

# CLIMATE ANOMALIES, THEIR DRIVERS AND TECTONIC CONNECTIONS

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Solar influence on climate occurs (by high-frequency modulation) through the “external-way” (Sun → magnetosphere → troposphere) and (by low-frequency) through the “internal-way” (Sun → Earth’s endogenous energy → energy exhalation). The percent role of either “way” depends on the spectrum of the solar change. The “external-way” modulation displays substantial uniformity, the “internal-way” a largely variable spacetime anisotropy. A higher percent of “internal” driver implies greater vorticity in fluid Earth, oceans, and atmosphere (the present Sun is very anomalous).

Fluid dynamics of every ionized medium is a very effective and ubiquitous dynamo (according to the Cowling’s generalized theorem), from the micro- through the macro-scale. Vorticity supplies altogether increased atmospheric electricity, water condensation and precipitation, larger cloud cover, larger albedo, smaller capture of solar radiation, colder and variable climate.

Very different phenomena are thus correlated to one another. (1) Localized thermal expansion of lithosphere and crust, (2) changes of subsoil electrical conductivity, and (3) gas exhalation, change altogether the electromagnetic (e.m.) coupling between subsoil and atmosphere, thus justifying anomalous and otherwise unexplained events (wildfires), deep-ocean fauna beaching (due to deep water poisoning), and eventually also energy-threshold phenomena (volcanic paroxysm, earthquakes, hurricanes), and seismic/atmospheric (meteorological and/or ionospheric) correlation.

Modern high frequency climate is modulated by solar system orbital physics variation in electromagnetic/gravitational coupling between the Earth and other astrophysical bodies. Solar rotation and orbital influences of the Moon, Jupiter and Saturn have dominant roles in modern climate high frequency modulation. While Earth’s longer orbital cycles, such as eccentricity (~100 ka), obliquity (~36 ka), and precession (~26 ka) modulate ice ages, 100 ka year cycles, and various other climate proxies, are known as Milanković cycles.

Ancient palaeo-climate is controlled by (1) Earth e.m. resonance (410 ka years; i.e. eccentricity modulation), (2) Solar System crossing of galactic equatorial plane (~14 Ma), and (3) timing of endogenous energy release (27.4 Ma, Earth’s “electrocardiogram”), with different proxies (hotspot volcanic sequences, geodynamic spirals, etc.).

Other cycles are the result of the size and structure of the Earth, with its associated typical timing, such as the so-called “terminations”, or the 179 Ma cycle of continent and orogen generation and destruction by weathering and erosion. This is where the abstract should be placed. It should consist of one paragraph giving a concise summary of the material in the article below. Replace the title, authors, and addresses with your own title, authors, and addresses. You may have as many authors and addresses as you like. It is preferable not to use footnotes in the abstract or the title; the acknowledgments of funding bodies etc. are to be placed in a separate section at the end of the text.

## 1. Introduction - The “external” and “internal way”

Solar-terrestrial relations are a key item in our life. Let us call “climate” the environment which occurs in the space-time domain where life can develop: it is a real very tiny fraction of the whole solid Earth’s volume. In a terrella model, 1 : 10,000,000 scale, the Earth is a

ball of ~128 cm diameter, while the troposphere, a tiny layer of ~0.01 cm, and the biosphere, including humankind is a lesser mustiness inside it.

The best known solar influence occurs through the solar electromagnetic (e.m.) radiation. A lesser acknowledged - and much more uneven - effect occurs through the corpuscular radiation, i.e. the solar wind, which is identified with a steady expansion of the solar

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corona. This is not, however, a regular and smooth phenomenon, being rather characterized by inhomogeneity in space and time, as shown by several pictures of the solar corona, observed either during total solar eclipses, or by several space probe images.

The Earth, with its magnetosphere, captures only a fraction ( $\sim 0.5 \times 10^{-9}$ ) of the spherical expanding solar corona. Therefore, the Earth eventually experiences severe consequences from solar wind inhomogeneities. In contrast, during the human time domain solar radiation results, comparably, substantially much more regular, smooth, and stable.

The Earth's climate results therefore controlled by the Sun through both the "external" and "internal way" (figure 1).

The "external way" is a chain of cause-and-effect, beginning from the Sun and its e.m. and corpuscular radiation, through the Earth's magnetosphere, higher atmospheres, and troposphere. This is generally known as "space weather".

The physical mechanism has been extensively and critically discussed in Gregori (2002; shorter accounts in Gregori, 2006a, 2006b, 2009, 2014).

The "internal way" is rather a chain beginning from the solar wind through its long-period e.m. induction inside deep Earth, which modulates the production of endogenous energy, hence of its fluid exhalation into oceans and atmosphere, with a final control on climate.<sup>†</sup>

Climate can be likened therefore to the ensemble of phenomena that occur inside a condenser during its discharge. The upper plate of the condenser - which includes solar wind and higher atmospheres - is powered by an electric current generator (the solar wind). Its lower plate - which is generally underground - is powered by an electric potential generator (the tide-driven geodynamo).

