



Major geophysical events and transitions of heliospheric magnetic field in the beginning, middle and end phase of the Maunder solar minima

Michele Casati (1), Valentino Straser (2), and Alessandro Feron (3)

(1) Independent researcher Altopascio (Lucca), Italy (michelecasati1974@alice.it), (2) Independent researcher Terenzo (Parma), Italy (valentino.straser@alice.it), (3) Independent researcher Peccioli (Pisa), Italy (zedeq74@alice.it)

Abstract

In recent decades we are moving towards the hypothesis that electromagnetic (EM) processes inside the solar system (not yet fully understood from a physical point of view), may be linked with the energy released during major geophysical events (energy expressed in magnitude or Volcanic Explosivity Index).

This research has focused on analysis of the temporal relationship between EM processes inside the solar system and major geophysical events around the crucial phase of the Maunder solar minima (1645-1715).

To carry out this study thirty-five limit values of the heliospheric magnetic field strength HMF (minimum and/or maximum) were compared, in terms of time, with twenty-one major geophysical events which occurred between 1600 and 1729.

In the solar-terrestrial interaction, the concomitant conditions necessary for the amplification of the energy of the geophysical event, are two:

- i. low solar activity during a long period (from decades to centuries), for example, the historical solar minima: Wolf, Sporer, Maunder, Dalton, etc. and
- ii. fast and impulsive EM solar dynamo reorganizations in the short-term (one year or two years), are characteristic in the two periods of the solar cycle border, the incoming or outgoing of the solar minima or solar maximum.

The reconstructed intensity of the heliospheric magnetic field (HMF) was the main set of data used to carry out the present study. HMF evaluated by the annual cosmogenic ^{10}Be ice core data from Dye 3 and North GRIP, in Greenland [McCracken;Beer,Sol.Phys.,2015 in press].

Analysis of the data shows that all the major geophysical events, with magnitude and volcanic explosivity index: $8.7 < M < 9.5$ and VEI5+, occurred in proximity of twenty-two limit values (maximum or minimum) of the reconstructed field strength HMF. The possible proof of the link (time occurrence) of major geophysical events with unknown dynamics EM, in the deep solar minimum, is confirmed by taking into account the comparison of the dates of major geophysical events with:

- i. the biannual variations of the content of carbon ^{14}C , in the tree rings of pine trees in the southern Urals, 1600-1730 [Kocharov,1995] and
- ii. the recent hypothesis of the solar minima that occurred in Maunder [Zolotova,2015].