be related to a great number of such zones, including those located on the periphery of the Pacific Ocean. Some subduction zones can be activated, whereas the lithosphere subsidence in other zones slows down. Nevertheless, the relation of ocean level variations to seismic regime changes in the period 1982–1993 is recognizable in this case as well. Note that such a rapid ocean level drop started immediately after two large (M =8.0 ± 0.2) earthquakes that occurred in the SW, Indonesian part of the Pacific Ocean in 1979 and 1980 and concluded the long series of

similar events before the seismic quiescence of 1982–1993. In this respect, it is interesting that, according to observations of oceanologists, the most intense variations were observed after1993 precisely in this part of the Pacific Ocean.

It is equally important that even supporters of the ideas of a nearly absolute influence of temperature on ocean level variations had to admit that some values obtained in the period considered by them (1993–2003) cannot be accounted for by temperature changes alone [4].

Conclusion

A large number of various factors, including dynamics of lithospheric plates and global seismicity, control the geological formation and the water surface level on the Earth. However, these factors mentioned above have not received proper attention as yet, although the interrelation of seismogeodynamic and hydrogeodynamic processes and phenomena has long been known at the level of regional and source seismicity [5].

The Earth is a structurally complex dynamic system, and the modern system approach should be applied to the study of processes developing under strongly non-equilibrium conditions of its geospheres, with their inherent self-organization phenomena.

Dynamics of the Earth's crust and the whole lithosphere is due to the accommodation processes of volumes of the geophysical medium to applied long-term force actions, including those on the planetary scale. From this standpoint, the alternation of increases in elastic stresses with their subsequent releases in the form of slow deformations or rapid stress drops in earthquake sources is the most efficient self-organizing regime of geodynamics. The fractal structure of the medium predetermines its specific response to external deformations. Thus, in the case of weak forces applied to the medium, the seismic regime is nearly stationary and characterized by the occurrence of weak earthquakes. If the forces increase, for example, as a result of large seismic or creep motions, the seismogeodynamic system is transformed into a qualitatively new and more organized state and sources of large earthquakes interrelated in space and time arise.

Although the geodynamic system continuously changes its state, the Earth as a whole is in dynamic equilibrium, which is favored by the observed periodicity of the accumulation and release of geodynamic stresses.

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ON POSSIBLE RELATION BETWEEN REGISTERED DEVIATIONS FROM THE GRAVITATIONAL CONSTANT AND GEODYNAMIC PROCESSES

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Abstract

Years-long registration of gravitational constant variations by scientists from different countries has aroused considerable debate about their causes. Simultaneous deviations of the Cavendish balance indications from the gravitational constant G values were registered for the period between 2010 and 2011 in three measurement points: Baku (Azerbaijan), Islamabad (Pakistan) and Yogyakarta (Indonesia). These deviations may have been possibly caused by tectonic waves, the source of which lies at the earth's outer core and lower mantle. Tectonic waves appearing as a result of a pulse emission of endogenous energy are carriers of deep energy of the Earth in the form of alternate tectonic stresses from the outer core to the lithosphere. Upon reaching the earth's crust, tectonic waves contribute to the increasing geodynamic activity, acting as a trigger mechanism. Cyclicity of geodynamic processes is a result of pulse emissions of endogenous energy.

A logical explanation is provided for the varying deviations from the gravitational constant ΔG as caused by alternating stress fields in the earth's interior. It is suggested to use ΔG as a new physical parameter to be a source of additional information on geodynamic processes.

The effect of constantly changing external masses formed by geodynamic processes in the earth's interior on the gravitational interaction of loads in the Cavendish balance makes it impossible to determine with high precision the value of the gravitational constant on the earth's surface at a single measurement point. To calculate the precise value of G on the earth's surface, long-term monitoring is to be carried out by synchronized measuring at different registration sites located as distantly from each other as possible.

Keywords: *tectonic wave, gravitational constant, ATROPATENA station, seismic activity, geodynamic processes, earthquake*

Introduction

As measurement precision for the value of the gravitational constant G increases, so do, strangely, the differences between the results obtained. A great number of studies by many scientists have addressed this problem. In 1999, for instance, V.P.Izmailov, O.V.Karagioz and A.G.Parkhomov published their research findings on variations of gravitational constant measurement results (*6*), having slightly modernized the classic Cavendish experiment. The authors (*6*) found variations of measured G values in the third decimal place, which were significantly higher than errors of the measuring instrument.

Meanwhile, when summarizing the results of their research, the above-mentioned scientists came to the following conclusion: "It is reasonable to surmise that this analysis reveals not changes in the value of a physical constant, which is the gravitational constant but the effect of some factors

unaccounted for by researchers and affecting, directly or indirectly, the measurement results". The research conducted by the authors (*6*) shows that geomagnetic field fluctuations, instability of temperature and atmospheric pressure, residual gas flows in the vacuum chamber, changes in the inclination of the facility cannot lead to the effects observed. Gravitational field variations associated with changes of the mutual position of the Earth, the Moon and the Sun are too little to directly and tangibly affect the measurement results.

The two most precise **G** measurements have been made by teams of scientists at the University of Washington in Seattle and at the International Bureau of Weights and Measures near Paris, with experimental errors being 1/10000 in both cases; however, the difference between the obtained values significantly exceeds possible errors. The value obtained in Seattle is (*7,19*):

$$G = (6.674215 \pm 0.000092) \cdot 10^{-11} \, \textbf{m}^3 \cdot \textbf{kg}^{-1} \cdot \textbf{s}^{-2}$$

Jean-Paul Mbelek and Marc Lachieze-Ray believe they have managed to understand the cause of this divergence between experimental values. They took into account the geographical location of the laboratories where these experiments were carried out. The researchers conjectured that the observed divergence was based on the mutual influence of the gravitational and electromagnetic fields. In their works they presented calculations of expected values of the gravitational constant in different regions of the planet. The calculations were based on the theories suggesting the existence of hidden dimensions of space (in particular, the string theory merging the electromagnetic and gravitational fields) (*19*). The calculations lead to the conclusion that the terrestrial gravity is stronger in the areas where the magnetic field is stronger, i.e. peak values are to be expected around the north and south magnetic poles. According to them, available experimental data are quite in agreement with the theory but high-precision measurements are still required, both in the polar areas and in the equatorial regions.

Scientists believe that solar studies also confirm their hypotheses. If a model is used which employs a lesser value of the gravitational constant, there is a better agreement with experimental data.

Mbelek reported that, according to their calculations, the magnetic field's effect on the gravity force is weaker at high temperatures. So, in their view, it can be expected that the G constant has a lesser value inside the Sun (*19*). However, many scientists do not share the concepts of the above-mentioned researchers.

A new experiment by a team of Swiss physicists from the University of Zurich has yielded a result different from the research findings (*7,19*). In a special cemented cellar near Willigen, Switzerland, they used a sensitive laboratory scales to measure the difference in masses of two small weights, with two huge mercury containers weighing 13 tons (*23*) placed above or below them. Measuring with the supersensitive scales changes in weight of the experimental loads, the researchers obtained the gravitational constant value which was equal to:

$$G = (6,67546 \: 0,0005) \cdot 10^{-11} \, \textbf{m}^3 \cdot \textbf{kg}^{-1} \cdot \textbf{s}^{-2}$$

Their data are different from the results obtained by the Seattle group and the French scientists.

Stephan Schlamminger, head of the Zurich group, believes that this disproves the Parisian result.

In any case, attempts to get more precise measured values of *G* have led so far to a higher variance in the data obtained by different researchers of the world. This adds to some confusion experienced by scientists since *G* variations are not consistent with the basic provisions of the general theory of relativity.

It could be attributed to miscalculations caused by measurement errors or neglected interference, if it were individual cases. Meantime, differences in measured *G* values have been observed globally over the last decades, increasing in proportion to the higher precision of measurement systems (*6,13*).

1. Material and Methods

To study spatiotemporal variations of the measured G values experimentally, a new instrument was created, named by the author (*15*) the ATROPATENA detector. A PCT patent application has been filed for the ATROPATENA device (*14*).

The ATROPATENA device is designed for more effective research and better understanding of the recorded G variations. It represents the Cavendish balance using two, rather than one, beams positioned perpendicularly to each other, with minor weights attached to their ends. They are placed in a closed glass tank isolated from the outside environment. Inside the tank, 10^{-4} vacuum is constantly maintained, with the beams' deflections logged using the laser registration system. The deflections of the beams are recorded with a frequency of 1 Hz. The entire system is installed in a room which is far away from vibrational and electromagnetic interference. In (*14,15*), a detailed description of the detector's design and principle of operation is given.

The measurements were made simultaneously and synchronously using the ATROPATENA stations at three measurement points: in Baku (Azerbaijan), Islamabad (Pakistan) and Yogyakarta (Indonesia), Fig. 1.

**Fig.1. Location map for ATROPATENA gravitational constant registering stations –
▲ ATROPATENA registering stations;   1, 2, 3 – station numbers: 1 – Yogyakarta (Indonesia); 2 - Islamabad (Pakistan); 3 – Baku (Azerbaijan).**

(*16*) shows that before and after the disastrous magnitude 9 earthquake in Japan that occurred on 11.03.2011, all three ATROPATENA stations deployed in Yogyakarta, Islamabad and Baku registered a deviation from G in the third decimal place. The authors of the article suggested a new concept of the mechanism of these G deviations. In their opinion, large-scale deformations

taking place in the lithosphere, in the earthquake focus area before and after an earthquake generate low-frequency stress waves (tectonic waves), with their transverse component which, while passing under the registering stations, alternately changes the density of the Earth's crust horizontally, creating alternating masses which cause deviations of the Cavendish balance from the invariable G value. Thus, according to the authors (*16*), deviations from G do not reflect gravitational constant variations but are rather a consequence of varying masses of geological origin in the Earth's interior affecting the interaction of loads in the Cavendish balance. Therefore, we have named this new parameter as deviation from the gravitational constant (ΔG). A detailed study of ΔG will help better understand the processes of mechanical stress and deformation redistribution in the earth's crust and mantle.

ΔG detected with each of the two mutually perpendicular beams in the ATROPATENA station is recorded as separate channels. This article provides an analysis of the records from one channel only since both channels have shown similar indications.
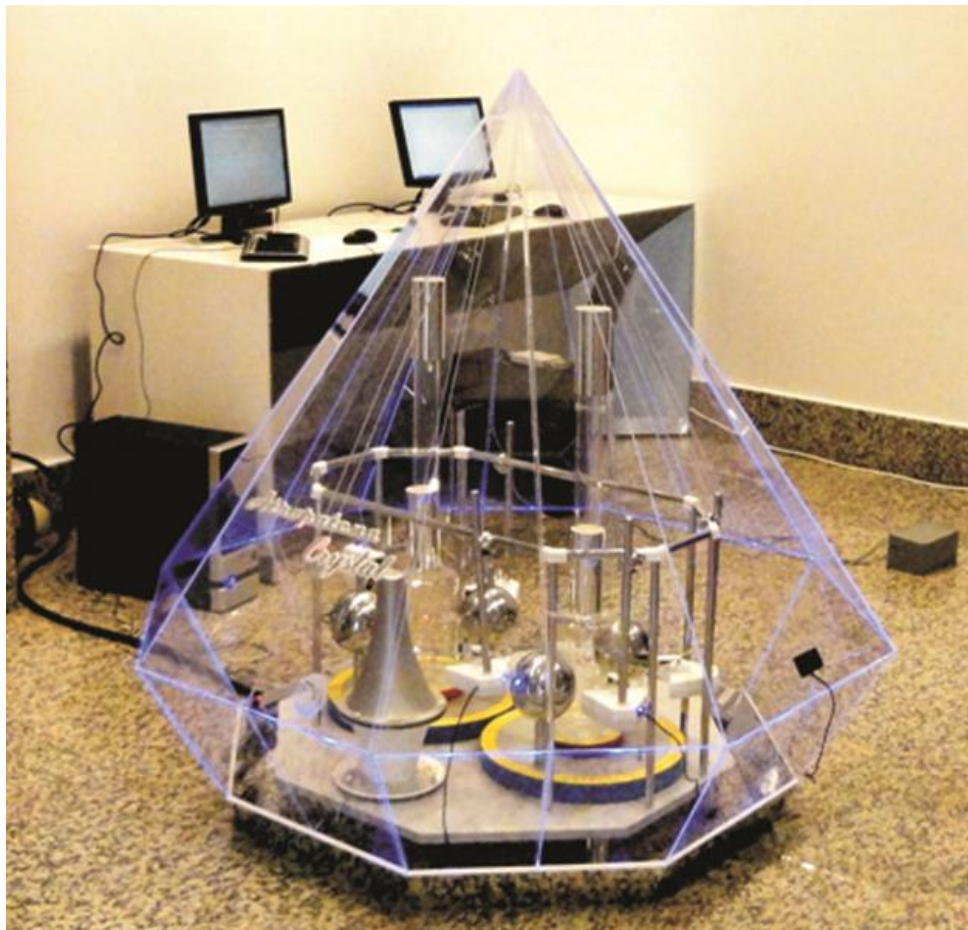
Photo of ATROPATENA station

2. Theory/Calculation

2.1. Analysis of Registered Deviations from the Gravitational Constant

To study the nature of the gravitational constant's variations in time for the period between 2010 and 2011, we have drawn graphs for variations of the measured values of the gravitational constant between 01.01.2010 and 30.12.2011.

The graphs were drawn as follows. In analyzing long (more than 24 hours) time series, there is no need to use the ATROPATENA station's high data recording rate, which is 1 Hz. For the convenience of study, the database algorithm automatically averages each value of the time series as a function of its length (the selected time period). With plotting the graphs automatically, we set the length of the series for any selected time period as standard 1442 values. Each value of the time series is calculated according to the formula N = n/1442, where N is the averaged value, n is the number of values with 1 Hz frequency in the selected time period. The averaging window for the data series examined by us for the period between 01.01.2010 (Time 00:00) and 30.12.2011 (Time 23:40) is 730 minutes.
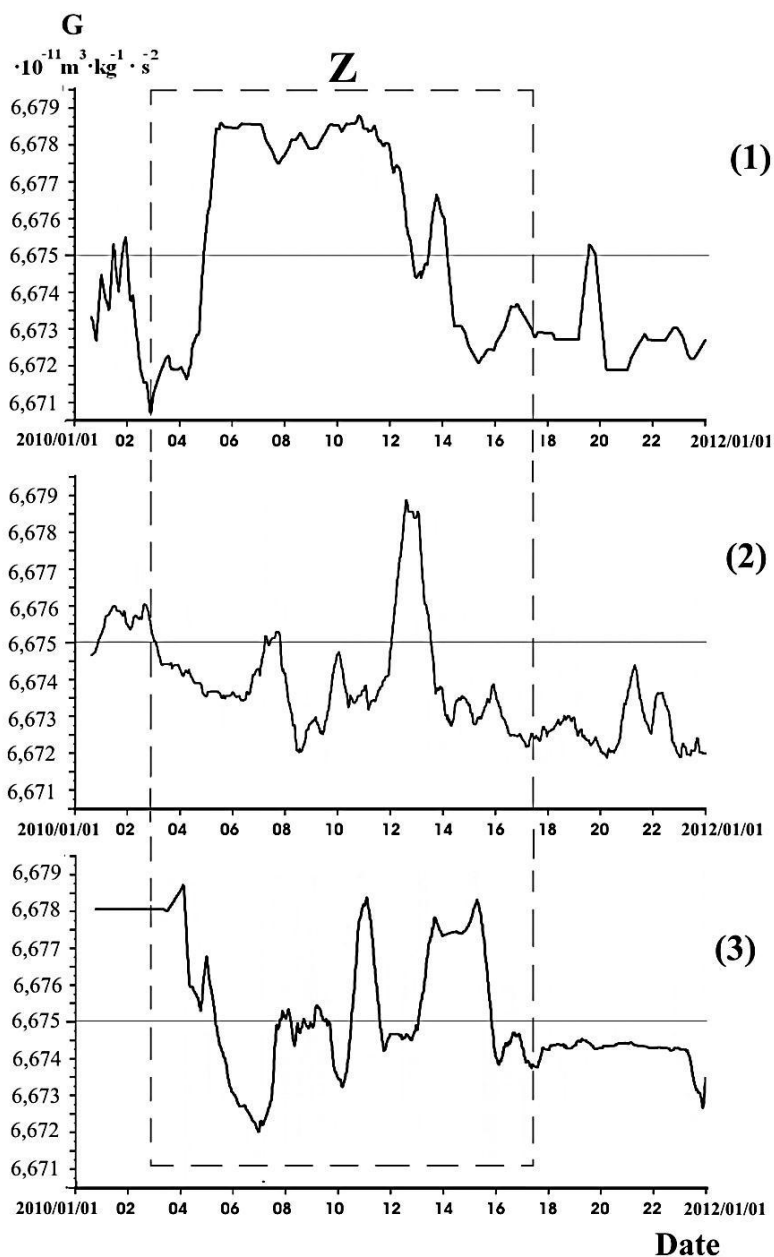
Fig.2. Graphs for deviations from gravitational constant between 2010 and 2011 (by E.N.Khalilov, 2012). The ordinate shows the measured values of the gravitational constant; 1, 2 and 3 – measurement graphs for Yogyakarta (Indonesia), Islamabad (Pakistan), and Baku (Azerbaijan), respectively.

Then, to better analyze the most typical trends, approximation of the graphs was carried out using the moving average method with 20-day linear filtering. Since the author was never tasked with determining the exact value of the gravitational constant, G values with the precision of up to the third decimal place were used.

To study variations ΔG, the value **6,675 $\cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2}$** was taken as a conditional center line; deviations in all graphs were approximately uniform relative to this value. G deviation analysis showed the presence in all graphs of a period of increased ΔG variations with the highest amplitudes possible in the third decimal place (Fig. 2). This period of higher amplitudes of ΔG variations is indicated as area Z.

During a more detailed analysis of graphs, an inverse correlation was found between graphs 2 and 3, Fig 2. For better visualization of the correlation, graph 2 was inverted and placed above graph 3, Figure 3.
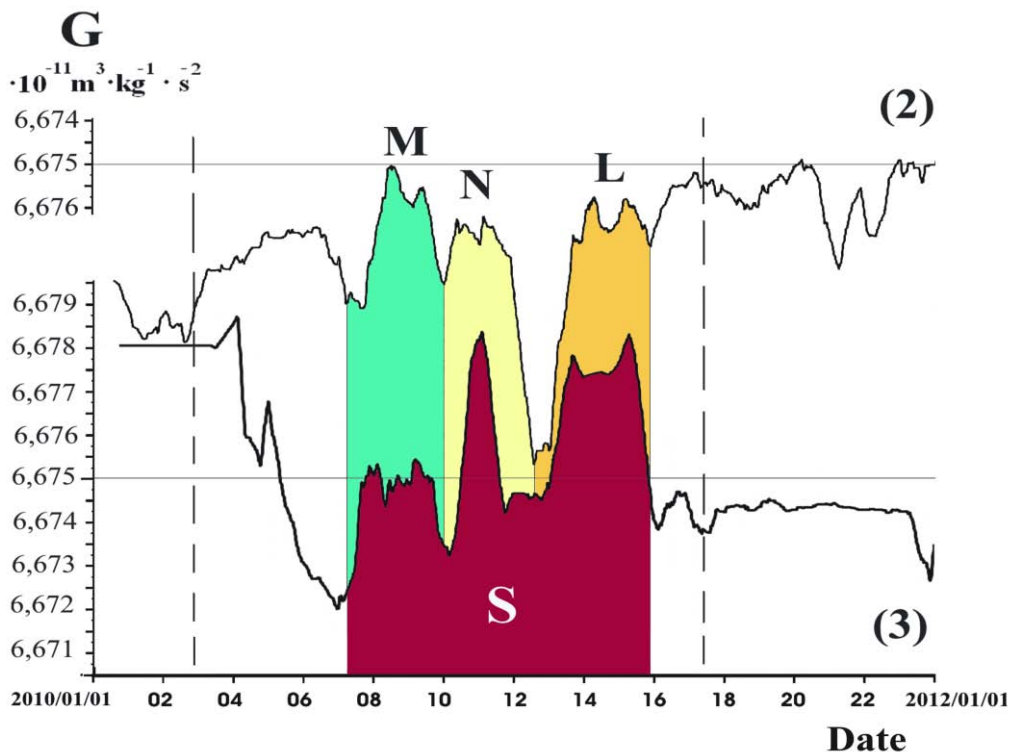
Fig.3. Comparison of graphs 2 and 3.
ΔG – deviation from the gravitational constant

For a more detailed comparative analysis (Fig 3), we chose the time period indicated in the graph 3 as S. Within the S period, we identified three cycles of intensive ΔG variations - M, N and L, with periods which coincide in time and last three months on average. A high similarity in shape has been found between Cycle L in the graph 2, with a slight temporal shift forward, and the similar cycle in the graph 3. Thus we established a high similarity between the cycles of high intensity variations ΔG in graphs 2 (Islamabad station) and 3 (Baku station).

The distance between stations 1 and 2 is 6045 km, the distance between stations 2 and 3 is 2192 km, and the distance between stations 1 and 3 is 8166 km. So, the graphs for ΔG variations between the closest stations share the highest similarity possible and are in antiphase.

The observed regularities of high-amplitude ΔG variations, registered at three measurement points separated by large distances cannot be a mere coincidence, having pronounced similarities in character. One would assume that these deviations could be caused by the gravitational impact of cosmic character, being associated, for example, with the movement of planets. Meanwhile, the calculations in (*1*) show that similar ΔG in the third decimal place cannot be caused by the cosmic influence such as lunar and solar tides or the effect of the gravitational fields of other planets of the Solar system. Besides, the impact of gravitational fields of cosmic origin on indications of the Cavendish balance should have resulted in simultaneous changes of ΔG variations at all observation points. However, the registered variations have significant shifts in time relative to each other. For example, Fig.3 highlights the high similarity in shape between Cycle L in graph 2, with a slight temporal shift forward, and the similar cycle in graph 3.

(*15, 16*) present the concept that ΔG variations may be associated with intense wavelike deformation processes in the lithosphere, causing its compression in some areas and expansion in others.

2.2. Tectonic Waves and their Possible Registration

The basics of the concept of tectonic waves were laid in W. Elsasser's mathematical model according to which, the compressive forces averaged along a cross section of the elastic lithosphere are compensated with tangential forces formed as a result of horizontal movement of the lithosphere along the viscous asthenosphere (Elsasser W., 1969) (*4*). Later this model was used for quantitative assessment of aftershock activity transfer (*2,9*). J.Rice supplemented the Elsasser model with the effect of viscoelastic response of the asthenosphere to horizontal displacement of the lithosphere. He also took into account the actual bidimensionality of the process (*24*).

Theoretical analysis of the propagation of seismic activity waves in the lithosphere was given in the works of F. Lehner and other researchers (*17*). The effect of bending of the lithosphere on the liquid lithospheric base was covered in works by A.Nadai and E.V.Artushkov (*1,21*). Later, V.N.Nikolayevskiy, A.V.Karakin and L.I. Lobkovskiy made an attempt to develop the two-dimensional theory of waves of the lithosphere's bending and compression on the viscous asthenosphere (*8*). V.N.Nikolayevskiy and T.K.Ramazanov combined the approaches of the previous studies and proposed a two-dimensional equation of tectonic bending- compression waves with due regard to the viscoelasticity of the asthenosphere (*22*).

Some researchers consider major tectonic faults as a sort of waveguide within which tectonic waves spread over long distances (*9,24*). A number of researchers suggest also taking into account, when constructing a model of tectonic wave processes, phase transitions and heat transfer, partial melting of the asthenosphere and its two-phaseness associated with it, gravitational instability, etc. (*3,5,8*). Very interesting from the point of view of studying wave transmission of tectonic energy are findings and calculations by N.A. Kasyanova (*10*). For example, based a detailed analysis of the spatiotemporal distribution of earthquakes within the Sinai Peninsula and the Gulf of Aqaba, seismic energy migration from 1976 from east to west and from 1983 from north to south was established.

The movement of transverse tectonic waves causes alternate changes of rock density in a large stratum of the lithosphere, perpendicular to the direction of wave propagation, Fig.4. The successive alternate compression and expansion of the lithosphere in the area where the transverse wave passes causes an alternating increase and decrease of the rocks' mass on different sides from the registering stations. Therefore, the ATROPATENA stations register the

alternating changes of the gravitational field in two perpendicular horizontal directions, as is shown in the model, Fig.4. (*15*).
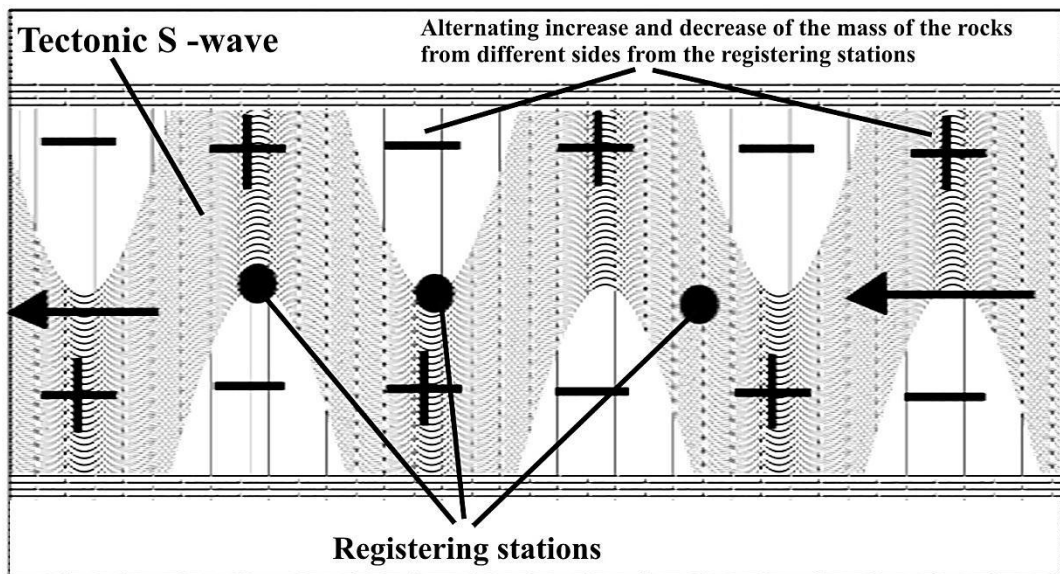
Fig 4. Diagram of model of tectonic S wave impact on the alternating tangential change in the density and mass of the earth's crust in the area of the wave front.

Taking the theory of tectonic waves as a basis, we can try to substantiate the fact that cycles M, N and L of the anomalous region S in graphs 2 and 3 are in antiphase (Fig. 3). This can be explained by the source of tectonic waves being located at unequal distances from the measurement points.

2.3. The Rossible Nature of Cyclicity of Geodynamic Activity

It is known that geodynamic activity of our planet is subject to cycles of different scales, ranging from hundreds of millions of years to months. What are the causes that generate these cycles? (*11,12*) shows that cycles of different scales are formed by various processes of endogenous and exogenous origin. The largest cycles with periods of hundreds of millions of years are associated with the processes of galactic scale, for example, a complete revolution of the solar system around the galactic center (220-250 million year cycle). There are shorter cycles: 22-year and 11- year ones associated with solar activity cycles (*11,20*). Meanwhile, given that the earth's endogenous activity is directly connected with energy processes in its core, its cyclicity is dictated by the periodic changes of energy released at the boundary of its outer core and lower mantle (*5*). Release of extra endogenous energy must be reflected in the formation of tectonic stresses and their long-distance transportation through tectonic waves. In this case, not only should they be registered as an alternating variation of masses, but also affect seismic activity of the Earth. To verify this concept, we conducted a comparative analysis of different gravitational constant deviations and the earth's seismic activity.
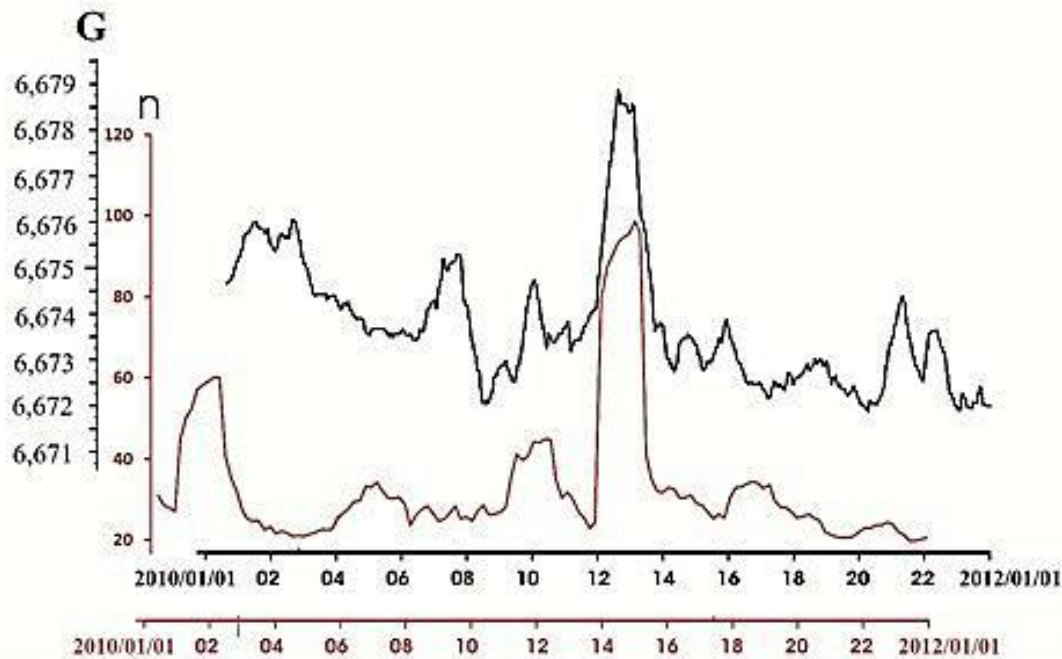
Fig.5. Comparison of graphs for deviations from the gravitational constant (black) and the earth's seismic activity (red) between 01.01.2010 and 01.01.2012
G – registered values of the gravitational constant; n – weekly number of earthquakes with magnitude ≥ 5, smoothed with 8 - week averages

Fig. 5 shows a comparison of graphs for deviations from the gravitational constant and the earth's seismic activity between 01.01.2010 and 01.01.2012. The comparison of the graphs reveals their high similarity, with the seismic activity graph shifting two months forward in time (for clarity, the time axis of the seismic activity graph is shown as shifted two months backwards). The comparison results clearly demonstrate a possible relationship between the earth's increased seismic activity and different deviations from the gravitational constant, reflecting the distribution of tectonic waves.

Tectonic waves generated by deep energy processes at the level of the earth's lower mantle and outer core are carriers of the deep energy of the Earth in the form of alternate tectonic stresses to the lithosphere. Reaching the earth's crust, tectonic waves contribute to the increasing geodynamic activity of the Earth, which is reflected in the growth of seismic activity in compression (subduction and collision) and extension (oceanic and continental spreading) zones, as well as in transform fault areas. The two-month lag of seismic activity after the tectonic wave is registered can be explained by certain inertness of these processes. That is, from the moment the tectonic wave approaches the earth's surface to the moment when intensification of seismic processes begins, certain time is required for the accumulated tectonic stresses in earthquake focuses to cross the critical threshold needed to overcome the mechanical strength of the geological medium in the earthquake's focal zone.

So, tectonic waves travelling to the surface of the Earth from the outer core - lower mantle level are associated with the process of periodic release of the deep endogenous energy and act as an indicator showing that the intensification of tectonic processes has started, causing increase in seismic activity. Tectonic waves most probably act as a trigger mechanism, contributing to the beginning of discharge of tectonic stresses in earthquake focuses where they have reached a

critical level. Thus, the assumption about the possible effect of tectonic waves on intensification of seismic processes is validated by the comparison of the graphs in Fig. 5.

So, the following idea, in our opinion, can be considered most reasonable as a basic concept, which explains the global deviations from G observed at three points of the Eastern Hemisphere.

The source of the registered tectonic waves is presumably located at the level of the earth's outer core and lower mantle. Tectonic waves appearing as a result of a pulse emission of endogenous energy are carriers of deep energy of the Earth in the form of alternate tectonic stresses from the outer core to the lithosphere.
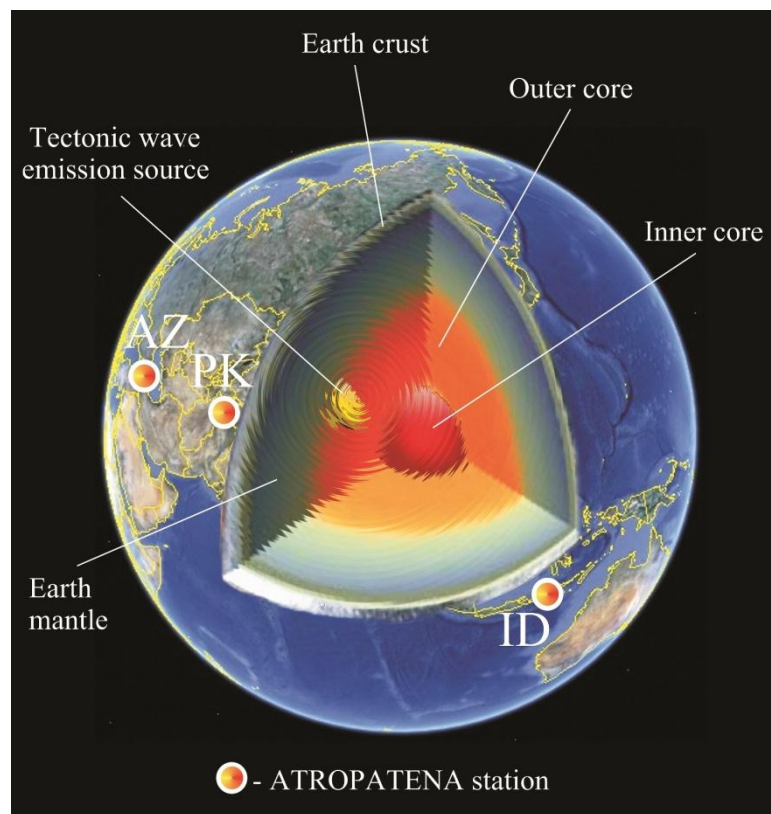
Fig.6. Diagram of possible model mechanism of emission and registration of tectonic waves AZ, PK and ID are ATROPATENA stations in Azerbaijan, Pakistan and Indonesia, respectively

The diagram in Fig. 6 demonstrates a possible model mechanism of endogenous energy release at the boundary between the outer core and the lower mantle, accompanied by emission of tectonic waves.

Deformation processes registered by the ATROPATENA stations in most of the Eastern Hemisphere may indicate the localization of their source at a great depth, at the level of the outer core and the lower mantle.

3. Metrological Problems of Registration of the Exact Value of G

Taking into account that tectonic waves constantly exist in the mantle and the crust, it is considered problematic to perform one-time precise registration of the gravitational constant in Earth's conditions, regardless of the accuracy of a measuring device and a measurement method. This is also indicated by the research findings by many authors (*6,13,15,19*). To calculate the exact value of the gravitational constant in Earth's conditions, long-term monitoring of ΔG in

different regions has to be carried out, preferably at spots as maximally distant from each other as possible. The mean ΔG value simultaneously measured over a long period of time by registering stations deployed at large distances from each other will make it possible to obtain the most accurate value of G in Earth's conditions.

4. Discussion and Results

The research findings have allowed the author to come to the following conclusions:

1. Large-scale deviations from the gravitational constant (ΔG) have been registered in the Eastern Hemisphere, which may be caused by tectonic waves. The source of the registered tectonic waves is presumably located at the level of the earth's outer core and lower mantle. Tectonic waves appearing as a result of a pulse emission of endogenous energy are carriers of deep energy of the Earth in the form of alternate tectonic stresses from the outer core to the lithosphere.

2. It is suggested to use deviations from the gravitational constant ΔG as a new physical parameter to be a source of additional information on geodynamic processes in the earth's interior.

3. The answer to the question about the possible causes of deviations from the gravitational constant ΔG registered by different scientists for many years has been found.

4. A comparison of graphs for deviations from the gravitational constant and the earth's seismic activity reveals their high similarity, with the seismic activity graph shifting two months forward in time. The two-month lag of seismic activity after the tectonic wave is registered can be explained by the fact that it requires time for the tectonic stresses in earthquake focuses to cross the critical threshold needed to overcome the mechanical strength of the geological medium in the earthquake's focal zone. Tectonic waves travelling to the surface of the Earth from the outer core - lower mantle level are associated with the process of periodic release of the deep endogenous energy and act as an indicator showing that the intensification of tectonic processes has started, causing increase in seismic activity. Tectonic waves most probably act as a trigger mechanism, provoking the beginning of discharge of tectonic stresses in earthquake focuses where they have reached a critical level. The cyclicity of geodynamic processes is a result of pulse emissions of endogenous energy.

