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Correlation-based characterisation of time-varying dynamical complexity in the Earth's magnetosphere

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The dynamical behaviour of the magnetosphere is known to be a sensitive indicator for the response of the system to solar wind coupling. Since the solar activity commonly displays very interesting non-stationary and multi-scale dynamics, the magnetospheric response also exhibits a high degree of dynamical complexity associated with fundamentally different characteristics during periods of quiescence and magnetic storms. The resulting temporal complexity profile has been explored regarding several approaches from applied statistics, dynamical systems theory and statistical mechanics. Here, we propose an alternative way of looking at time-varying dynamical complexity of nonlinear geophysical time series utilising subtle but significant changes in the linear auto-correlation structure of the recorded data. Our approach is demonstrated to sensitively trace the dynamic signatures associated with intense magnetic storms, and to display reasonable skills in distinguishing between quiescence and storm periods. The potentials and methodological limitations of this new viewpoint are discussed in some detail.