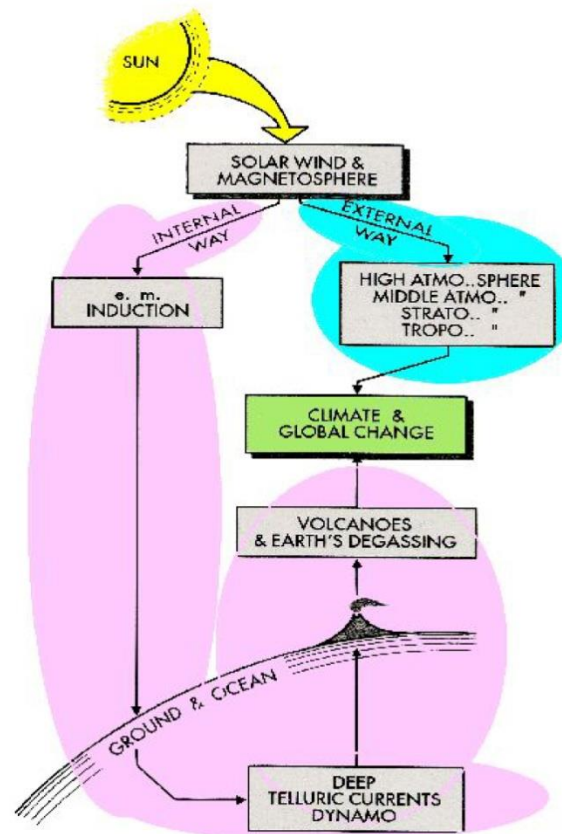


Figure 1 – The "external" and "internal way" in solar-terrestrial relations (after Gregori, 2002).

## 2. The "Cowling dynamo" and its several manifestations - Atmospheric water condensation, fog and precipitations

Following the previous discovery of the solar magnetic field (Babcock), Larmor proposed (in 1919-1920) an explanation: the violent fluid dynamics inside the Sun or inside every star is associated with very intense electric currents and magnetic fields. The resulting MHD (magneto-hydro-dynamics) phenomena are such that the whole system acts like a very effective dynamo supplied by the endogenous heat.

Extensive modelling is now available, and this explanation results to be very appropriate to explain phenomena inside stars and galaxies.<sup>‡</sup>

<sup>†</sup>Note that e.m. induction in deep Earth cannot occur if the Earth is structured like an "onion" in terms of concentric approximately spherical layers. This is a false paradigm, derived from the need for mathematical simplicity while deriving models for the Earth's interior. Sound physical arguments from college physics show, rather, that real "antennas" underground connect the deep Earth to much shallower layers. Owing to brevity purpose, these items cannot be here repeated.

<sup>‡</sup>The same model was later proposed for the Earth's or planetary interiors. This is, however, physically absurd, due to the lack of any physical source analogous to the thermonuclear energy that forbids total blocking of the system. See Gregori (2002; shorter accounts in Gregori, 2006a, 2006b, 2009).

In 1932 Cowling showed a famous theorem: if a natural system has a *perfect* cylindrical symmetry, no dynamo can be operative.

This caused a real nightmare among solar physicists. An intensive debate was started, essentially still lasting. At present a few tens of proofs of the Cowling theorem are available. Every proof relies on different assumptions. It has been even authoritatively claimed that every proof is biased by some *ad hoc* assumption. But all proofs agree on the same final result. The problem remained apparently unsettled.

For completeness sake, recall that in 1953 Chandrasekhar and Fermi showed the virial theorem for plasmas, and proved that every system of ionized matter with no kind of confinement (such as gravitational) and no other internal source can be self-contained. Rather, it must search to expand in space as much as possible.

Just by a matter of chance, a generalization of the Cowling theorem appeared in Gregori (2002) who did not realize its relevance. No specific assumption is required, rather only the Maxwell's laws. Every system of ionized matter with some internal dynamics - of any origin - must develop a dynamo of either one of two possible topological patterns (figure 2).

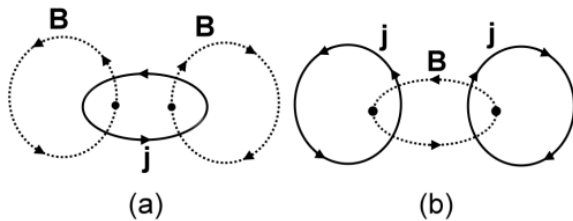


Figure 2 – Two topological patterns of the dynamo originated inside a system of ionized matter. The topology of  $j$  and  $\mathbf{E}$  is the same. After Gregori (2002).

Both these structures lead to an equilibrium state which is a dynamo. But, it can be shown that the case history with toroidal  $\mathbf{E}$  and poloidal  $\mathbf{B}$  (figure 2a) is a state of *unstable* equilibrium, unlike the case of toroidal  $\mathbf{B}$  and poloidal  $\mathbf{E}$  (figure 2b), which is a state of *stable* equilibrium.

That is, only the case of toroidal  $\mathbf{B}$  and poloidal  $\mathbf{E}$  (figure 2b) can be really observed.

However, in the case that the system has a *perfect* cylindrical symmetry, the energy of this stable state is zero, and this gives justice to the original Cowling result.

But, a *perfect* cylindrical symmetry is a simplifying abstraction (much like the concept of point, line, plane etc. in Euclidean geometry) that can find no real equivalence in natural reality. Therefore a dynamo always occurs, being more or less intense depending on

the intensity of MHD motions. It is a ubiquitous phenomenon, on every space-time scale. In the following it will be here briefly called “Cowling dynamo”.