5. The effect of constantly changing external masses formed by geodynamic processes in the earth's interior on the gravitational interaction of loads in the Cavendish balance makes it impossible to determine with high precision the value of the gravitational constant on the earth's surface at one measurement point. To calculate the exact value of G on the earth's surface, long-term monitoring has to be carried out with synchronized measurements at different registration points located as distantly from each other as possible.

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PRELIMINARY RESULTS OF ANALYSIS OF THERMAL SATELLITE AND GROUND BASED RADON DATA RECORDED PRIOR TO HARIPUR EARTHQUAKE, PAKISTAN

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Abstract

Radon gas production occurs continuously throughout the Earth's crust, but when an earthquake is imminent the production of radon decreases in the compression zone near the epicenter and increases in stretching zones away from the associated fault. The release of radon ionizes the surrounding air and creates near-earth plasma in the form of long-living ion clusters. These changes can be detected by both ground- and satellite-based instruments. Investigations throughout the world over the past 15 years provide evidence, which indicate that significant variations of radon concentration may occur in association with major geophysical events such as earthquakes and volcanic eruptions (Al-Tamimi and Abumurad 2001; Chyi et al. 2005; Fu et al. 2005; Walia et al. 2005, 2006; Yang et al. 2005; Singh et al. 2006; Kumar et al. 2009). Due to such observed correlation, radon is considered as one of the few promising precursors for earthquakes (Kumar et al. 2010). In the last decade, several studies have recognized the anomalous behavior of radon gas emission from Earth prior to an earthquake that could be the sign of an imminent earthquake. It is believed that the radon is released from cavities and cracks as the Earth's crust is strained prior to the sudden slip of an earthquake (Chung, 1985; Teng and Sun, 1986). Similarly, Satellite thermal infrared (TIR) imaging data, from sensors on board satellite platforms, have been reported to record thermal anomalies in epicenter and adjacent areas in the Thermal Infrared (8-14μm) spectral range prior to major earthquakes and associations with fault systems (Ouzounov et al., 2006). The identification of such thermal anomalies is difficult to record from the ground based stations for a large area. The satellite telemeters measure these phenomena quickly round the clock and cover a large area. The satellite data have not only revealed stationary (long-lived) thermal anomalies associated with large linear structures and fault systems in the Earth's crust (Carreno et al., 2001; Fizzola et al., 2004) but also transient (short-lived) features prior to major earthquakes (Tronin et al., 2004a,b; Tramutoli et al., 2005). These short-lived anomalies typically appear 4–14 days before an earthquake affecting the regions of several to tens of thousands square km. It displays a positive deviation of 2–4°C or more; and dies out a few days after the event. The thermal anomalies have also been observed at distances of 200–1000 km from the epicenters, between few hours to two weeks before the event occurred in China, Japan, Russia, Turkey, Mexico and Greece; (Liu et al., 2000; Tramutoli et al., 2001). In this paper we will present and discuss recorded radon gas anomaly along with variations in Thermal Infrared (TIR) transients and overall radiation field in the earthquake preparation zone prior to Haripur earthquake (m_b = 5.2, Lat: 33.871° N Long: 72.890° E, Oct 11, 2010).

Methodology and Data Sets

According to Planck's Law, each warm object on emits certain amount of thermal radiation at a particular wavelength depending on its temperature. For a much clearer picture, the relationship between Earth's surface, its brightness temperature and the spectral radiance can be understood by referring to Figure-1 (Lillesand and Kiefer, 2004).
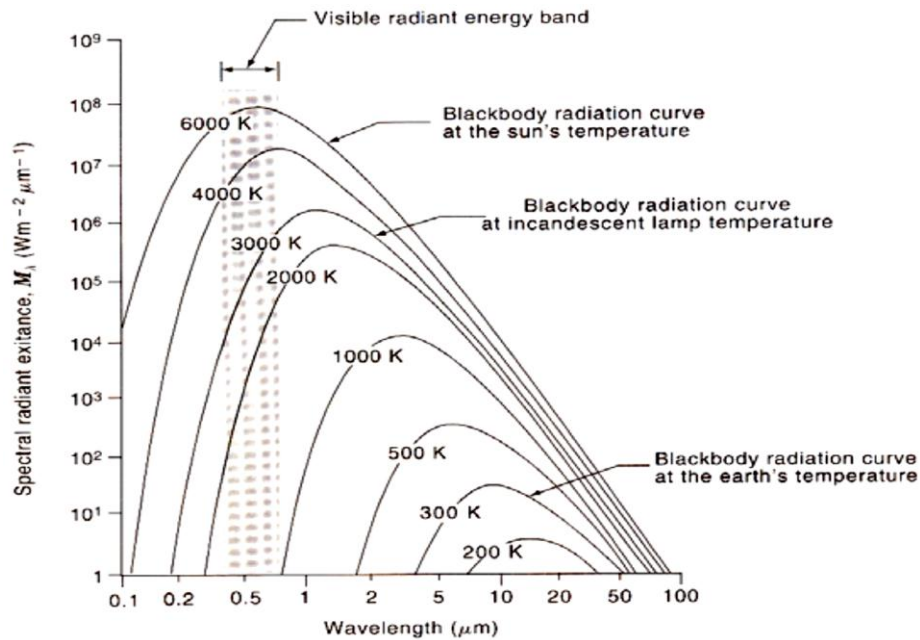
Fig.1. Black body radiation curves showing peak wavelengths at various temperatures

Satellite data of MODIS pertaining to calibrated radiance of cloud free day time was downloaded from the web site: http://laadsweb.nascom.nasa.gov/ for all the selected earthquake events. The grid of $3^o \times 3^o$ was selected in such a way that epicenter of each selected earthquake lies in the middle of the grid for the analysis. The radiance data of each day, one month before and after the occurrence of earthquake, was critically viewed to ensure the cloud free data otherwise it would represent the radiance of clouds not the earth's surface. The radiance values were converted to surface temperature values, which is more physically useful variable and is the effective at-satellite temperature of the viewed Earth-atmosphere system. The following conversion formula (Liu, 2002) is used.

$$ T = \frac{K_2}{\ln\left(\dfrac{K_1}{L} + 1\right)} $$

Where T is effective at-satellite temperature in Kelvin; K1 and K2 are calibration constant having value 666.09 Watts/ (meter2 * ster* μm) and 1282.71 Temperature degrees in Kelvin respectively and L is spectral radiance in watts/ (meter2 * ster * μm).

Results and Analysis

Analysis of radon data:

CES is in process of establishing a network of Radon monitors across Pakistan to monitor the Radon anomalous signals prior to earthquakes (Fig. 2). Radon counts are recorded with one hour interval at each station. Data was averaged out by using 24hrs moving average method. The Analysis of Radon data recorded at nearest station (Nurpur) shows that the average radon counts in the area is 2-3 Pci/l, which were significantly increased to 6-7 Pci/l 1-2 days before the occurrence of earthquake (Fig. 3).
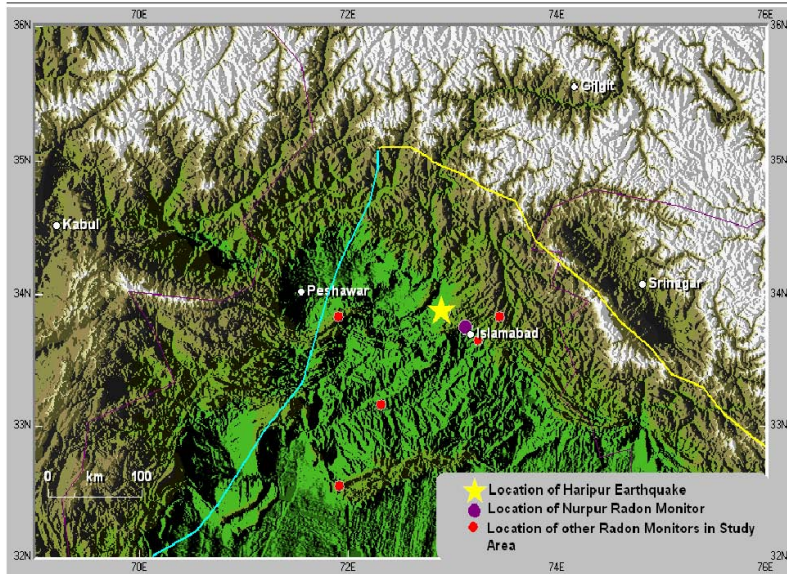
Fig. 2. Network of Radon monitors in northern Pakistan
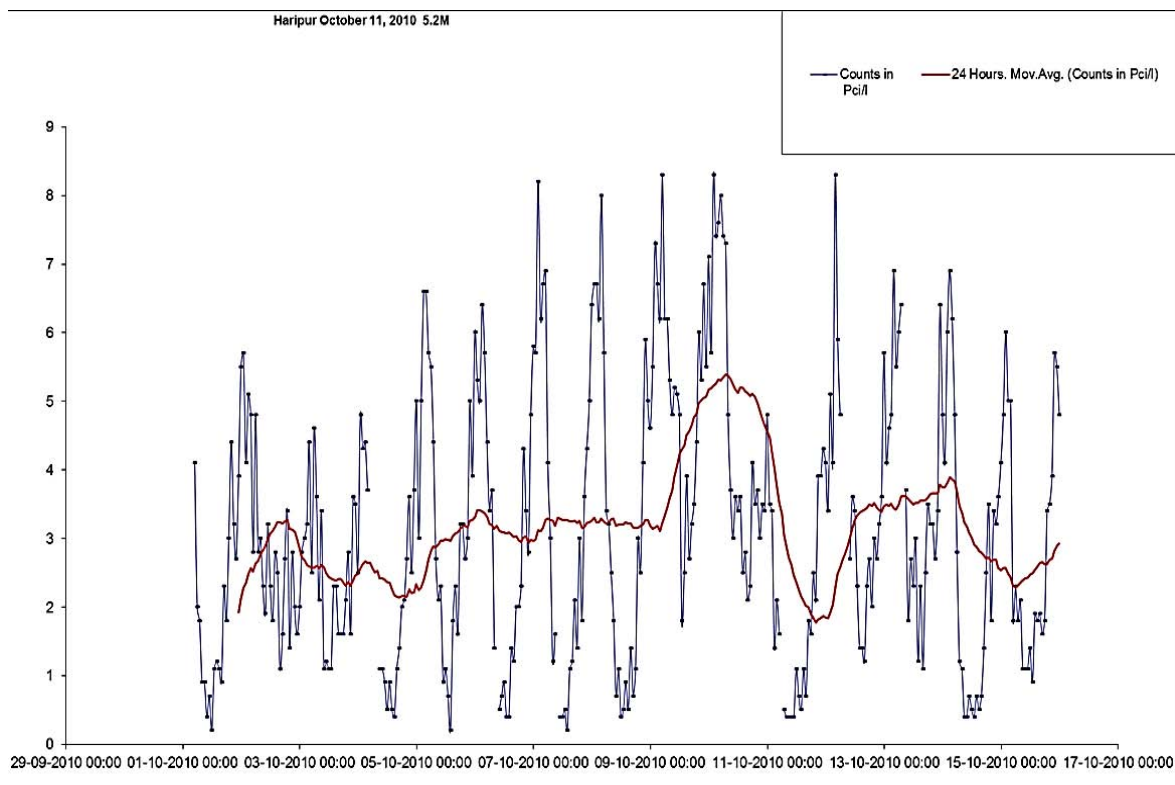
Fig. 3. Graph showing Radon counts in month of October, 2010

Analysis of TIR data:

Using ENVI software radiance values (minimum, maximum and average) and the corresponding surface temperature values were noted for all the processed data regarding the following earthquakes for analysis. As the normal temperature of the study area is not available we assume that minimum value of radiance/temperature is normal in the preparation zone for this study.

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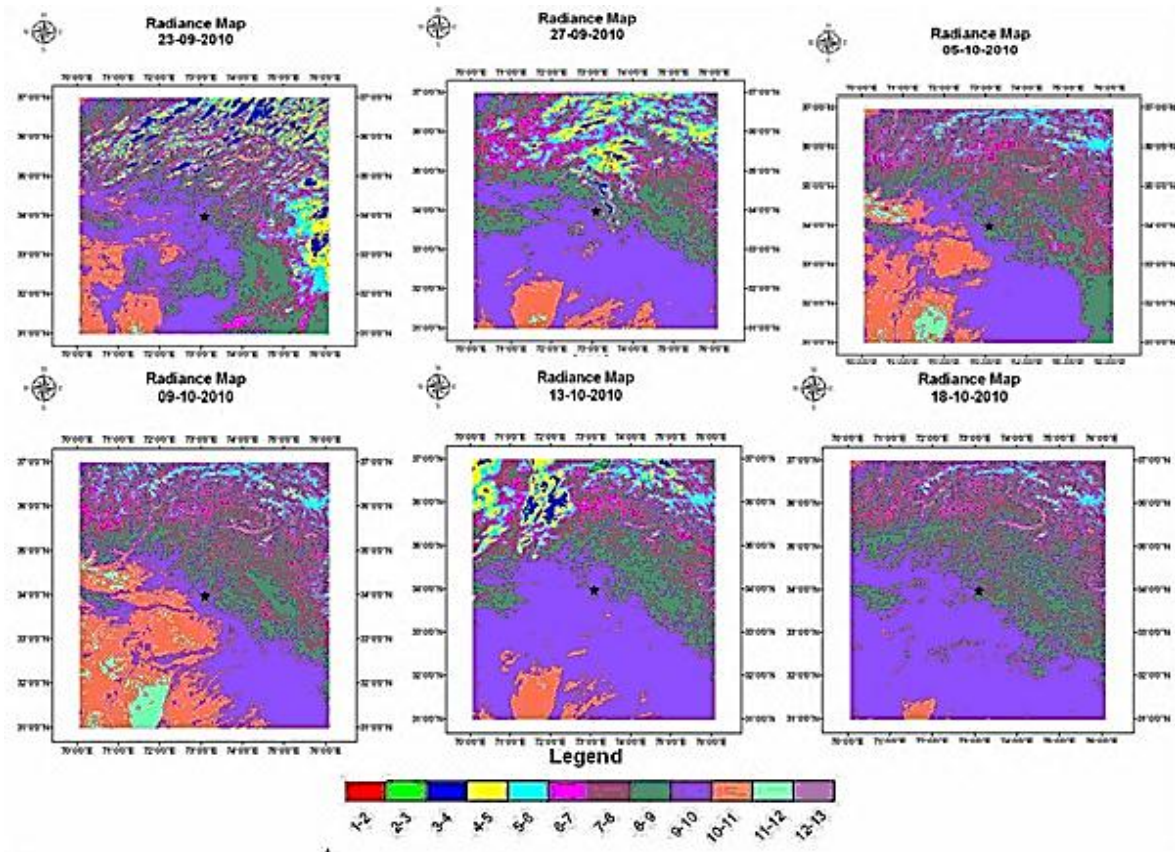
Fig. 4. Radiance values before and after the Occurrence of Haripur Earthquake

Table 1.

Radiance and Temperature values before and after the Occurrence of Haripur Earthquake

Date	Minimum value of radiance	Maximum value of radiance	Average value of radiance	Average Temperature Celsius
23-09-2010	2.50	11.85	7.82	15
27-09-2010	2.66	11.13	8.20	18
05-10-2010	3.82	11.79	8.75	22
09-10-2010	**3.54**	**11.61**	**8.89**	**23**
13-10-2010	2.18	11.03	8.36	19
18-10-2010	3.77	10.97	8.72	22

From the analysis of processed satellite data for radiance (Fig. 4) and surface temperature values for Haripur earthquake it was observed that the minimum average value of radiance/temperature in the ROI (Region of Interest) was 7.82/15 on September 23, 2010 which increased significantly and reached at maximum, 8.89/23 on October 09, 2010. It shows the energy concentration in the epicenteral region before the occurrence of earthquake. After the occurrence of earthquake the average value of radiance is decreased significantly i.e. 8.36. The radiance and corresponding temperature values before and after the occurrence of Haripur earthquake is given in Table-1 and corresponding graph is given in Fig. 5.

37
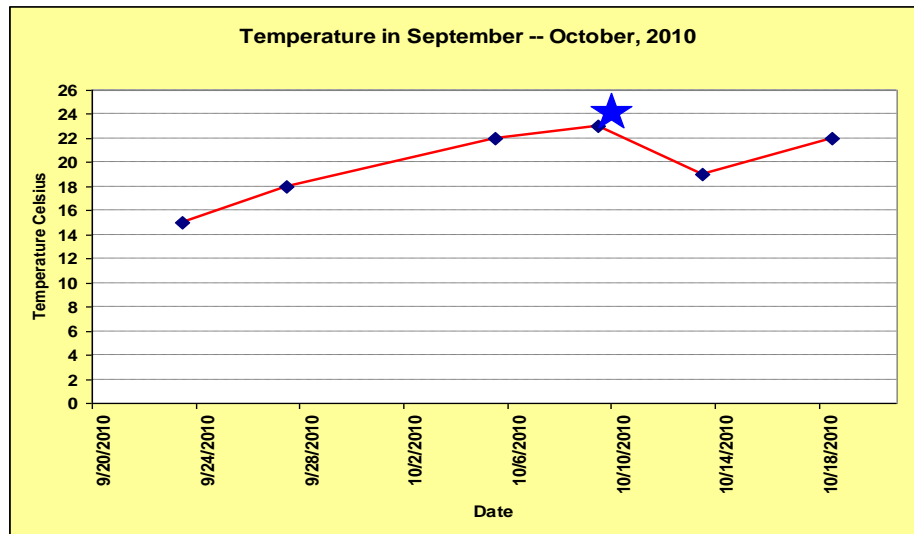
Fig.5. Variation of surface temperature before and after the Haripur earthquake

Conclusions

Analysis of Radon data reveals that the radon values increased from 2-3 Pci/l to 6-7Pci/l, 1-2 days before the event. From satellite-based study of anomalous behavior of thermal infrared radiation for Haripur earthquake, it has been observed that average temperature of earthquake preparation zone was convergent to highest level about 5–6 days before the earthquake. The average temperature also manifest decreased trend just 1–2 days before the earthquake and attains its normal value after the occurrence of earthquake. The variation of surface temperature from 1 to 5ºC was observed and maximum radiative energy was shifted towards the epicenter during this period. The location of epicenter was found within the anomaly area. The observed thermal anomalies confirmed the association with studied earthquake. Moreover, if the record of normal temperature of a specific region is available, then in case of thermal anomaly, the occurrence of impending major earthquake may be assured.

Acknowledgements:

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Human and Nature

PHYSIOLOGY AND EARTHQUAKES

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Aim. To determine whether there were any changes in systolic (S) and/or diastolic (D) blood pressure (BP) and/or heart rate (HR) in relation to the 2011 Tohoku megathrust earthquake and tsunami.

Background

Bracketing the 12 May 2008 Wenchuan magnitude 8.0 earthquake in China, locomotor activity of mice monitored automatically around-the-clock was found to be dramatically decreased in 6 of the 8 animals on day 3 before the earthquake, the behavioral change lasting 6 days (1). Analyses of concurrent geomagnetic data showed a higher total intensity during the span when the circadian rhythm in activity was dampened (1). Unusual murine behavior has also been reported prior to the Kobe earthquake on 17 January 1995 (2), consisting of drastic increases in locomotor activity both during the rest and active spans. Abnormal behavior in fish, snakes, dogs, frogs and mice before an earthquake has been reported (3-5). Changes in groundwater chemistry prior to seismic events have been considered to account for their possible effects on

animals (5, 6). Most accounts of changes in animal behavior remain primarily anecdotal, however, with only few exceptions (1, 2). In humans, the literature has primarily focused on consequences from cataclysms such as earthquakes on health risks. For instance, earthquake-induced potentiation of acute risk factors has been reported in hypertensive elderly patients and the question has been raised whether cardiovascular events may be triggered after a major earthquake (7). By 1948, the incidence of hypertension has been reported to increase following events such as the Texas City disaster, a deadly industrial accident that took place on 16 April 1947 and began with a mid-morning fire on board a vessel docked in that city's port (8). Reportedly, the majority of these victims showed definite although not prolonged diastolic hypertension (8). In a case-control study, somatization (hysteria) and anxiety were positively correlated with hypertension in flood victims of hurricane Agnes (9). BP elevation associated with mental loads following a natural disaster could, in turn, increase mortality from cardiovascular disease (10, 11). This investigation draws on the ongoing self-surveillance of BP and HR for health monitoring by several individuals to seek any changes that may have either followed or perhaps preceded the onset of an earthquake.

Subjects and Methods

Thirteen Japanese residing in Tokyo were measuring their BP and HR around-the-clock at 30-minute intervals for 7 days bracketing the magnitude 9.0 Eastern Japan Great Earthquake Disaster (EQ) that occurred at 14:46 on March 11, 2011, striking the northern part of Japan from Iwate to Ibaraki Prefectures. Strong tremors in Tokyo measured upper 5 on the Japanese seismic intensity scale of 7. A model consisting of cosine curves with periods of 24 and 12 hours was fitted to the data, separately for each calendar day and also for each day relative to the time of occurrence of the earthquake. The daily standard deviations (SD) of HR and estimates of MESOR (Midline Estimating Statistic Of Rhythm, a rhythm-adjusted mean) and amplitudes of the 24-hour and 12-hour components were normalized for each profile and the relative values analyzed by one-way analysis of variance across the 13 subjects testing for any day-to-day differences. Similar analyses were conducted on two sets of data serving as controls. One set consisted of data from 11 similar patients monitored during previous years at about the same calendar date (mid-March). Another set stemmed from data from one of the study participants (YW) who has been monitoring himself for over 20 years. Week-long profiles in mid-March from 11 prior years were used as an additional control from the same individual. The two sets of data hence provided both a transverse and a longitudinal control. As the 2011 earthquake occurred on a Friday, Friday was chosen as the reference "event" day to account for any weekly pattern known to characterize BP and HR (12-14) as well as the incidence patterns of adverse cardiovascular events (15).

Results. The SBP data, expressed as a percentage of the 7-day mean, and averaged across subjects are shown in Figure 1 for the 13 subjects monitored in March 2011 and for the transverse and longitudinal controls. Based on analyses of 7 calendar days, day 4 being the day when the earthquake occurred, the 12-hour amplitude of SBP was decreased 2 days prior to EQ (F=3.903, P=0.002), a feature not observed in the controls. The 12-hour amplitude of HR was increased 3 days prior to the earthquake and decreased the day after it struck (F=2.724, P=0.020). Albeit not statistically significant, a somewhat similar pattern was found for the two sets of controls. When considering 3 days prior to the time of the earthquake and 3 days thereafter, ANOVAs confirmed an increased 12-hour amplitude of HR on day 2 prior to the event and a decrease on day 2 after it occurred (F=2.797, P=0.024). Again, a similar pattern was observed for the two sets of controls, albeit results on controls only reached borderline statistical significance.

A progressive increase in the MESOR of HR peaking 1 day after the earthquake was of borderline statistical significance (F=2.103, P=0.076), Figure 2. The corresponding pattern of controls was also found to be non-random, similar for the transverse (F=2.279, P=0.059) and longitudinal (F=2.978, P=0.020) controls, but different from that seen in relation to the earthquake. Instead of a steady increase in HR-M, a peak on day -2 was followed by a trough on day -1, in keeping with a Wednesday peak associated with the circaseptan component.

As seen from Figure 3, the HR-SD was larger before the earthquake and started decreasing on day 2 after the earthquake (F=2.486, P=0.040). As for HR-M, a statistically significant non-random pattern was observed for the transverse controls but this pattern, similar to that seen in the longitudinal control, differed from the pattern in March 11 associated with the earthquake. Again, the controls showed a Wednesday peak likely associated with the expected circaseptan variation.

Particularly noteworthy is the steady increase in the MESOR of SBP, reaching a peak on the first day after the earthquake (F=3.157, P=0.013), Figure 4. Patterns in the controls were not statistically significant and showed primarily no noticeable change over the 6 (Figure 4, right) of 7 (Figure 4, left) days.

Discussion and Conclusion

Comparing patterns of the different endpoints among the three datasets, characteristic features associated with the 2011 earthquake, not seen in the controls, include a steady increase in the MESOR of both SBP and HR preceding the earthquake and peaking one day after the disaster and a drop in the SD of HR starting on the second day after the earthquake. Whereas the latter effect may be a response to the disaster and may contribute to an increase in cardiovascular disease risk, in keeping with earlier reports (7, 10, 11), a decreased HR variability being a risk factor (16), the increase in both SBP and HR preceding the earthquake is a novel finding in humans, akin to earlier observations of precursor signs made in animals (1-3). The question has been raised whether the 12-hour component may represent a rhythm in its own right rather than being merely a harmonic of the circadian rhythm (17).

Whereas this is a valid question, convincing evidence is hard to find. The different patterns of resynchronization of the 24-hour and 12-hour components of BP and HR after crossing several time zones do not necessarily prove that the 12-hour component is independent from the 24-hour component. An advance versus delay observed for the two components can be expected when the transmeridian flight involves more than 6 time zones as was the case between Minnesota, USA and St Petersburg, Russia (9 time zones) (17).

The higher sensitivity of the 12-hour over the 24-hour phase change following a change over only 3 time zones, as observed in a study involving travel from Minnesota to the Artic Circle, is also expected as it involves a larger phase angle (18), but this greater sensivity of the 12-hour versus the 24-hour component may deserve scrutiny in any other data sets, retrospectively and prospectively. Continuous physiological surveillance could serve not only for primary prevention in healthcare but also as a way to monitor the antecedents of cataclysms in the environment. Monitoring on a broader scale in different geographic locations can yield signals that may eventually serve as a warning. If found to be amenable to generalization in different populations at different times, the data may be particularly welcome to those seismologists who hold the view that earthquakes are unpredictable. The biosphere needs to be tested for use as a very sensitive frequency-dependent magnetometer.
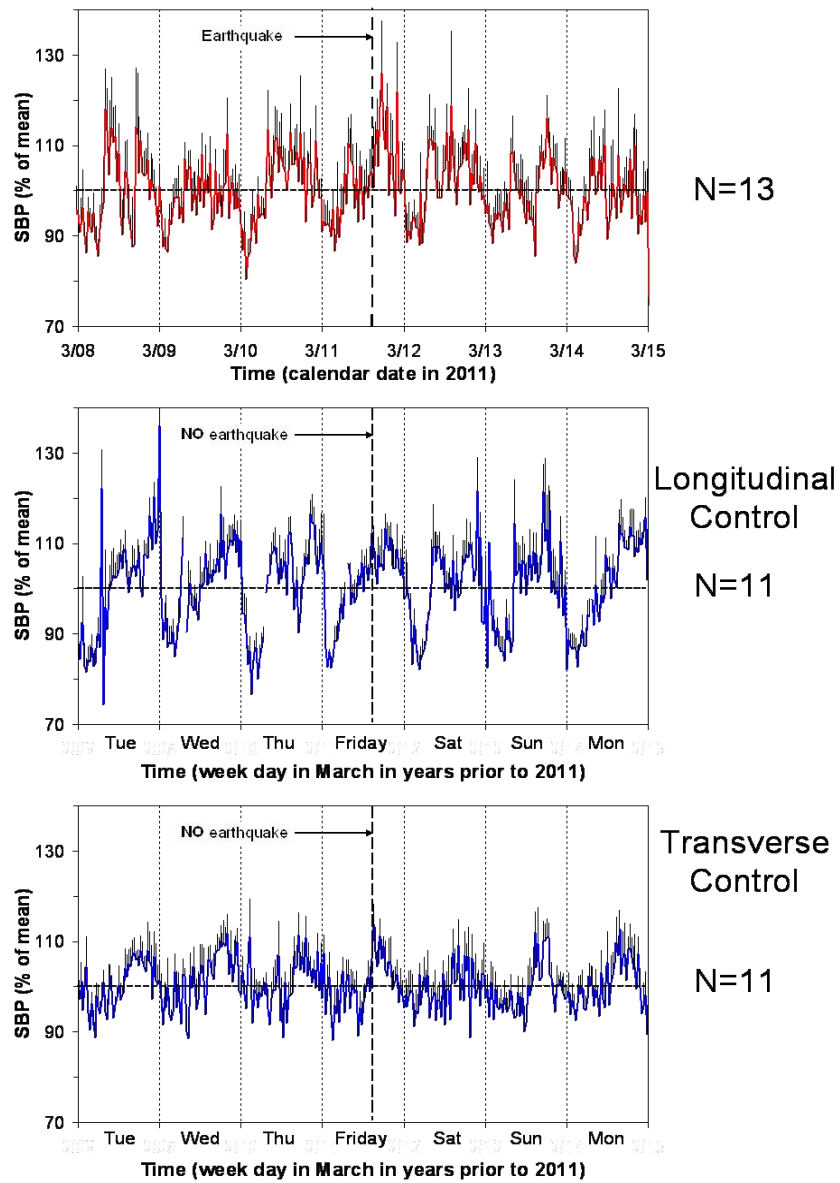
Fig. 1. © Halberg
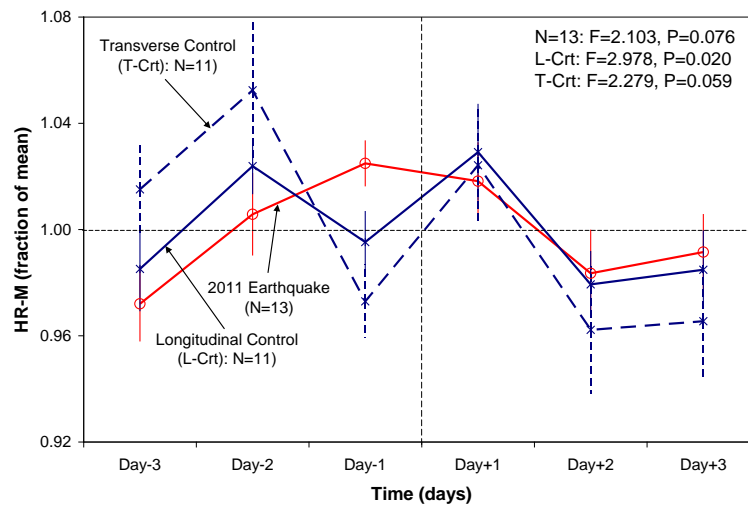
Fig. 2. © Halberg
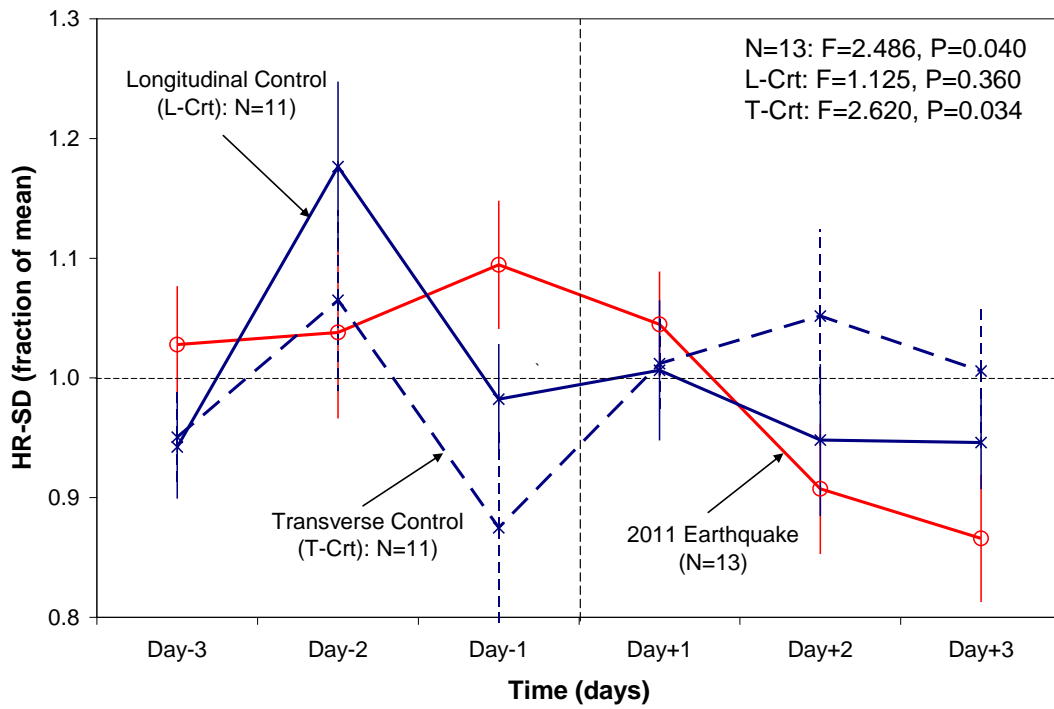
Fig. 3. © Halberg

MESOR (M) of Systolic Blood Pressure (SBP) from 13 Subjects Bracketing 2011 Earthquake (top) Compared with 11 Controls Monitored in Prior Years (bottom)
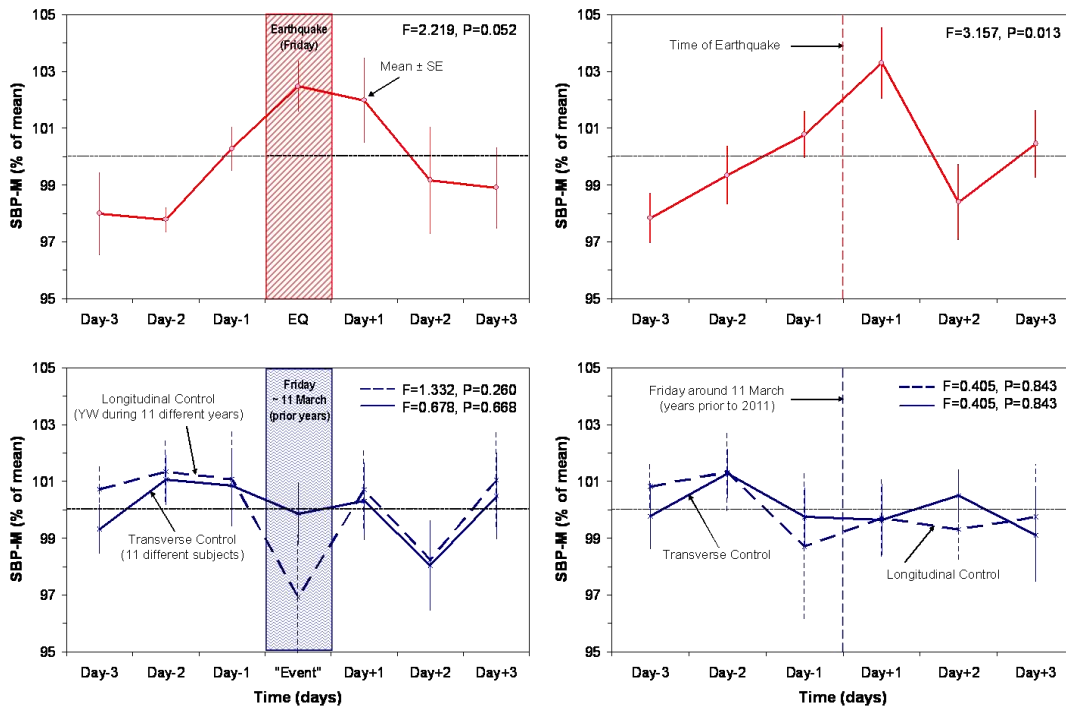
Fig. 4. © Halberg

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META-ANALYTIC HISTORY OF CONGRUENT CYCLES IN SPACE WEATHER, THE HUMAN MIND AND OTHER AFFAIRS

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We need tools for understanding, predictions, alerts and the rational design of countermeasures of societal cataclysms, such as terrorism and war, and of natural disasters such as earthquakes, and may find these tools in data collected to avoid personal cataclysms such as massive strokes. In the same data, antecedents of the cataclysms, in the form of time structure alterations not found in various controls, may be sought. These could prompt the evasion of natural disasters and perhaps the avoidance of other man-made cataclysms. With historical data meta-analyzed herein, mapping the time structures of terrorist acts and of a host of environmental variables leads to putative triggers affecting the mind of populations, analyzable as cycles in individuals (9). Cycles in aggression and their periodic counterparts in our environment, far as well as near, currently (with notable exceptions; 1, 2) ignored in the West, have long been recognized in importance in Russia and its associated states (3-7). Yet in England, already in 1801, Sir William Herschel had raised concerns about the consequences in human and other earthly affairs, including crops, of an "ill-disposed" sun (8). Apart from the foregoing reasons, basic science needs to monitor not only the weather on earth and in extraterrestrial space, but also the consequences of space weather in populations and individuals. The mechanism involved can be studied at the cost of computer-aided self-surveillance for avoiding a stroke.

According to The Lancet, "public health systems were transformed on September 11, 2001, from an unappreciated utility to a central component of [we add "inter-"] national security" (10). Security requires more than training police officers and personnel at airport or border checkpoints, and ascertaining that a given white powder cannot spread anthrax. Forecasting or nowcasting weather in extraterrestrial space (e.g., 11, 12) for consequences on earth, preferably in the light of yet-to-be-extended investigations of environmental nonphotic (magnetic)-biospheric associations, may also be considered as a feature of international security in the light of accumulating evidence reviewed herein, within the scope of global concerns for populations coping with crime and broader aggression.

