Fractality of Magnetic Clouds

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Abstract

Magnetic clouds are transient events emerging from the Sun, which have a smooth rotating magnetic field [3]. In this work, the fractal behavior of the solar cycle 23 magnetic clouds is presented, using the box-counting method [2], in order to study the variation of their complexity as a function of the solar activity levels, and to explore the usefulness of this method to identify magnetic clouds in solar wind time series from satellite missions.

The box counting method was used to obtain the fractal dimension of the magnetic field time series given by the ACE mission [1], for all events classified as magnetic clouds in solar cycle 23 (Fig. 1.(A) contains an example of a cloud), according to Richardson and Cane classification [5]. It was observed that the fractal dimension of the cover (*sheath*) is greater than that flux rope, reflecting with the higher level of intermittency of the former. The results are consistent with those previously obtained in Ref. [4]. As can be seen in Fig. 1.(B), a significant variation in the fractal dimension is not observed throughout the solar cycle, but there is a slight decrease in the dispersion of the data near the solar maximum, a behavior that should be studied in greater depth in the future.

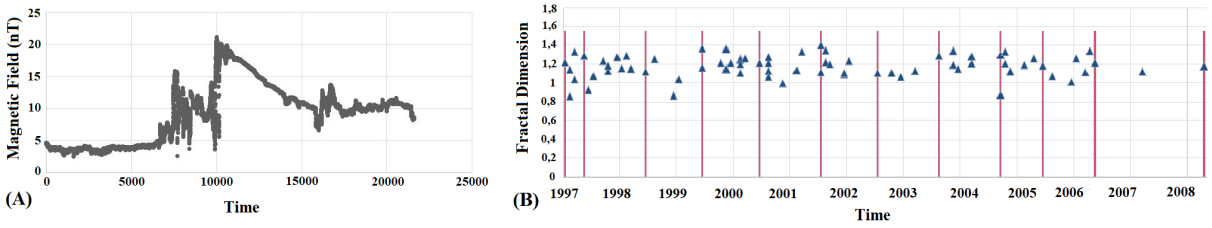

Figura 1: *(A) Total magnetic field of a magnetic cloud on October 28, 2000, with a time resolution of 16 seconds. (B) Fractal dimensions per year of all magnetic clouds of solar cycle 23.*

Acknowledgments

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