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Session : [SM3.2 Earthquake precursors, bioanomalies prior to earthquakes and prediction](#)

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Short-term earthquake predictions reliable with an advance warning of several hours or days are currently not possible for technical reasons. In the last years major efforts were undertaken to study and understand earthquake precursor signals to establish a robust earthquake prediction science on sound scientific grounds. In addition, unusual animal behaviour, and other bio-anomalies as a precursor phenomenon prior to earthquakes, have been reported previously but they still create problems with monitoring and reliability. Recently, ground breaking advances in solid state physics, combined with other approaches such as satellite technology and radio sounding methods, electromagnetic anomalies, along with some fortuitous observations of pre-seismic biological changes, have enabled a greater understanding of how some of these physical- and bio-anomalies may come about. The session covers both, the interaction and feedback mechanism between the abiotic and biotic environment prior potentially destructive earthquakes, in order to advance the state of earthquake precursors and biology research and encourage alternative prediction methods.

Possible relationship between changes in IMF, M7+ earthquakes and VEI index, during the transition between the solar minimum cycle 23 and the rise of solar cycle 24

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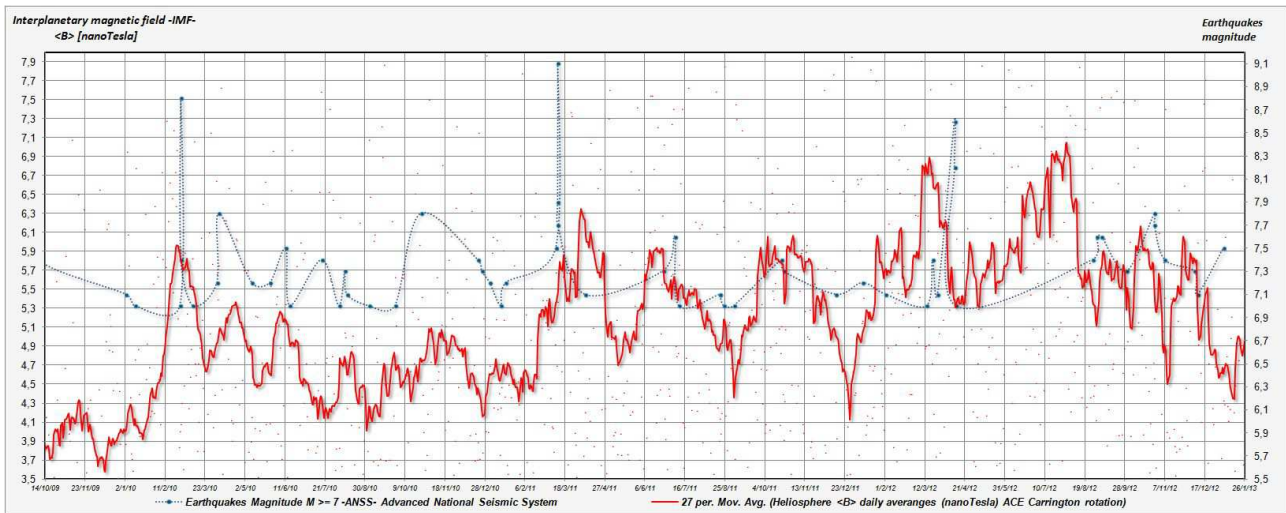
Abstract

Numerous scientific papers seem to suggest a possible influence of solar activity on geological dynamics (hypothesis triggers earthquakes or volcanic activity) on Earth. In the following study, all earthquakes around the globe with a magnitude greater than or equal to 7, from January 2010 to November 2012, were taken into account which corresponds to the appearance of the first sunspot of Solar Cycle SC24. The data was then compared with the graph that shows the variations of the interplanetary magnetic field (IMF). This second track is the result of a moving average equal to 27 (solar rotation of Bartel) starting from the daily values of the field, detected by the magnetometer on board the probe Advanced Composition Explorer (ACE). The analysis reveals a first major change in February 2010, when the IMF changes from 4.5 nT to about 5.8 nT. A second identical significant change is found in February 2011, when the IMF, went from 4.5 nT to about 5.8 nT. In March 2012, we have, the other way around, a third important change in the IMF, with later's dynamics registering a variation from 5.6 nT to about 6.8 nT. We find that the three most important seismic events of the last three years (M8.8 in Chile 27/02/2010; M9 in Japan on 11/03/2011, and M8.6 on 11/04/2012 in Sumatra) occurred at the same time or slightly after the peaks (Bmax) of increase in the magnetic field of the heliosphere "facing the Earth" were reached.