Public health systems (along with homeland and international security agencies) could routinely tackle much more than mere storage and descriptive reports of epidemiologic data. Automatized systematic monitoring with sequential testing of time structures of natality, morbidity and mortality statistics from various causes could complement monitoring of blood pressure and heart rate for personal self-surveillance. The pool of the same aligned physiological, epidemiological and physical environmental data could be examined for any role of space weather in human-made and natural cataclysms and may thus lead to countermeasures for

societal health care. Education could achieve implementation of computer-aided self-surveillance of psychophysiological variables for strain assessment, vascular variability anomalies' detection and for the prevention of diseases such as stroke. As a dividend, by analyses of the same data, an indispensable international security system for alerting and preferably avoiding September-11-like events may be sought.

The importance of marked seasonal changes in environmental light and temperature notwithstanding, analyses of databases on terrorism reveal (in spectra) the absence thus far of a calendar-yearly component and the worldwide dominance of transyears (cycles with periods whose 95% confidence interval does not overlap the 1.00-year length, constituting a broad band around 1.3 years, drifting in the region ranging from 1.061 to 1.7 years. In 5 of 9 geographic locations at the precise calendar year length, there are actually spectral valleys rather than peaks, Table 1. In various biospheric data sets, nonstationary spectral peaks (periods, □) correspond to those known to characterize changes in solar activity and/or geomagnetic disturbance. They can be validated by several glocal inferential statistical approaches (i.e., by combining the [global] analysis of a time series as a whole with a [local] analysis of consecutive sections of the series as a function of time).

Based upon paired, since congruent, biospheric and environmental spectral components, one can compare the behavior of cycles in and around us and test any effect in the biosphere of the subtraction (damping of the amplitude, A) and addition (amplification of A) in frequency bands of an environmental spectral component, if not by complete disappearance or replacement of an environmental spectral band (9; cf. 29).

Table 1.

Mostly transyear prevalence in spectra of terrorism incidence gauged by annual vs. para-annual amplitudes

Geographic region	N of incidents	Amplitude*		Amplitude ratio**
		$\tau_1 \equiv 1$ year	$1.75 < \tau_2 < 1.061$ years	
Local				
Middle East/Persian Gulf	16977	0.026 (0.996-1.023)	0.216 (1.39)	8.85
South Asia	6464	0.073 (1.006-1.122)	0.069 (1.47)	0.91¶
Western Europe	5801	0.007 (valley***)	0.045 (1.71)	6.43
Latin America	3816	0.016 (0.985-1.022)	0.047 (1.24)	2.94
Southeast Asia/Oceania	3051	0.021 (valley)	0.059 (1.72)	2.81
Eastern Europe	1652	0.005 (valley)	0.032 (1.18)	6.4
Africa	1499	0.009 (0.986-1.024)	0.021 (1.05)	2.33
North America	604	0.005 (valley)	0.011 (1.58)	2.2
East & Central Asia	259	0.002 (valley)	0.006 (1.68)	3.0
Global				
Whole world	40122	0.089 (0.973-1.007)	0.251 (1.70)	2.82

*Amplitudes (A, measures of extent of change) at periods, τ, of exactly 1 year (τ_1) and at a peak, τ_2, in a region of periods longer than 1.0 year and shorter than 1.75 years (transyears);

**Ratios of As of transyears vs. calendar years

***Valley: no confidence regions according to Marquardt for any As overlapping 1 year. In this case the conservative 95% confidence interval of τ near exactly 1.00 year, does not cover that precise year length.

A transyear characterizing the incidence of international terrorism is prominent when this component is more strongly expressed in non-photic environmental variables. As an "addition approach", the appearance of a statistically significant transyear in solar wind speed (SWS) or in the antipodal geomagnetic index (aa) is followed, with a lag, by a statistically significant transyear (at the same 1.33-year τ).
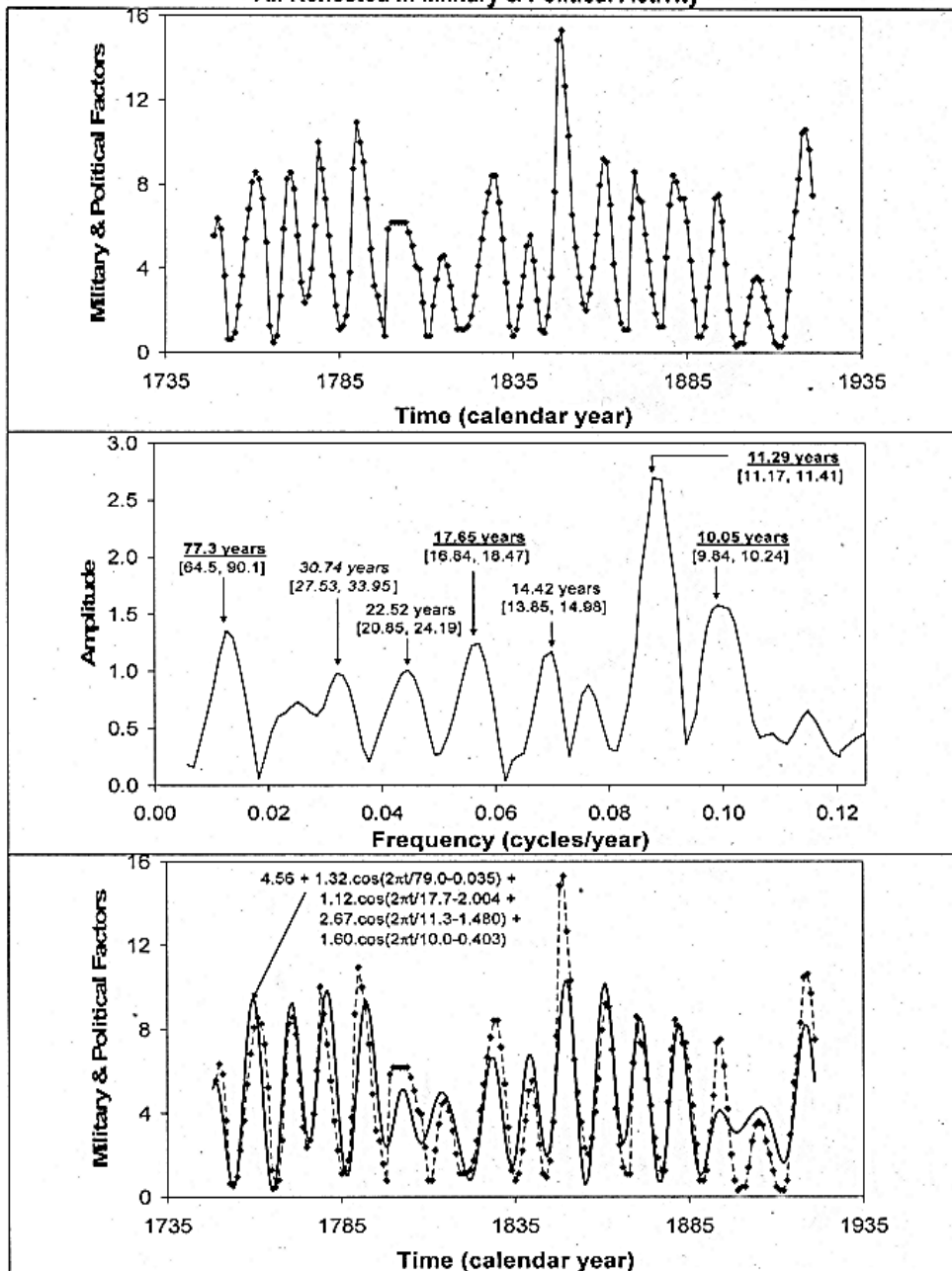
Fig. 1. Data on military and political factors during 1749-1921 assembled by Alexander Leonidovich Chizhevsky (top) were analyzed by the nonlinearly extended cosinor. A least squares spectrum (middle) identifies peaks that happen to correspond, among others, to known solar activity cycles (and a candidate of 14.42 years). Periods are resolved with their tentative uncertainties as 95% confidence intervals listed in₁₀ A model based on four of the components detected spectrally approximates the original data (bottom). © Halberg.

A subtraction approach in an individual's record of systolic blood pressure can be applied to data obtained as a dividend from serving primarily for personal self-surveillance aiming at the

prevention of strokes and other personal adverse events. The same self-monitoring data, analyzed cost-effectively, immediately contribute useful marker variables for as-one-goes associations with forecasts and nowcasts of space and terrestrial weather, including magnetism, and for the recognition of potential threats to national and international security.

Both an addition and a subtraction approach document an association of the prominence of an about (~) 7-day (circaseptan) component in heart rate with a similar component in solar activity by its amplification in the presence and damping, but not disappearance, in the absence of a solar circaseptan. Thus, the study of cycles represents a timely approach to the background of old knowledge.

Background

The facts that there are sometimes spots on the sun and that a (magnetic) force acts on a needle may have been known to the ancient Chinese (13, 14), and sunspots were familiar to the ancient Romans. In Ferrara in 1651, Giovanni Battista Riccioli (13) surmised that a coincidence might exist between sunspots and changes in terrestrial weather. That aurorae cycle (15), as do sunspots, gained in interest once their circadecadal rhythms were recognized (16, 17) and thereafter ~33-year (18-22) and ~22-year (23) changes were recorded.

Eduard Brückner extrapolated that a paratridecadal cycle may be responsible for immigration into the USA from Europe and for the westward migration within the USA (24). Chizhevsky summarized, succinctly yet poetically, that life on earth is an echo of the sun (3; cf. 4) -- "Peut-être même nos sentiments et nos pensées ne sont-ils qu'un faible écho de ces vibrations du cosmos .... Involontairement, une antique idée nous vient à l'esprit: notre connaissance des phénomènes de la nature ne serait pas autre chose qu'un écho, reçu par nos organes, des processus réels de l'univers" ("Perhaps even our feelings and thoughts are just a weak echo of the vibrations of the cosmos .... Involuntarily an old idea comes to mind: Our knowledge of natural phenomena will not be different from an echo, received by our organs, of the real processes of the universe") (25).

For his scholarly descriptive statistics, Chizhevsky was rightly offered a Nobel Prize, which Stalin forbade him to accept. Our meta-analyses of his data included in Figure 1 inferentially statistically validate his broad perspective and his reference to military and political affairs is further supported with data sets added by Suitbert Ertel (1), Raymond Wheeler (26), Miroslav Mikulecky (2) and Pavel Grigoryev et al. (6).
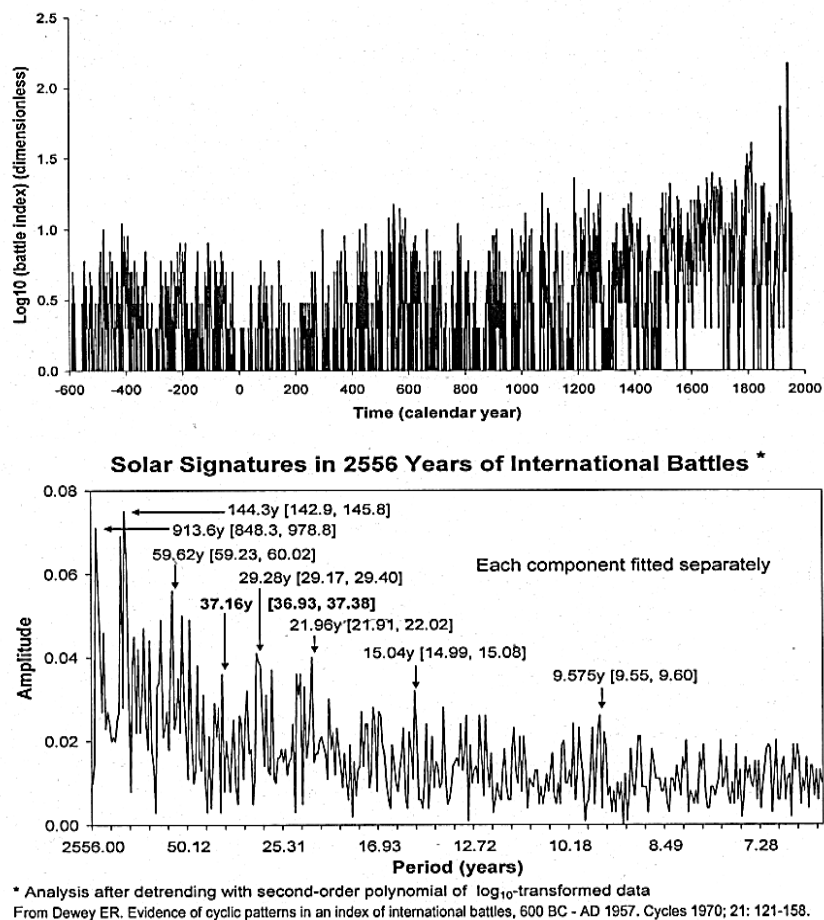
Fig. 2. Solar signatures in international battles from 599 BC to 1967 AD. Original data of Raymond Holder Wheeler (26) transformed into a spectrum looking for periods that the unaided eye cannot all find. © Halberg.

Chrono-Meta-Analyses

Chizhevsky's original data shown in Figure 1 (top row) reveal in our meta-analysis (second row) components all found in solar activity. A multiple-component model provides a good fit (bottom row). In 1982, Boris Vladimirskiy considered atmospheric infrasonics as a possible factor transmitting the effect of solar activity on the biosphere (5). Whatever the non-photic mechanism involved, we propose a complementary mandate for public health systems in general and strive in particular for the paradox of achieving a truly personalized computer-aided health care practice, with the use of the same data flowing (from individuals' cost-free self-surveillance) into a monitoring of a population's mass psychophysiology complementing the concomitant sequential analysis of natality, morbidity and mortality, in order to track solar activity with repeated passes over the accumulating database for the assessment of longer and longer periods, known to modulate psychophysiology and epidemiology (9). This tracking is also done by the meta-analysis of international battles, Figure 2.

Nelson et al., in their Global Consciousness Project, a large-scale network type system of the Princeton Engineering Anomalies Laboratory, noted correlations of continuous random data with major world events (27). This project reported reliable yet small changes in the output of up to

70 widely distributed random event generators (REG) in association with life-threatening situations experienced by groups of individuals. Wendt (28) analyzed nearly 250 events spanning solar cycle 23 (1998-2007) in the framework of polarity of the interplanetary magnetic field (IMF). He found associations between entropy changes of the REG output when it coincides with the groups' emotional arousal and a composite measure of the IMF polarity during the prior Bartels (about 27-day) synoptic solar rotation. Most substantial effects were reported for human violence such as bombings, assassinations and warlike acts (r=0.648, P<0.001). Results change little with different classifications of regions or types of violence.

Prominence of Transyear over Calendar Year in Incidence of International Terrorism
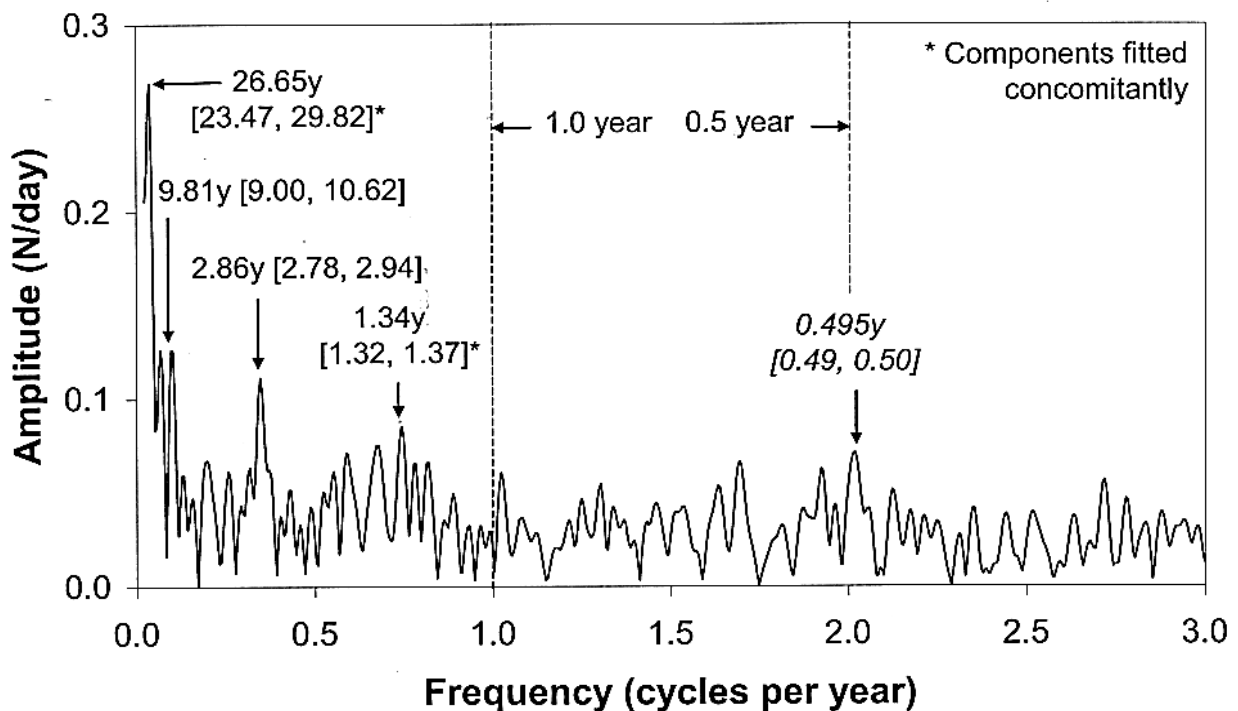
95% Confidence Intervals in [ ] indicate statistical significance

Fig. 3. Analyses by the extended cosinor of the incidence of terrorist acts (assessed monthly and expressed in number of cases per day) in a Memorial Institute for the Prevention of Terrorism (MIPT) database indicate cycles of nonphotic rather than photic solar origin. Whereas an anticipated yearly component is not detected in the least squares spectrum, a cycle with a period of about 1.3 years similar to changes characterizing solar wind speed and geomagnetic disturbances is validated statistically by nonlinear least squares, as shown by the 95% confidence intervals listed in [ ] for the period estimates obtained by nonlinear least squares. © Halberg.

In an attempt to examine the mostly unseen, non-photic effect of space weather while avoiding uncertain correlations among cyclic variables, the relative prominence of yearly vs. para-yearly spectral components is a major topic of this note. A transyear characterized the incidence of violence and/or terrorism in the Princeton database (51 events during 1998-2007) (9). A yearly component was not detected, also using the Memorial Institute for the Prevention of Terrorism (MIPT) database, Figure 3, suggesting that non-photics may have a larger influence on terrorism than the yearly (seasonal) changes in light and temperature. Using data on suicide terroristic attacks in Israel, Iraq and Afghanistan (1062 cases, 1994-2008), Grigoryev et al. reported that

geomagnetic activity significantly increased (P<0.0001) on the day of attack and that interplanetary magnetic field polarity "tends to change on the day before attack (P<0.03)" (6).

Transyears, Cycles Longer than a Year, No Calendar Year, in a US President's Popularity (2002-2007) *
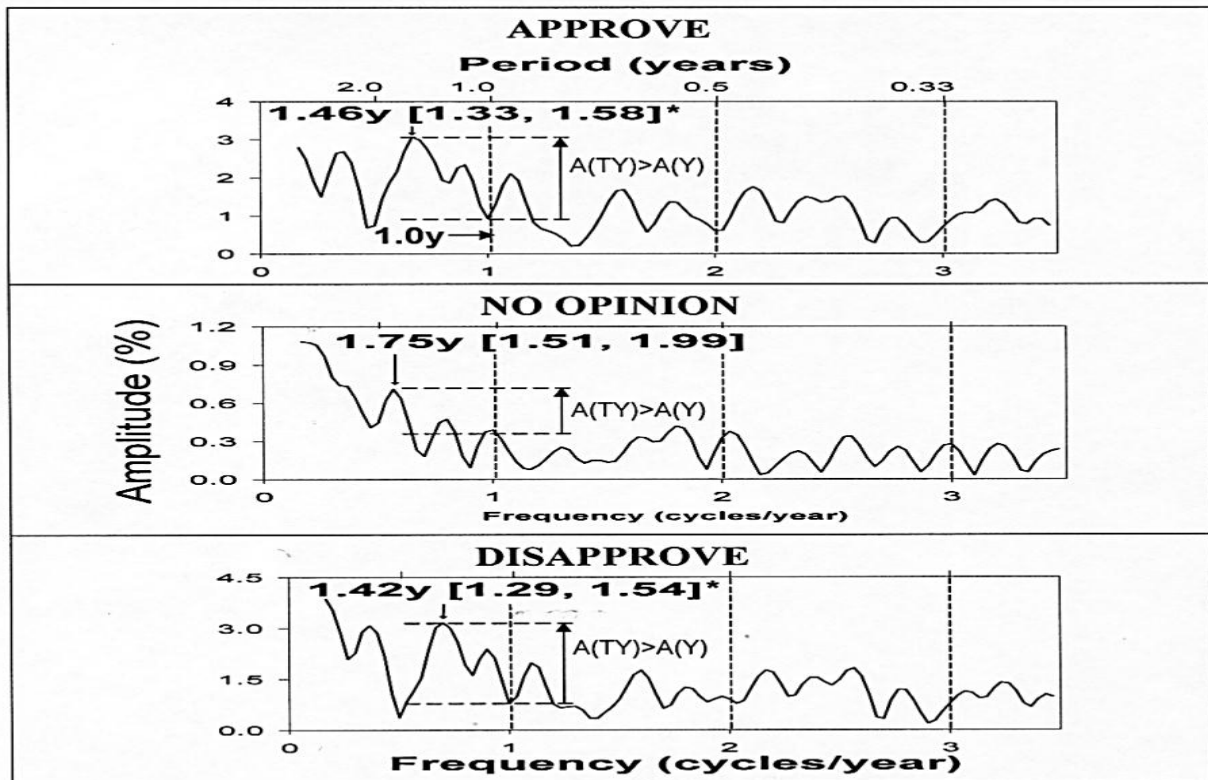
* Results from the extended linear-nonlinear cosinor obtained after linear detrending of Gallup polls during last 6 years. Note replacements of (absent) photic-thermic-social calendar-year component by statistically significant non-photic cycles.

"*" next to period estimate, listed with CI (95% confidence interval) in [ ], indicates statistical significance (P<0.05) of transyear, which is similar for approvals and disapprovals, and longer for no-opinions. CIs of the 3 transyears overlap and no calendar-yearly component is detected with statistical significance in the spectra. Clearly transyears in the example of political affairs replace any effect of the seasons.

Fig. 4. Entries in this graph are percent of samples, each of about 1,000 respondents, who approved, disapproved or offered no opinion, respectively, about the president's overall performance over his tenure to the date of a Gallup poll. An excursion around the overall trend at the beginning of the record may be related to the 9/11 terrorist attacks of 2001. The inclusion of these data might bias the detrending and results, hence the data actually used are limited to the following 6 years (polls between Feb. 2002 and Dec. 2007). Regression lines fitted to the latter or the complete series differ only slightly. Residuals from the linear trend fitted to the 6-year data were analyzed by the extended cosinor in linear-nonlinear rhythmometry. Periodograms reveal that approval and disapproval rates show neither a calendar-year nor a half-year component. Instead, both response classes exhibit a transyear, with a period of ~1.4 years. Earlier work suggested ~1.3 years as frequent markers of solar dynamics. Using 1.3 years as the initial value, the nonlinear analysis yields period estimates and 95% confidence intervals of respectively, 1.46 [1.33, 1.58] years and 1.42 [1.29, 1.54] years for the approval and disapproval ratings. No reliable trend could be detected in the No Opinion responses. The one-year spectral peak visible is not statistically significant. Apart from a long-term trend which cannot be assessed from the available records, the largest spectral peak corresponds to a period of 1.75 [1.51, 1.99] years. This 95% confidence interval slightly overlaps the period's uncertainty of the approval and disapproval responses. © Halberg.

Our analyses of the incidence of international terrorist acts during Feb 1968-Mar 2007 (downloaded from www.tkb.org/) identified several transyear spectral peaks (9). Of particular interest was the presence of an ~1.3-year component similar to that characterizing solar wind speed and the absence of a calendar yearly variation. As shown in Figure 3, the ~1.34-year component is but one of several peaks in this spectral region, whereas at precisely one cycle per year, spectral power reaches a trough as it did in political affairs, including the popularity in a Gallup Poll of a U.S. president (Figure 5).

Additions and Subtractions (loss and replacement) of Spectral Components in and around us, Based on 14,579 Cases of Terrorism in 39 years (B and A, row 3) and Systolic Blood Pressure (C, row 2)

Aeolian behaviors of solar wind speed (SWS), geomagnetism (aa), and terrorism (MIPT) reveal a far-transyear in the absence of a dominant calendar year (*); about 1.33-year component in terrorism lags with intermittent statistical significance behind SWS and aa
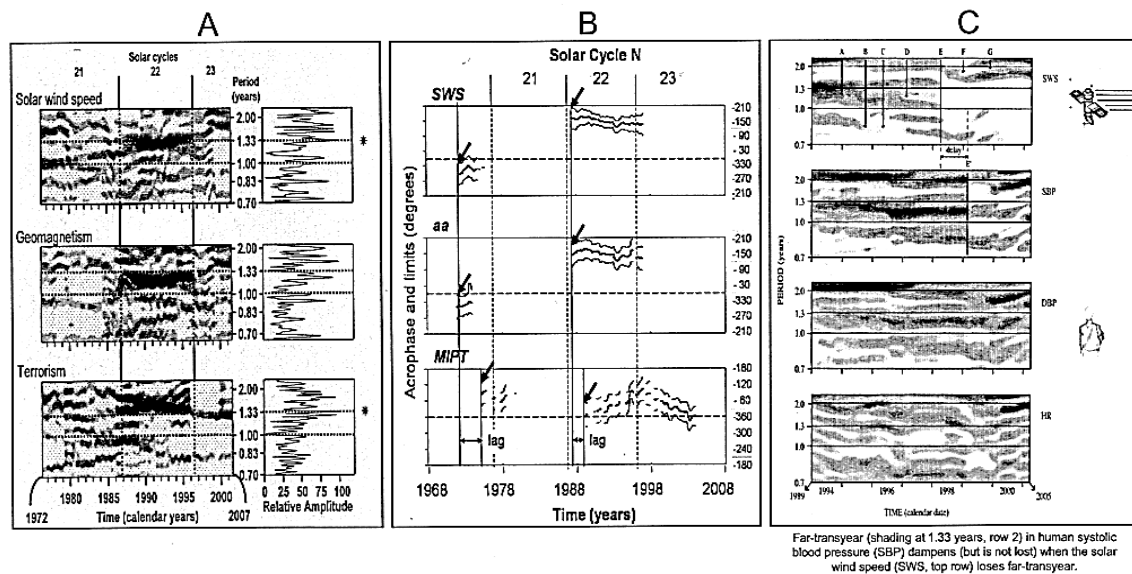
Fig. 5. In order to examine the extent of consistency of the ~1.3-year (transyear) component found to globally characterize the incidence of international terrorist acts (MIPT database), the data were analyzed locally by gliding spectral windows (A-left, bottom). This time structure is compared with that of solar wind speed (A-left, top) and of the antipodal index of geomagnetic disturbance aa (A-left, middle) in the same frequency range. The transyear is observed to be particularly prominent in all three variables during solar cycle 22, as seen from the darker shading at a frequency of about one cycle in 1.33 years. Changes with time of the phase of the transyear component, estimated at the average global period (B-middle) indicate further that statistical significance for terrorism relatively shortly follows (with only a lag) that in solar wind speed and geomagnetism and that it may persist after statistical significance is lost for the two environmental variables. Despite some expected wobbliness, the transyear appears to be relatively stable in all variables during most of solar cycle 22. A transyear is also detected in the blood pressure and heart rate of men and women of different ages (not shown).In particular, it is illustrated for a man monitored around-the-clock for 23 years, with interruptions (C-right, rows 2- 4). Compared with changes in prominence and frequency of this component in solar wind speed (C-right, row 1), the transyear in systolic blood pressure (C-right, row 2) is dampened but persists when this component fades in solar wind speed, suggesting that the transyear may be partly built-in while also amenable to resonance with environmental transyears (29). The fact that a predictable cycle characterizing the incidence of terrorism is also present in the physiology of individuals renders it amenable to monitoring and to further scrutiny for the eventual design of rational countermeasures. © Halberg.

In order to examine the degree of generality of this finding, this database (now available up to 2010 from http://www.rand.org/nsrd/projects/terrorismincidents.html) was revisited with a complementary scrutiny of terrorism incidence in different geographic/ geomagnetic regions.

Table 1 shows (with only one qualified since slight exception) that the transyear dominates over the calendar year, using the transyear-to-year amplitude ratio as a gauge, and finding a spectral valley at precisely 1-year in several regions. These results confirm that nonphotic solar influences may be stronger than the seasonal changes in light and temperature, in these cases, Figures 3-5, and some others thus far.
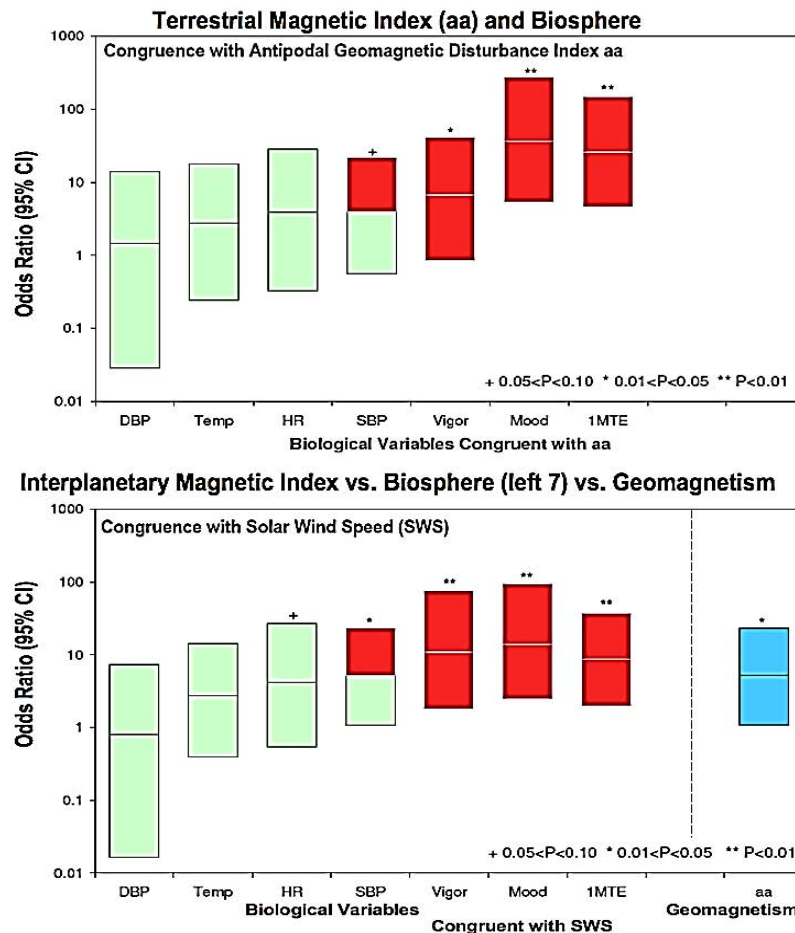
Fig. 6. Influence of the non-photic environment (gauged by solar wind speed, an approximation of interplanetary magnetism) and the antipodal index of geomagnetic disturbance aa) on human psychophysiology was assessed by means of the congruence of spectral components (in the frequency range of one cycle in 2.5 years to 3 cycles per year, defined by overlap of their 95% confidence intervals). The biological data stem from 40 years of self-measurements of oral temperature (Temp), systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) and of ratings of mood and vigor and the estimation of 1-minute by counting (1MTE), performed about 5 times a day by a clinically healthy man (30, 31). Congruences (assessed by means of odds ratios based on the noncentral hypergeometric distribution) found for 1MTE and for other variables more than equal that of the known association of helio- and geo-magnetism (bottom, last column on right of dashed vertical line). Mental functions show higher congruence than somatic functions. Among the latter, SBP is responsive, perhaps constituting a seemingly acceptable proxy for the mental functions. P-values are based on the non-central Fisher hypergeometric distribution, with 95% confidence intervals computed using Fisher's exact test, used since the null hypothesis was rejected in some, yet not all cases. © Halberg.

Not only was there a congruence in frequency, there was also a concordance in time when the global spectral analyses are complemented glocally, by local analyses by gliding spectra and chronobiologic serial section, Figure 5 (left and middle). The transyear is detected with statistical

significance in the incidence of terrorist acts when this component is particularly strongly expressed in solar wind speed and the antipodal index of planetary magnetic disturbance (during solar cycle 22).

The Human Mind and Space Weather

The international meeting on Geochange in Istanbul, Turkey, September 19-21, 2011 (www.geo-change.org), organized by Acad. Elchin Khalilov of Baku, Azerbaijan (admin@geochange.org), has on its agenda the development of a consensus on the specifications for an international multilingual educative and researching website, automatically analyzing as a service the individual's data from vascular self-surveillance, eventually also processing epidemiological data and using the data flow from service and epidemiology for basic science research including the aim of eventually combating the ills of individuals and of the global population. It may be feasible to implement a system of personal and international security against natural and human-made cataclysms, so that the personal cataclysm of a stroke, a population cataclysm such as that of September 11, 2001, or the natural physical cataclysm of an earthquake may be prevented or evaded, as the case may be by multidisciplinary physical and biospheric monitoring. Results in Figure 6 for the first time allow an inferential statistical demonstration of cosmic effects upon the human mind, gauged by congruence (overlapping of the 95% confidence intervals of the biospheric periods paired with those in interplanetary or earth magnetism) in ratings of mood, of vigor and in 1-minute time estimation, and indirectly in systolic blood pressure. In almost all cases, various time series used for Figure 6 were observed around the clock for ~40 years and summarized weekly, giving a total of 2080 (40 x 52) data points. All periods between 1/3 year and 2.5 years were considered by a global analysis. In terms of Fourier frequencies, the 1/3 year is 120 (3 x 40) cycles in the data and the 2.5-year period is 16 cycles in the data for a total of 105 Fourier frequencies (= 120 − 16 + 1). So, if we let N denote the number of frequencies under consideration, N = 105. (If, instead of 40, we considered 35 years, we would have N = 115 − 14 + 1 = 102, and results would not differ markedly from those obtained for N=105.) Because we deal only with one biological and one cosmological time series at a time, our notation can be simple and avoid subscripts. We condition on the cosmological frequencies reported, and, in essence, assume that they constitute all and only those frequencies that matter in each of the cosmological data sets. That is, we ignore the fact that they resulted from data analysis and may have errors of omission (type II errors) and spuriousness (type I errors). We denote the number of frequencies at which a signal is detected for the environmental variable used as reference by U for universe, rather than C for cosmological (because C could also stand for congruent and/or common and may thus be confusing). For each biological sequence, we have three related random variables: 1) B = total number of frequencies corresponding to a statistically significant component; 2) C = number of biological frequencies with non-zero amplitude in common with the cosmological series; 3) A = number of biological frequencies that are NOT in common with the cosmological series. Relationship: B = A + C. The actual values assumed by these random variables will be denoted *a*, b** and *c**. In this context, let us consider congruence as the proportion of biological frequencies found in the cosmological series, C/U (CU). The larger C/U, the stronger is the congruence. We assume that N and U are fixed and known. We assume that the frequencies in B are found by standard 2 degree of freedom F tests at $\alpha = 0.05$, and that all are equally likely. The probability Pr(B=b) can be expressed as a hypergeometric Pr(C=c|B=b) times a binomial Bin(N,0.05). Results of computations of P-values for associations of several biological variables with the antipodal geomagnetic disturbance index (aa) and for solar wind speed (SWS) as a measure of congruence are given in Figure 6. Odds ratios more than match the generally accepted association of solar activity with magnetic disturbances on earth (30, 31). Clinical and life science investigators and

practitioners who perform repeated determinations on different days could readily enter their past and future date- and time-stamped data into a comprehensive database that would become amenable to further studies of the ever-present role of chance in computing congruences in addition to comparing, among others, results on stormy vs. quiet days as a means for monitoring health effects of space weather. Associations of magnetic storms have already been documented with the pineal (39) and hypothalamus *in situ* (32), on cell division (33) and on the heart (34, 40) and circulation (35).