It is impossible to report here in detail its several manifestations. Let us give only very few and very brief mentions, from the largest through the smallest space-time domain.<sup>§</sup>

It can explain the filamentary structure of galactic superclusters, or also the unexplained self-collimation of the solar wind, and the  $\mathbf{B}$  of galaxies and stars including their poloidal jets (and the so-called Fermi bubbles of the Milky Way).

On the space-time microscale, tiny convection inside the atmosphere generates a very feeble  $\mathbf{E}$  that displaces the tiny agglomerates of water molecules around every ion. These agglomerates move through the neutral water molecules and collect them operating like “brooms”, thus leading to the formation of a tiny droplet. This can eventually float through air (fog or cloud), or precipitate. This mechanism solves – due to the Cowling dynamo - the very well known “mystery” (almost a nightmare for every present climate modeller) of the physical reason for water condensation and precipitation.

Comparably smaller Cowling dynamos coalesce into larger Cowling dynamos, leading to progressively stronger  $\mathbf{E}$  that contribute to the migration of electric charges through the Earth's atmosphere.

Two items need to be considered in some detail: (i) a spark or a lightning discharge, and (ii) terrestrial gamma flash (*TGF*).

Let us begin and recall a laboratory experiment by Versteegh *et al.* (2008). An electric current is thrown through a tiny water layer located on the point of an electrode. A “light-ball” is generated that lasts a few tens of milliseconds and moves upward for several tens centimetres. Inside it the temperature is a few thousand Celsius degrees, while at its boundary the “ball” is essentially cold. This is a perfect laboratory model for the well-known phenomenon of “ball lightning”. This also explains the so-called jellyfish flames (Phillips, 2014b) observed onboard the *International Space Station (ISS)*.\*\*That is, as long as an internal heat source can supply a Cowling dynamo, a toroidal  $\mathbf{B}$  pattern is established, which originates a plasma bottle that confines all hot ions inside it. When the heat source fades off, altogether with the Cowling dynamo, also the “light-ball” rapidly evaporates.

<sup>§</sup>An extensive discussion is given in an 8-volume set in preparation by G. P. Gregori (see a short presentation in Gregori, 2014).

\*\*[http://science.nasa.gov/science-news/science-at-nasa/2014/10sep\\_jellyfish/](http://science.nasa.gov/science-news/science-at-nasa/2014/10sep_jellyfish/)

At present, the physical process is claimed to be essentially unexplained, either of a spark or of a lightning discharge. In contrast, it is triggered whenever a “micro”-Cowling dynamo triggers a former “light-ball”. When this fades off, its internal heat triggers a new nearby Cowling dynamo. The process progresses like a domino effect, thus displaying a luminous discharge that moves at some limited speed, thus giving the appearance of a spark or of a lightning.

Huge Cowling dynamos developed inside stormy clouds, and this explains the largest percent of intra-cloud lightning discharges, compared to cloud-ground discharges, etc.

Also several transient luminous effects (*TLE*), which are being progressively observed and reported, can be explained like peculiar similar case histories.

But the huge Cowling dynamos inside clouds have very important additional implications.<sup>††</sup>

Astrophysicists were searching for intense gamma-ray signals from outer space, and they were shocked when they found several intense *TGF* events originated from the lower atmospheric layers, i.e. inside clouds. The most complete account is maybe Marisaldiet *al.* (2014) who report about a systematic regular observations inside the latitudinal belt  $\pm 2.5^\circ$  carried out by the almost equatorial satellite *AGILE*. The frequency (for events up to 30 MeV) is  $\sim 0.3$  per day. But also event of higher energy (up to 100 MeV and larger) have been reported. A more recent estimate Phillips (2014c) envisages an even dramatically much larger number of *TGF*, i.e.  $\sim 1100$  per day.

*TGF*'s are known since several years. Their explanation relies on an astute mechanism formerly envisaged by Gurevich in 1961 (although its role was acknowledged only later on). The cross-section of electrons in air rapidly decreases with their energy. There is need for a “seed” by some **E** that causes an initial acceleration of electrons. When they attain a given threshold, the abrupt decrease of their cross-section is such that they can be very rapidly accelerated. Thus they release - by Bremsstrahlung - a high-energy gamma-ray.

A difficulty, however, is about the need for the **E** “seed” (Tavani, private communication, 2014): the Cowling dynamo is the lacking element of the cause-and-effect chain.

This phenomenon also has a very dramatic implication for security: Tavani *et al.* (2013a) have shown, in a multidisciplinary study, that these *TGF*s cause an instant and unrecoverable disruption of every

electronic device through a combined action of e.m. signals but also of a neutron flux originated by gamma-rays. This can explain the otherwise mysterious abrupt disappearance of every kind of communication with some aircrafts (either through standard radio links or through portable satellite-connected telephones of passengers). The immediate total loss of control of the aircraft leads to its precipitation like a stone, until its crash at Earth's surface.