The analysis also suggests further connections between earthquakes with $M > 7$ and when the peak (maximum value the IMF) were reached, recorded in other changes in the field in these three years. Like, for example, the earthquake of M7.5 in India of 12/06/2010, when the IMF increased from 4.5 nT to 5.2 nT, or the earthquake in Sumatra 25/10/2010, when the IMF went from 4.4 nT to 5.1 nT. The variation of the IMF, recorded in May 2011, from 4.7 nT to 5.9 nT, relates, for example, not only with the M7.6 earthquake in Kermadec (07/06/2011), but also with volcanic eruptions of Puyenne Cordon Caulle in Chile (05/06/2011) VEI4, of Grimsvotn in Iceland (21/05/2011) and of the Nabro in Eritrea (12/06/2010). The other two most significant eruptions in the last three years are that of Eyjafjallajokull (VEI4) in Iceland 20/03/2010 and of Merapi (VEI4) in Indonesia on 25/10/2010.

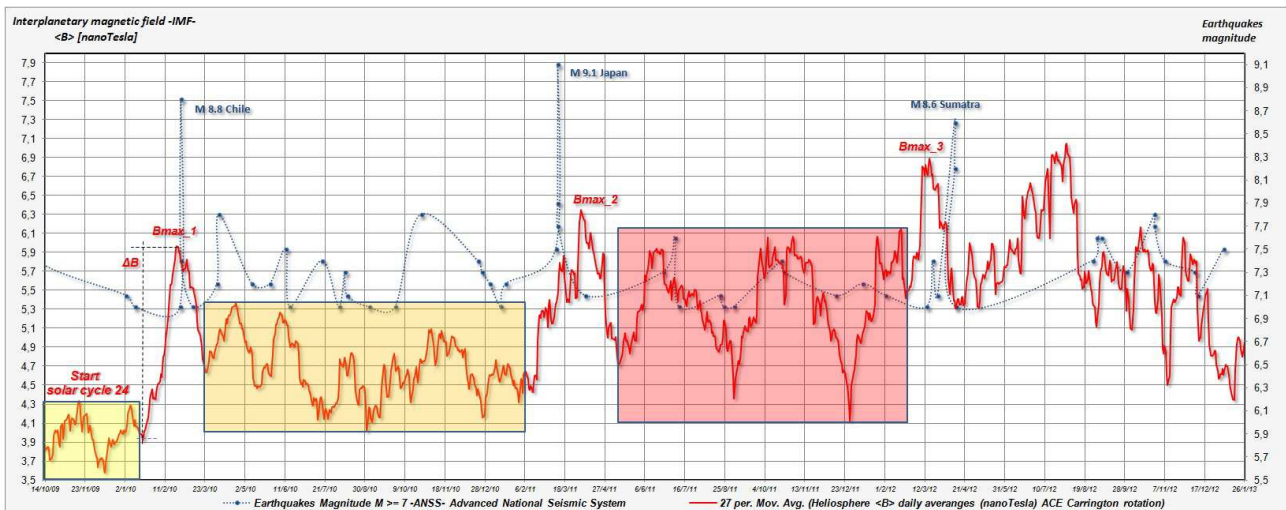
Events which are also to be connected to further variations of the IMF, of February 2010 and October 2010. The graphics elaborated in this study also show, further connections between the changes of the planetary magnetic field and M7+ seismic events.

We conclude that this research further confirms that while coming out from periods of low activity, in the long period - deep solar minima, and the simultaneous fast oscillation, in the short period and impulsive electro- magnetic activity, the recovery of the EM activity of the Sun can trigger significant geophysical events in terms of energy release as regards the magnitude or the VEI index.



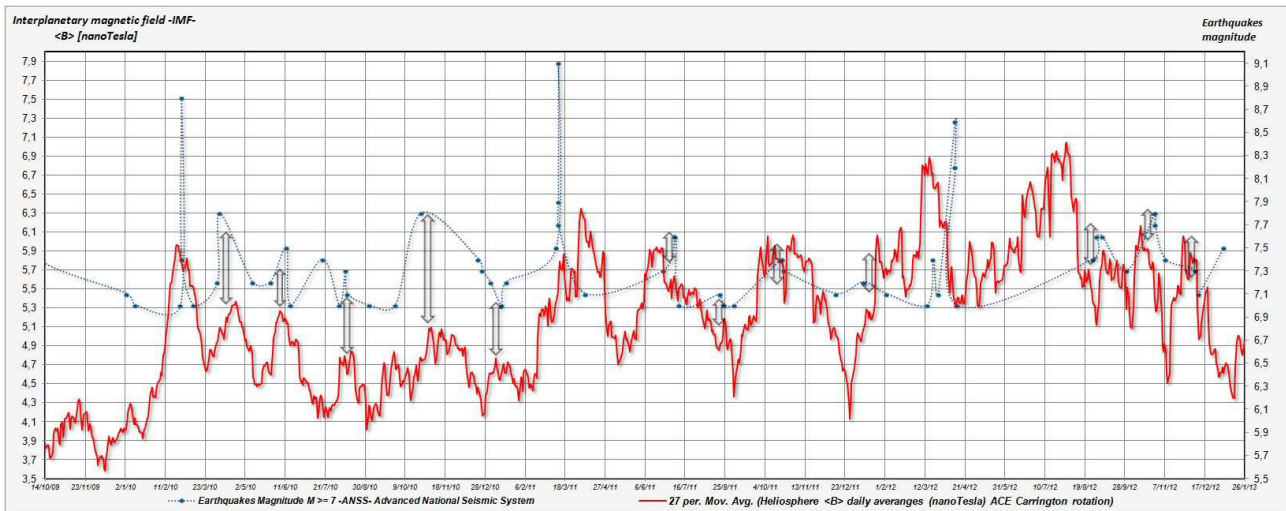
Graph "A" - The graphics processing data -