Summary and Outlook

For the first time (35, 36), we have been able to present the long-sought inferential statistical evidence showing that the human mind is influenced by space weather in following the descriptive steps of Egeson, Brückner, Lockyer, and most competently by Chizhevsky. Meta-analyses have also been presented to associate space weather with human military-political and economic affairs. This meta-analysis of some of the literature validates, again in inferential statistical terms, the vision of pioneers and establishes, with its uncertainties, a spectrum of periods in the biosphere that mirror solar activity. For the first time, we also present odds ratios for the long-known relation of interplanetary and terrestrial magnetism and use these as a reference standard for the association of human mental functions on the one hand and either interplanetary or earth's magnetism on the other hand. A long history of claims is thus validated, at least in one case below the 5% level by using the criterion of congruent periods assessed as overlapping 95% confidence intervals of the periods compared. In asking whether this association with the human mind is good, bad or indifferent, we can turn to religious proselytism and find, with qualifications of latitude-dependence, that the number of hours spent in the service of the church by the proselytizers reveals a didecadal sunspot or polarity Hale cycle (37). We also see the reflection of the decadal Horrebow-Schwabe sunspot cycle in human crime (38) and can recall in that same connection Raymond Holder Wheeler's data on 2,556 international battles, another echo of periods in the cosmos. That these population phenomena relate to human well-being, that is to health was already documented by Chizhevsky for incidence of cholera; it can now be studied in individuals whose circulation also reflects the partly novel and transdisciplinary spectrum with non-photic components. The remove-and-replace approach applied thus far to transyears and about-weekly components must be extended as opportunities arise. Laboratory studies done opportunistically when a magnetic storm happens to precede the day of the study show that the pineal and the hypothalamus' melatonin *in situ* responds to a storm, a finding which has also been shown to characterize human salivary melatonin. The ECG is another human gauge documented to respond to magnetic storms, as is mitosis, at the cellular level a responder to magnetic storms (33). The latter are natural cataclysms, like earthquakes, volcanic eruptions, floods, hurricanes and tornadoes, that have caused hundreds of thousands of deaths and cost billions of dollars. They affect not only extra-high-voltage transformers (41), but also the human mind, more broadly health, and other affairs. Maintaining health to prevent strokes (if massive, personal disasters) is a self-sufficient aim. Studying the biospheric associations of other cataclysms in the same data may provide information concerning other human-made disasters such as wars and terrorism, and may tell us about biospheric antecedents of natural geochange and its cataclysms. The physicists' concerns (42, 43) may gain transdisciplinary support from computer-aided self-surveillance of blood pressure (9).

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POST-DISASTER HEALTH REHABILITATION AFTER NATURAL AND ASSOCIATED DISASTERS

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Abstract

Since 2003 an Azerbaijani-German group of highly qualified scientists and experts in the field of pharmacology, virology, chemistry, mineralogy, petrophysics and other areas of science has been carrying out research in cooperation with the Scientific Research Institute for Prognosis and Studying of Earthquakes (SRIPSE, Baku, Azerbaijan) on the possibility of using natural, environmentally friendly mineral compositions based on natural zeolite to enhance immunity, reduce stress, increase vitality and for psychophysiologic rehabilitation of people in disaster areas. In particular, those studies focused on identifying the adsorption and ion exchange capacity of mineral compositions based on natural zeolite, on the example of AZEOMED pills produced in Azerbaijan. Supplying a weakened human body in disaster areas with minerals, microelements and metals necessary for life and boosted vitality was investigated as well. The AZEOMED preparation is made on the basis of natural zeolite of Azerbaijan's Aydag deposit and produced by YeniTex LTD Company (Baku) together with German researchers with the participation of SRIPSE, which carried out physical and chemical analyses of zeolite and other minerals in their laboratories and funded much of the research. The preliminary findings of the experimental studies have yielded promising results published in collections of scientific papers and journals presented at international conferences. In particular, the obtained data indicate high adsorption capacity against viral and bacterial infections. The results of these studies have been used as a basis to obtain 8 national and 2 Eurasian patents. Also, technical specifications (national standard, issued by the Azerbaijan State Committee on standardization, metrology and patents) for production and application of AZEOMED preparation in Azerbaijan have been approved, a hygienic certificate has been issued by the Azerbaijan Ministry of Health, a certificate of conformity to the national standard and an authorization to manufacture the products were issued by the Azerbaijan Ministry of Economy.

Introduction

The overall goal of the research is to reduce the negative effect of natural disasters and emergencies on human health.

The main objectives of research within this research are investigation of the properties of natural zeolite-based preparations, their production and testing, including, but not limited to:

1. Study and classification of characteristic threats to human health and life in areas affected by strong earthquakes and other natural disasters.
2. Boosting the body's resistance under a viral or bacterial infection through correction of human immune status.
3. Modification (changing the cation content) of zeolite containing compositions for their target-oriented application.
4. Restoration of human psychophysiological state in areas affected by earthquakes and other natural and human-made disasters.

5. Enhancement of the adsorption capacity of zeolite containing compositions as to radionuclides and toxic substances.

Of particular topicality in medicine is the development of methods of body purification from alien organisms, compounds, toxins, etc. using natural sorbents, zeolites in particular. This is explained by the known difficulties with etiopathogenetic treatment of viral and bacterial infections, which dictates the need to search for new directions in antiviral and antibacterial therapy.

It is only since recently that application of natural zeolites for prevention and treatment of various diseases has become widespread, that is, in the last 15 years. The examples of the most well-known products include MEGAMIN (Croatia) and Litovit (Russia). However, these preparations are not destined for targeted application in areas affected by strong earthquakes and other natural disasters, being designed to be used in standard conditions.

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The most important precondition for the successful implementation of the proposed NATO SPS project is the fact that Azerbaijan owns the Aydag deposit of high-quality natural zeolites, which is the biggest in Europe.

One of the new and most rapidly developing directions in science today is nanotechnology. Choosing the optimal size of nanoparticles and studying their interaction with biological objects is a necessary stage of this research.

Foundations of Research

Of particular topicality in medicine is the development of methods of body purification from alien organisms, compounds, toxins, etc. using natural sorbents, zeolites in particular. This is

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Basic Research

In recent years, disturbed environment, non-observance of the principles of rational nutrition, predominance of food rich in fats and carbohydrates, violation of mineral homeostasis and sedentary lifestyle have led to cardiovascular disorders of different types. To prevent the occurrence of cardiovascular diseases or to improve their course in case they have already occurred, cardiologists focus their efforts on: Normalization of blood pressure; Normalization (reduction) of cholesterol level in blood; Normalization of body weight; Normalization of exchange of micro- and macroelements /1/.

Cardiovascular system diseases and, above all, ischemic heart disease still remain along with cancers one of the major causes of death and disability among the elderly.

Exacerbation of ischemic heart disease in elderly and senile patients is accompanied by severe atherogenic disorders of lipid metabolism. The free radicals oxidation process decreases intensively on the background of decreased antioxidant activity, facilitating the formation of the prolonged adverse nature of the disease in this group of patients /2/.

Reduced functional activity of leukocytes and its reserve reflects the peculiarities of the clinical course of ischemic heart disease (IHD) in elderly patients.

Adding zeolite-containing natural minerals and antioxidants: tocopherol and ascorbic acid backgrounded by basic therapy contribute to a more rapid stabilization of the condition and improvement of quality of life in patients with IHD of elderly and senile age. The mineral component in this case is applied in sparing doses of 1.5 grams per day for 30 days in order to prevent its adverse effects associated with intestinal dysmotility /2/.

Zeolites are known as excellent ion exchangers and are composed of more than 30 different metal cations. Sodium and potassium are the leading elements that play a major role in myocardial contractility.

Copper is a component of many enzymes and proteins involved in redox processes and is responsible for full-scale energy metabolism of the cardiac muscle. With its unique ion exchanging properties, zeolite supplies the body with the missing elements if they are deficient and removes them from the body if they are in excess /1/.

The first report on natural zeolite was published in 1756 by Swedish scientist A. Kronstedt. Stilbite crystals isolated from water solutions of aluminum silicate would swell when heated; that is why Kronstedt named them "zeolite" meaning "boiling stone" in Greek.

As Swedish scientist K.V.Scheele and French scientist A. F.Fontana established in the 17th century, zeolite crystals can be reversibly dehydrated without significant damage to their crystal structure and morphology.

In the 70-80s of last century, natural zeolites were extensively used in various branches of economy, mainly as adsorbent for gas purification from water, for separation of gas mixtures, for sewage treatment as a filter for drinking water pre-purification, and as catalysts. Further research revealed that zeolites have unique adsorptive and ion-exchange properties. So, studying of the adsorption activity as compared with activated carbon in respect of tricyclic antidepressants, trichlorfon, digitoxins, sodium arsenates, mercuric chlorides, organophosphorous compounds, arsenic, and heavy metals has shown that absorbing activity of the investigated zeolite is not lower, and in some cases 1,5-2 times higher than absorbing activity of activated charcoal.

Zeolite is a crystalline aqueous aluminosilicate containing as cations the elements of periodic table groups I and II, namely sodium, calcium, potassium, magnesium. Infinite sizes of zeolite windows formed by 5, 8 and 10-membered rings are as follows: 4,0-5,6 Å in 8-membered rings parallel to the horizontal axis; 4,4-7,2 Å in 10-membered rings and 4,1-4,7 Å in 8-membered rings with 50 towards the horizontal axis.

The cations are localized in three types of places – two on channel walls and one at the intersection of 8-membered rings. Water molecules in the channels coordinate with cations. Due to such pore size, clinoptilolite exhibits its sorptive properties against not only ions of macro- and microelements but also small-sized compounds (methane, hydrogen sulfide, water, ammonia, carbon monoxide and dioxide, nitrogen oxides etc.) avoiding direct interaction with vitamins, amino acids, proteins and other complex organic compounds.

There are more than 30 species of zeolites in the nature, differing in crystal-chemical structure and composition. Only clinoptilolite having oval structure is permitted for use in food and medical practice. Zeolites of even the same sort but from different deposits can have dissimilar properties. A large Aydag clinoptilolite deposit with about 28 million tons of reserves is located in the Tovuz region of Azerbaijan. The clinoptilolite structure contains three types of channels forming a two-dimensional system.

Biogenic elements whose content is higher than 0.01% of the body mass are considered macroelements. There are 12 of them, and 99% of all living tissues contain only six elements: C, H, O, N, P, Ca. The following ones: K, Na, Mg, Fe, Cl, S are oligobiogenic elements with content varying from 0.1 to 1%. Biogenic elements whose total content amounts to about 0,01% belong to trace elements (microelements), with content of each starting from 0,001% (10-3-10-6%). Elements whose content is less than 10-5% are ultra-trace elements.
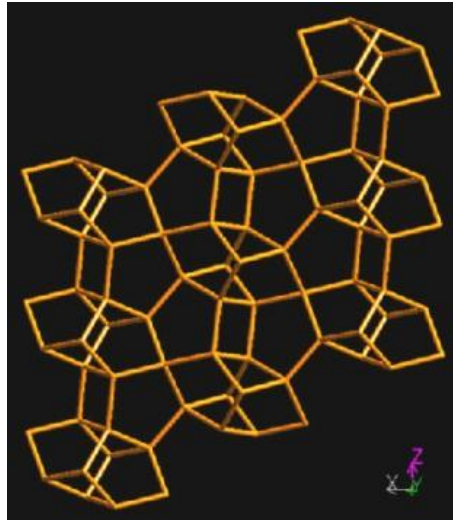
Fig. 1 Crystal structure of zeolite-clinoptilolite.

The elements needed by the body to build cells and organs and maintain their vital activity are called biogenic elements. Some 70 elements are relatively permanent in the body. Some 30 elements have been found to be biogenic.

Chemical composition

Component	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	P_2O_5	K_2O+Na_2O	As	Pb	Cu	F
Quantity	71,5	13,1	0,9	0,2	2,1	1,07	0,033	5,03	0,0015	0,002	0,02	0,025

Microelement composition mg/g

Component	Mn	Zn	Ga	Th	Rb	Y	Zr	Nb	Ba	Ce
Quantity	242	45	20	12	110	22	235	22	232	52

A human or animal body contains Ga, Ti, Al, As, Cr, Ni, Se, Ge, Sn as well as some admixture of Te, Sc, In, W, Re and other elements.

Lack of the Following Metals Can Cause Various Diseases:

Co - slower skeletal growth;

Mg - muscle cramps;

Fe - anemia;

Zn - skin injury;

Cu - weakness;

Mn - infertility, growth deterioration;

Mo - slower cell growth;

Co - pernicious anemia;

Ni - increased depression frequency, dermatitis;

Cr - symptoms of diabetes;

Si - atherosclerosis, skeletal growth disorder, weak blood vessels;

F - dental caries;

I - thyroid gland disorder;

Se - muscle and heart weakness;

Mg, Mn, Fe, Co, Cu, Ni, Cr - involved in protein synthesis;

Co, Ti, Cu, Mn, Ni, Zn - involved in hemopoiesis;

Mg, Fe, Cu, Zn, Mn, Co - involved in breathing.

Nearly one third of the enzymes (and there are about 2000 of them) are activated, for example, by transition metals. Negatively charged parts of molecules (ligands) are grouped around positive metal ions.

A human body contains over 22 chemical substances as part of inorganic substances. So, if a person weighs 70 kg, then Ca content is 1700 g, K-250 g, Na-70 g, Mg-42 g, Fe-5 g, and Zn-3 g respectively. The total share of metals in a human body is about 2,1 kg. Elements whose content is less than 10-3 are part of enzymes, vitamins, hormones and other important substances. For example, Fe, Co, Mn, Zn, Mo, V, B, W are necessary for protein, carbohydrate and fat metabolism.

The reason why zeolites are so sought after in various fields of science, including medicine is that they contain trace elements and possess ion-exchange and sorptive properties. This is equally true for completely different fields of medicine, from dietary supplements to remedies for treating diseases of various organs.

As enzymatic catalysts (biocatalysts), zeolites contribute to the normalization of enzyme activity according to the needs of the body, by directing and regulating cell metabolism.

With its unique selective ion exchange properties, zeolite supplies the body with deficient macro, micro, ultra micro-, nano-, and picoelements when they are insufficient and removes them from the body if they are in excess. Entering a human body, zeolite's trace elements start acting only when there is a bodily shortage of them.

So here are basic factors why zeolites can be numbered among natural minerals with therapeutic and prophylactic properties:

1. *Ion-exchange properties of zeolites, contributing to normalization of salt metabolism and cation content in the human body;*

2. *Presence of ions of transition elements with oxidation-reduction properties, capable of forming complexes, with toxins excreted by various bacteria and microorganisms as ligands;*
3. *Presence of silicon which, as mentioned above, not only supplies the body with this element but also is involved in metabolism of about 70 elements that cannot be absorbed without silicon, and is favorable for progress of most biochemical reactions;*
4. *Creation of a weakly alkaline medium fatal to many bacteria and pathogens.*

The Novosibirsk Regional Cardiology Dispensary has experience in administering zeolite-containing natural mineral to more than 200 patients with cholesterol level over 5.5 mmoles per liter, i.e. 6 to 1,3 mmoles per liter (hyperlipidemia). During 4 weeks the preparation was taken by a 5g dose 40-60 minutes before meals, accompanied by a hypocholesterol diet and one free of meal day. Following the course of administering a zeolite-containing product, cholesterol level dropped by 22% on average and the triglyceride content by 16-18% as compared with the control group on a hypocholesterol diet only. It is important to note that re-monitoring 2-3-6 months later revealed that cholesterol and triglyceride level had stabilized from 3 to 6 months. The resulting effects allow zeolites to be recommended for complex treatment of atherosclerosis which is one of the major causes of cardiovascular diseases /1/.

Anti-atherosclerotic effect of taking a zeolite-containing product is quite important against such serious diseases as stenocardia, postinfarction and postapoplectic periods. In patients taking a zeolite-containing product who suffer, in addition, from essential hypertension, there is observed a rather strong tendency towards normalization of the tone of the blood vessel wall. Using zeolite-containing products also eliminates the existing meteosensitivity in 78% of patients.

Another major factor related to cardiovascular diseases is the increased body weight, affecting 34 to 60% of the planet's population. As early as in 1997 the Novosibirsk Cardiology Dispensary carried out researches that demonstrated the efficacy of taking this mineral by patients with increased body weight. The preparation was administered during 2 months at a dose of 15 g 2 times a day in combination with the diet number 10 with weekly tubages and using an infusion of cholagogic herbs. Patients who received the same recommendations but were not administered a zeolite-containing product were taken as the comparison group. In the course of taking the preparation, the patients reported a sufficient loss of appetite and more frequent bowel movements. The effect occurred in 83.3% of patients, with the weight reduction ranging from 3 to 12 kg. The weight reduction in the volunteer group was 0.4-1.5 kg. Therefore, use of the zeolite-containing mineral leads to improvement in three main factors affecting the cardiovascular system: Normalization of arterial pressure as a result of reduced atherosclerosis; Body weight reduction; Normalization of the exchange of micro- and macroelements.

Hecht and Baumann /5/ described sanogenesis as a complex auto-regulatory process that is used to stimulate functions of adaptation, protection, and self-healing. Sanogenesis is to be viewed as a holistic process, in which primarily the nervous system, the hormone system, the immune system, and the metabolic system, as well as the regulation of extracellular matrix and the healing and growth system are involved in the selfregulatory process /6-8/.

The role of mineral homeostasis disturbances in the origination and development of stress-induced myocardial damage is now undisputed. Analysis of the content and distribution of calcium and magnesium in the "blood - lymph - lymph nodes - cardiac muscle" system on the background of proactive use of selective enterodonorosorbent shows that lymph nodes, interstitial fluid and lymph play the role of functional trigger which provides adaptive metabolic resetting / 9 /.

Scientific Research in Azerbaijan

Researches have been held in various scientific research institutions of Azerbaijan by several medical scientists, with "AZEOMED" (it is made also in the Czech Republic under the name ZEOBALANCE) - mineral food supplement (MFS) being the main research subject.

"AZEOMED" bioactive supplement comprised of zeolite-containing (clinoptilolite-containing) activated rock and extra refined dolomite was produced in Azerbaijan in association with German scientists (Prof. Dr. Karl Hecht, PhD. Elena Hecht-Savoley) on the basis of natural clinoptilolite from the Aydag deposit /10-12/.

1. Research by virologist, Doctor of Medicine, Prof. F.E.Sadykhova, based on the MFS's absorption quality (AZEOMED being a zeolite sorbent of viral and bacterial flora) has revealed by a thorough analysis that AZEOMED pills provide desorption-free, 100% malignant cell adsorption as well as complete adsorption of pathogenic microflora and some viruses.

2. Psychophysiological and neurophysiological research by neurophysiologist, Doctor of Medicine, Prof. A.F.Allahverdiyev resulting in some conclusions as follows:

- Taking of AZEOMED food supplement improves the functional state of the cortex of large cerebral hemispheres, normalizes the balance of activating and inhibitory mechanisms within nonspecific systems, restores the appropriate level of corticosubcortical psychosomatic interrelations and enhances the body's adaptive capacity.

- Action of AZEOMED pills improves the state of depression and causes the level of apparent depression, if there is such, to decrease.

- During the course of taking the pills, the cardiac activity is bettered, the heart rate normalized and cardiac activity indicators improved.

3. Research by pharmacist, Doctor of Pharmacy, Prof. M.N. Veliyeva based on studying of AZEOMED preparation's effect on some cellular and humoral immunity indices, providing experimental and pharmaceutical justification for using AZEOMED as an immunotropic agent.

Also, there have been several clinical researches conducted in the Center for Lung Diseases and "Vektor" Novosibirsk virology center.

Effective Set of Mineral Substances

Composition of natural zeolite and dolomite allowed obtaining unique results on prophylaxis and increase of effectiveness of treatment of many complex diseases. In accordance with joint international scientific program of Azerbaijan and Eastern-European section of International Academy of Sciences, on base of Azerbaijan natural zeolite from Aydag deposit and dolomite, production of mineral supplements "AZEOMED" started since October 2002.

Natural micro pore silicate minerals found in mountains of different countries are called zeolites. There are 106 different types of zeolites (Lelas 2000), but by that three categories are distinguished: phase, layered (scaly) and crystalline.

The main skeleton of crystalline lattice of zeolite consists, first of all, of tetrahedron. This skeleton discovers cavities, where are located ions of, for example, sodium, potassium, calcium, which easily exchange to each other and surrounding substrate. This specific crystalline mineral structure of zeolite is perfectly represented in organism, connecting to itself such toxic substances as ammonia and other compositions of nitrogen as well as heavy metals, and extracting them from intestine through exchange processes. Removed toxic substances are replaced by minerals, which organism strongly needs. Thus, homeostasis of organism, especially

mineral metabolism is maintained or restored. Thanks to this, most vulnerable systems of organs, |such as brain, nervous, hormonal, immune systems, liver not only obtain protection from toxins, but their endurance to toxic pathogenic influences. Analyses show that crystalline structure of zeolite is not destroyed during grinding i.e. crushing in a cross mill and during rubbing in agate friction cup, by that crystal preserves the properties of lattice.

Effects When Used for Prophylaxis:

•Rejuvenation of the whole body at cellular level;
•Significant increase of immunity and resistance of organism;
•Increase of work capacity and power of endurance;
•Rejuvenation and smoothening of skin;
•Overcoming of stress, improvement of mood and memory;
•Improvement of mental work;
•Improvement of sleep;
•Tooth caries prophylaxis (the pill should be softened in mouth and gum surface lubricated by the tongue);
•For quick removal of toxic substances and prophylaxis of damage of mucous coat of stomach and intestine at food poisoning.

At various Diseases:

•Suspension of development, capsulation and decrease of different tumors;
•Improvement of endurance of radiotherapy and chemical therapy by oncology patients;
•Removal or weakening of inflammation of mucous membrane of mouth after application of chemical therapy; •Acceleration of cicatrization of burns, wounds, scars;
•Increase of effectiveness of treatment of different infectious diseases;
•Increase of effectiveness of treatment of tuberculosis and suspension of its development;
•Application during diseases of gastro-intestinal tract: gastritis, increased acidity etc.
•Application during treatment of different gingival diseases, its bleeding, periodontosis;
•Increase of effectiveness of treatment of hair shedding and falling of nails;
•Decrease of pathological adiposity of thighs and buttocks of women and of cellulite formation;
•Increase of effectiveness of treatment of neurodermatitis, eczema, psoriasis and other inflammation changes of skin;
•Increase of effectiveness of treatment of musculoskeletal system, for example osteoporosis, degenerative changes of joints;
•Normalization of functioning of vegetative nervous system during vegetative vascular diseases;
•Improvement of emotional state during mental diseases;
•Application for endocrine system diseases: thyroiditis, diabetes.

Dosage and Method of Use

Optimally, "AZEOMED" pills should be taken twice a day by one 500-mg. pill for not less than 4 weeks.

Also can be used as an appetite booster if taken 15-20 minutes before a meal, with a glass of water;

During the meal for weight stabilization;

After the meal for those who want to lose their weight;

Duration of dose for people with clear signs of allergy: fractionally for not less than 3 months; to be taken by 1 pill a day for 2 weeks, with a 1-week break, next 2 weeks 1 pill twice a day with a 1-week break, and so on.

For prophylaxis purposes, to be taken by 1 pill twice a day: for juveniles aged from 8 to 22 for adults after 40 (especially needed for women for prophylaxis of osteoporosis and periodontosis). For prophylaxis purposes, to be taken by 1 pill once a day before 6 PM for kids 1 to 8 of age for adults 22 to 40 of age.

The second half of the twentieth century has been characterized by steady growth in cardiovascular diseases of pandemic nature, which embraces all industrialized countries equally/ 9 /. Processes of myocardial conduction and contractility as well as changes in ECG parameters largely depend on the condition of electrolytic exchange. Changes in ion exchange constants are considered by many authors an important link in the development of the processes of myocardial recovery and damage.

Using enterodonorosorbent (natural zeolite) to prevent damage to the stress-affected cardiac muscle leads to normalization of index values of the mineral homeostasis, electrophysiological and pathological data both in acute and early rehabilitation period of stress-induced myocardial damage.

<center>**Tangible Research Results:**</center>

- Identification and classification of characteristic threats to human health and life in areas affected by strong earthquakes and other natural disasters, and formulation of criteria for purposive creation of zeolite products.
- Development of new natural zeolite compositions based on theoretical and experimental studies.
- Investigation of properties of new modified forms of zeolite.
- Expert opinions following clinical trials for new natural zeolite-based preparations

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NEW VIEW

HURRICANE SANDY AND TORNADOS IN AMERICA AND THE LARGEST EARTHQUAKES ON THE EARTH. REASONS OF ORIGIN

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Abstract

The article has studied the greatest catastrophes in the history, including two earthquakes in Sumatra during 2011-2012, the greatest earthquake and accident on the Fukushima power plant in Japan (March, 2011), two most violent hurricanes in the USA, one of them Hurricane Sandy (end-October 2012) and proved that the reason is the recent rapid increase in the number of the launching weight of space rockets, including heavy weight ones. It has been formed a concept about the influence of rocket launches on the catastrophes and concluded that the launch of much heavier rocket launches planned in the USA and Russia in 2013 may result in damages and loss of life on a much greater scale than it has been so far, even the global catastrophe.

Keywords: catastrophes, Sumatra, Fukushima, Sandy, rockets, America, Russia, India, Japan

Introduction

The research has shown that all greatest catastrophes in the history, including those during recent two years – two earthquakes in Sumatra, the greatest earthquake in Japan, the Fukushima nuclear accident, two greatest hurricanes in the USA, one of them is Hurricane Sandy at the end of October 2012 – is the result of a rapid increase in the launching weight of carrier rockets, including heavy weight ones.

Within the investigation we have analysed the dynamics of accumulation and decrease in electric charges in space launching zones, in the atmosphere and oceans, and traced the connection various catastrophic processes in the areas with the number of rocket launches according to their launching weight. The research has also provided a critical evaluation of possible consequences from future launches of heavy rockets produced in the USA, Russia, as well as from rockets of new space countries.

If we do not take immediate steps to stop further launches of space rockets mentioned, and to limit launches of others, many countries, particularly, the United States, will encounter massive loss of life and all living organisms on a much larger scale than hitherto. And collapse of civilization on the Earth predicted by many scientists and forecasts may become possible.

1. Sharp rise in the greatest earthquakes in the world is caused by rocket launches

To develop this interrelation we have produced a graph demonstrating change in the number of the largest earthquakes on the Earth of magnitude 8.5 and higher (Fig. 1), and a graph of the most lethal earthquakes in the world (Fig. 2), which are based on [1].

The graph on the section before 2050 is equivalent to recent 11 years, as a matter of fact, it can be much steeper.
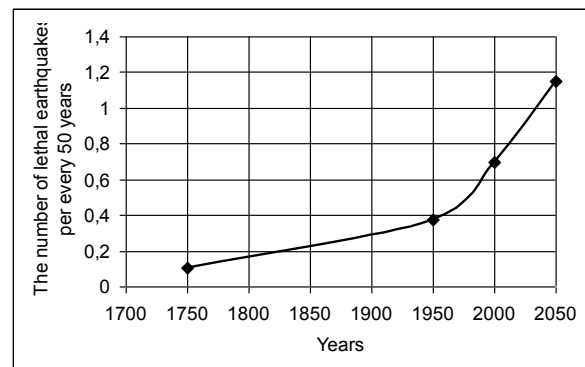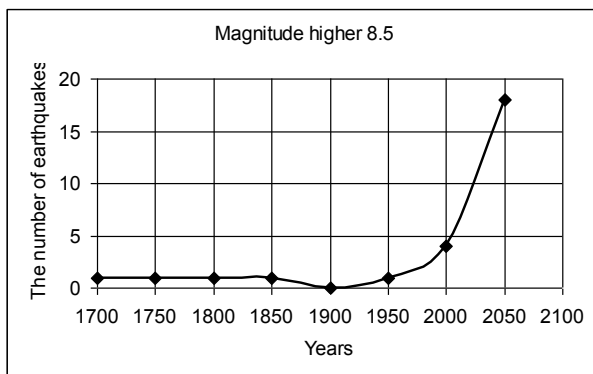
Fig. 1 Graph of changes in the number of the largest earthquakes on the Earth of magnitude 8.5 and higher

Fig. 2 Graph of the most deadly earthquakes in the world

The dynamics of powerful earthquakes has been set under steady flow of thermodiffusion electrons of the Earth (internal flow) and thermodiffusion outflow of electrons from the Earth surface into vacuum (external flow). If the internal flow exceeds the external one the Earth heats, otherwise it gets cold.

The section to 1950 on the graph corresponds to the dynamic equilibrium during centuries and millenniums in which gradual growth of the Earth charge resulted in periodic discharge by means of earthquakes and other catastrophes with the subsequent slow charge growth in cycles of about once per 50 years (actually, 42). Obviously, such cycles characterized also periodic

changes of the temperature of the Earth. However, since the 1950s, the number of earthquakes has begun to increase dramatically.

As we have already mentioned in our previous letter addressed to you (as well as UN General Secretary, Presidents of Russia, the USA and Ukraine), and in the report enclosed to it, increased frequency and force, as well as other global catastrophes are mostly caused by space rocket launches, particularly those from US launch sites.

They started less than 50 years ago and now they have evolved with increasing power of rockets, and besides catastrophes have contributed to the Magnetic North Pole shift (actually, as we believe, the Electric North Pole).

However, global catastrophes due to the North Pole shift under the influence of carrier rocket launches are still prospective, though in the near future. At the same time catastrophic influence of rocket launches on earthquakes, hurricanes, typhoons and tsunamis have already become apparent and are getting more frequent, devastating and lethal.

It is rocket launches, particularly the most powerful Space Shuttle rockets and their explosions which have led today to the terrible Hurricane Sandy in the USA. Rocket launches from the Sriharikota Space Center in India have led to serial (even twice in 2012) and the most powerful earthquakes in Sumatra (Indonesia), and from other spaceports have recently led to earthquakes in Chile and in Japan.

3. Earthquakes in Sumatra (Indonesia)

Fig. 3 demonstrates the location of the Sriharikota Space Center and the largest earthquakes in Sumatra. As one can see the last earthquake before this century occurred in 1833, i.e. 179 years ago. Since 2004, a series of large earthquakes has begun, in 2004, 2005 (one by one every year) and in 2012 (January and April), Fig. 4. It coincided with the opening of the launch site in India and launching the first space rocket from it in 1980. The earlier light-weight rockets were superseded since 1993 by PSLV heavy-weight ones with a launching weight increasing from 298 to 414 tons.

According to the figure and graphics there is no doubt that the biggest earthquakes in 2004 and 2005 in Sumatra were caused by increasing number of rocket launches in 2002 and 2004. Accordingly, two earthquakes in 2012 following one another in 3 months were caused by an even greater number of rockets launched in 2008 and 2010 (11 units), two of them exploded, which probably has substantially increased the frequency of earthquakes.

Thus, a catastrophic rise in the number of the largest earthquakes in the last few years in Sumatra was evidently caused by the opening of the Indian Sriharikota launch site and its carrier rocket launches.

Fig. 3 Location of Indian Sriharikota Space Center and places of earthquakes in the Sumatra in different years
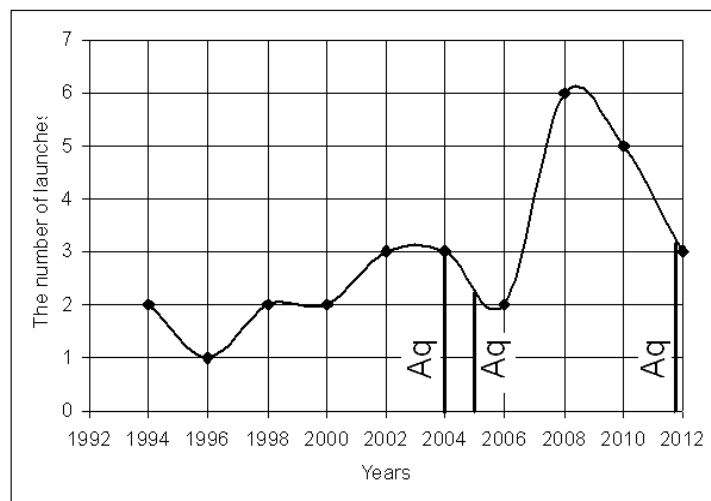
Fig. 4 Graph of PSLV rocket launches from the Indian Sriharikota Space Center per 2 years (AQ - earthquake)

4. Earthquake in Japan 2011

The main space launch center is Tanegashima, which is functioning since 1975.

Fig.5 shows a graph of the number of carrier rocket launches by years from this space center. As is evident, the number of launched rockets per each 2 years has dramatically increased after 2000. The starting weight of carrier rockets has increased significantly during the same period (Fig. 6). By the time of the largest earthquake in March 2011, the number of launched rockets was the highest; besides, the rocket of the largest launching mass of 550 tons was launched a month and half before the earthquake.

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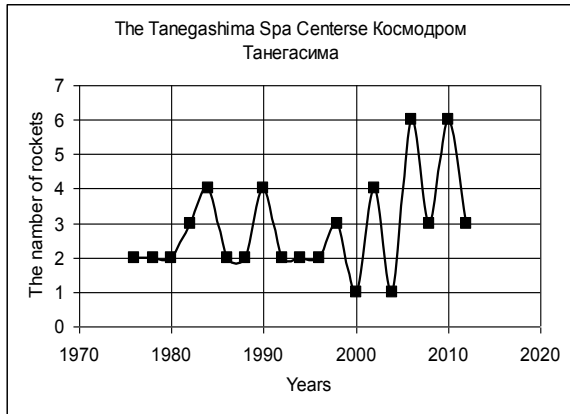
Fig. 5 The number of carrier rocket launches (per 2 years) on the Tanegashima Space Center by years
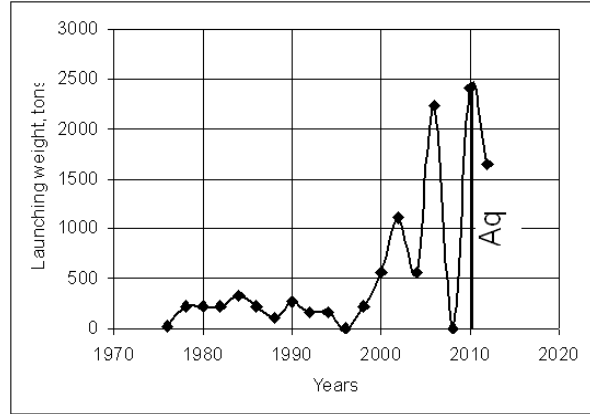
Fig. 6 Change in the carrier rocket launching weight (per 2 years) from the Tanegashima Space Center by years (AQ - earthquake)

These data show that the cause of the largest earthquake and, accordingly, the accident at the Fukushima nuclear power plant is the increasing number and increasing launching weight of carrier rockets launched from the Tanegashima Space Center.

4. Hurricanes, in Particular, Hurricane Sandy (and tornadoes) in the Usa

Hurricane Sandy that hit the USA, causing the greatest destruction and loss of life in New Jersey and New York states, also resulted from carrier rockets launched from the Kennedy Space Center, Cape Canaveral and the French Kourou. The graph of changes in the starting weight of rockets launched in 2012 is presented by Fig. 7. The launching weight of carrier rockets, launched on 28 September 2012, reached the highest value for the year, about 2,200 tons. It is characteristic that soon after another maximal launching weight in May (1700 tons) was reached, a heavy hurricane hit Washington, DC (June 29, 2012) [2]. Fig. 8 shows a similar graph of change in the carrier rocket starting weight in 2011 by months. The launching weight of a Space Shuttle rocket (2030 tons), launched in February is excluded from the graph as the hurricane season has not begun yet [3].
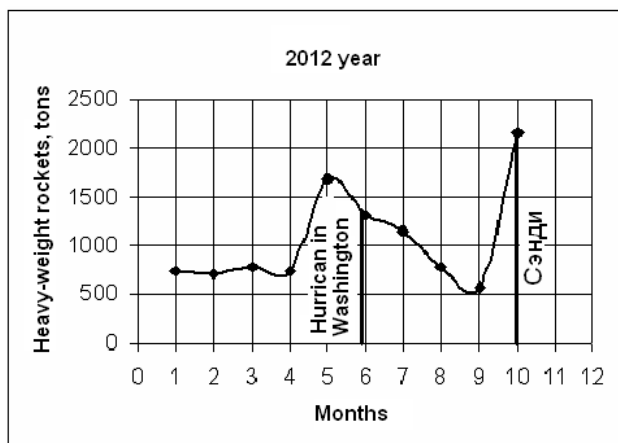
Fig. 7 The change in the launching weight of carrier rockets launched from the Kennedy Space Center, Cape Canaveral, Vandenberg and Kourou in 2012 by months
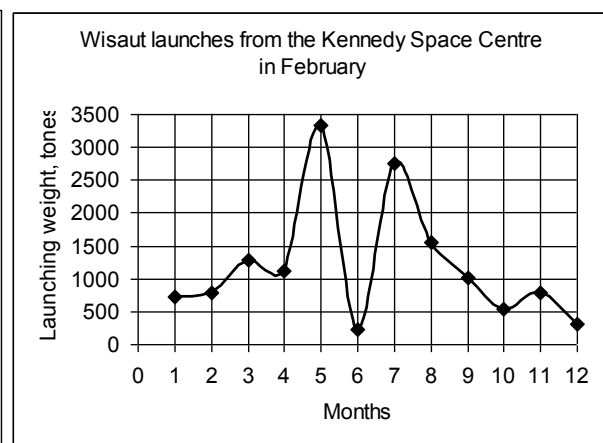
Fig. 8 Change in the launching weight of carrier rockets launched from the Kennedy Space Center, Cape Canaveral, Vandenberg and Kourou in 2011 by months

The launching mass of carrier rockets reached in May its highest value per year, about 2,200 tons. The same year a hurricane in Joplin (May 22) and a series of the strongest tornadoes (windspouts) occurred.