### 3. Solid Earth's effects

Geodynamics, tectonism, chemical geodynamics, seismicity - in its most extreme frequency range, also including the seismic free oscillations [*SFO*], soil exhalation, volcanism, wildfires, deep water fauna beaching (due to water poisoning by floor exhalation), deep water life forms as the beginning of a continuously regenerating food web, etc. - are all items that ought to require a very long discussion.<sup>‡‡</sup>

We want here to mention only the two probably least known items: (i) wildfires, and (ii) the coupling between underground phenomena including earthquakes, and atmospheric phenomena (both clouds, and ionospheric effects).

NASA's Earth Observatory provides<sup>§§</sup> with a permanently updated planetary mapping of wildfires (a movie with one frame every month since March 2000). Arson events are manifestly a negligible perturbation. The phenomenon has an obvious seasonable dependence, as it requires three ingredients: (i) dry underbrush, (ii) wind to trigger friction electricity and a micro-spark, (iii) soil exhalation of methane and/or inflammable geogas. Wildfires are an effective proxy datum suited to monitor the space-time variation of soil exhalation.

Several features can be recognized in this movie. But the most surprising evidence deals with the Indochina peninsula. Let us briefly describe this interesting and apparently very regular and repetitive phenomenon.

Owing to some evidence that cannot be here reported, the Banda Sea reasonably seems to be an area of anomalous large release of endogenous heat. This has been proposed as a possible trigger of El Niño Southern Oscillation (*ENSO*) driven by gravitational teleconnection (Leybourne and Adams, 1999, 2001) along the Central Pacific Megatrend between the Banda Sea and Easter Island volcanic complexes (Smoot and

<sup>††</sup> One possibility, in principle, deals with the exploitation of the electric energy which is inside the atmosphere. But this item is not here discussed.

<sup>‡‡</sup> Refer to the aforementioned 8-volume set in preparation.

<sup>§§</sup> [http://eoimages.gsfc.nasa.gov/images/globalmaps/data/mov/MODI4AI\\_M\\_FIRE.mov](http://eoimages.gsfc.nasa.gov/images/globalmaps/data/mov/MODI4AI_M_FIRE.mov) retrieved on February 19th, 2014.

Leybourne, 2001). An increase of endogenous heat is associated with a thermal expansion of the mantle beneath the Banda Sea. The local geotumor is uplifted and the Indochina lithosphere slides northward on its slope. Crustal stress propagates through the peninsula, and with it also soil exhalation: wildfires are thus seen to move northward.

When the wildfire moving “wave” reaches (roughly) the Himalaya region, it bifurcates.

One branch moves along the eastern coast of China until it reaches a point, which is seemingly located slightly north of Beijing. This branch ends into some kind of “flash point” of an almost abrupt occurrence of a large number of wildfires.

The other branch apparently disappears while it likely moves (indicatively) along Himalaya, where no dry underbrush can be found. The wildfire “wave” however is likely to proceed until it reaches some area roughly around Karakoram where a “flash point” is observed, even more regular and intense than the aforementioned point north of Beijing.

When this is completed, a new cycle starts from Indochina etc. The phenomenon is impressive and quite regular.

The interpretation is that the lithosphere slides on the slope of the Banda Sea geotumor until it finds some strongly holding obstacles.

One obstacle is located North of Beijing, and, when it yields, it is likely to be the main cause of the violent earthquakes that sometimes hit that region.

The other obstacle is located around the Karakoram area, and it explains the origin of a ~500 km-long region with very high elevation above sea level.\*\*\*

Correlation between wildfire outbreaks in Southern California and Coronal Mass Ejections around Halloween, 31 Oct. 2003, suggest this may have a similar mechanism linked to the Hawaiian hotspot and Guaymas Basin Rift in Gulf of Baja (Leybourne et al., 2004a, 2006).

The correlation between seismicity and peculiar clouds is also a very recent subject of investigation, being rapidly developed. In contrast, the seismic connection with the ionosphere (through e.m. phenomena or airglow) is a much older topic that was systematically

\*\*\*Consider that the time scale for the erosion of continents by weathering can be estimated to be ~179 Ma (Mortari, 2010), which is a comparatively very rapid phenomenon. Therefore, high mountains must be continuously uplifted in order to keep their altitude. The phenomenon depends on a delicate long-time-range balance. The rapidity of mountains weathering has been one of the main concerns – it was a real nightmare - for Leonardo da Vinci: he was correct, but he could not know that mountains are steadily being uplifted.

investigated e.g. by the satellite *DEMETER* (by Michel Parrot and co-workers).

#### 4. The Sun’s MiniMax and its climatic implications

In the past, on some occasions, when the solar activity has been anomalously low, some tremendous famines eventually occurred, due to the loss of crops originated by cold summer seasons.†††This, however, did not occur on the occasion of *every* very low solar minimum.

At present, the Sun is during a maximum that, however, is impressively low and anomalous. Phillips (2014a) proposed the name solar “MiniMax” to denote it (figure 3).

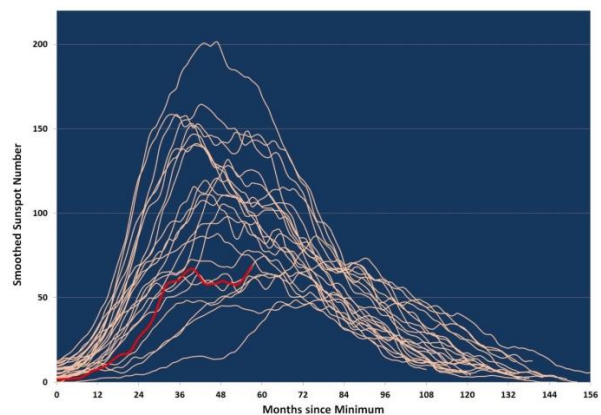


Figure 3 – Several sunspot cycles superposed in order to show the difference between different case histories. This shows the smoothed sunspot number of Cycle 24 (red), i.e. the present MiniMax, vs. the previous 23 cycles since 1755. After Phillips (2014a).

