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Study of nonlinear relation between the magnetosphere and solar wind dynamics - Chaos analyses of magnetic time-series of the investigated systems

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The paper deals with the nonlinear dynamical connection between the magnetosphere and solar wind. The nonlinear behaviors of both systems have been thoroughly investigated in the last decades. For the case of the magnetosphere, however, it is sometimes difficult to decide which part of the behaviors comes from the intrinsic dynamics of the magnetosphere and which part is inherited from the solar wind. Some papers argue that the nonlinearities in the magnetosphere are attached with chaotic dynamics, but this behavior is significantly covered by the strongly turbulent and multi-dimensional nature of the solar wind during storm time periods. In the first part of this paper, the chaos analyses (investigation of embedding dimensions, surrogate data tests, etc.) of quiet and storm time geomagnetic time-series are shown in order to investigate, how the temporal dynamical changes affect the chaotic properties of the geomagnetic fluctuations. We use data with resolution of 1 second from geomagnetic observatories of different geomagnetic latitudes. In the second part of the paper, a comparative chaos analysis of contemporary geomagnetic and in-situ solar wind-magnetosphere magnetic time-series is presented. Our aim is to show the differences in the chaotic or non-chaotic nature of the magnetic fluctuations originated in the solar wind and the magnetosphere systems. In-situ magnetic data are from the Cluster spacecrafts that visit different regions of the magnetosphere and solar wind during a yearly cycle.