As we can see the increased number of carrier rocket launches from the US launching sites and from the French Space Center in 2011 caused heavy storms in the USA.

5. Influence of Carrier Rocket Launches from the us and French (Kourou) Space Centers on the Number of Tornadoes in the Usa

The data of the number of tornadoes in the USA published in the report by the Chairman of the International Committee on Global Geological and Environmental Change GEOCHANGE were used to produce a graph of the number of tornados in the USA from 1950 to 2007 (Fig. 9). For more detailed determining the number of tornados we have inserted the grid chart. [4].
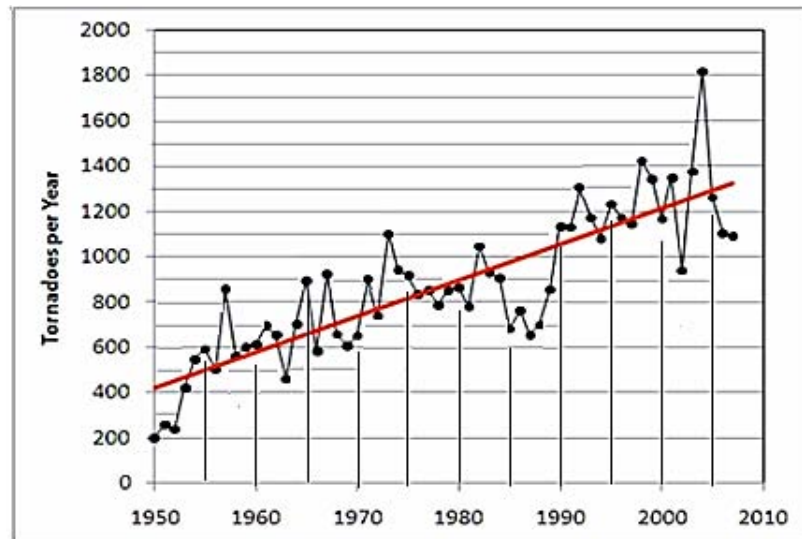
Fig. 9 Graph of the number of tornadoes in the USA from 1950 to 2007 [4]

We have compiled the lists of orbital launches during the same period presented on Wikipedia, for example [5], and analyzed the data on carrier rocket launches from the Kennedy Space Center, Cape Canaveral, Vandenberg and the French Kourou Space Centre, located in the USA. The compiled graph of launches from 1957 to 2007 is shown in Fig. 10.

Fig. 11 shows accumulative graphs regarding the number of rockets launched and tornadoes. For comparability the number of tornadoes in the graphs is multiplied by 0.025 (is divided by 40).
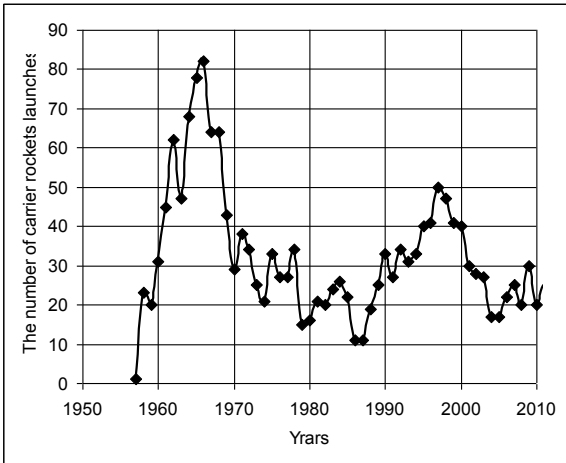
Fig. 10 The graph of carrier rocket launches from the Kennedy Space Center, Cape Canaveral, Vandenberg and Kourou situated in the USA
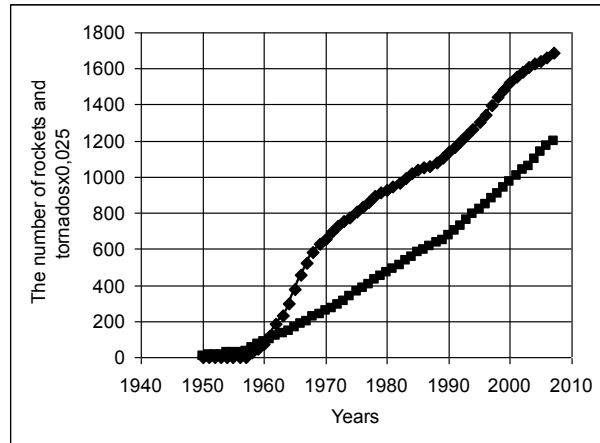
Fig. 11 Cumulative graphs of the number of rockets launched and tornados on the territory of the USA during 1950 – 2007

As one can see, there is a close correlative connection after 1970 between the quantities. The number of rockets increased much faster than the number of tornados before 1970.

This dependency indicates that the increasing number of tornadoes in the United States in the last decade is resulted from carrier rockets launches. And the rate of increase in the number of tornados was lower than the rate of increase in the number rockets launched. After 1970 the rates are becoming equal due to continuous accumulative influence of previous launches (not just while launching).
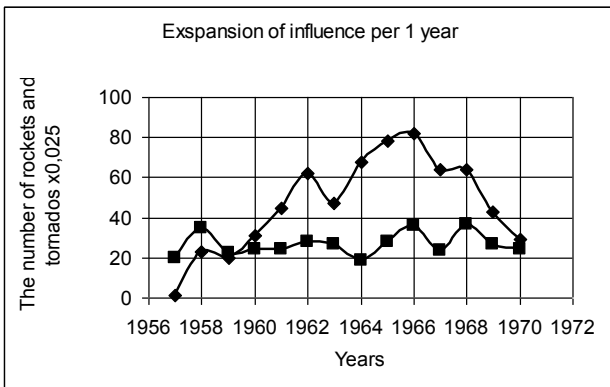
Fig. 12 The number of rocket launches and tornados (x0,025) during 1957 – 1970
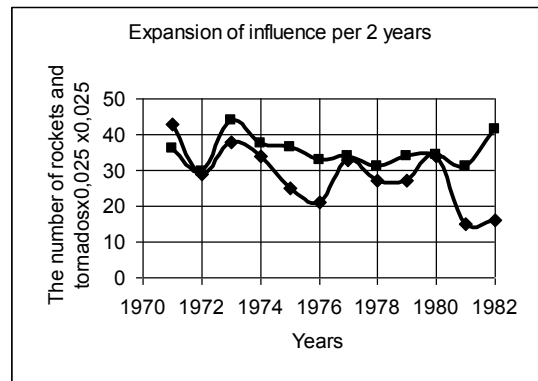
Fig. 13 The number of rocket launches and tornados (x0,025) during 1971 – 1982

Analyzing the above-mentioned we have produced graphs of change in the number of rockets and tornados in some periods, considering different starting mass and duration of influence from the rockets (Fig. 12, 13, 14 and 15).

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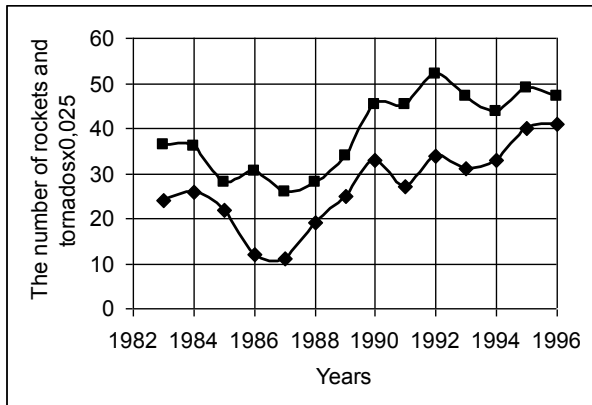
Fig. 14 The number of rocket launches and tornados (x0,025) during 1983 – 1996
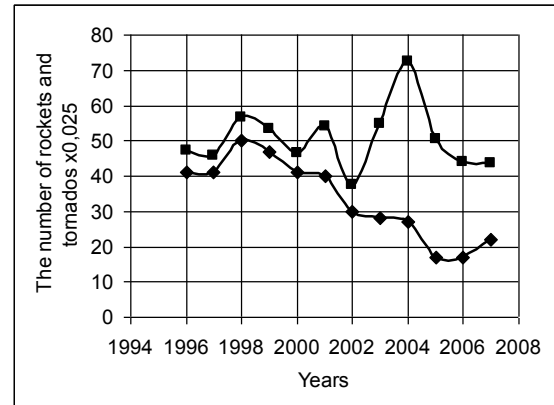
Fig. 15 The number of rocket launches and tornados (x0,025) during 1996 – 2007

These graphs (Fig. 11-15) evidently testify that a sharp increase in the number of tornadoes in the United States is result of carrier rocket launches, and we can observe both cumulative (increasing for longer periods) and short-term influence (up to 1 year).

So far, the cumulative effect has reached such a level that every launch of a heavy-weight rocket leads to even more powerful, regarding the height and width, tornado and, therefore, more serious damage.

Weaker influence from rockets launched in 2012 was the result of stopping super-heavy Space Shuttle rocket launches (with a starting weight of 2030 tons).

However, the launch of Falcone Heavy rockets, planned by the USA, instead of those, in our opinion, will lead to even greater disasters - tornadoes, floods, hurricanes - and not only in America.

Further increase in the number of rocket launches may lead to such disasters as North and South America separation, disruption of platforms, and global earthquakes.

6. The Nature of Influence from Carrier Rocket Launches on the Number and Scale of Disasters in the Usa and Other Countries

Without detailed calculations and diagrams, let us describe qualitatively the physical meaning of the influence from carrier rocket launches on the number and scale of disasters in the United States and other countries. It consists of the following.

Under the launch of a rocket fuel combustion leads to high temperature inside the engine, and as a result there is predominant thermodiffusion of electrons from the flame and accumulation of the excessive negative charge outside the flame and positive charge within it. A blasting off rocket carries negative charge of more mobile electrons, and positive charge of less mobile positive cations of the fuel is behind.

Consequently, the rocket produces on its way a giant electric dipole (with a hundreds kilometers lever). And the launch zone and surrounding area accumulate a large positive charge, penetrating into the soil and buildings, and the atmosphere over and in the ocean accumulates a large excessive negative charge. Adsorbed on grains and particles of soil and hydrated in water, these charges are preserved for a long time, and are being accumulated as the number of rocket launches increases.

The charge in the ocean induces decreased water surface tension, large repulsion forces in its structure, breaking away high layers from the bulk in the ocean. Accordingly, the water rises (sinks in the other places), evaporates rapidly, that leads to the formation of tsunamis and hurricanes.

The excessive positive charge on the land penetrated into soil particles causes formation of repulsive forces, large in scope, between soil particles, soil desintegration, and, accordingly, tornados.

Rotation of tornados and hurricanes is a result of attraction of the negative pole (above the ocean) of the large electric dipole to the Electric North (positive) Pole. In accordance, the positive pole of this dipole repels the positive North Pole.

Conclusions

Taking into account all given above there is a need to prevent launches planned from 2013 of Falcon Heavy rockets and even more powerful rockets built in Russia, and to limit the number of smaller rocket by stating limitation on launch frequency and launching weight. The limitation should consider dynamics of accumulation and electric charge reduction in launching areas, atmosphere and oceans, as well as dependencies between different catastrophic processes in areas and the number of rocket launches according to their launching weight, based on a more detailed investigation. A critical evaluation should be given to possible effects of prospective super heavy rocket launches, created in Russia, and the rockets of new space countries.

If we do not take immediate steps to stop further launches of space rockets mentioned, and to limit launches of others, many countries, particularly, the United States, will encounter massive loss of life and all living organisms on a much larger scale than hitherto. And collapse of civilization on the Earth predicted by many scientists and forecasts may become possible.

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PLANETARY DEFENSE: AN EXTRATERRESTRIAL IMPERATIVE

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Abstract

In an atmosphere of the threat of war worldwide, the Russians have proposed a joint science driver program called the Strategic Defense of Earth (SDE), named after the Strategic Defense Initiative. We present this report as a response to that proposal, by investigating the nature of what could be called true threats to human civilization. First, we illustrate the paradoxes which demand a new, revolutionary view of our universe, a view which puts the principle of anti-entropy first. Then, we describe how several immediate threats to humanity would be seen in such a universe. We conclude with an enhanced proposal for SDE, as included within a Mars colonization program, which lets the human creative potential become our key resource we can rely upon, within our own creative universe.

Introduction

This present report is written against the backdrop of a series of writings by Lyndon LaRouche, the author of the original Strategic Defense Initiative, and is the product of the collaboration of our Basement Team's ongoing work with him. For a summary of LaRouche's international efforts, the reader is referred to a concise interview with him on the website http://terra-america.ru/*, and also to read LaRouche's latest writings.[1]*

The world's population is still reeling from last year's natural disasters. Japan, a first-world nation, was brought to its knees by a magnitude 9.0 earthquake and subsequent tsunami in March; the US faced a record number of weather-related disasters; East Africa was hit with the worst drought in over half a century, putting 30 million people at risk; and the list goes on. If we find ourselves so vulnerable to threats which should be predictable, what hope do we have in the face of threats never before encountered?

Such 'natural' disasters cannot be separated from matters of human policy. For example, as detailed in the first report of the GEOCHANGE group, the difference in mortality rates caused by the earthquakes of Haiti and Japan was largely due to economic disparities.[2] Even now, the policies of deindustrialization, globalization, and runaway speculation, which have declared, for example, that maintaining levees in New Orleans was too expensive or not profitable, continue to drive towards an accelerating collapse of the trans-Atlantic-centered global financial system as well as a closely connected drive toward an immediate specter of thermonuclear war.

Recently, circles in Russia have proposed to judo the current insanity of a drive towards war by invoking Lyndon LaRouche's principle of the Strategic Defense Initiative (SDI). [3] Termed the Strategic Defense of Earth (SDE), this new initiative would focus on cooperation between the USA and Russia for missile defense, as well as defense against the threat of asteroid or comet impacts. [4] This is not the stuff of science fiction, as this very real threat was underscored by the recent near-miss of asteroid 2005 YU55. It also addresses the same issue that underscored the original SDI: in the age of nuclear and thermonuclear weapons, general warfare is not an option. A new basis for international relations must be adopted, one that is subsumed by a mission to discover new physical principles for the common aims of mankind.

This follows the same general intention expressed in a recent proposal for international collaboration on a network of satellite and Earth-based observation systems to provide warnings of earthquakes, extreme weather, and other natural disasters before they occur, as well as help to coordinate any emergency response measures needed. The proposal, called IGMASS (International Global Monitoring Aerospace System), would monitor everything from structures and changes in the Earth's crust (from mineral deposits to fault lines), to the electrical, magnetic, and particle conditions of the atmosphere, ionosphere and above, providing a comprehensive picture of the interactions of these Earth systems. [5] This would be our first serious step toward gaining a competent understanding of "weather" conditions inherent to our galaxy, with which not only Earth, but any body we begin to inhabit, must contend. Ultimately, as we will outline in this report, we must set out now to do what is presently unthinkable – to come to not only understand, but to increasingly control these forces.

Mankind exists within a universe that is inherently anti-entropic. This means it is impossible to indefinitely maintain any fixed level of economic development, and any attempt to do so, under the pretext of "sustainability," will guarantee the extinction of the human species. [6] Instead, mankind's ability to ensure its own existence depends absolutely upon our unique powers of creativity, made manifest in our conscious utilization of ever higher qualities of power sources, representing increases in levels of energy-flux density. Thus, the relatively immediate future existence of the human species will necessarily be characterized by mastery of what LaRouche has identified as the nuclear/thermonuclear economic platform, spearheaded by a Moon-Mars colonization perspective. (see Appendix 1: Energy Flux Density)

In this report, we take up the subject of strategic defense by, first, looking at the developing nature of the cosmos. We will then see how this continuing transformation is reflected here on the Earth, and finally how those considerations bear on the shaping of a space colonization policy, which will be the ultimate platform for a competent strategic defense of earth. [7]

The real threat is not from events in a passive universe, but in the fact that the galaxy itself is evolving, and that its rate of evolution defines what must be our own.

Overturning the Big Lie

Borrowing from President John F. Kennedy's famous 1962 Rice University address, if we take the age of the Earth as one day, the development of complex life on Earth began about 3 hours ago. Humans have existed for a mere 3 minutes, and recorded human history began only within the last tenth of a second. The story of humanity's existence is one of a newcomer to our galaxy.

We can locate the mere several million years of mankind's existence within the development of complex life over the past half billion years, since the Cambrian explosion. Written in the fossil record is a history of ceaseless development and increasing activity, a process that can only be characterized as anti-entropic. (See Appendix 2: The Principle in Evolution)

Reading this story, the development of life shows a clear periodicity of rise and fall, punctuated by great dips called mass extinctions. The overall trend of the increase in diversity and dominance of life is characterized by these cycles, one of about 60 million years, and another of about 143 million years. [8] All life as we know it on Earth is subject to these geologically sudden apparent disasters, within an overall envelope of anti-entropic progress. Mankind apparently has yet to experience one of these periodic events, although we have indications that we may be entering into such an era now.

There have been attempts to pin the blame for these extinction events solely on external causes, such as asteroids, volcanic eruptions, changes in sea-level, and so forth, but no one event appears to be the key culprit. Indeed, the Earth itself has revealed that most, if not all, of these categories of events are periodic, and coherent with the two major biological signals. (see Fig. 1)

Evidence has emerged that the entire Earth appears to pulse to the rhythm of a ~60 million year cycle. Shanan Peters and Steve Meyers show that the rate of sedimentation over, at least, North America increases and decreases with a semi-regular ~56 million year period. [9] Such a phenomenon would be caused by changes in the relative heights of sea level and continents ("continental freeboard"), which could be driven by either melting of icecaps, or continental uplift. Such a ~60 million year period has also been indicated by Prokoph, et al. (2006), in the production of continental large igneous provinces, also suggesting regular uplift and collapse of the continents, possibly related to the formation of supercontinents. [10]

Long-term climate variations of the entire planet correspond with the longer of the two biological cycles. It is well known that the Earth goes through periods of widespread glaciation ("ice house") and periods of warming ("hot house"). Several scientists have dated the occurrence of apparent "ice house" epochs in our Earth's history, and have noted that there is a prominent periodicity in their recurrence – between 140-150 million years. [11]
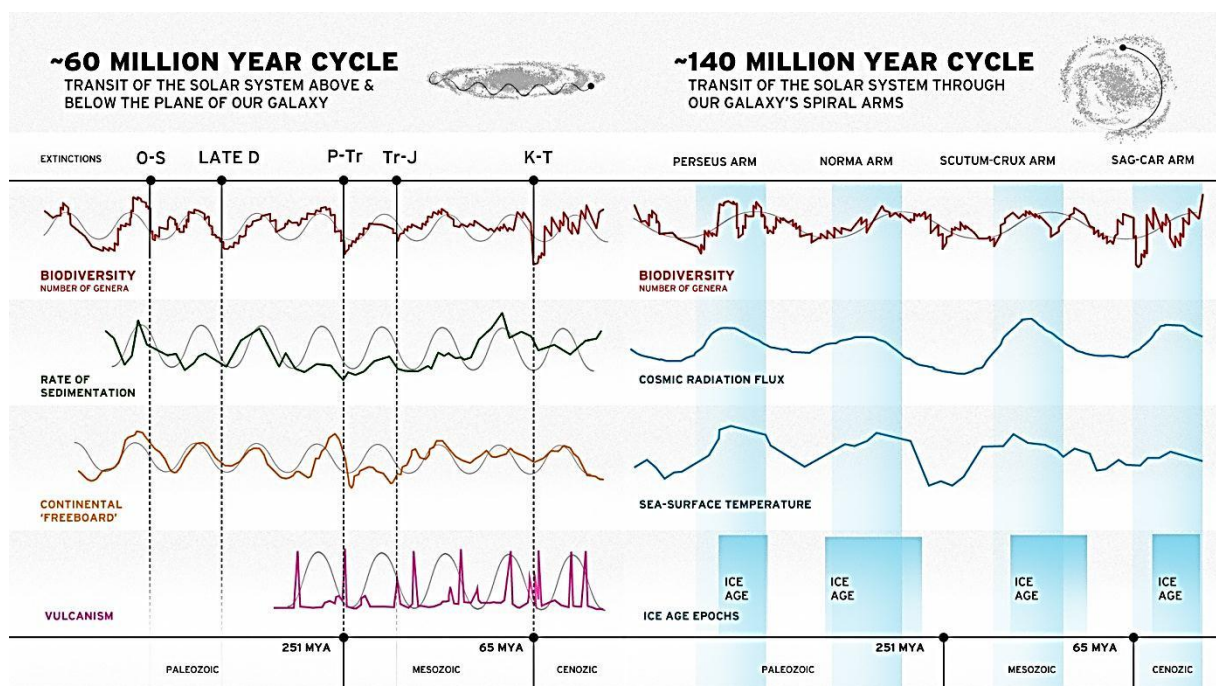
Fig. 1. Graphical representation of the two theorized orbital cycles of our solar system through our galaxy, and the corresponding cycles in biodiversity and geophysical/climate activity. [8][9][10][12]

In trying to unravel the tale of these cyclical changes the Earth has experienced, we are apparently led beyond our planet and our solar system. Even the longest cycles of Earth's motion with respect to our solar system, as was demonstrated by Milankovic, are only on the scale of hundreds of thousands of years. In searching for longer cycles, we must investigate phenomena at the galactic level.

Nir Shaviv has hypothesized, that the long cycle of ice house events on the Earth are driven by changes in cosmic ray flux, which is in turn conditioned by the passage of our Solar System through the arms of the Milky Way galaxy. Shaviv has shown that just such increases and decreases in galactic cosmic ray (GCR) flux are preserved in the isotope record of iron meteorites found on the Earth. The GCR flux oscillates on a ~143 million year cycle, which coincides well with the cycle of both ice house events and with the long-cycle of biodiversity. [12] On the shorter scale, astronomers such as John and Safi Bahcall have shown that the entire Solar System may "bob" through the galactic disk, passing through once every 26-37 million years. [13] The entire perpendicular cycle, from one extreme and back again, would take on the order of 52-74 million years, matching both the cycle of geophysical pulsation of the Earth and the biodiversity cycle of life. [14]

But, we must remember that these hypotheses of cause derived from hypotheses about our travel through the galaxy, are just that: hypotheses. There may be a more fundamental driver for these long cycles. Russian biogeochemist Vladimir Vernadsky established that our universe is composed of at least three distinct phase-spaces, which interact and overlap in a Riemannian fashion: the abiotic, the living, and the Noetic (human-creative). (See Appendix 3: Vernadsky's States of Space) Each phase space has its own spacetime characteristics, and dominance proceeds from the top down, from the creative down to the abiotic. Bounded spacetime is ubiquitous within the living phase space, as is evidenced by regular temporal cycles within organisms - e.g. Franz Halberg's "circadian" and other cycles. It has been suggested, by Halberg's group and others [15], that the much longer term evolutionary cycles - including the ~60 million year and ~140 million year cycles - are as inherent in the biological phase space as circadian rhythms. Organisms, across generations, may exhibit such cycles as internal to the phase space, but are able to entrain those internal rhythms to external cues, such as those galactic cues referenced above. Perhaps, it is necessary to apply Vernadsky's reasoning, and investigate whether the rhythms apparent in the geologic, astronomic, and galactic systems are also expressions of this internal, living phase space?

Here, we run into a contradiction. While the evolution of life on Earth has followed a clearly anti-entropic path, astronomical and cosmological investigation is dominated by a fraudulent extrapolation of the Second Law of Thermodynamics, a law of increasing entropy. [16] This false doctrine is typified by the work of Pierre Simon Laplace, whose misrepresentation of linear time and empty space has become a corrupting dogma, crippling scientific understanding among today's researchers. There must be a harmony between the anti-entropy evident in the development of the biosphere and processes of the galaxy at large, if we are to reconcile the coincidence of the cycles we just identified. Instead of starting from the assumption that pockets of anomalous anti-entropy may exist within a universe otherwise governed by a false law of increasing universal entropy, we must begin with the empirical generalization that, since the development of the Earth's biosphere has always been anti-entropic, such anti-entropic development must already be an inherent property of our own galaxy.

This begs the question: what, exactly, is our galaxy?

The Anomalous Redshift

Here, we aim to permanently dispel the idea of an assumed entropic fate of heavenly bodies. What we can discover in a study of galaxies, unhindered by false assumptions, is the creation and growth of galaxies, evolving into new states – indicating not only a maturation (as opposed to death), but even what we could call creativity.

This evidence comes from the early work of the American astronomer Halton Arp, studying the systemic associations and physical interactions between very high-redshift galaxies and low-redshift galaxies, something which is prohibited in the doctrine of Second Law cosmology. The entirety of present cosmology demands that two galaxies with vastly different redshifts must be greatly separated in space and in time – yet we see clear examples where this is not the case. [17]

This demonstration explodes the standard Big Bang theory. However, our focus here is not a treatment of the Big Bang as such, but of the much larger issue of the underlying assumption of the fraudulent Second Law of Thermodynamics.

There are two particular types of celestial objects which help to expose the fraud. The first type of object is a specific class of galaxy known as a Seyfert galaxy. These galaxies have very active central cores (nuclei) which shine much more brightly than the nuclei of other galaxies, and across a broad range of the electromagnetic spectrum.

The second type of object is known as a quasar. [18] These are most well known by their extremely high redshifts, and when they are viewed in the sky, they appear relatively faint and small. [19] Standard cosmological doctrine requires that these quasars, on account of their extremely high redshifts, be extremely far away – much, much farther away than the Seyfert galaxies we see.

However, Arp demonstrates that these two classes of objects, which should be vastly separated in space and time, and therefore should be absolutely unrelated to each other, are actually systemically associated. This means that in the general regions around Seyfert galaxies we find significantly higher densities of quasars than we would find if these two types of objects were completely unrelated. This correlation suggests that an actual physical relationship between the two objects must exist, i.e. they are close to each other in space and time, meaning that the standard assumptions about redshift fall apart. There must be some other cause for the dramatic redshift of quasars.

Arp calls this anomalous redshift, which cannot be attributed to anything within the framework of Second Law cosmology, the *intrinsic redshift*, a property shared by all galaxies as well as quasars. As will be discussed below, this requires a new approach to physical phenomena, incorporating the notion of a fundamentally creative universe, whose properties require a thorough study of the phenomena of life and cognition.

Not only did Arp show that there is a general association between Seyfert galaxies and quasars, but also that there is a tendency for pairs, or even multiple pairs of quasars to line up perfectly across these active galaxies, as seen in Fig. 2.

As both Seyfert galaxies and quasars are relatively rare objects, the chances of those in the image above being unrelated, and only accidentally seen near each other in the sky, is quite small. The chance of finding just two unrelated quasars with similar redshifts this close is only about 1 in 100. Add to this the probability of seeing a Seyfert galaxy this close to the pair, and the likelihood of being a chance occurrence drops dramatically. Include the fact that they all line up nearly perfectly, with the Seyfert galaxy almost exactly in the middle, and the likelihood that this is mere coincidence becomes vanishingly small.
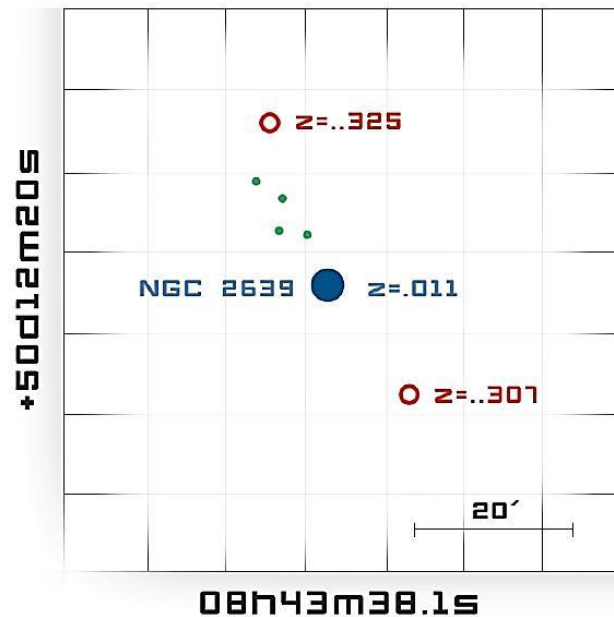
Fig. 2. Seyfert galaxy NGC 2639 with a pair of quasars perfectly aligned across the galaxy. This is an exceptionally good example, as the quasars have very similar redshifts as well. If redshifts were actually indicative of distances, these quasars would have to be ~20-30 times farther away than the galaxy. The redshift values are indicated by the letter z, and are usually given in one of two forms, either in terms of a special scale ranging from 0.0 to extremely high values of 8+, or the measure of kilometers per second, which is generally used for lower redshifts (even though the object may not actually be moving at that speed, this is still used as a convenient measure of the redshift value). [17]

Perhaps one or two incredibly rare exceptions could be tolerated, but by the mid-1990s Arp had identified dozens of very clear cases of such alignments.

Not only does this mean that these objects with dramatically different redshifts are located very close to each other in space and time (close in extra-galactic astronomical terms at least), but, as we will see below, these examples also point to the creative nature of galaxies, acting to generate new states of existence in the universe.

This evidence of the paired alignments, gathered from what were then new x-ray observations, fits in perfectly with decades of Arp's earlier work, during which he had studied anomalous cases of galaxies that were known to be ejecting massive structures from their central cores.

These earlier studies uncovered numerous cases of objects with very high redshifts in close proximity and along the same direction as the jets of ejected material, and sometimes even within the jets, showing that these high redshift objects were actually being ejected from much lower redshift galaxies (Fig. 3). This evidence has long indicated that it is not just quasars that have this intrinsic redshift property, but that all galaxies do as well.

Creative Galaxies

The evidence of intrinsic redshift shows us a creative universe, in which galactic systems are created and then evolve and develop, more closely resembling the morphogenesis of a living organism than any Second Law, entropic process. [20]

Though more work needs to be done to determine the exact nature of these processes, the intrinsic redshift values observed for different quasars and galaxies appear to correspond to distinct stages of galactic evolution, in which quasars may represent something akin to an embryonic stage, characterized by very high intrinsic redshift values, which then progressively decrease as the quasars evolve into full-fledged galaxies. [21]

Further insight into how redshift indicates an evolutionary stage, can be gained by looking at relatively small systems of galaxies understood to be physically associated with each other because of their similar locations in the sky and similar luminosities and sizes. These are called galaxy groups.
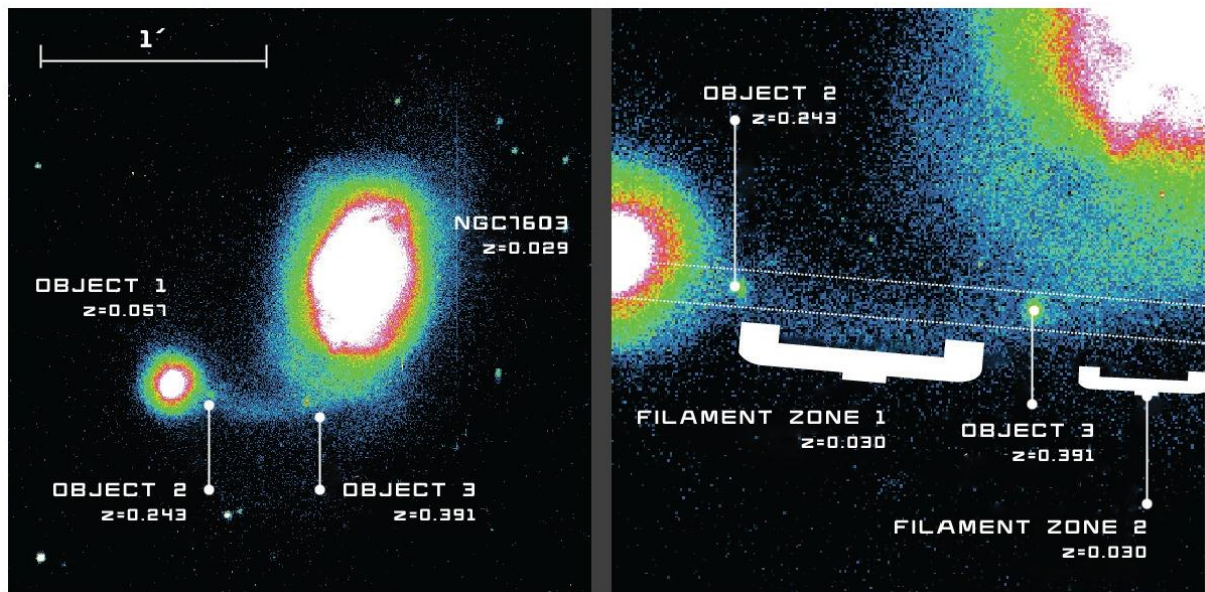
Fig. 3. Famous case of the Seyfert galaxy NGC 7603. A bridge of ejected material stretches out from the main galaxy to connect to a smaller companion galaxy with twice the redshift. Two quasars with much higher redshifts also appear to have been ejected along with this bridge. Image credit: López-Corredoira M., Gutiérrez C. M., 2002, A&A, 390, L15.

One of the closest and best studied groups is the M81 group, so named because its brightest and largest member is the galaxy M81 (Fig. 4).

As Arp shows, if we take all the galaxies of the M81 group and plot them by their redshift we see that all of the companion galaxies surrounding M81 have a higher redshift than this parent galaxy.

This phenomenon of smaller companion galaxies having consistently higher redshifts than the respective dominant parents of their group was confirmed in other groups studied, as well as in studies of the entire Virgo cluster of galaxies. [22] This adds further proof that the intrinsic redshift we measure is an indication of the stage of evolution of a galactic system, and that new galaxies are being created, developing, and growing.

Looking back to our home, our own Local Group of galaxies, of which our Milky Way is a member, is no exception. For our Local Group, the dominant galaxy is the Andromeda galaxy (M31), and again, all of the major companion galaxies around it, including our own, have higher redshifts (Fig. 5).

Combining the M31 and M81 groups, and plotting the members by their galaxy type and by their redshift, we again see how the larger, older spirals galaxies (M81 and M31), have lower redshifts than their companions.
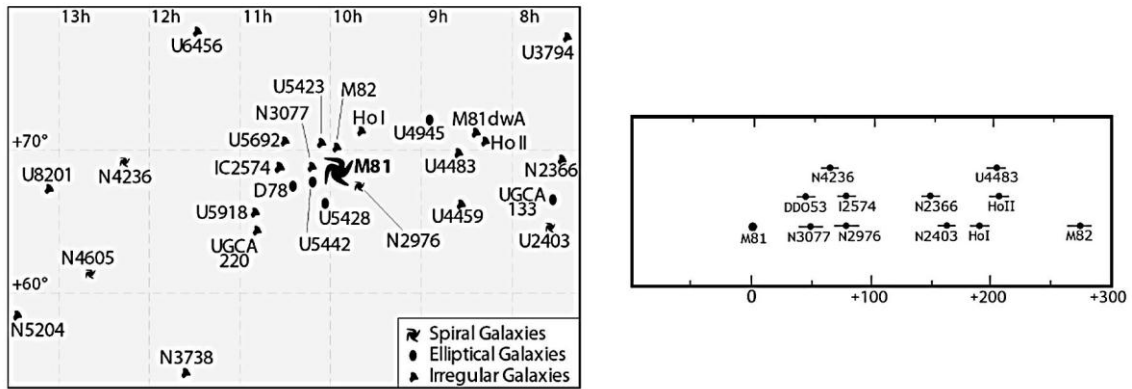
Fig. 4. (Left) Map of the M81 Group as observed in the sky (sizes not to scale). **(Right)** Main members of the M81 Group plotted by their redshifts relative to M81, increasing redshift towards the right. [21]
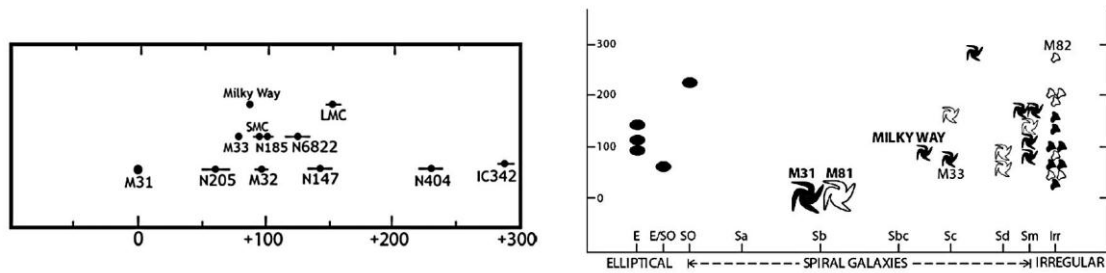
Fig. 5. (Left) Main members of our Local Group of galaxies plotted by their redshifts relative to M31, increasing redshift towards the right. **(Right)** Main members of the M81 group (outlines) and the M31 group (solids) plotted by their galaxy types and redshifts, again taken relative to the parents M81 and M31. Redshift is along the vertical axis. (note: more members of both groups have been discovered since 1998, when this study was first published. The new galaxies are all consistently more redshifted than their parent galaxy.) [17]

When we observe the Andromeda galaxy from the Earth, we see it as one of the rare galaxies with a negative redshift (blueshift). The standard assumption of attributing shifting spectral lines to the effect of relative motion has led to the popularly stated claim that our own galaxy and Andromeda are crashing towards each other, destined to collide in some 2 to 5 billion years. But we have already shown this to be an unfounded assumption.