Note that every sunspot cycle can be very different from all others. But their difference is more evident mostly during the first half of every cycle, i.e. during its first ~5.5 years, while the remaining part appears like a smooth decay towards the next minimum.

Note that sunspot number is a very rough and empirical indicator of solar activity. It relies on an arbitrary weight given to sunspot groups, and on another arbitrary weight given to every solar observatory depending on the kind of instrumentation that it uses, etc.

†††Do not confuse, however, these occurrences with the events associated with large volcanic explosions. Compared to the present case histories, those events were a completely different phenomenon. They are the so-called “nuclear-winter scenario”. That is, dust in the stratosphere increases Earth’s albedo, and climate has less energy supply from solar radiation. Thus it gets colder etc.

Several other proxies are certainly better representative of solar activity (e.g. tree rings, or isotopic ratios, etc.). But, in general, every proxy is biased by some unknown additional driver (either climatic, or biological, etc.). This item is much debated.

This MiniMax feature is also associated with an anomaly in the extension of sunspots. Figure 4 shows the unusual largest active region seen on the Sun in 24 years that envisages an anomalous heterogeneous spatial large-scale distribution of the solar wind at 1AU.

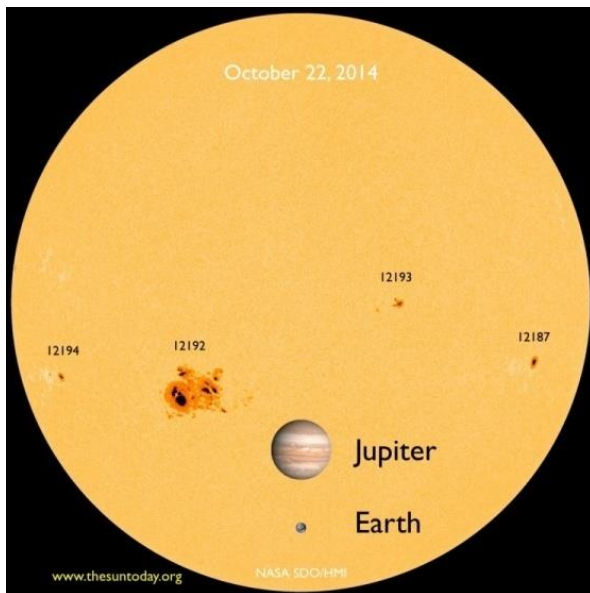


Figure 4 - The Jupiter-sized sunspot AR 12192 is the largest active region seen on the Sun in 24 years. Credit: C. Alex Young/The Sun Today. AR 2192 was actually one of the biggest observed sunspots of all time, ranking 33rd largest of 32,908 active regions since 1874, according to NASA scientists C. Alex Young and Dean Pesnell. After Kramer (2014).

That is, an anomalous large sunspot is likely to be associated with a corresponding overall pattern of the interplanetary environment that is projected outward through space. This ought to be eventually responsible for the generation of anomalous very large storm on the outer planets [such as observed on Saturn and Neptune in 2010, or on Uranus in 2014 (Howell, 2014)]. Outer planets have no seas, hence their “hurricanes” cannot be supplied by sea surface temperature (*SST*) as it occurs on the Earth (Wall, 2011). Therefore, their energy supply must occur through the “internal way”, which is modulated by low-frequency e.m. induction by the solar wind.

At present, climate appears to be very anomalous all over the world. A significantly large increase is reported of extreme climatic events from

different countries, with fatalities, and no explanation is available.

We propose here a reasonable mechanism, although its final confirmation must wait for careful observations to be collected during the next few decades, in order to check expectation with observed features.

The leading criterion is that solar control on climate is certainly associated with a time varying different percent control, respectively, by the “external way” and by the “internal way”.

The “external way” operates by means of phenomena that unavoidably are of planetary extent, and therefore, compared to the effects associated with the “internal way”, they result comparably smoother.

In contrast, the “internal way” is associated with phenomena that appear almost “point-like”, e.g. like a volcano at Earth’s surface. Note, however, that volcanoes are an extreme manifestation of a phenomenon that is ubiquitous and widespread on the planetary scale. Geothermal energy accounts for roughly ~60% of the whole energy balance of the Earth (Gregori, 2002).

Everybody knows that, during the late afternoon of very hot days in summer, an isolated mountain triggers atmospheric convection that finally causes a storm associated with a localized eventually intense shower. Suppose that the percent role of the “internal way” gets eventually larger. In this case, the Earth’s surface displays a comparatively larger spatial gradient of endogenous heat release and soil exhalation. That is, it is like in the case that a temporarily large number of “mountains” triggers several convective cells. Let us briefly state that the atmosphere has increased its “vorticity”.

