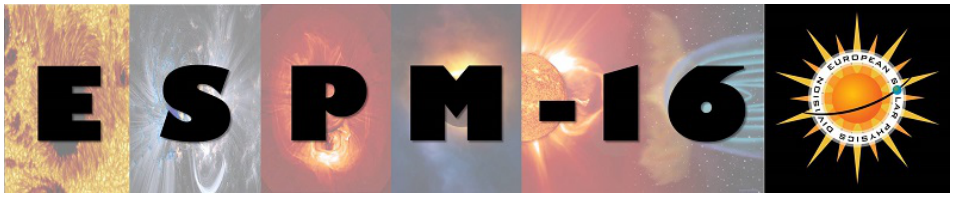

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The characteristics of flare- and CME-productive active regions

Thursday 9 September 2021 14:20 (20 minutes)

Flares and coronal mass ejections (CMEs) cause immediate and adverse effects on the interplanetary space and geospace. In an era of space-based technological civilization, the deeper understanding of the mechanisms that produce them and the construction of efficient prediction schemes are of paramount importance. The source regions of flares and CMEs exhibit some common morphological characteristics, such as δ-spots, filaments and sigmoids, which are associated with strongly sheared magnetic polarity inversion lines, indicative of the complex magnetic configurations that store huge amounts of free magnetic energy and helicity. The challenge is to transform this empirical knowledge into parameters/predictors that can help us distinguish efficiently between quiet, flare-, and CME-productive (eruptive) active regions. Such predictors were first introduced when systematic ground-based observations of the photospheric magnetic field became possible and the relevant research was boosted by the introduction of near real time, uninterrupted, high-quality observations from space, which allowed the study of large, statistically significant samples. Nowadays, machine learning methods accommodate the processing of data of increasing volume and complexity, comprising not only photospheric magnetograms, but also EUV images, spectra, and time series, thus widening our inventory of data sources and feature extraction methods. In this talk I will review these efforts to parameterize the characteristics of eruptive active regions and their application in operational prediction schemes. I will discuss some of the challenges of flare and CME prediction as well as the importance of transforming new knowledge into more efficient predictors and including new types of data.

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