Dynamical System Approaches to Study the Earth’s Magnetospheric Dynamics

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The Earth’s magnetospheric dynamics in response to interplanetary medium changes displays many features of a complex system, such as, for instance, scale-invariance, multiscale properties, criticality. On the other hand, in coincidence with geomagnetic storms and substorms, relevant dynamical changes, similar to those observed during non-equilibrium phase transitions, occur. Here, we present recent results describing some features of the Earth’s magnetospheric dynamics in the framework of dynamical system theory. We discuss the different character of the scale-to-scale fluctuations of the geomagnetic indices AE and SYM-H, used as proxies of the dynamical changes of certain magnetospheric current systems, by estimating the correlation dimension $D_2$ and the Kolmogorov entropy $K_2$. Furthermore, we present the result of a Langevin/Fokker-Planck approach for the characterisation of the dynamical changes of short- and long-timescale fluctuations observed during geomagnetic storms via the associated state functions. The relevance of our results in the framework of Space Weather is outlined.