Owing to the aforementioned Cowling dynamo process, this triggers an increase of atmospheric precipitation, of atmospheric electrical activity, and a greater development of cloud cover, which implies a greater Earth’s albedo with a corresponding decrease of solar radiation captured by the Earth’s atmosphere. Climate thus results rainier, colder, stormy, perturbed, anomalous.

For instance, in Italy a definitely very anomalous 2014 summer occurred. An unusual number of otherwise very rare and exceptional tornadoes were reported. Intense and unpredictable flash-floods occurred with causalities etc. in different parts, and within very few days.

Note that a flash flood can occur depending, first of all, on the specific orographic configuration of the area: when some exceptionally warm and humid air strikes against a mountain range it causes very localized

and intense precipitation. But, when no mountain range exists to trigger such an anomaly - such as when dealing with an almost flat landscape - a local area of comparatively larger geothermal flux can sometimes be the ultimate trigger that pushes the system above the threshold for a catastrophe occurrence (this occurred e.g. in October 2014 at the border between Tuscany and Latium).

Other phenomena occurred, such as an anomalous paroxysm of Stromboli (in August 2014 a new boca was opened; the regular tourist excursions had to be stopped). Also around Rome some very unusual new fumaroles appeared. During these same months a renewed concern (maybe) dealt with the Caronia phenomenon, i.e. St. Elmo fires on top of an invisible underground spike that cause abrupt and dramatic spontaneous fires inside some houses. The phenomenon was intense and reported by mass media, during the winter 2003/2004. Recently it apparently strengthened anew.

In addition, occasionally, a few beaching episodes of sperm whales were reported from the Adriatic. These events are absolutely exceptional, and occur only once every several years. Note that, during the aforementioned past occurrence in 2003/2004 of the Caronia phenomenon, exactly during a one week of its most intense and regular manifestation, also water circulation inside the Adriatic Sea reversed, from its standard counter-clock-wise pattern to clock-wise pattern, consistently with an increase of geothermal flow underneath the whole Adriatic sea floor. Multiple earthquake clusters within the Adriatic and Mediterranean Basins in 2003 appear to drive increases in *SST* anomaly magnitudes, geospatial extent, and duration. Manifestations of this phenomenon may be observed in clustered earthquake swarms at the base of the lithosphere, at 10-33 km depths. Burst pulses over several days to weeks appear to precede subsequent *SST* anomalies within days or months after observed seismic swarms. *SST* anomaly patterns overlying earthquake events are hypothesized to be the result of increased heat emission from seafloor volcanic extrusions and/or associated hydrothermal venting (Leybourne et al., 2004b).

Also an anomalous season of tornadoes has been reported from central USA and some unpredictable very intense snow storms in October 2014 on Himalaya (with a few tens of casualties among hikers on Annapurna), etc., while the 2004/2005 U.S. hurricane season was devastating and lightning strikes in the Tampa Bay region the "Lightning Strike Capital" of the U. S. doubled (Leybourne, 2008, 2012).

Summarizing, we guess that, at present, owing to the solar MiniMax, the percent role of the "internal way" is likely to be much larger than during "normal" conditions. This same occurrence happened in the past during some (although not every) period of very low solar minima.

Note that it appears impossible to monitor instrumentally the low-frequency component of solar wind induction into deep Earth. In reality, the unique available "detecting device" seems to be Earth's "climate" according to the aforementioned rationale, or the sunspot area, or the width of outer planets "hurricanes".

## 5. A short reminder about climatic variability

Just a short reminder can be here given about natural climate variability.

A debated item has been the effect of planetary tides on the Sun, and its feedback on the Earth's climate. The effect is certainly feeble, but real. In particular, it can explain (Tattersall, 2013) some features of paleo-climate, and also some impressive correlation with some long-range time variation of the duration of the length of the day, with a time shift of 30 years, in order to account for friction inside the deep Earth's body that opposes mass displacement.

One can thus eventually recognize inside the climatic data series some effects that appear to be modulated by solar system orbital physics variation in e.m./gravitational coupling between the Earth and other astrophysical bodies. Solar rotation and orbital influences of the Moon, Jupiter and Saturn have dominant roles in modern climate high frequency modulation.

These periodic variations ought to be distinguished from Earth's longer orbital cycles, generally known as Milanković cycles, such as eccentricity (~100 ka), obliquity (~36 ka), and precession (~26 ka), the modulation of ice ages (which is a very complicated and delicate topic that cannot be here discussed in detail), 100 ka year cycles.

In particular, a very remarkable phenomenon deals with the so-called "terminations" evidenced very well in ice cores. Climate gets progressively cooler, until an eventual ice age occurs. Then, it recovers very rapidly. At present, the cause seems to be unexplained. But, this is consistent with the concept of the Earth like a battery (Gregori, 2002) which stores energy. Energy progressively "opens" its way towards Earth's surface. When it affords to open a "channel" through which it can escape above Earth's surface, the discharge capability of the Earth-battery abruptly changes. The

battery discharges, the “channel” slowly closes and the recharging process starts anew.