The light blue curve represents the track of all earthquakes with magnitude greater than or equal to 7, recorded from January 2010 to end 2012 on a global scale. The red curve is the result of a moving average equal to 27 interplanetary magnetic field (opposite the ground), starting from the daily values of the field, detected by the magnetometer mounted on board of the probe "Advance composite explorer".



Graphic "B" - The interplanetary magnetic field changes in vision and great earthquakes of magnitude $M > 8.5$ -

The graphical analysis shows that the three major seismic events recorded during the rise of solar cycle SC24, are placed during or shortly after this transition between three distinct areas. Areas, within which, the fluctuations of the interplanetary magnetic field (ΔB) were lower in terms of variation (ΔB) and / or reaching the peak of the field (B_{max_1} ; B_{max_2} ; B_{max_3}), the most significant changes, conversely, that were recorded at the same time or shortly after major earthquakes in recent years.



Graphic "C" - Minor changes in vision of the interplanetary magnetic field and other seismic events with magnitude $M > 7$

The arrows to chart, aim, to show that most of the earthquakes with magnitude $M > 7$, during the rise of this solar cycle occurred in contemporary or slightly delay the achievement of the corresponding peak during the specific variation of the interplanetary magnetic field.

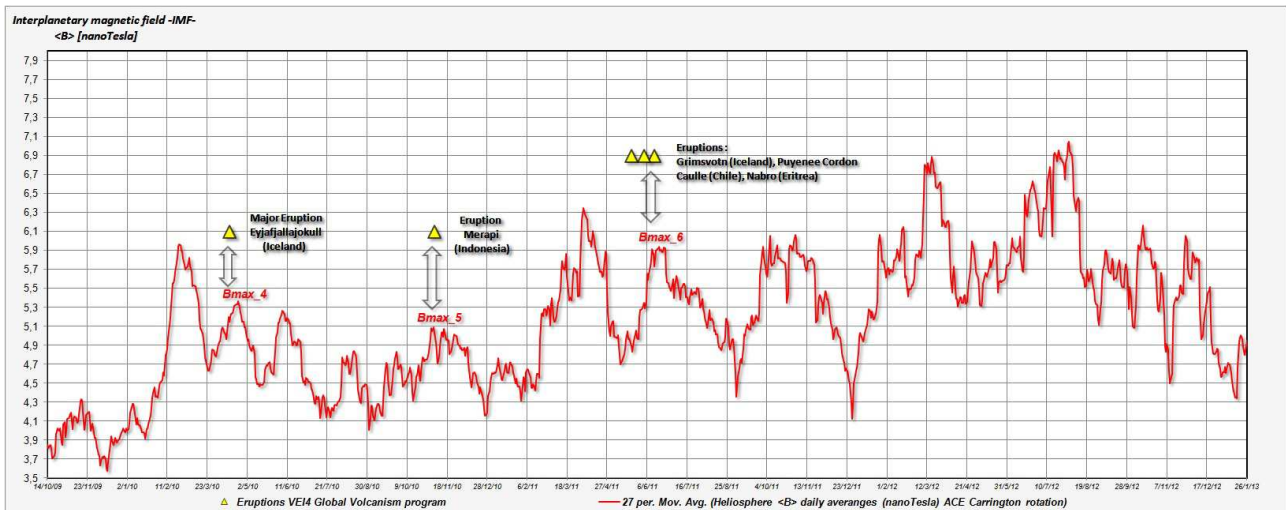


Chart "D" - Changes in the interplanetary magnetic field and volcanic eruptions VEI4 -

In the chart below, have been reported, the major eruptions in terms of volcanic explosivity index, recorded between 2010 and 2012. The analysis shows that the five most significant volcanic eruptions, in terms of energy released, are placed at the same time to achieve the maximum peaks of the interplanetary magnetic field (see Bmax_3; Bmax_4; Bmax_5), reached during some of the important variations of the same field between 2010 and 2011.

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