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Information theory and "Predictive" space weather

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It is rather well recognized that the global dynamics of the Sun-Earth relationship involves complex nonlinear phenomena. Here we present preliminary attempts to characterize phenomena involved in Space Weather, as the influence and the timing of the solar magnetic activity on the near-Earth environment or the storm-sub storm relationship, based on quite novel tools of information theory. The preliminary examples shown in some detail pertain both the Sun-Earth direct forcing, and the relationships among sub-systems of the near Earth plasma. In the first example, we investigate the time behavior of the delayed mutual information applied to the solar wind forcing on ionospheric irregularities in a stormy period of November 2004; in the second example, we study the evolution of a possible measure of relative complexity for the diurnal variability of the vertical total electron content during the "Halloween Storm" of year 2003.A third example is devoted to illustrating how the same information theory tools may be applied to learn something about the complex dynamics of geomagnetic storms, and the storm-sub storm relationship in particular .In the future, a stronger use of data from the GNSS systems will give a definitive improvement to the application of these techniques to Space Weather.

Biography

Massimo Materassi has completed his Ph.D. at the age of 30 years from University of Perugia, Italy, and postdoctoral studies from Space Research Center in Warsaw. He is working as a theoretical physicist in the Institute for Complex Systems of the National Research Council of Italy (ISC-CNR), a premier scientific organization within the European Union. He has published more than 25 papers in reputed journals and is serving as a scientific referee for several journals.

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