But also other much longer cycles can be recognized e.g. in the magma emplacement rate from the Hawaii hotspot (see e.g. Gregori, 2002 or brief accounts also in Gregori, 2006a, 2006b, 2009, 2014, and references therein). Ancient paleo-climate is controlled by (i) Earth e.m. resonance (410 ka i.e. eccentricity modulation), (ii) Solar System crossing of galactic equatorial plane (~14 Ma), and (iii) timing of endogenous energy release (27.4 Ma, Earth’s “electrocardiogram”), with different proxies (hotspot volcanic sequences, geodynamic spirals, etc.).

Recall also the aforementioned 179 Ma cycle observed, among others, in sediments (Mortari, 2010). Consistently with the overall tectonic and geodynamic perspective of the Earth’s battery model, this is the likely evidence of the timing of generation of continents and orogens, and subsequent destruction by weathering and erosion.

Atmospheric chemistry suffers by dramatic variations. For instance, the Russian school by Ronov (1982) envisaged the “principle of preservation of life” by which a greater amount of volcanism has always been clearly associated with a greater amount both of carbonate content and of fossil carbon inside the Earth’s crust. They claim that this envisages that the greater release of  $CO_2$  by volcanism has been the primary strictly essential “fuel” for the development of the biosphere. That is volcanism is the source for  $CO_2$  and biosphere its sink. Or with no volcanism, no life could exist on the Earth.

But every chemical element, other than carbon, had its long-range cycle. These topics are extremely complicated and the progress is very slow of our understanding, including the crucial role of the biosphere in the control of the whole Earth’s system. It is impossible to deal with these items in a short paper.<sup>\*\*\*</sup>

## 6. Perspective of understanding, natural catastrophe mitigation, “myths” and concreteness

Several present frontiers of research are certainly going to contribute to achieve substantial improvements in our understanding, although the challenge appears very difficult, and it will require a long time.

The ever increasing available capabilities to monitor “climate” from satellite and space platform is steadily improving our observational information that is the real backbone, or “paradigm”, of our investigation.

At the same time, we must, however, be extremely “humble” in front of Nature. That is, we must avoid to impose on Nature with logical schemes and paradigms. Mostly we must refrain from believing that some “simple” model or explanation can get rid of all of what is observed.

In particular, a so-called “numerical model” is an effective tool which is suited to confirm (or not) that our guessed interpretation is correct, and it can also check the amount of detail that we afford to explain by means of a limited set of laws and simplifying assumptions.

But the physical, chemical and biological interpretation of observations is not a numerical model. The model has to be envisaged by means of the exploratory analysis (Tuckey, 1977).

For instance, it makes totally a nonsense to carry out the ongoing - sometimes even very harsh - debate about the role of  $CO_2$  or other gases of anthropic origin that enhance the greenhouse effect, etc.

Important planetary evidence is provided by the recently launched NASA satellite OCO<sub>2</sub>. Its released dataset, showing the average atmospheric concentration of  $CO_2$  over a period of about 6 weeks late in 2014 (figure 5), indicates that there is  $CO_2$  input in tectonically active oceanic areas. Maxima of  $CO_2$  concentration are observed above the two almost antipodal region of larger release of endogenous energy, roughly located around the Hawaii hotspot and in Botswana. Other maxima occur roughly around the Banda Sea, and in the South American Anomaly. Lesser maxima occur in South Atlantic and in the Indian Ocean (mainly in their respective eastern part), and in the Fiji Island region. Two remarkable maxima are also observed. One is located in north-eastern China that seems not to be associated with anthropic pollution. Rather, it appears to be possibly related to the aforementioned “flash point” of wildfires. The other is located close to Greenland, consistently with several other evidences that suggest that a steady large increase is in progress of endogenous heat underneath the northern polar cap (Phillips, 2014d). This feature seems very likely to be a primary driver in the present ongoing global warming.

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<sup>\*\*\*</sup>Also for this refer to the aforementioned 8-volume set in preparation for the discussion of several related items. But no really exhaustive and final discussion can be given.



