

## Statistical validation of the possible Lithosphere-Atmosphere-Ionosphere Coupling prior to earthquakes by means of 3.5 years of Swarm satellite electromagnetic data analysis

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SAFE ( “Swarm for Earthquake study” ) project (funded by ESA in the framework of "STSE Swarm+Innovation" ) deals with the integrated analysis of more physical parameters whose abnormal variations have been found to be possibly associated with impending earthquakes. These observations are mainly: electromagnetic variations, total electron content and the electron density in the ionosphere, measured both from Swarm satellites and ground-based observatories. We show here the results of a systematic analysis of around 3.5 years of magnetic and electron density Swarm satellite anomalies in the whole space-time interval of interest, avoiding high magnetic latitudes, which are correlated with earthquakes by means of a superposed epoch approach. Both magnetic and plasma data analyses show that the anomaly concentrations are larger than random anomaly distributions by a factor of more than 2.5, and a deviation from the random mean by more than 40 times the standard deviation, supporting the hypothesis for a lithosphere-atmosphere-ionosphere coupling in the preparation phase of earthquakes.

The recent launched CSES satellite mission with dedicated scientific payload for pre-earthquake anomaly detection will let us available more electromagnetic data for applying the same techniques for searching precursors of future earthquakes.

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