



North west area of Tuscany, Italy : Are the solar maximum and solar minima a particular period for increased frequency of floods and local geological destabilization ?

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Abstract

The purpose of this study is to verify a possible relationship between solar activity transitions (minimum and maximum), seismic activity and atmospheric circulation in a particular area. The hypothesis has already been advanced by other authors and is found in studies, for example:

[Sytinsky A.D.,1980,1987,1997][Mazzarella,Palumbo, 1989][Odintsov, et al, 2006][Khachikyan, Inchin, Lozbin, 2012][Czymzik,Markus, 2013][Nedeljko,Vujović,2014].

The geographical area studied is approximately 8x13 km sq. and includes villages such as Fivizzano and Equi Terme, in north-west Tuscany, Italy, on the Lunigiana/Garfagnana border. The North Apuan Fault Zone" (NAFZ) is found in the area of study and major historical earthquakes have occurred in this area [Di Naccio Deborah, et al., 2013]. In this research, we compared the local seismicity with heavy rainfall (in quantity) that occurred in a short time frame in this area (measured by the daily rain gauge accumulations). These events occurred during the numerous floods from 2009 to 2013 (the transition between the solar cycle SC23 and SC24 solar and the rise of solar cycle SC24).

The data was provided by the hydrological sector of the Tuscan Region Hydrological Service (SIR) and the LaMMA consortium. In this study we hypothesize, a slow and continuous destabilizing action on local geological structures, due to the multiple and violent atmospheric disturbances (V-shaped, flash floods, squall-line, etc..). Destabilization that led to an earthquake of magnitude Mw 5.36, which occurred on 21 June 2013.

Comparing the SIDC count of sunspots with:

- a) the historical local seismic events catalogue with magnitude M4.5 + (CPTI15, the 2015 version of the Parametric Catalogue of Italian Earthquakes),
- b) the recent earthquakes of magnitude M 2.5+, which occurred from 1984 (ISIDE working group (2016) version 1.0), and
- c) the historical reconstructed maximum annual flows of the Serchio river from 1750, the daily maximum annual flows of the Magra river since 1939 (Data provided by Serchio River Authority and Authority and Magra Interregional River Authority),

we observe that floods and/or local seismic events occur more frequently when there are solar maximum and solar minima.