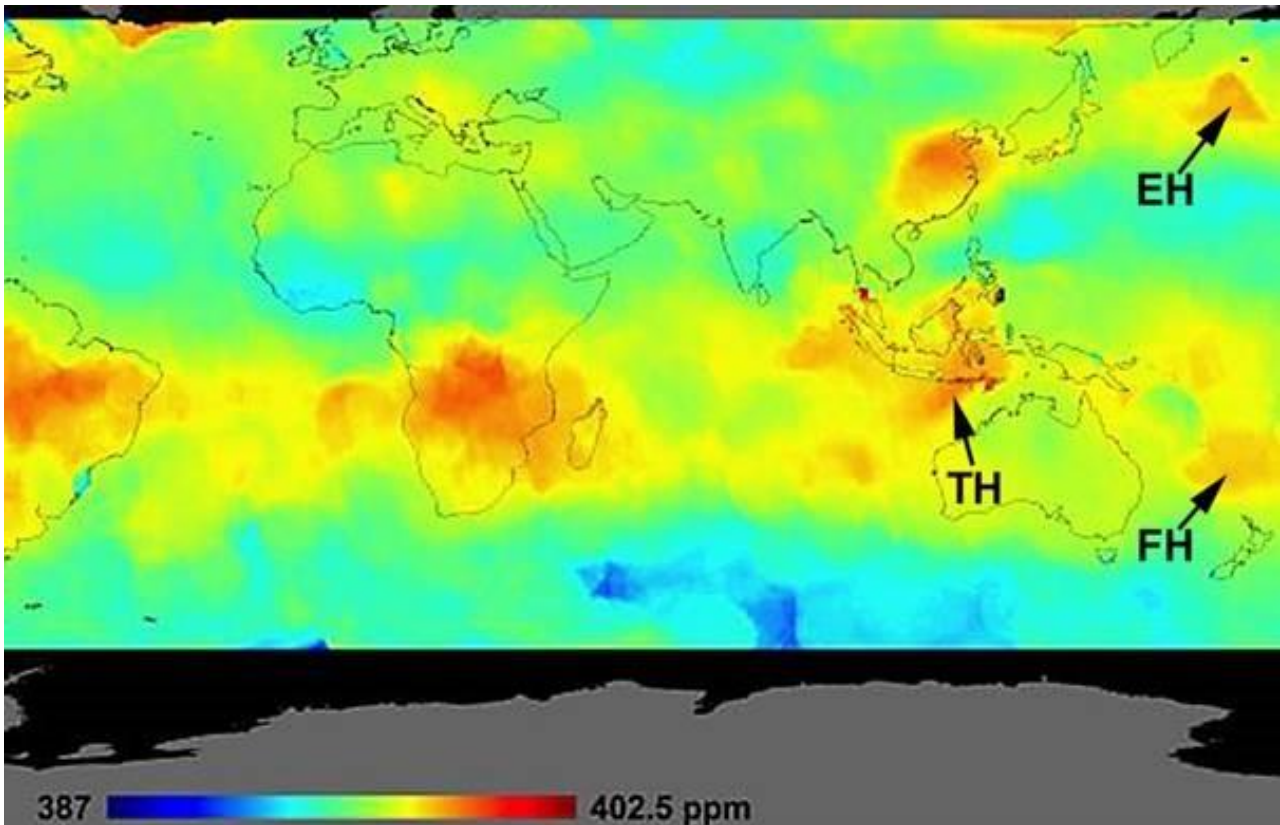


Figure 5 – “Portions of the initial published OCO<sub>2</sub> data, showing the locations of the three CO<sub>2</sub>-hotspots discussed herein. TH=Timor CO<sub>2</sub>-hotspot; FH=Fiji CO<sub>2</sub>-hotspot; EH=Emperor CO<sub>2</sub>-hotspot. They are all apparently associated with tectonically active processes on the underlying seafloor.”<sup>§§§</sup>

It is beyond any doubt that climate is not the same every year, and that a climate change is in progress, just like it happened several times during the entire Earth’s history.

It is obvious that humankind has an impact on climate – much like it occurred for every other natural presence inside the Earth’s system, of any kind, either living forms or not. Humankind is no exception to this very general and everlasting rule.

It is obvious that humankind must be concerned with avoiding dangerous impacts on “climate”, as this can be decisive even for human survival etc.

But, claiming that CO<sub>2</sub> has the main responsibility for climate change is totally unscientific as, according to the present understanding, no serious “proof” in a strict sense can exist that supports such a belief.

Perhaps, the present harshly debated scenario reminds one about an analogous historical circumstance. In the past, on several occasions, a pestilence hit society. For instance, in the XVII century in northern Italy, the dramatic situation was very effectively illustrated in the famous novel “*I Promessi Sposi*” (“*The Betrothed*”) by Alessandro Manzoni (1785-1873), which is one of the best known and influential classics of the Italian literature.

The “current opinion” in the XVII century ascribed the main responsibility for pestilence to the “untori” (literally “greasers”) who were supposed to disseminate the contagion by some infectious “grease”. A real manhunt often occurred. Today, the Italian axiomatic form is still frequently used “caccia all’untore” (“hunt for the greaser”) to mean a search for

<sup>§§§</sup><http://wattsupwiththat.com/2015/01/02/nasas-new-orbiting-carbon-observatory-shows-potential-tectonically-induced-co2-input-from-the-ocean/>

somebody who is simply speculated to be guilty of something with no real proof against him.

In reality, it is now known that sewer rats were responsible for the contagion. But at that time the “official” “generally agreed” science recommended to refrain from taking bath (Sorcinelli, 1998), as water made the pores of the skin widen, thus favouring contagion.\*\*\*\*

Today, the new “untore” (or “greaser”) seems to be CO<sub>2</sub>, and this forbids concentration of our research toward prevention from several other forms of anthropic pollution that perhaps, compared to CO<sub>2</sub>, are even much more challenging and dangerous.

That is, a sound and realistic humility in front of Nature and of its laws is the fundamental prerequisite in order to manage the very difficult challenge (i) of optimizing the interaction between environment and the ever increasing demographic occupation of our planet, and (ii) of mitigating the consequences of unavoidable natural catastrophes. Every preconceived “simple” paradigm must be avoided.

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\*\*\*\*Hygiene was a real weapon in antiquity. For instance, the ancient Romans searched for great water availability, by means of huge aqueducts. Water was used to manage fire hazard and for hygienic purposes (through several fountains, or the famous public Baths). Thus, large urban settlements could be planned, being reservoirs of soldiers. An efficient road network favoured communication, and a limited number of soldier/policemen permitted to manage a huge territory. This was a real “globalization” of ancient world, by means of an effective communication and exchange between formerly reciprocally very far and isolated regions.

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