Since our galaxy is a companion to Andromeda, the parent galaxy of our Local Group, we should have our own intrinsic redshift relative to our parent, indicating the continual growth and development of our own galaxy. This rate of development of our own Galaxy constitutes the baseline rate of development for survival within that Galaxy. If mankind does not maintain or exceed this rate of growth, we face the same fate as countless species before us, who were similarly outpaced by the increase in energy flux density requirements. This understanding bears on how national and international economic policy must be determined, in order to guarantee our continued existence within this system.

The State of Galactic Spacetime

How is a galaxy able to act as a single system such that we observe this unified effect? That is, when we look at another galaxy, what we see is the result of light being emitted from millions to trillions of seemingly discrete stars, yet we do not see a variety of redshifts: rather, we see one intrinsic redshift of the whole system. Since the galaxy as a whole possesses this intrinsic redshift, how does each individual star of that galaxy know to emit light of the same intrinsic redshift? Or, more simply, since each star is emitting its own light, how do they all act in harmony to a single effect? [23]

This underscores the importance of eliminating the empty-space conceptions of our universe. We have to rid ourselves of the fallacy that a galaxy is simply an accumulation of stars held together only by gravitational attractions — stars which would otherwise be autonomous, discrete objects. The above considerations require that we understand that stars don't compose the galaxy, but the galaxy composes the stars.

Along with other observational anomalies, such as the galactic rotation problem, these considerations raise the question of how to investigate our own galaxy as a self-bounded, developing system, and what this implies for our own existence within our galaxy's solar system.

The work of Albert Einstein and Vladimir Vernadsky provide a fundamental basis for investigating this question.

With Einstein's work on special relativity, it was realized that new causes for redshift were possible. In special relativity, objects traveling at extremely high velocities relative to one another, approximating the speed of light, observe each other undergoing a distortion of their respective measures of distance and time. Light emitted from such a "slower" time will appear to have a lower frequency. The observer who receives this light will thus experience it to be shifted toward the red end of the spectrum, just as with the Doppler redshift. This redshift, however, is in a sense native to the observed object, as it is a product of a transformation of the internal spacetime relationships that the object experiences.

What if there are other means to effect this sort of spacetime distortion? It is feasible that two adjacent objects, experiencing no relative motion between them, could yet manifest totally different redshifts due to a difference in their respective spacetimes. It is even conceivable that more intricate distortions of the expected spectral lines could arise, shifting the different spectral bands of different elements in distinct ways, such as those currently being attributed to a change in the fine structure constant. (See Appendix 4: Fine Structure, Constant?)

In fact, such a *heterogeneous* spacetime is required by the later work of Vernadsky.

In the 1930's Vernadsky had reexamined the qualitative distinction between life and non-life (an area broached earlier by Louis Pasteur and then Pierre Curie) from the standpoint of the work of Bernhard Riemann, opening up an entirely new depth of understanding of this distinction. [24]

The product of this work is reflected in a trilogy of papers on the Problems of Biogeochemistry and On the States of Physical Space. [25] In these works Vernadsky demonstrates that the concepts of absolute space and absolute time must be thrown out. The physical properties of the space and time can not be brought in from outside assumptions, but are determined by the phase-space of the process itself, and thus become a subject of empirical investigation.

(See Appendix 3: Vernadsky's States of Space)

All this combines again to make us ask: What actually are the spacetime properties of an anti-entropically developing galaxy? To what phase space do they belong? Are we justified in the assumption that they belong to the abiotic? Might they in fact belong to the biotic? The cognitive? Something else entirely?

This will only be determined by an investigation of the galactic system itself, and how it changes and develops.

Message From a Guest Star

Our own solar system, though billions of years old, is still a relatively recent addition to our evolving galactic home. Only a fraction of that relationship is recorded in the cycles of the development of complex life on our tiny planet over the past half-billion years, as discussed above. We are left to wonder, with the human species existing on this planet only for a few million years (not even the length of one complete cycle), how has our entire galaxy changed over the course of even just these "recent" galactic cycles?

Even much shorter than the period of the existence of our species, all of recorded human history becomes an almost infinitesimal slice of one of these galactic cycles.

Probably the most famous expression of the constant development of our galaxy is the Crab Nebula. This amazing anomaly of the night-time sky is an incredibly recent addition. Though the nebula was first observed with a telescope in 1731, later taking the first place in the famous Messier catalog, its location corresponds to that of a supernova observed by Chinese astronomers in 1054 AD. This gives the Crab a birth-date well within the limits of human history, less than a thousand years ago, more recent than the reign of Charlemagne. [26]

Since that recent date, the Crab has risen to become the most conspicuous character in our evolving galaxy. [27] Currently expanding at a rate of 1000 kilometers per second, a transformation which is clearly visible in photographs taken over decades [28], the Crab boasts, as one of the first shocks that it delivered to astronomers, the fact that its expansion is in fact accelerating rather than winding down — behavior rather uncharacteristic of a simple explosion or a dying star. Again, we see a universe whose character is in fact developing and growing, and this at accelerating rates.

This steady transformation of the Crab has not ceased. Beginning in 2009, the relatively recently launched Fermi Gamma Ray Space Telescope and also the Italian AGILE telescope began observing short, intense flare-ups of gamma rays possessing energies of up to 10 quadrillion electron volts. But then, on April 12 and 16 of 2011, two "super flares" occurred which were over five times brighter than anything previously observed in our neighborhood. The source and cause of these flares is still entirely unknown. When the Chandra x-ray telescope was turned to observe the Crab on these dates, absolutely no changes in the x-ray structure of the Crab were recorded. In fact no changes in any other frequencies were observed by other telescopes.

The rate at which these gamma ray flare-ups occur and then die down precludes the possibility that these emissions could arise from any known method of heating of the nebula's gases — the "cooling" phase would be far too rapid to be explained. However, if the suggested alternative is true, that electrons are being accelerated rapidly enough to produce the high-energy gamma radiation from their acceleration, these would be the highest-energy electrons connected to any known astronomical body. Add to this the fact that the largest flares occurred over the span of hours, and astronomers are at a complete loss for how such acceleration of electrons to such energies would occur. Is there perhaps some other possibility for the source of these flares?

Considered from the standpoint of the implications of our own galactic redshift, the more interesting likelihood is that we may not be able to explain the flare-ups by means of mechanisms occurring within the Crab itself. [29] In this case we must have recourse to a cause that is imposed upon the Crab, by its home galaxy, which renders the Crab a true expression of the development of that galaxy as a totality. Thus, what is usually discussed as a chaotic "explosion" actually displays some of the most remarkable expressions of change and development of our own galactic system — a process that we have witnessed over the course of relatively recent recorded human history.

Looking back to the Earth, we find our own home is as much an integral part of the intrinsic redshift-bound spacetime of our galaxy as the Crab nebula. What are the full implications of this for the inhabitants of our planet? As we will see below, the existential challenge — something only the human species has demonstrated the potential to address — is to define the needed science-driver program which will provide mankind with both a greater understanding of the totality of our relationship with our galactic system, as well as insights into how we can increasingly bring these interactions under our own control. (See Appendix 5: Empty Space?)

Local Weather From Your Local Group

We now proceed to a discussion of several areas which illustrate the immediate requirements of a system of planetary strategic defense. We begin with the recent weather, as an expression of our Solar System and its galactic and intergalactic environment, and then discuss the possibilities of defending against and potentially changing the threats of extreme weather, earthquakes, and pandemic diseases.

2011 gives us an intimation of what humanity may be in for. It all began with a gigantic blizzard in the American Midwest on Groundhog Day, which exploded as part of a dramatic, unforecasted shift within the atmospheric pressure regimes around the Arctic Circle. What followed was a series of deadly storms, earthquakes, and other major disasters, which now ranks 2011 as one of the most devastating years on record, globally, for natural disasters. [30]

Throughout the year, as disasters mounted, the British Monarchy's environmentalist attack dogs struggled to pin the blame on man-made global warming. The British "humanity did it" dogma is not only wrong, but ignores the fact that our entire Solar System has erupted with unusual activity in the recent few years. For example, in December 2010, a massive, planet-wide storm flared up on Saturn, and lasted until July 2011. This is the largest storm we have ever observed on the planet, and nobody knows why it started now. Typically, large storms have been observed on Saturn every 30 years or so, which coincides with its orbital period. They have always developed right around the time that Saturn entered into its northern hemisphere summer, and may have a kinship with the tornado season that hits our planet every northern hemisphere spring. But, this time, the storm initiated much too early. Saturn shouldn't transition to the stormy season for at least another seven years – some other factor caused this megastorm. Perhaps there are some who might claim that human emission of carbon dioxide on Earth is causing this extreme weather, also? (Fig. 6)

The Sun, itself, is transforming dramatically, in a way we haven't seen for at least 400 years. All important indicators of solar activity are telling us that the Sun is going into a new phase of activity, a Grand Solar Minimum possibly like the great Maunder Minimum of the 17th Century. [31] After coming out of an anomalous solar minimum, which lasted over two years, the Sun exploded with two large X-class, x-ray flares in early 2011. [32] This was followed by months in which several processes became decoupled. The northern hemisphere experienced surges of x-ray flares, while the southern hemisphere remained strangely quiet until later in the year. Seemingly independent of the flares, the Sun became amazingly productive in coronal mass ejections, some of which struck the Earth. Although the solar maximum for this cycle is forecasted to happen in 2013, various indicators are now saying that the solar activity abruptly accelerated late in the year, and that we had already reached maximum by late 2011.

It is important to note here, that this poses an immediate threat to human civilization in the near future. When a coronal mass ejection strikes our geomagnetic field, it can set off a geomagnetic storm, which, if powerful enough, could destroy electrical equipment through induced currents. The danger is that, should we suffer a direct hit by a large coronal mass ejection, it could blow out crucial elements of existing electricity transmission networks, crucial elements that can no longer be manufactured and replaced quickly by our devastated economy. Studies conducted to assess our vulnerability to such an event have shown that half the US population could be left

without power for over a year, a situation which would lead to dark age conditions literally over night. [33] As one person involved in the studies commented, imagine the aftermath of hurricane Katrina, but happening simultaneously in 10-20 major cities, and lasting well over a year.

During the second half of 2011, we already witnessed several coronal mass ejections that, had they happened only a few days earlier or later, may have been able to inflict such devastation. Some of the largest geomagnetic storms we suffered this year, were the result of grazing near-misses by some of these magnetic mega-blasts. [34]

This "Fireball of Damocles," under which we precariously stand, is a very conspicuous reminder of how little we know about our own solar neighborhood. The entire system is transforming, as a system. Within this context, the development of a true strategic defense policy means that we must understand what drives that transformation. This capability is what the genocidalist green agenda, spearheaded by the global warming hoax, is blocking.

Cloudy With a Chance of Cosmic Rays

The unscientific basis of current carbon-obsessed climatology has been most notably exposed by the work of Henrik Svensmark and others on cosmic rays and cloud formation. [35] Low level cloud formation can be catalyzed by ionization from incoming cosmic radiation interacting with our atmosphere, playing a significant role in mediating a cooling and warming effect on Earth, as well as affecting precipitation. According to this theory, the influx of cosmic radiation catalyzing this process is mediated by galactic changes, galactic cosmic rays being the greatest known source of cosmic radiation, while solar activity plays a further mediating role. When the Sun is more magnetically active, the electrically-charged cosmic rays tend to get deflected from the Earth by solar wind. This includes outbursts from such events as coronal mass ejections, leading to so-called Forbush Decreases in galactic cosmic rays.

While paleoclimatic studies have shown strong correlations between cosmic-ray influx and cloud cover over geological timescales, there are indications that such coupling can have dramtaic short-term effects as well. In 2008, V.G. Bondur and Sergey Pulinets authored a paper called "Role of Variations in Galactic Cosmic Rays in Tropical Cyclogenesis," which examined a different manifestation of precisely this kind of effect on the Earth's weather systems, treating the case of hurricanes, specifically the 2005 Hurricane Katrina. [36] In the days prior to this devastating hurricane, the Sun unleashed a coronal mass ejection, which caused a geomagnetic storm here on Earth. Pulinets and Bondur showed evidence that the decreased cosmic radiation influx as the result of this solar event caused a decrease in atmospheric ionization normally caused by the cosmic rays. Condensation around these ions normally releases large amounts of latent heat. According to the authors, the sudden decrease in latent heat release high in the troposphere could have affected the atmospheric convection enough to cause an intensification and a change of the path of the hurricane, all ultimately potentially being driven by the change in galactic cosmic radiation interacting with the Earth's atmosphere.

The hypothesis of a significant cosmoclimatic effect is also supported by a number of experiments on the microphysics of ionization-induced cloud nucleation, most notably the recent CLOUD experiment at the CERN particle physics laboratory, which showed that cosmic ray ionization increases potential cloud condensation centers by at least a factor of ten. [37] This study also resulted in more questions than answers about the science of climatology, including the role of atmospheric gases in cloud formation; for example,the study revealed that even the basic atmospheric aerosol composition of clouds itself is far from being understood. The promotion of the anthropogenic climate change agenda has thus increasingly revealed itself to be nothing more than a British imperial program to push for deindustrialization and depopulation, as well as a fraudulent excuse for the onset of famines and other weather disasters.
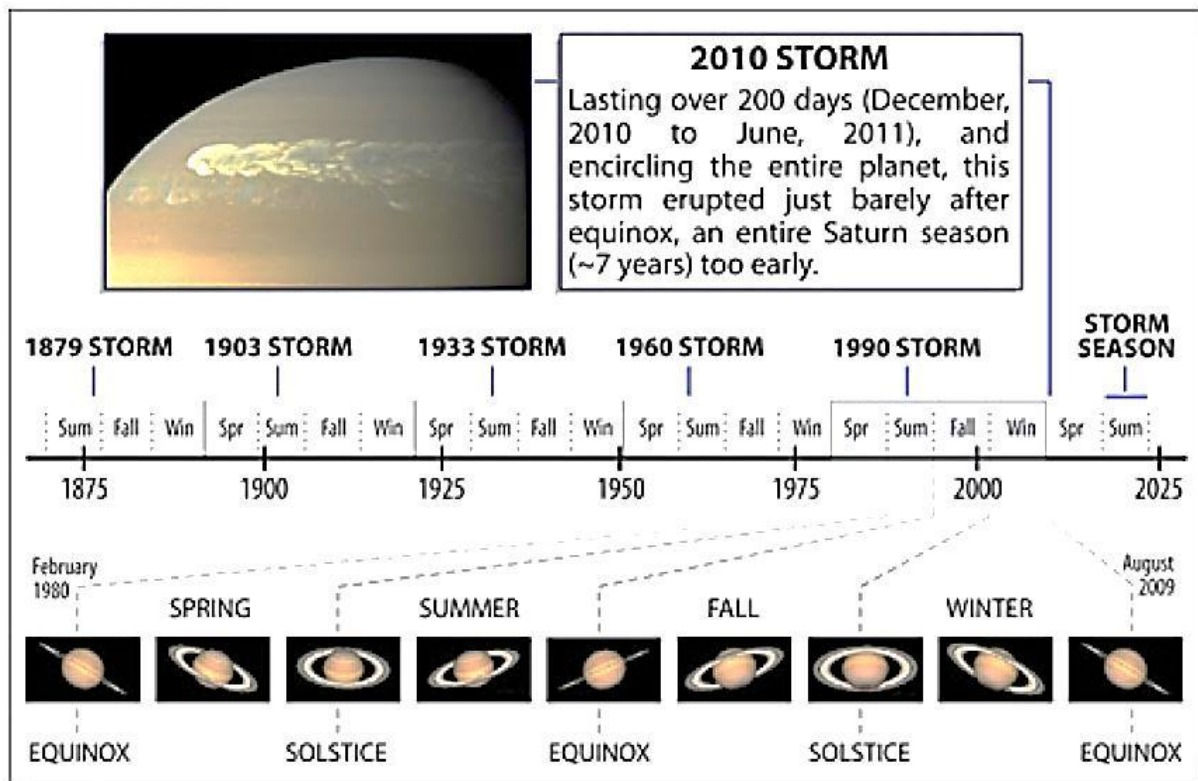
Fig. 6. The giant storm on Saturn

However, human-induced climate change itself is inevitable, and, in fact, necessary for a proper understanding of climatic processes. There have been long-standing experiments to induce rainfall, for example, largely through cloud-seeding. In recent years, a new approach to weather modification based on artificial ionization of the atmosphere has been gaining traction, drawing on the insights gained from cosmoclimatology. [38] This has the potential to give us greater leverage over key parts of the hydrological cycle. In combination with large-scale water management projects like the North American Water and Power Alliance (NAWAPA), which will increase the moisture available in arid regions, the direct manipulation of atmospheric parameters such as ionization can improve rainfall patterns, as well as mitigate destructive storms such as hurricanes. [39]

Investigation of atmospheric physics also gives us insight into processes deep below the surface of the planet.

We have renewed reason to conceive of seismic and weather phenomena, normally viewed as completely distinct kinds of processes, as different expressions of the same, much larger, environmental changes. This is typified, but not limited to, the study of atmospheric earthquake precursors. [40] These atmospheric earthquake precursors are tied to the Earth's Global Electric Circuit, which is also the case for weather events such as thunderstorms and lightning. But on a broader scale, these different kinds of punctuated events also express changes potentially occurring within our sun, our galaxy, and beyond. Let's explore further the case of earthquakes and earthquake precursors.

The Fallacy of Simply "Geo"- Physics

Official seismology continues to treat megaquakes, such as that which devastated Japan in March 2011, as essentially random events. Indeed, every single one of the most deadly earthquakes of the past decade has been off the charts of the U.N.-sanctioned Global Seismic Hazard Assessment Map, which is based on statistical extrapolations of worldwide seismic data from roughly the last hundred years. In other words, megaquakes such as the one that struck Japan each came as a total surprise to seismologists. Clearly, statistics alone will fail in precisely those dangerous situations that depart from the assumed norm, with the price for such failure paid for in human lives (Fig. 7).

This does not mean, however, that earthquakes are inherently unpredictable.
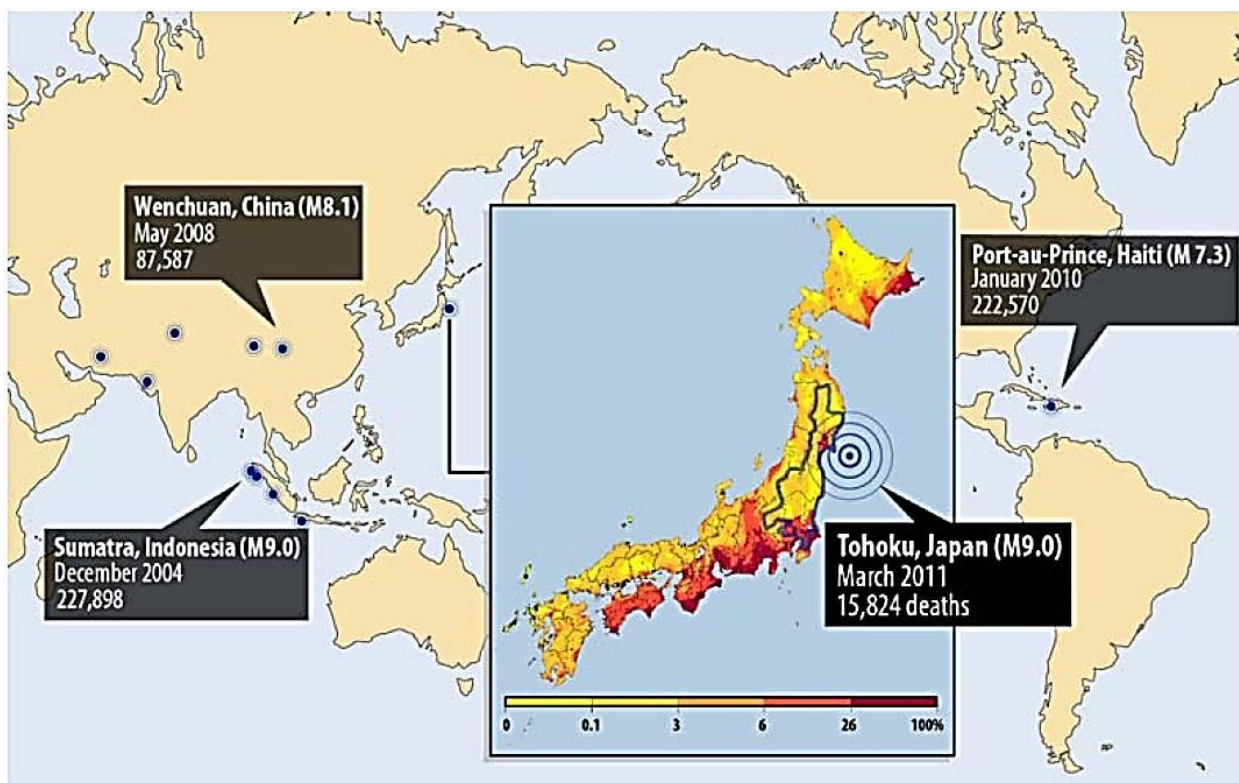
Fig. 7. Between 2000-2011, the 12 deadliest earthquakes (11 are shown on the map here) claimed some 700,000 lives. In every case, the actual seismic intensity of the earthquake exceeded the maximum predicted by the Global Seismic Hazard Assessment Program (GSHAP) map published in 1999, which is used as a standard government reference respecting building codes and emergency response. On the map of Japan, which has the densest network of seismometers in the world, the colored bars indicate the government's predictions of the probability of a "high hazard" or "very high hazard" (according the GSHAP seismic intensity criteria) earthquake occurring within 30 years, beginning in January of 2009. As can be seen from the blue outline, the region which actually experienced this level of seismic intensity from the March 2011 earthquake was generally assessed as a relatively low-hazard region. Sources: Vladimir Kossobokov, International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences; Japan Meteorological Agency.

In fact, it has been clearly demonstrated by a number of scientists working in different countries, nearly all without government support, that large earthquakes are preceded by an array of

measurable non-seismic precursor signals which could be incorporated into an early warning system. These precursors are the result of a complex and largely unseen process of physical preparation, of which the rupture of a fault zone is only the most dramatic manifestation.

Many of these signals are projected as subtle electromagnetic fluctuations within the roughly 100-mile-thick curtain of atmosphere that extends from the weather-producing troposphere up to the electrically-conductive ionosphere, which interfaces directly with cosmic and solar radiation. For example, prior to the Japan quake, satellites registered atmospheric heating above the future epicenter, as well as perturbations in the total electron content of the ionosphere (Fig. 8). With an adequate array of ground- and satellite-based remote sensing instruments (such as that called for in IGMASS and similar proposals [41]) and dedicated real-time monitoring of precursor signals, these "whispers from the Earth" can not only tell us of impending disasters, but hint at the possibilities for breaking down the artificial barrier between space physics and geophysics (Fig. 9). [42]
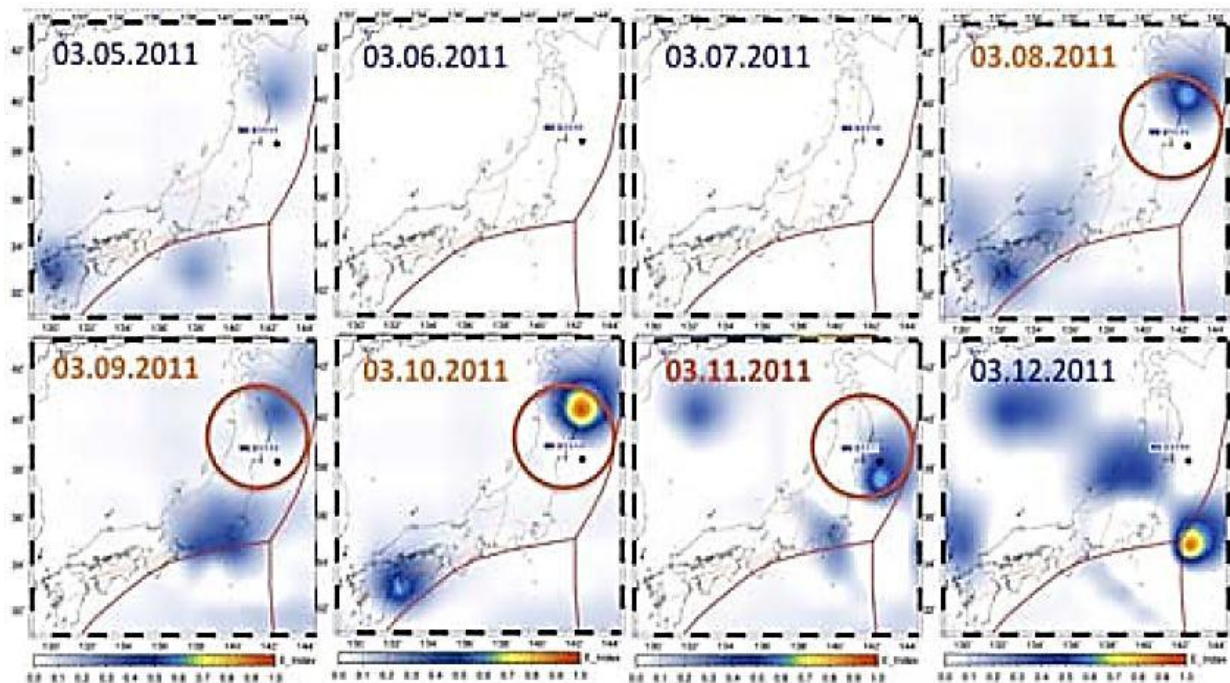
Fig. 8. Graphic from satellite observations of anomalous infrared emissions starting three days before the the March 11, 2011 Tohoku, Japan earthquake, and appearing near the epicenter. Graphic from "Atmosphere-Ionosphere Response to the M9 Tohoku Earthquake Revealed by Joined Satellite and Ground Observations. Preliminary results," D. Ouzounov et. al., 2011.

For example, several studies have pointed to a correlation between earthquake activity and the decadal solar cycle. Most recently two researchers out of Kyushu University, Japan, took the 4,108 large, shallow earthquakes from 1963-2010, and compared them with the phases of the last four solar cycles. [43] What they showed was that for each magnitude range there were consistently more earthquakes during the declining phase of the solar cycle through solar minimum, when compared with the ascending phase through the solar maximum. This discrepancy was most pronounced for the largest earthquakes.

The last decade, which contained the longest solar minimum of the century, also saw the most magnitude 8.0+ earthquakes and the greatest number of large volcanic eruptions for any decade over the past century. [44]

These relations should cause us to consider what types of similar activity might be occurring on other bodies of our solar system. Unfortunately, the best data we have is from the eight years
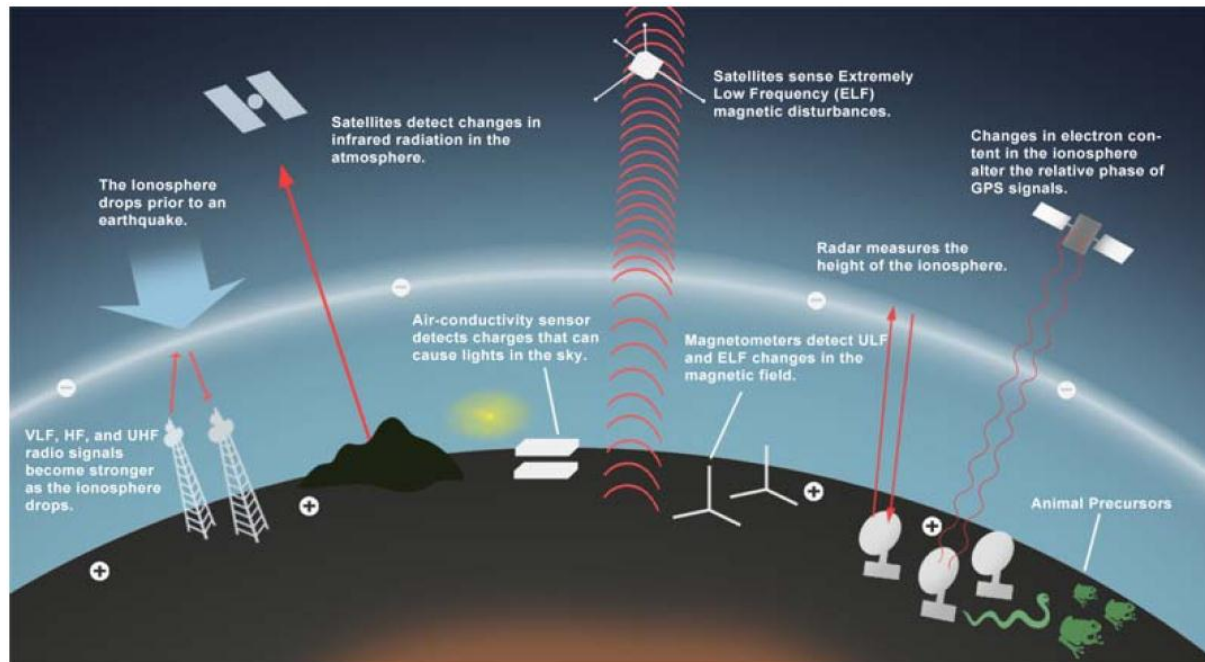
Fig. 9. A diagram of various forms of non-seismic precursors to large earthquakes.

during which we had operational seismometers on the Moon (1969-1977, left behind from some of the Apollo missions). During this operational window, out of the 12,500+ registered lunar seismic events that originated below the lunar surface (not due to surface impacts by meteorites, for example), 28 have been identified as "shallow moonquakes."

What is remarkable is that 23 of those 28 shallow moonquakes occurred during the half of the Moon's orbit when the near side of the Moon (on which the seismometers were placed) was facing a specific direction relative to the fixed stars, indicating a relationship not even to solar activity, but, as the author of the study says, to something originating outside of our solar system (Fig. 10). [45]

In light of this evidence for extraterrestrial influences on earthquakes, the deployment of a network of planetary seismometers, beginning with the Moon, should be an included feature of any comprehensive natural hazard monitoring program.
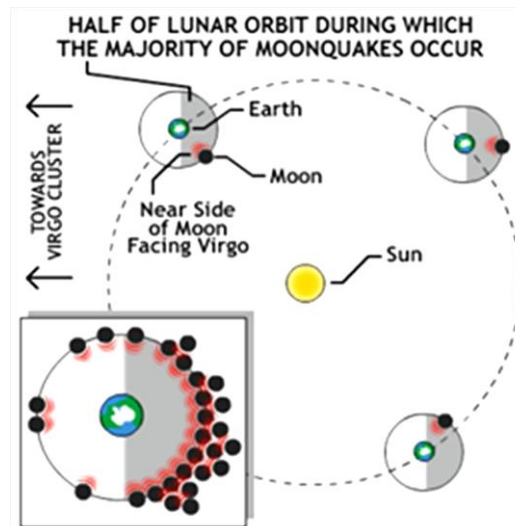
Fig. 10. 23 of the 28 shallow moonquakes recorded from 1969 to 1977 occurred when the Moon occupied the half of the lunar orbit in which the seismic network on the Moon's near side faced towards a certain direction in the fixed stars. This suggests a yet unknown influence coming from outside the solar system.

Solar Cycles: Something to Sneeze at

As with the deadly earthquakes discussed above, the challenges posed by our interactions with our solar system and galaxy are life or death issues for humanity. The potential already exists for monitoring atmospheric and ionospheric precursor signals of impending earthquakes to provide early warnings, a capability we must develop and expand with the needed satellite and Earth-based monitoring systems. But how might we expand such programs to incorporate the broadest range of threats?

For example, one of the largest periodic causes of mass death has been the outbreak of disease.

There is long-standing evidence showing that the incidence of diseases fluctuates with the Earth-Sun relationship. The most well known of these fluctuations is the seasonal flu pandemic. None of the conventional explanations for why influenza flares up during the northern hemisphere winter (environmental humidity, vitamin D deficiency, etc.) has yet been validated, yet the seasonal variations are very real. Further, this cycle of seasonal outbreaks is also a cycle of the evolution of the virus itself, a phenomenon which has not been explained by the standard models of mutation and selection. This seasonal variation would seem to imply a relationship between influenza outbreaks and the location of our planet with respect to the Sun.

In fact, looking beyond the yearly variations, the major flu pandemics of the past century exhibit an interesting pattern: the dates were 1946, 1957, 1968, and 1977, which imply a period of roughly 11 years, provocatively matching the sunspot cycle over this period (Fig. 11). Taking this back farther, if we map the major flu pandemics against the cycles of sunspot numbers for the last 300 years we get the plot on the following page. [46]

Here, you might not immediately see a correlation between specific solar cycle maxima and pandemics, but you can see that the pandemics occur in clusters. If we connect the sunspot peaks, which indicate how solar activity changes from one cycle to the next, then we see that the pandemic clusters occur during periods of more active successive solar cycles.
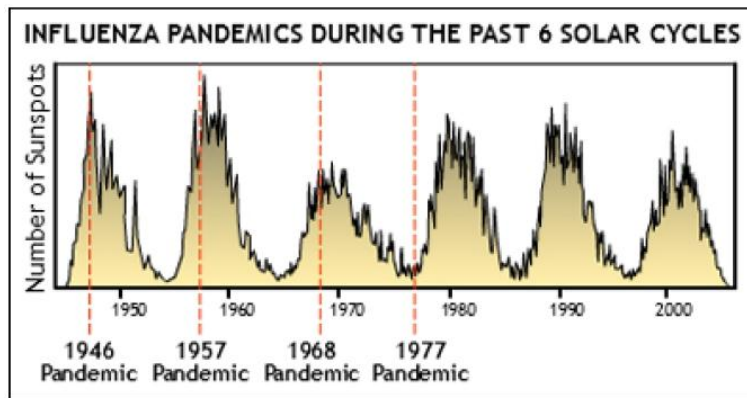
Fig. 11. The 1946, 1957, 1968, and 1977 pandemics shown over the last 6 solar cycles.

(Source: Tapping, Matthias, Surkan 2001)

An initial hypothesis might be that such a correlation implies a relationship between some solar parameter, such as ultraviolet radiation, and influenza pandemics.

Notable exceptions to this correlation – specifically, the cases where pandemics fall on years of sunspot minima — point to a causal agent on a grander scale. Researcher Yu Zheng-Dong has shown evidence that pandemics occurring during solar minima show a close coincidence with bright supernovae and other sources of ground-level cosmic radiation (Fig. 12). [47] This implies a galactic rather than solar driver of the phenomenon, with cosmic radiation influx from outside of our solar system as the main culprit, rather than incident solar UV radiation. That is, the changes associated with solar activity are likely rather caused by the Sun's well-known role in moderating the influx of cosmic radiation into our solar system, mentioned above.

If we take into account the increasing recognition of the role of viruses, particularly retroviruses, in human and animal evolution [48], we see a means by which the long-term development of life on our planet can be closely tied to such galactic cycles. This begins to point to the idea that what we currently call disease is instead simply a malfunction of a broader process of evolution. Many of the important biological traits in both humans and animals are seen to have a viral origin to them, when we look at the role of endogenous retroviruses (sequences in the genome thought to be derived from ancient viral infections).

Further, real-time examples of the mediating role of viruses in the development and interaction of organisms is seen in the case of ocean viruses. By far the most abundant biological entity in the ocean, they play a very specific role in moderating the evolutionary development of life there. For instance, viruses have been discovered which contain all of the genetic material necessary for photosynthesis. [49] This material is not used by the virus itself, obviously, because viruses do not photosynthesize. It exists only so that the virus can "infect" some other organism with this capability for photosynthesis. In fact, 60% of all photosystem A genes are from viruses which infect bacteria, and it is likely that 10% of all photosynthesis globally is carried out by photosystems with a viral origin. [50] Likewise, the vast majority of viruses "infecting" humans are not causing any sort of illness.

