Solar wind-Magnetosphere coupling: Data analysis versus analytical studies

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The magnetosphere is a complex nonlinear dynamical system that evolves under the solar wind's influence. In spite of numerous measurements it is still impossible to deduce from the first principals the ultimate mathematical model that can be used to predict the dynamics of the magnetosphere. A much simpler question which is not completely clear is: What are the best modelling inputs, the most influential parameters, that affect the evolution of the magnetosphere? Correlation function that are often used to answer this question is appropriate only for linear relations and it is not a proper tool for such a nonlinear complex system and the magnetosphere. In the present paper it is shown how application of methodology developed for the analysis of nonlinear systems can clarify problem of solar wind- magnetosphere coupling functions and to identify pitfalls in analytical studies.