Fig. 12. Pandemic influenza mapped against sunspot number and nova occurrences (mostly flare-ups of our near neighbor Nova Carinae) for the past 300 years.
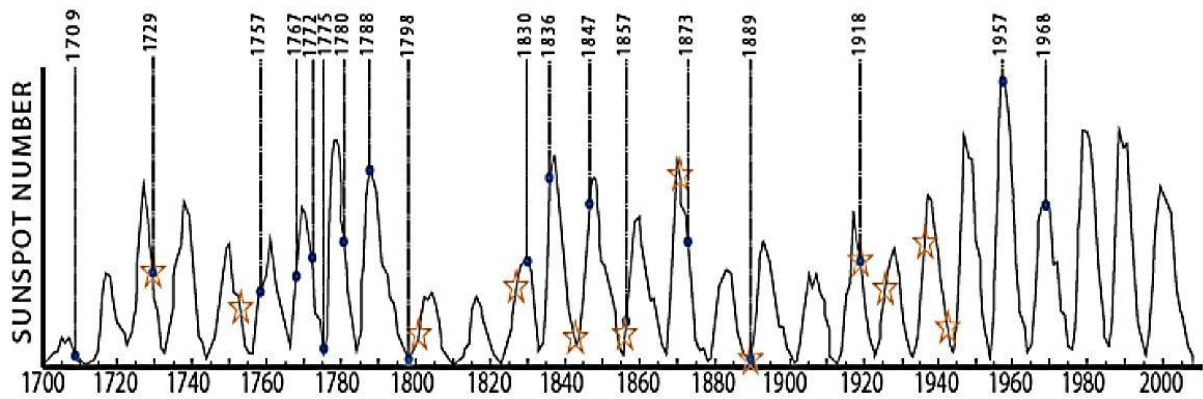
The number of symbiotic viruses contained within the healthy human body is currently unknown, though a recent viral census of only the human intestinal tract uncovered 4000 different viruses, 80% of which had been previously unknown. What role do these viruses play, if not as disease agents? In fact, compared to the relative infrequency with which a human being suffers from pathogenic viral infections (two to three colds a year), it would seem that the vast majority of viral infections are either innocuous or — as is the case with human gut bacteria — perhaps helpful and necessary. There may in fact be no means to control such processes of disease without taking voluntary control of such evolutionary processes in their entirety. Such control, tied as it is to larger-scale galactic processes, would evidently not be possible from our currently limited location here on the surface of the Earth. The research potential for the study of viruses is necessarily and greatly expanded when viewed in this context, and gives us another important application for any collaborative monitoring and defense system. How must we expand these global monitoring and defense systems in light of these considerations?

Remote sensing has already begun to be used to search for "disease precursors" on Earth. A 2009 paper titled "Using Satellite Technology to Model Prediction of Cholera Outbreaks," reported that remote imaging technologies developed by NASA "have been used to relate sea surface temperature, sea surface height, and chlorophyll A levels to cholera outbreaks." What we are discussing here is somewhat different, however. The role of viruses in such large-scale evolutionary processes and their relation to development on galactic and supergalactic scales presents us with the exciting but daunting prospect that, in order to control disease on Earth, mankind will likely have to take control of the very processes on a galactic scale which fuel such evolutionary development. Could Earth's cosmic radiation environment be consciously managed to such effect?

The Extraterrestrial Imperative or Extinction

As we have shown in this report, the defense of mankind against threats that have the potential to be "extinction-level," requires us to revise our view of the universe we live in. The universe evolves antientropically, expressing systems of higher and higher energy flux densities. When the universe becomes upgraded from one system to a higher system, the creatures of the biosphere also become upgraded, leaving the old ones to die off. Mankind, however, has the unique ability to seemingly transform his species, from a lower grade to a higher, which is

marked by the utilization of power sources of higher energy flux density. Man is not merely life, but inhabits the superior phase space of the Noösphere. Hence, we conclude with a schematic, for a comprehensive Strategic Defense of the Earth.

1) Make the next level of breakthrough in Man's application of higher energy flux densities, by mastering controlled thermonuclear fusion. The intensive efforts of the 1970s and '80s have been largely stymied by government pessimism, most notably in the United States and Russia, and replaced by a tiny number of huge experiments (such as ITER, or the National Ignition Facility) upon which almost everything depends. We need to return to an era of full government investment into a variety of experimental configurations, since it is absolutely not clear which configuration will make the first breakthroughs. Progress in fusion, especially thermonuclear fusion of the isotope Helium-3, will not only provide an enormous amount of cheap electricity, but also give us growing power over controlled plasmas, and the ability to propel spacecraft at constant accelerations quickly throughout the inner Solar System to intersect potential threats. [51] This is also the area where we will make necessary discoveries about the fundamental construction of matter in our universe.

2) We must rapidly expand our observational capability within our Solar System. This includes both ground-based monitoring devices like superconducting magnetometers (for the detection of earthquake precursors) and orbital satellites for observing the Earth. It also includes ground-based and orbital instruments around other planets, such as seismometer networks and orbiting telescopes. For example, Lyndon LaRouche has proposed a network of telescopes within the orbit of Mars, in order to perform long-baseline interferometry observations of the most anomalous objects in the cosmos, such as the Crab Nebula and our galactic center, to locate what new domains of principle we will need to grapple with in the next generations.

3) We must expand our studies of life in deep space. All of the biological cycles, such as those governing disease, have been studied only within the gravitational and magnetic cradle of the Earth, and we are thus limited by our lack of experimental controls. All interactions that we know of between life and the cosmos have so far been modulated by the Earth. We must take life beyond the Earth's influence, to study how life interacts with other radiative environments, in order to constrain which effects are due to the cosmos, and which due to the Earth. This means we may discover new domains of cosmic radiation itself, due to the high level of biological sensitivity to weak fields. This proposal also requires mastery over creating controlled environments for both living organisms and humans, for survival within the harsh environment of space. Practice with such controlled environments could be done on the Earth up in the Arctic regions, such as Russia is planning with its Arctic city of Umka. [52]

4) We must master the water cycle on the Earth, through attempts at large-scale water management and weather modification. We have already referenced the NAWAPA system as a shelf-ready system of taking control over the water cycle of North America, which must be adopted and moved on immediately, but there have also been attempts at directly modifying the weather, using methods of air ionization, which have also shown varying levels of success. Responsible nations will take these attempts seriously enough to either validate or invalidate them, as the potential to mitigate the extremes of both storm and drought would save millions.

5) Apply the resources of the military to all of these endeavors. A redefinition of the notion of strategic defense also implies a corresponding redefinition of the role of the military, the institution traditionally tasked with this mandate. The republican military tradition in the USA, typified by the founding of the Army's West Point Academy as an engineering institution, was once dedicated to nation building, by securing and defending the frontier. The frontier of space promises new challenges and opportunities for the cooperative application of national military resources and skills.

Yes, these steps sound suspiciously like a program for space colonization. In fact, an international collaboration for colonizing Mars would be the most efficient, and awe inspiring, method of meeting all of these requirements for the defense of Earth and humanity. Each step, from the mastery of fusion for accelerated flight to Mars, to the construction of terraforming projects like NAWAPA, will give us added power to manage our solar and galactic environment, and thus to ensure the immortality of our species.

These and other questions related to the strategic defense of the human species cannot be answered by simply projecting from present conditions. It is in the very nature of space science to operate at the very limit of knowledge, in which the most important gains to be made are not on tasks we can already foresee, but in the new questions that invariably arise when those limits are pushed. By committing to our extraterrestrial imperative, we give ourselves ever-expanding capabilities to answer these questions.

Such is true economics. Such is true strategic defense.
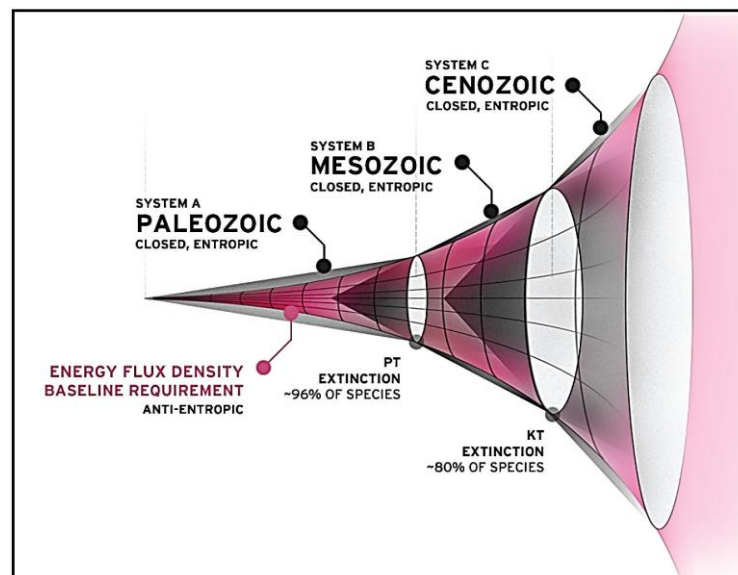
Fig. 13

Appendix I: energy flux density

If we define time by means of physical phenomena, rather than positing an a priori geometric conception, we find a way to escape the pseudo-paradoxes of Laplacian determinism (Fig. 13). The time of physics is a derivative quantity, like all of the so-called "fundamental units" of physics. Rather than describing processes as occurring "in" space and time, we ought to derive distinct models of space and time from distinct processes. This is, in fact, the methodological approach followed by Einstein in developing his special and general theories of relativity, though, as Vernadsky expressed this repeatedly, the geometrical notion of space and time there is applicable only to the specific phenomena of physics from which it was derived. Observations of the unique spatiotemporal properties of living and cognitive processes should yield distinct notions of these "fundamental units," in the same way as the attempt by Einstein to reconcile mechanics and electromagnetism led to the redefinition of space-time and matter-energy.

Studying biological time in all of its various expressions – particularly morphogenesis, the succession of generations, and evolution – gives us a texture of antientropic development which

distinguishes itself sharply from the linear models of time which have been successful in most areas of physics (though problematic already when applied to quantum phenomena).

Dividing biospheric history by functional systems rather than "time periods" allows us to identify a unique texture to such anti-entropic processes. This texture is operative in these processes at any resolution where successive distinct systems may be identified, but certain of its properties are most clear with the division given above, into the systems of the Paleozoic (old life), Mesozoic (middle life), and Cenozoic (new life) flora and fauna. Each closed system is characterized by a specific mode of operation which can be termed its "energy flux density," in essential agreement with the economic concept introduced by Lyndon LaRouche. In physical economy, this is typified by the succession of wood burning, to coal, to oil, to nuclear fission, and potentially to thermonuclear fusion and matter/antimatter reactions. In the development of the biosphere, the energy flux density of each system is well represented in each successive system by the metabolic character of the dominant predator in each of these periods, which serves as a singular expression of the energy throughput of the biosphere as a whole. Each system develops up until an upper limit is reached, at which point an extinction event ensues, on the other side of which a subsequent system, operating at a higher energy flux density, rises to dominance.

Additionally, it is possible to extract from this model an underlying continuous curve, which we have here termed our energy flux density baseline. The question is: Does this baseline actually represent something physical, or is it simply an artifact of our model? The answer to this question lies in the correlation between evolutionary cycles and processes on a galactic scale. We do have an external metric of progress against which the anti-entropy of life must measure itself: It is the anti-entropic development of galaxies as a whole which has been the topic of this report. It is likely on that scale that we find the origin of our baseline, which defines the requirements for energy flux density increase required at any moment to avoid the extinction of both animal and human systems.
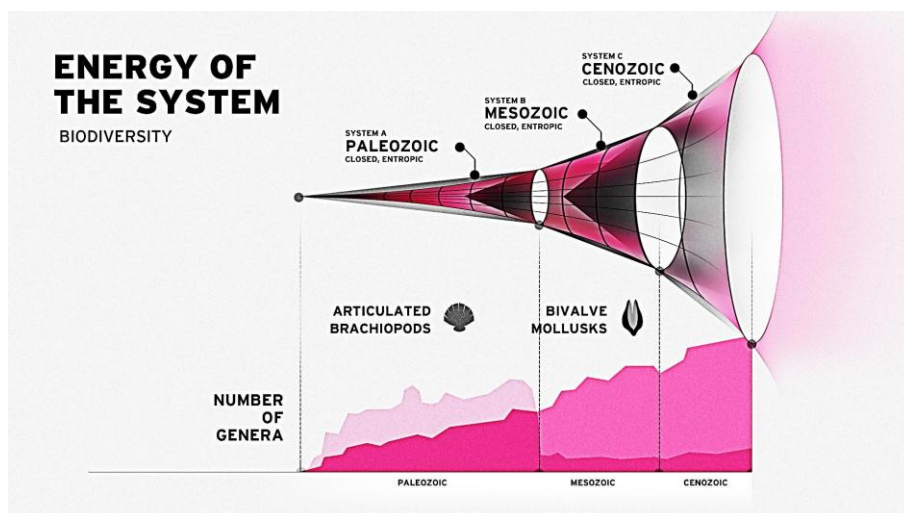

Fig. 14

Appendix II: The Principle of Evolution

As Vladimir Vernadsky first demonstrated, living organisms act as the driving force in the utilization of solar and cosmic radiation for the continuous transformation of the planet Earth, generating energetic and chemical conditions on which further life depends. Over the course of evolutionary history, life has always created pathways for higher and higher levels of energy-flux density, increasing the rate at which it transforms the surface of the Earth, and expanding the extent of its reach. We witness this development in the fossil records uncovered in the layers of the Earth's crust, which also express the development of the galactic environment which life on Earth has experienced over this period.

In this process we see that the species that are fixed to lower levels of energy-flux density, and are incapable of adapting to a higher system, are wiped out. Periodic extinctions, and even mass extinctions are necessary consequences, as the system of life moves forward.

To highlight one illustrative example, examine the tale of two forms of shelled sea creatures: "articulated brachiopods" and "bivalve mollusks." (Fig. 14) [53]

Despite the fact that these two types of sea creatures clearly have a very similar general structure, composed of two half-shells hinged together on one side, protecting a fleshy creature inside, according to the standard biologist's "tree" of life they are in completely different phyla and are not at all closely related. In fact, according to this standard view, their "closest common relatives" existed over 600 million years ago (creatures which did not visually resemble either of these two examples), and they are said to have since evolved separately, independently coming to have similar physiological structures. This is referred to as a case of "convergent evolution."

They also occupy similar positions in the food chain. They are generally of the same size, can live in similar locations, eat the same types of food, and are preyed upon by similar predators.

Whereas the brachiopods were extremely diverse and prolific during the Paleozoic Era (lasting from ~540 to ~250 million years ago), they are much rarer in our modern times, in which the bivalves dominate (for example, clams, oysters, mussels, and scallops are all bivalves).

For years the ascendancy of the bivalves was assumed to be a classic case of "survival of the fittest," by which one type of organism gradually replaced another through competition. However when paleontologists uncovered a clear enough reading of the fossil record it was seen that this was simply not the case.

Instead, despite sharing many physiological characteristics, as well as occupying the same general location in the food web, the mass extinction of the Permian-Triassic boundary selectively devastated the brachiopod populations, but hardly affected the bivalves.

Top-level experts in applying lazy reasoning to the field of paleontology claim that there is no overall structure to this process, and that it simply played out this way because one form just happened to be eliminated instead of another.

What the record shows is that the Permian-Triassic mass extinction (which is estimated to have resulted in the extinction of ~96% of all marine species), is one of the largest inflection points in the rising energy-flux density of the system of the biosphere as a whole. The periods following the P-T extinction are characterized by the dominance of qualitatively more energy-dense forms of life, as well as an overall increase in the energy of the biosphere as a whole, supported by qualitative transformations in the photosynthetic activity in both the oceans and on land.

As an expression of this, we see that the bivalve mollusks are characteristic of a biosphere of a higher rate of energy-flux density, when compared with the articulated brachiopods. The

bivalves have a metabolic rate roughly 10 times greater, contain a significantly greater relative amount of fleshy biomass (even when the shells are the same size), and are overall more active and mobile.

Appendix III: Vernadsky's States of Space

Russian-Ukrainian biogeochemist Vladimir Vernadsky used the experimental work of Louis Pasteur [54] to draw the conclusion that the spacetime characteristics of life are fundamentally distinct from the space and time of the mathematician or geometer. Such a concept of a malleable space and time is probably best known from the work of Albert Einstein, but Vernadsky's application of such an idea to the field of life is instructive for the investigation of unique physical spacetimes of other processes, even at the cosmic level.

Immanuel Kant wrote on the problem of handedness [55], and concluded that left and right were fundamentally the same, except only for an arbitrary choice in choosing their names. Outside of that choice in naming, there would be no way to distinguish a priori, with geometry and without referring to other objects of reference [56], a left from a right hand. However, living processes disagree with the world of Immanuel Kant.

Louis Pasteur showed the unique preference which a living organism has for either the left or right hand, or enantiomer, of a given chemical compound when the compound exists in such a handed form. The rotation of the plane of polarization in polarized light either to the left or right by an organic solution prompted Pasteur to investigate at what level this handedness existed.

For the organic compounds, it could not have been at the level of the larger crystal structure, since quartz crystals (a non-organic compound) will rotate the plane of polarization in their crystal form, but will not do so when dissolved, whereas the organic compounds do rotate the polarization in their dissolved form. This led Pasteur to hypothesize a unique molecular asymmetry of living matter, such as the right-handed character of naturally occurring tartaric acid. It is now known that with few exceptions, sugars used by living organisms are right-handed and amino acids are left-handed [57]. Any variation has shown the opposite handedness to have a completely different physiological effect, such as the case of rare left-handed sugars and right-handed amino acids (Fig. 15). [58]
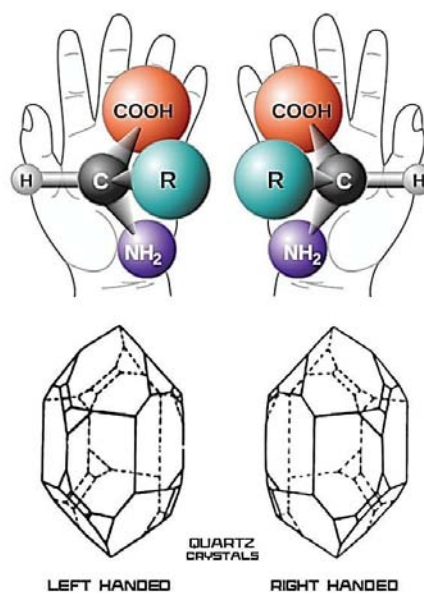

**Fig. 15. (Top) Generic structure of an amino acid.
The left-handed form is predominant in life. (Bottom) Left and right quartz crystals.**

There are also notable cases of medications which show the effect of a change in handedness, such as dextromethorphan (Robitussin), the well-known cough suppressant, whose mirror-image levomethorphan, an opiate painkiller, will have no effect on your cough. The sense of smell also registers the difference between two enantiomers, caraway and spearmint being two among many examples, chemically identical except for their effect on our noses.

However, Kant's original question remains: If, in Euclidean space, it is impossible to privilege left over right, what metric do organisms use to make such a radical distinction? If this a priori distinction does not in fact exist in Euclidean space, might it exist for some other geometry?

This problem coincides with yet another, seemingly unrelated problem. Just as Euclidean space is incapable of distinguishing, a priori, between left and right, Newton and Laplace's simple linear time is incapable of distinguishing between progress and regress. It was just this problem that drove Ludwig Boltzmann to his premature death by suicide. Life, however seems to encounter no such problem. Space and time measurements, as we now know well from Einstein, are also fundamentally linked to one another. If the space of life has fundamentally unique properties, would not the temporal characteristics also require the same?
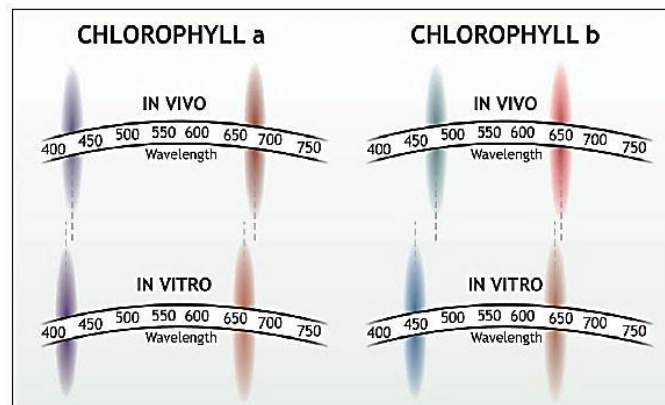
Fig. 16. Here we see two cases of a biological redshift for chlorophyll pigments. The top left shows the mean absorption wavelengths for chlorophyll a in vivo (435, 675 nm), and the bottom left, in vitro (420, 660 nm). On the right we have the same for chlorophyll b in vivo (480, 650 nm), and in vitro (453, 643 nm). Notice that the magnitude of the shift is not the same. The same irregular shift (and occasionally, a splitting of the mean wavelength) exists for other pigments.

These unique characteristics of the physical spacetime of life ought, however, to express themselves in other ways. In particular, we might expect that such variations in spacetime geometry ought to manifest in a distinct behavior of electromagnetic radiation, just as we see in special and general relativity, usually manifested on an astrophysical scale, but perhaps more intricate — a sort of biological redshift [59]. The difficulty here would seem to be observing the spectral lines produced by a compound while it was still within a living process [60] and then comparing those to the ones produced by the same compound while it was no longer part of a living process. In fact, such an experiment can be carried out using the biological process of photosynthesis (Fig. 16).

Within a given organism (in vivo), the responsiveness of a photosynthetic pigment like chlorophyll to specific types of light can be measured by observing its effects on the organism's metabolism. The same pigment can then be measured outside of the organism (in vitro) by the usual methods (Fig. 16). [61] We observe that it is in fact the case that a given mean absorption wavelength of light of a photosynthetic pigment is shifted (and at times split) when inside versus

outside of the organism. This is a shifting of the spectral lines more reminiscent of what we observe in what is now being attributed to a change in the fine structure constant (see Appendix 5: Fine Structure, Constant?).

Appendix IV: Fine Structure, Constant?

In addition to intrinsic redshift, there is another peculiar property of galaxies worth noting. A recent study of the absorption lines of distant galaxies yielded yet an additional shift, this one of an unusual character. Once the overall redshift from these objects is normalized, an irregular distribution becomes clear. That is, the amount of redshift of various spectral lines can not be completely attributable to a simple red- or blueshift (Fig. 17). The hypothesis of the investigators is that this might correspond to the irregular shifting of spectral lines associated with a change in the fine structure constant, a physical constant which is derived from a study of the interaction of electromagnetic radiation and matter at the atomic scale.
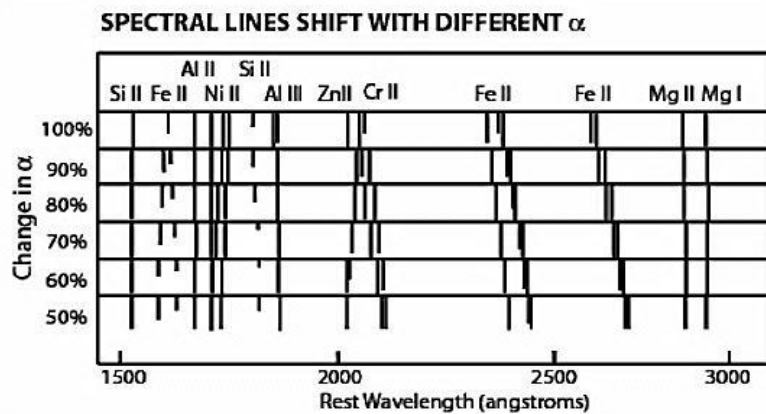
Fig. 17. Alpha is the fine structure 'constant.' The top row gives the absorption spectra of various elements as measured in the laboratory. Image reproduced from "Are the Law of Nature Changing with Time?" John Webb, Physics World, April 2003.

Since we have already discussed the existence of an intrinsic redshift effect as expressive of the stage of evolution of a galaxy, might this also be an intrinsic effect? It would be indicative of the physical spacetime which characterizes these objects. As we've discussed above, Vernadsky's work might give us other potential sources for such an irregular variation. In fact, it may be similar to the sort of irregular spectral shifting that we see with chlorophyll.

Appendix V: Empty Space?

The psychologist Wolfgang Köhler diagnosed the pervasive belief in Newtonian absolute space to be a mental illness which arises from an excessive belief in sense perception. [62] The limitations of our sense of vision cause us to tend to separate our visual field into "objects" and "background." Our extended electromagnetic sensorium, however, shows us that what we refer to as background is nothing of the sort.

Fig. 18 shows the constellation Orion. On the left, it is viewed in the familiar visible spectrum. On the right, it is viewed through the Spitzer infrared space telescope.

It is worth noting that the image on the right gives us a slightly better idea of the nature of the environment through which humans will travel during our colonization of outer space. Also,

given the level of activity of this invisible medium, as documented in this report, it is not inaccurate to liken this medium to the cytoplasm of a cell — while less obvious than the organelles, it is nonetheless more primary. We should take advice from the Scottish poet Robbie Burns, and learn to "see ourselves as others see us:" An observer standing on the Orion nebula, using their own version of the Spitzer infrared telescope, would not see the Earth floating through empty space. They would see us interacting with a lively medium which looked very much like the image on the right.
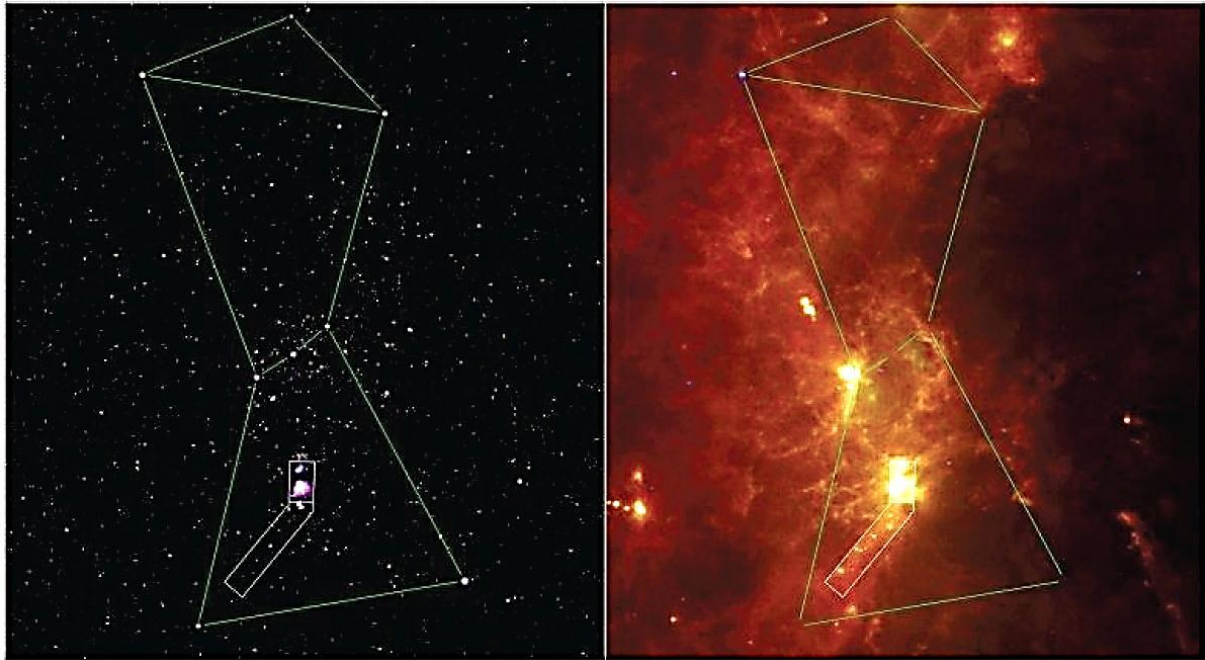
Fig. 18. The constellation Orion in visible light (left) and in infrared (right).

Appendix VI: The Very Large in the Very Small

Over the past few years an apparent interplay between the astrophysical and submicroscopic domains has been revealed in the relationship between nuclear decay rates and solar activity. Conventional physics dictates that the decay rates of radioactive elements are supposed to be an intrinsic property of the nucleus, not influenced by any outside factors. However, within the last four years, a series of studies have been published showing that the decay rates of samples of Radon-226 and Silicon-32 varied on a yearly cycle, corresponding with the changing Earth-Sun distance. [63] A follow up study showed that singular solar outbursts also can have an effect, as the decay rate of a sample of Manganese-54 was shown to have dropped at the same time as a significant solar flare in 2006. [64]

Despite the fact that these studies are still being fiercely contested by ardent reductionists, it is not a real surprise. Indications of even more interesting extraterrestrial influences on radioactive decay have been demonstrated by experiments over the past half century.

A team led by Russian researcher Simon Shnoll has published a series of studies based on over five decades of observation of the non-random fine-structure of decay rates and other processes (Figures 19 and 20). [65] They were not measuring the long-term variation in decay rates over time as in the above study, but were instead examining the fine structure of fluctuations over scales of seconds or minutes. It was expected that there would only be random variations in the

rate of activity, averaging to a random distribution curve. However, what they found was remarkable.

They did not get random distribution curves, but curves with specific peaks and troughs which would become more and more pronounced as the measurements went on (instead of averaging out, as expected).
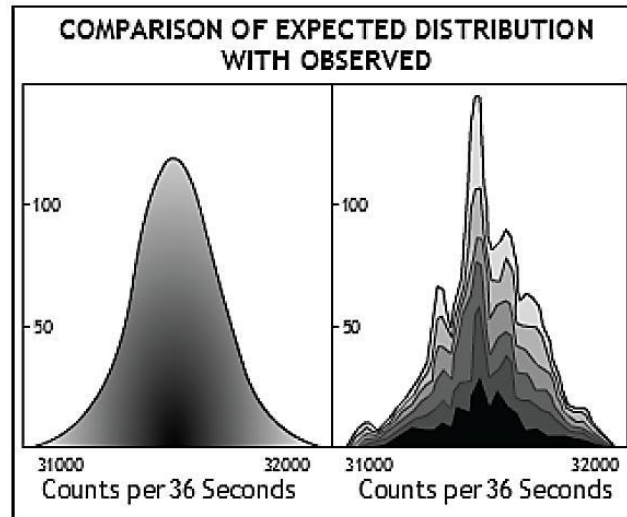

Fig. 19. The left shows a (Gaussian) distribution curve. If the process is completely random, an increase in the number of measurements would lead to a histogram cumulatively approaching this curve. However, in reality, as seen in the right, a real histogram shows the results of 1200 consecutive measurements of the decay rate of a sample of iron-55, each measurement lasting 36 seconds. Successive samplings are shown in different shades of gray. Notice on the right how the peaks and troughs of the distribution become more exaggerated as the data set gets larger (with each layer representing 200 measurements) rather than more smoothed out. The experiment was conducted in Russia, on February 18th of 1982. [65]

This non-random signature alone was interesting, but only the very beginning of the story. It was shown that these fine structures would change over time. However, when two independent samples where measured at the same time − despite the fact that they were independent samples, measured by independent instruments, and could even be in different cities − they showed extremely similar fine structures.

Still, this relationship goes even beyond separate samples of the same radioactive element, as different elements, even with different types of decay, show similar fine structures, when they are measured at the same time. Even completely different types of reactions, such as radioactive decay and biochemical reactions, will show similar fine structures when compared with each other if the reactions are occurring at the same time.

These remarkable results indicate the need for a revolution in our basic understanding of the context for physical, chemical, and biological reactions. Despite the vast difference in the types of activity, the energy levels involved, and the scales (from macromolecules to atoms), Shnoll shows an intimate connection between the fine structures of their activity.

Could this indicate an intimate connection with the entire galaxy as well?

The fine structures for these reactions change with time, and when Shnoll compared different fine structures separated by intervals with no physical significance, say 11.5 days for example, they showed no similarity. But when the intervals between measurements did have a physical

significance, such as one day, one year, or 27 days (perhaps either relating to the rotation of the Sun, or the orbit of the Moon) then they again showed remarkably similar fine structures! This indicates the influence of these large astronomical cycles on activity in the small.

So what were supposed to be purely random fluctuations of the rate of atomic, chemical, and biological reactions (all seemingly distinct types of reactions), actually express a harmony with each other, and with astronomical cycles.

To add to this wonderful anomaly, the daily period in the fine structure was found not to be a perfect 24 hours (the period of the Earth's rotation relative to the Sun), but ~23 hours and 56 minutes, a very precise match with the period of rotation of the Earth relative to the fixed stars – pointing to a relation outside of our solar system, and into our galactic environment.

Shnoll and some of his colleagues suggest that this indicates that time itself is heterogeneous, that each moment is different from another. [66] Might we be seeing in the very small the expression of the physical spacetime of the entire galaxy, perhaps relating to what the redshift case implies?
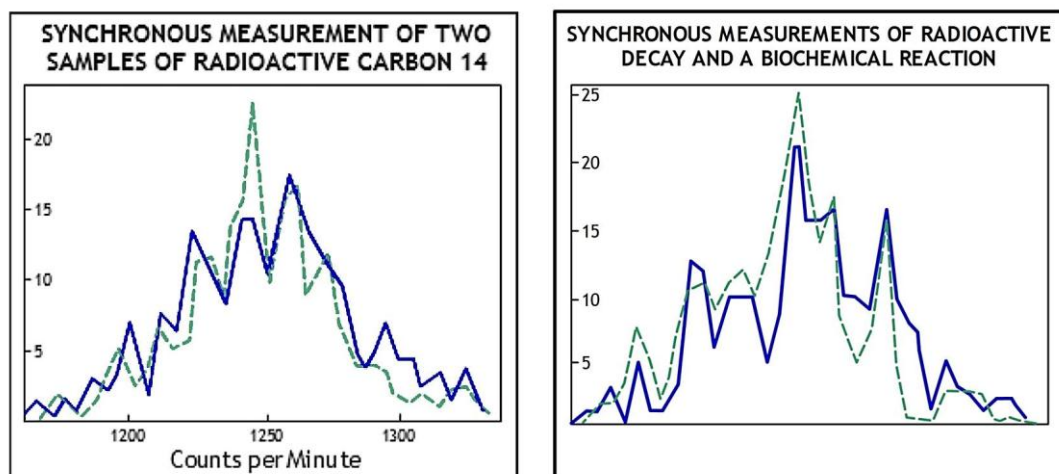
Fig. 20. (Left) Synchronous measurements of the radioactivity of two separate samples of carbon 14, using two independent measuring stations. Notice how similar they are to each other, but how they differ from the image above. (Right) Synchronous measurements of the rate of beta decay of a sample of carbon 14, and the reaction rate of vitamin C with the chemical DCPIP. [65]

References

1. The interview is published in Russian here - http://terra-america.ru/stremlenie-britanskoi-imperii-pomeshat-osvoeniu-solnechnoi-sistemi-ochevidno.aspx It can be found translated in English here - http://larouchepac.com/node/22352 For a listing of LaRouche's most recent writings and statements, see http://larouchepac.com/larouche Two specific papers that contextualize the current report are "Principle or Party?," "The Fall of the British Empire: Obama's Armageddon End-Game" and "What is Creativity, Actually?: The Real Human Mind," both at http://www.larouchepac.com

2. Khalilov E.N. Global geological and environmental change: threatening the stable development of civilization. GEOCHANGE: Problems of Global Changes of the Geological Environment. Vol.1, London, pp.54-220, ISBN 978-9952-451-11-5; ISSN 2218-5798

3. See the feature video, "A Brief History of Lyndon LaRouche's Strategic Defense Initiative", LaRouchePAC.com. Lyndon H. LaRouche, Jr., "SDI Revisited: In Defense of Strategy," 21st Century Science & Technology, Summer 2000.

4. This initiative was proposed in October by current Deputy Prime Minister for Defense Dmitry Rogozin, then the Russian ambassador to NATO. See, "As World War Threatens, Russia Proposes SDE," Executive Intelligence Review, November 25, 2011.

5. The project has been presented several times at the United Nations, and as of the summer of 2011 was being headed up by former Roscosmos Chief Anatoly Perminov. Several nations, including China, Ukraine, Argentina, and Indonesia have expressed their interest in this project. See "Russians Propose Global Monitoring," Executive Intelligence Review, April 22, 2011.

6. The policy of halting economic progress has been the explicit intention of the British Empire, and is part of its genocidal depopulation agenda. To get this from the Empire's own mouth, see "People and the Planet," The Royal Society Science Policy Centre, 2012. "Living Planet Report 2012: Biodiversity, biocapacity and better choices, " World Wide Fund For Nature (WWF), 2012. "A Global Forecast for the Next Forty Years: 2052," Jorgen Randers, a report to the Club of Rome commemorating the 40th anniversary of "The Limits to Growth," published by Chelsea Green Publishing, Vermont, 2012. For a fuller discussion of this, see "Behind London's War Drive: A Policy To Kill Billions," by Nancy Spannaus, Executive Intelligence Review, Vol. 38, No. 45.

7. Immediately, the United States must return to its Hamiltonian tradition as an economic credit system, and break from the British Empire's global monetary system. This can be initiated by the reinstatement of the original 1933 Glass-Steagall legislation, to separate out the mass of hyperinflationary speculative debt of the presently failed monetary system, a debt to which a sovereign United States has no obligation. This must be paired with industrial programs on the scale of the North American Water and Power Alliance (NAWAPA). For a fuller description of how this initial policy would work to drag human civilization from the maws of complete economic breakdown, and thus prepare the field for the fruits of progress, please see the LaRouche PAC special report "NAWAPA XXI," available at http://larouchepac.com/nawapaxxi

8. The initial hint of a periodicity in the fossil record was noticed in the 1980's, then thought to be about 30 million years. In 2005 a reanalysis with improved dating scales indicated a strong periodicity of 62 million years, and a weaker but significant period of 143 million years. See Rohde & Muller, "Cycles in fossil diversity," Nature, Vol. 434, 2005; and, John Sepkoski, "What I Did With My Research Career — Or How Research on Biodiversity Yielded Data on Extinction," found in the book, The Mass Extinction Debates: How Science Works in a Crisis, by William Glen, Stanford University Press, 1994.

9. "A 56 million year rhythm in North American sedimentation during the Phanerozoic," Meyers S and Peters S, Earth and Planetary Science Letters, V. 303, No. 3-4, pp. 174-180, 2011. Also, "Environmental determinants of extinction selectivity in the fossil record," Peters S, published in Nature, Vol. 454, 2008 (http://strata.geology.wisc.edu/vita/reprints/Peters2008.pdf)

10. "Time-Series Analysis of Large Igneous Provinces: 3500 Ma to Present," Prokoph A, Ernst R, and Buchan K, published in the Journal of Geology, vol. 112, 2004, pp. 1-22 (http://www.geofys.dk/waveletcourse/articles/8 - Time-Series Analysis of Large Igneous Provinces.pdf)

11. "87Sr/86Sr, δ13C and δ18O evolution of Phanerozoic seawater," Veizer J, Ala D, Azmy K, Bruckschen P, Buhl D, Bruhn F, Carden G A F, Diener A, Ebneth S, Goddéris Y, Jasper T, Korte C, Pawellek F, Podlaha O G, and Strauss H. Published in Chemical Geology, v. 161, p. 59–88, 1999.

12. See Shaviv, "Cosmic Ray Diffusion from the Galactic Spiral Arms, Iron Meteorites, and a Possible Climatic Connection?" Physical Review Letters, Vol. 89, 2002. Also, "The

Milky Way Galaxy's Spiral Arms and Ice-Age Epochs and the Cosmic Ray Connection," by Nir Shaviv at http://www.sciencebits.com/ice-ages and "The Spiral Structure of the Milky Way, Cosmic Rays, and Ice Age Epochs on Earth."

13. "The Sun's Motion Perpendicular to the Galactic Plane," Bahcall J and Bahcall S, Nature, Vol. 316, 1985.

14. "Do Extragalactic Cosmic Rays Induce Cycles in Fossil Diversity?" Medvedev M and Melott A, Astrophysical Journal, Vol. 664, pp. 879-889, 2007

15. "A 38-million-year cycle among myriadennians in the diversity of oceanic genera." Cornélissen G, Bakken EE, Sonkowsky RP, Halberg F. Abstract, III International Conference, Civilization diseases in the spirit of V.I. Vernadsky, People's Friendship University of Russia, Moscow, Oct. 10-12, 2005, p. 47-49. Also, "Following the beat of a different drummer," Martinson P. Published in a LaRouche PAC online special report, "The Extended Sensorium." 2011. http://larouchepac.com/node/17172

16. There is a general disagreement as to what exactly the Second Law of Thermodynamics even states. In its original form, it was a quite reasonable observation by Sadi Carnot, made in the course of his work on heat engines, that heat never flows from a colder body to a warmer one. This observation falls well within the domain of provable, experimental physics. In the hands of Rudolph Clausius, however, it became an irresponsible monstrosity, extrapolated to phenomena whose essential nature had never even been probed scientifically. It became essentially a sort of apocalyptic religious belief, the adherence to which no doubt contributed to poor Ludwig Boltzmann's choice of exit from this world.

17. The work of decades of research into this redshift anomaly is presented clearly in two successive books by Arp, "Quasars, Redshifts and Controversies," 1988, and "Seeing Red," 1998. However we are obliged to note a distinction between his observational work, and his theories explaining the new questions posed by the observations. Here we will stick to his observational demonstration of the existence of this anomalous redshift phenomenon, and draw implications, where we can, from there. A fuller treatment of his theories would require another occasion. With that said, credit should be given to Arp's commitment and continuity of work, despite decades of denial and attempted suppression by the academic institutions. By the early 1980's he was forced to move to Germany to continue his work, as he was increasingly denied access to the telescope at his previous occupation at the Palomar Observatory, despite his having worked there for 27 years, and despite the fact that he was considered one of the world's leading up-and-coming astronomers during his early career.

18. The name quasar comes from "quasi-stellar radio source." "Radio source" because the first quasars were discovered from their strong radio emissions, and "quasi-stellar" because they visually appeared as singular point sources of light (similar to how we see stars within our galaxy), instead of nebulous blobs (as other galaxies appear to us). Their dramatic redshifts indicated that they lay well outside of our own galaxy.

19. Arp also identified other objects in the image which he thought would turn out to be more quasars. In 2004 they were investigated, and the four unmarked objects in the image above did turn out to be additional high redshift quasars. See, "QSOs and Active Galactic Nuclei Associated with NGC 2639," E. M. Burbridge et. al., The Astrophysical Journal Supplement Series, 153:159-163, 2004 July.

20. Arp, in collaboration with Jayant Narlikar, developed a theory which attempts to explain the relation of redshift to a galaxy's evolution. This present report is not intended to treat the specifics of their theory. Instead we will propose an approach which is fundamentally different than that taken by Arp and Narlikar.

21. There is also evidence that the values of the intrinsic redshift of galaxies sometimes tend to cluster around certain quantized values. This is not always the case, but there are numerous surveys of systems of galaxies in which certain values of intrinsic redshift are more common than other values.

22. The Virgo Cluster is composed of somewhere between 1,000 to 2,000 galaxies. For more on this study see: Arp, Astrophysical Journal 430, 74, 1994.

23. If we include the evidence that some galactic systems tend towards specific quantized values of redshift, then this adds another dimension to the question of how a galactic system organizes itself.

24. The applicability of Riemann's work to the work of Vernadsky would make the spacetime effects more reminiscent of the sorts of phenomena that occur with general relativity. This would only approximate the ramifications of Vernadsky's later work, however, and a more thorough discussion will have to be undertaken in another location.

25. See, "The Problems of Biogeochemistry" I and II, and "The States of Space" by Vladimir Vernadsky, translated in 21st Century Science and Technology, Winter 2000, Winter 2005, Winter 2007.

26. Though, if we take into account the great distance to the Crab Nebula – probably several thousand light years – the time of its actual birth, as opposed to the time its light reached Earth, might actually coincide more closely with the time of the flooding of the Black Sea, about 5,600 B.C. On this scale, however, time and simultaneity become rather tricky things, as we know.

27. "The Crab has played a leading role in so many aspects of astrophysics that it was often said (at least by astronomers studying this object) that there are two branches of the field [of astrophysics] – studies that dealt with the Crab, and all the rest." - The Sky at Einstein's Feet by William C. Keel.

28. NASA's December 27th, 2001 Picture of the Day animates this change.

29. This would not make the Crab alone in this respect. It has been proposed that the peculiar character of our own Sun might be similar. The hottest region of the Sun is the solar corona, farthest from the Sun's center. As far as we can tell from our vantage point, the coolest regions of the Sun are within the sunspots — the closest we can yet observe to the Sun's center. This would imply a heating that moves from the outside in, rather than from the inside out. The current hypotheses about the centers of bodies such as the Sun and our Earth are just that, hypotheses. We have literally not even scratched the surface of any of these objects, including Earth. It is only Aristotelian prejudice that causes us to place the cause for their electromagnetic activities within the isolated bodies themselves, when so much evidence points to the primacy of their interaction and the medium which unites them. (See Box 1: Empty Space?).

30. Soon after the March 11 Japan earthquake, in April 2011, President Obama went on record as being worse than indifferent to the science of weather forecasting: "There are some things that we can't control. We can't control earthquakes; we can't control tsunamis; we can't control uprisings on the other side of the world. What we can control is our capacity to have a reasoned, fair conversation between the parties..." He made similar statements to the victims of the Joplin tornado in May 2011: "We do not have the capacity to answer. We can't know when a terrible storm will strike, or where, or the severity of the devastation that it may cause. We can't know why we're tested with the loss of a loved one, or the loss of a home where we've lived a lifetime. These things are beyond our power to control..." Under the Obama Administration, new earth monitoring satellites critical for weather and natural hazard forecasting have been eliminated or delayed due to budget cuts to NASA and NOAA.

31. http://www.nso.edu/press/SolarActivityDrop In June 2011, the National Solar Observatory and the American Astronomical Society released findings which indicate that solar Cycle 25 may be either very weak, or not happen at all. They reference the work of three independent observational groups: 1) The Global Oscillation Network Group (GONG), which observes solar surface wave activity (helioseismology), 2) Matt Penn and William Livingston, who have documented the diminishing strength of the magnetic field within sunspots, and 3) Richard Altrock of the Air Force Research Laboratory, who looks at coronal emission.

32. It may not be a coincidence, that both of these large flares occurred only a few days before two of the most deadly earthquakes of the year, the magnitude 6.3 in Christchurch, New Zealand, and the magnitude 9.0 in Japan.

33. See Laurence Hecht, "The Solar Storm Threat to America's Power Grid," 21st Century Science & Technology. In 2008, a report was published from a National Research Council workshop (under the National Academy of Sciences). In January 2010, the Metatech Corporation issued a report (commissioned under the 2006 Executive Order 13407), "Geomagnetic Storms and Their Impacts on the U.S. Power Grid". In June 2010, a joint report was released by the North American Electric Reliability Corporation and the Department of Energy, "High-Impact, Low-Frequency Event Risk to the North American Bulk Power System." These have detailed some of the "knowns and unknowns" of the threats from intense solar activity.

34. Such as the Kp=8 geomagnetic storm of Sept 26, 2011, which was generated by a grazing blow from a CME propelled away from sunspot 1302 on September 24.

35. It is widely acknowledged that the single largest source of uncertainty in climate models is the behavior of clouds, whose formation appears to be governed by various electrodynamic processes in the atmosphere, through which diffuse electrical currents constantly flow. This has been rather simplistically termed the "Global Electric Circuit," which actually refers to a set of processes representing the combined interaction of terrestrial (lithosphere and biosphere), solar, and galactic influences. See, for example, Carslaw, Harrison, and Kirkby, "Cosmic Rays, Clouds, and Climate," Science, 29 November 2002: Vol. 298 no. 5599 pp. 1732-1737.

36. "The Role of Galactic Cosmic Rays in Tropical Cyclogenesis: Evidence of Hurricane Katrina," Bondur V G and Pulinets S, Doklady Earth Sciences, 2008 Vol. 422, No.2, p.244-249.

37. "Role of sulphuric acid, ammonia, and galactic cosmic rays in atmospheric aerosol nucleation," Jasper Kirkby et al., Science, 2011.

38. This technique has been pioneered by Russian scientist Lev Pokhmelnykh. See, for example, Sergey Pulinets, "Weather Control? Yes, it is really possible..." Other attempts to affect cloud formation include recent experimental work on laser-induced condensation by Jerome Kasparian et al.

39. "NAWAPA XXI", Michael Kirsch et al., LaRouche PAC, 2012 (http://larouchepac.com/files/20120403-nawapaxxi-forweb_0.pdf) Also, see video "NAWAPA and Biospheric Engineering" on http://larouchepac.com/node/16500

40. "Lithosphere–Atmosphere–Ionosphere Coupling (LAIC) model – An unified concept for earthquake precursors validation," Pulinets S and Ouzounov D, Journal of Asian Earth Sciences, Volume 41, Issues 4–5, 5 June 2011, Pages 371–382.

41. The proposed Russia-U.K. collaborative project TwinSat is intended to be such a dedicated set of microsatellites searching for earthquake precursors, and has been proposed to be subsumed in the broader international IGMASS collaboration. The two satellites are planned to contain instrumentation to measure such electromagnetic effects in the ionosphere as have been observed to be related to earthquakes and other seismic phenomena. Separately, the Chinese plan to launch the first of three dedicated earthquake precursor monitoring satellites beginning in 2014, as part of a broader program of ground- and satellite-based precursor monitoring. The U.S. DESDynI (Deformation, Ecosystem Structure & Dynamics of Ice) natural hazard monitoring satellite was cut by the Obama Administration in 2011.

42. And, also, the possibility of acting directly on the seismogenic process. Beginning in the 1970s and 80s, Soviet Academician E.P. Velikhov pioneered the experimental use of magnetohydrodynamic pulses to induce electrical currents in the crust down to depths of tens of kilometers, which reportedly is capable of inducing small earthquakes. Such work could shed further light on the still poorly understood electrodynamic processes in the

earth's crust. See Novikov et al., "Discharge of Tectonic Stresses in the Earth Crust by High-power Electric Pulses for Earthquake Hazard Mitigation," 2nd International Conference on Urban Disaster Reduction, 2007. Also, see Oyang Teng, "Out of the Shadows: The Emerging Science of Earthquake Prediction", *21st Century Science & Technology, Winter 2011*-2012

43. "Large" refers to magnitude 4.0 and above, and shallow earthquakes have epicenters of 100 km or less. See, "Possible Correlation between Solar Activity and Global Seismicity", by Jusoh Mohamad Huzaimy and Kiyohumi Yumoto; proceeding of the 2011 IEEE International conference on space science and communication (IconSpace) 12-13 July 2011, Penang, Malaysia.

44. The argument is often made from the standpoint of thermodynamics that solar phenomena such as flares do not contain enough energy equal to that released in a seismic event here on Earth. This reasoning against a cause and effect relation between the two does not hold, however. A pointed stick may not contain the same energy as the difference between a sleeping bear and an angry bear, but it is nonetheless capable of bringing such a change about.

45. This study was led by a world expert on lunar seismic activity, Dr. Yosio Nakamura, sometimes referred to as Mr. Moonquake, out of the University of Texas at Austin. While the data set of 28 moonquakes is admittedly small, the evidence is too provocative to ignore. See "Possible Extra-Solary-System cause for Certain Lunar Seismic Events," by Yosio Nakamura and Cliff Frohlich; Lunar and Planetary Sciences, XXXVII (2006).

46. At the very dawn of viral studies, it was recognized already that viruses were sensitive to certain types of radiation. The example of UV radiation and lambda phage was elaborated by S.E. Luria, as in his "Radiation and Viruses" (1955). The work done by Alexander Gurwitsch on mitogenetic radiation, a unique kind of UV radiation produced by life, may enable the determination of even more precise effects.

47. "Using the Information of Cosmic Rays to Predict Influenza Epidemics," Yu Z D, NASA Goddard Space Flight Center 19th Intern. Cosmic Ray Conf., Vol. 5 p 525-528 (SEE N85-34991 23-93) 1985.

48. "Can viruses make us human?" Villareal L, Proceedings of the American Philosophical Society Vol. 148, No. 3, September 2004 and Ryan, F., Virolution, Collins, 2009. Also see LPAC's recent video reviewing a case study of viruses and evolution: "Strategic Defense of Earth: What You Didn't Know About Viruses" Episodes I and II @ LaRouchePAC.com/sde-viruses and sde-viruses-ii

49. "Photosystem I gene cassettes are present in marine virus genomes," Sharon I, et al., Nature, 461, 258-262 (10 September 2009).

50. "Viruses manipulate the marine environment," Rohwer F, Nature, 459, 207-212 (14 May 2009).

51. As a rough approximation, consider that the combustion of 13 tons (about the weight of a large school bus) of liquid hydrogen and oxygen, a commonly used rocket fuel, releases an equivalent amount of energy as 0.5 grams (the weight of a single Tylenol pill) of deuterium in a conventional deuterium-tritium fusion reaction. A more complete appraisal of the relative difference in energy-flux density would have to take into account the qualitative changes that come with the mastery of an entirely new set of physical principles—a concept foreign to President Obama, as shown in remarks he made in September 2010: "We wouldn't need new technologies. We wouldn't need to invent some fancy new fusion energy or anything. If we just took our existing building stock in homes and insulated them, had new windows... we could squeeze huge efficiencies out of that.

52. These proposals come in the context of the emergence of a new global frontier, the Arctic. Russia, China, and other leading nations have taken the first steps in what must become a full mobilization toward the development of this region — a prospect that should be seen as a new launching point for a renewed global focus on space colonization. See "Self-

Developing Systems and Arctic Development: Economics for the Future of Mankind," by Sky Shields and Michelle Fuchs, http://www.LaRouchePAC.com/2011/arcticdevelopment, as well as accompanying feature film "Window to Space," http://www.LaRouchePAC.com/windowtospace.

53. "Clams and Brachiopods-Ships that Pass in the Night," 1980, by Stephen Jay Gould and C. Bradford Calloway; "Seafood Through Time: Changes in Biomass, Energetics, and Productivity in the Marine Ecosystem," 1993, by Richard K. Bambach; Video: "The Ecology of Anti-Entropy" at LaRouchePAC.com/ecologyofantientropy

54. L. Pasteur, "On the Asymmetry of Naturally Occurring Organic Compounds," The Foundations of Sterochemisty, (Am. Book Co., 1901) Also see the works of Pierre Curie, and his biography "Pierre Curie," by his wife Marie Curie.

55. Kant, "Concerning the ultimate ground of the differentiation of direction in space," 1768.

56. That is, without comparing to something like the letters L and J, or on which side of your chest your heart is found.

57. There are various conventions for defining "left" and "right" handedness for chemical compounds. Here, by left and right we refer to the L/D naming convention which compares the structure of a molecule to that of glyceraldhyde. This is not the same thing as dextro- and levorotation of polarized light.

58. Uwe Meierhenric, "Minority Report: Life's Chiral Molecules of Opposite Handedness", Amino Acids and the Asymmetry of Life (Springer, 2008)

59. The unique characteristics of the physical spacetime of life, such as its handedness, were hypothesized by Vernadsky and Pasteur before him to have important implications for the study of spiral galaxies and the intrinsic structure of cosmic space. After their time, the case of redshift in a biological process, something generally only studied in cosmology, indicates how the study of biological space time which they pioneered can also inform astronomical investigations.

60. A living squirrel, placed in a Bunsen burner, unfortunately ceases to be a living squirrel.

61. "Photosynthesis," E. Rabinowitch and Govindjee, John Wiley and Sons Inc. NY. 1969

62. "The Place of Value in a World of Facts," by Wolfgang Köhler, Liveright Publishing Corporation, 1938

63. See J. H. Jenkins, et. al., 2008; "Evidence for Correlations Between Nuclear Decay Rates and Earth-Sun Distance."

64. It is also interesting to note that when the flare occurred it was in the middle of the night for the lab which contained the Manganese samples, meaning that if the variation in decay rate was an effect of some form of solar radiation, then the radiation would have had to travel through the Earth to affect the lab on the night side of the Earth. See J. H. Jenkins and E. Fishbach, 2008; "Perturbation of Nuclear Decay Rates During the Solar Flare of 13 December 2006."

65. This reference to Shnoll's work on the "fine structure" of decay rates and other processes is not the same subject as the changes in the "fine structure constant," which is discussed elsewhere in this report. Hopefully, no confusion arises from the similarity of the names chosen for these two subjects. For more on Shnoll's work see, Shnoll et al. 1998, "Realization of Discrete States during Fluctuations in Macroscopic Processes"; and "Russian Discovery Challenges Existence of Absolute Time," by Tennenbaum, Summer 2000 21st Century Science and Technology.

66. This heterogeneity of time is different from, but complementary to, what Vernadsky refers to as a "heterogeneity of spacetime."

Information about relevant conferences

HUMANITY'S DEPENDENCE ON SPACE APPEARS MUCH MORE SIGNIFICANT THAN THOUGHT

04.12.2012

November 21, 2012 was the last day of the international conference "King of Organs-2012" held in Al Ahsa, Saudi Arabia under the patronage of the Governor of the Saudi Arabian Eastern Province, His Royal Highness Prince Mohammed bin Fahd bin Abdul Aziz Al Saud. The conference was dedicated to the impact of cosmic and geophysical factors on the human cardiovascular system. The Chairman of the International Committee GEOCHANGE on Global Geological and Environmental Change (Germany), President of the Global Network for the Forecasting of Earthquakes (UK) Professor Elchin Khalilov, who made a welcoming speech at the opening ceremony on behalf of the international organizations headed by him, along with a scientific presentation, has been interviewed about the work and results of the conference

Dear Professor Khalilov, you are a geophysicist. What was your role at the conference?

The conference was multidisciplinary and dedicated to one of the least studied areas of science: the effect of cosmic and geophysical factors and processes on cardiovascular activity. I have been interested in this problem for long and the studies I have been conducting in recent years with Professor of Medicine Franz Halberg (USA), Doctor Abdullah Al Abdulgader (Saudi Arabia) and other scientists have yielded a number of important and surprising results.

Along with five leading scientists from Saudi Arabia, the U.S. and Italy, I was a member of the conference's Higher Scientific Committee. The conference was attended by world-known scientists from the U.S., Russia, the UK, Italy, Japan, Germany, Azerbaijan, Austria and other countries.

I would like to emphasize that the conference was organized at the highest level, with the attendance of royal and other high-ranking persons. Following the welcoming speech at the   presented the Gold Medal on behalf of the Board of the World Organization for Scientific Cooperation and the International Committee GEOCHANGE's Diploma of Honor to the conference's President Doctor Abdullah Al Abdulgader.

What was your presentation at the conference about?

My main scientific paper was presented at the final plenary session of the conference and was an integrated research on the impact of cosmic and geophysical factors on the cardiovascular system function. Along with me, the paper was co-authored by the world-known US scientist, director of the Halberg Chronobiology Center of the University of Minnesota, founder of the modern

science of chronobiology and director of the BIOCOS international program on the effect of cosmic factors on the biosphere involving 23 countries Professor Franz Halberg (USA); Doctor Abdullah Al Abdulgader, Director of the Prince Sultan Cardiac Center (Saudi Arabia); Prof. Yoshihiko Watanabe (Japan) and Prof. Germaine Cornelissen (Belgium). Naturally, my part in these studies was about monitoring of geophysical and cosmic processes. We also used the ATROPATENA stations' data in our work.

The conference participants were familiarized with the most recent results of our research. In particular, facts were given showing that three days before the catastrophic Japanese magnitude 9 earthquake of March 11, 2011 people living in Japan under medical supervision were experiencing deterioration of the cardiovascular system function, sharp blood pressure jumps and other negative manifestations. On comparing this data with a record of the Indonesia-based ATROPATENA station of the Global Network for the Forecasting of Earthquakes, a complete coincidence in time was observed between the registered three-dimensional variations of the

gravitational field in Indonesia and blood pressure ups and downs experienced by people in Japan three days prior to the shock.

There were other numerous comparisons as well, which confirmed the negative reaction of the human physiological state to the approach of strong earthquakes in different countries. Actually, this is the first comprehensive and fundamental scientific study to corroborate the fact that people can sense the approach of strong earthquakes and other high energy natural disasters. But the most interesting thing is that the approach of a major disaster can be sensed even by people who are at a huge distance from the impending cataclysm.

How do people sense the approach of a strong earthquake?

People can sense the approach of a major earthquake for two reasons. Firstly, the human body, particularly its cardiovascular system, is very sensitive to changes in the electromagnetic parameters of the environment: magnetic, gravitational and electric fields. This was demonstrated in our joint paper with Prof. Franz Halberg (USA), Dr. Abdullah Al Abdulgader (Saudi Arabia), Dr. Yoshihiko Watanabe (Japan) and in other scientists' presentations made at the conference. Prof. Carlo Ventura, Chief of the Laboratory of Molecular Biology of the National Institute of Biostructures and Biosystems (NIBB, Italy) presented irrefutable facts of possibility of the heart and brain function being affected by electromagnetic and acoustic radiation.

The second reason is the global changes of geophysical parameters which manifest themselves at large distances from the location of a forthcoming major earthquake a few days before the natural disaster. This explains the fact that the approach of the catastrophic earthquake in Japan in March 2011 was felt by people in other countries as well.

What meetings at the conference are remembered most?

There were a lot of interesting and important presentations corresponding to the conference's high status, and private meetings with various scientists. For example, it was very interesting for me to make the personal acquaintance of Dr. David Scott Jones, President and Director of Medical Education of the U.S. Institute for Functional Medicine, with whom I discussed cooperation issues.

Prof. Elchin Khalilov and His Highness Prince Abdul Aziz bin Muhammad bin Jalavi

I was deeply impressed by the communication with His Highness Prince Abdul Aziz bin Muhammad bin Jalavi who is well-informed about the current scientific problems and expressed his interest in our research findings as well as in the work of the International Committee GEOCHANGE on Global Geological and Environmental Change. Particularly memorable were interesting discussions with Professor Konstantin Korotkov of Russia, with Dr. Malcolm Edward John Kendrick from the UK, Dr. Rollin Inman McCraty (USA) and others.

Can the conjunction (planetary alignment) expected December 21, 2012 result in serious consequences for humanity and was this question discussed at the conference?

Of course, this question was addressed at the workshops. I will start with the fact that many people associate certain particular events on our planet with the Solar system's conjunction, when part of the planets align along a straight line passing through the sun to the center of our galaxy. Meanwhile, three important celestial bodies are expected to line up: Earth at the winter solstice, the Sun and the equatorial plane of the Milky Way galaxy. This event will coincide with a very special day – the day of winter solstice in the Northern Hemisphere, that is, in the extreme point of the orbit, which occurs once in 25,800 years.

A number of my publications including the monograph "Gravitational waves and Geodynamics" edited by Academician Victor Khain have addressed the possible impact of gravitational effects of the Solar system's planets and cosmic bodies on Earth. Calculations have shown that except for the moon and sun, the gravitational impact of the rest of the planets on Earth is very weak

and their total energy affecting Earth, even if they are all in one line, is negligibly small and will not seriously influence the energy and other processes of our planet.

Therefore, I am convinced that on December 21, 2012 there will be no significant events in the world, which could affect the existence or the future of the entire civilization. Natural disasters by late December will grow indeed, although slightly, due to the existing cyclicity in their manifestations. But these processes are not going to reach a planetary scale.

Does this mean there will be no global change?

Global changes of the earth's climate and geological environment have been occurring for the last two decades and their intensity has begun to rise exponentially. This is evidenced by the statistics of the number and energy of natural disasters in the atmosphere and the earth's crust. I would like to focus on the processes that may indeed be the basis of global change, not only on Earth but also throughout the solar system. December 21, 2012 is a conditional astronomical date, a kind of starting line to be followed, in my opinion, by changes in the energy of the sun and all the planets of the Solar system. The fact is that during this period the Solar system crosses the galactic equatorial plane. Some astrophysicists believe it is a somewhat conditional line drawn for the convenience of reference in the astronomical system of coordinates. But is that really so?
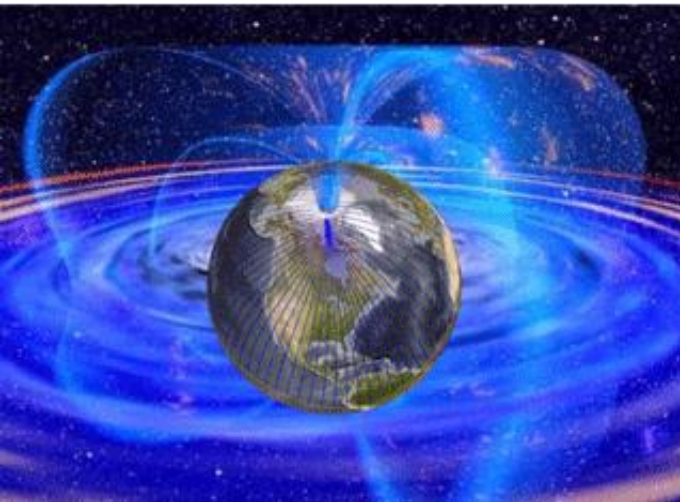
In reality, the galactic equator has a reflection on the physical level, although not as a line but rather a broad area to be entered by the Solar system by late December. Every 33 million years the Solar system crosses the plane of the galactic equator. This cycle is well manifested in global geological changes of our planet's face, its flora and fauna. Not only does the Solar system revolve around the galactic center but also produces oscillatory movements relative to the equatorial plane of the galaxy, crossing it every 33 million years. Currently, the Solar system is crossing the galactic equatorial plane, moving from its conventional top to the bottom. In terms of energy, this process is of much bigger scale than the planetary alignment. It may lead to a magnetic reversal. According to some scientists, the transition of the Solar system from the galaxy's conditional top to the bottom will be accompanied by changes in the fine structure of space at the quantum level.

All these astronomical phenomena coincide in time with a surge in natural disasters the peak of which is predicted by the International Committee GEOCHANGE for 2013-2014. The maximum of the 24th solar activity cycle falls on these years as well.

Thus, we expect no global changes on our planet affecting the life of humanity to occur for the rest of this year. Therefore, I would like to reassure people intimidated by many TV shows and media reports about the end of the world on December 21, 2012. Personally, I have planned for this day a number of important meetings at work and am not going to change my normal work schedule.

Thank you for the interesting and topical interview.

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PHOTO SESSION OF "KING OF ORGANS – 2012" CONFERENCE

2013

GEOCHANGE: Problems of Global Changes of the Geological Environment. Vol.2, Munich, 2013

NCSE'S 13TH NATIONAL CONFERENCE ON SCIENCE, POLICY, AND THE ENVIRONMENT. DISASTERS AND ENVIRONMENT: SCIENCE, PREPAREDNESS, AND RESILIENCE

Washington D.C., January 15-17, 2013

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Advisory Group

The 13th National Conference on Science, Policy and the Environment: *Disasters and Environment: Science, Preparedness, and Resilience,* is the result of the dedicated work of many people inside and outside of the National Council for Science and the Environment.

The Core Planning Group shown on the previous page set the initial vision and scope of the conference.

Members of the Advisory Group met on conference calls throughout 2012 to define the themes, work with session coordinators, develop new sessions, recruit speakers, advance the solutions-oriented outcomes, and assist this event in countless ways.

The Advisory Group members and session leaders were assisted throughout by NCSE staff members Lyle Birkey, David Blockstein, Stevenson Bunn, Marisa Campbell, Caley Corsello, Marissa Duda, Allison Feldman, Steven Feldman, Shelley Kossak, Gabriel Marty, Chris Prince, and Lilah Sloane.

To these advisors, session leaders and staff, I express my deep appreciation and gratitude.

Peter Saundry
Executive Director

Clayton Adams, Team Assistant, United Nations Environment Programme
Gordon Binder, Senior Fellow, World Wildlife Fund
Frederick "Skip" Burkle, Senior Fellow and Scientist, Harvard Humanitarian Initiative
Kitty Courtney, Marine Environmental Scientist, Tetra Tech
Rear Admiral **Scott Deitchman**, Associate Director for Terrorism Preparedness and Emergency Response, National Center for Environmental Health and Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention
Reginald DesRoches, Professor and Associate Chair, School of Civil and Environmental Engineering, Georgia Institute of Technology
Paul Domich, Executive Secretary, Infrastructure Committee, CIP-Consulting Inc.
Gus Felix, Global Head of Operational Risk Management, Citigroup
Elizabeth Ferris, Co-Director, Project on Internal Displacement, The Brookings Institution
Joseph Fiksel, Executive Director, Center for Resilience, The Ohio State University
Sherrie Forrest, Program Officer, Disasters Roundtable, The National Academies
Gerald E. Galloway, Research Professor, Glenn L. Martin Institute Professor of Engineering, University of Maryland
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Alan Hecht, Director for Sustainable Development, Office of Research and Development, U.S. EPA
Peter Jutro, Deputy Director for Science and Policy, National Homeland Security Research Center, U.S. EPA
Amy Luers, Director, Climate Change, Skoll Global Threats Fund
Ann Patton, 2nd Vice President, Natural Hazard Mitigation Association
Daniel Petz, Senior Research Assistant on Natural Disasters, The Brookings Institution
Ben van der Pluijm, **Brace R.** Clark Collegiate Professor of Geology; Professor of the Environment; Director of the Global Change Program, University of Michigan

Ed Saltzberg, Managing Director, Security and Sustainability Forum

Ayse Sezin Tokar, Hydrometeorological Hazard Advisor, Office of U.S. Foreign Disaster Assistance, USAID

Godfrey Uzochukwu, Professor and Director, Interdisciplinary Waste Management Institute, North Carolina A&T State University

Peter Saundry, **Conference Chair**

Peter Saundry, Ph.D., is Executive Director of the National Council for Science and the Environment (NCSE). He provides day-to-day leadership to the organization and is responsible for overall program, financial and staff management, strategic planning and development. He has served as Executive Director of the organization since 1993 and has led the creation and implementation of many of NCSE's programs and initiatives. Dr. Saundry is an experienced leader in building coalitions of individuals and organizations to promote environmental science and its utility in addressing societal concerns. Dr. Saundry received a Ph.D. in Physics from the University of Southern California, an M.S. in Physics from Adelphi University, and a B.S. in Physics, with honors, from Southampton University, U.K.

PHOTO SESSION OF NCSE'S 13TH NATIONAL CONFERENCE ON SCIENCE, POLICY, AND THE ENVIRONMENT. DISASTERS AND ENVIRONMENT: SCIENCE, PREPAREDNESS, AND RESILIENCE

Peter Saundry, Executive Director of the National Council for Science and the Environment (NCSE), Conference Chair

Margareta Wahlström, Special Representative of the UN Secretary-General for Disaster Risk Reduction
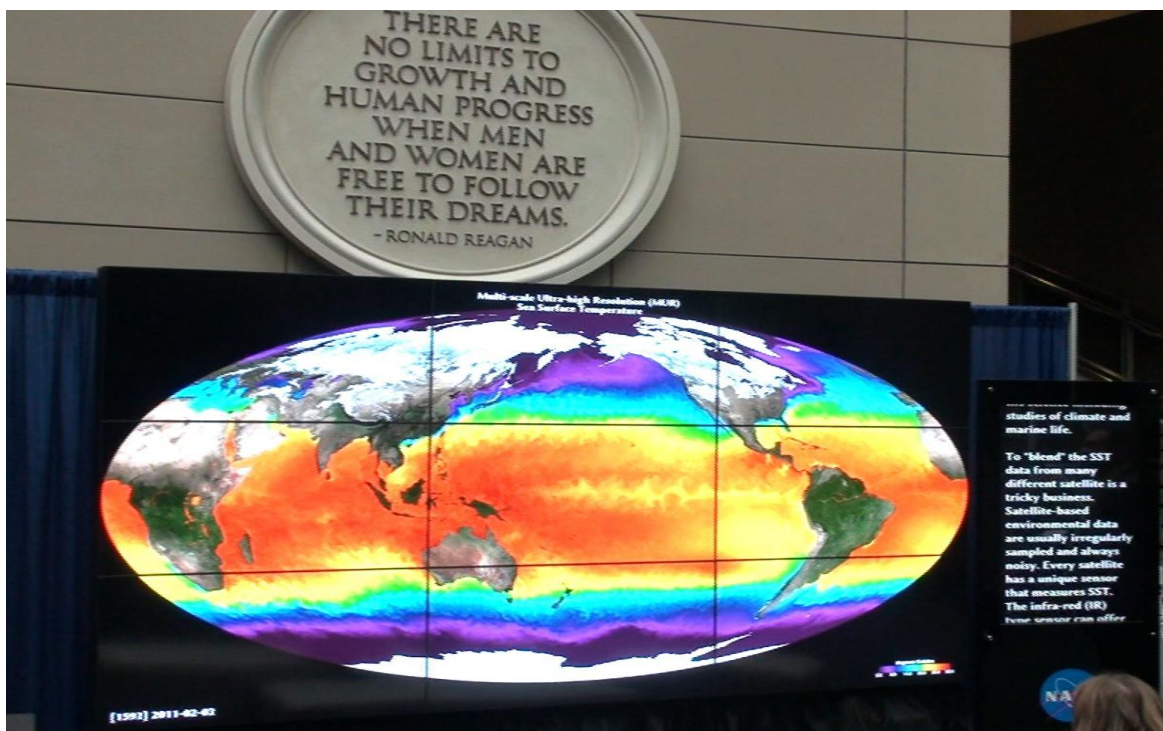

Marcia McNutt, Director of the U.S. Geological Survey (USGS)

William Craig Fugate, Administrator of the Federal Emergency Management Agency (FEMA)

LTR: Dr. Peter Saundry, Executive Director of the National Council for Science and the Environment (NCSE, USA), Conference Chair and **Prof**. **Dr. Elchin Khalilov**, Chairman of the International Committee on Global Geological and Environmental Changes – GGEC GEOCHANGE (Munich, Germany)