HOW CAN ADVANCED DATA ANALYSIS METHODS TEACH US ABOUT PHYSICS ?

R. J. Boynton[1], M. A. Balikhin[1] and N. Ganushkina[2]

[1]*Space Systems Group, ACSE, University of Sheffield, UK* [2]*Finnish Meteorological Institute, Helsinki, Finland*

The magnetosphere is a complex nonlinear dynamical system that evolves under the influence of the solar wind. In spite of numerous measurements it is still impossible to deduce from the first principles the ultimate mathematical model that can be used to predict the dynamics of the magnetosphere. Correlations between geomagnetic indices and solar wind parameters are often used to deduce these best input parameters. However it is obvious that this linear approach might lead to erroneous results for a nonlinear system such as the magnetosphere. In this study a data based NARMAX OLS-ERR approach has been used to deduce best inputs to explain the dynamics of D_{st} based upon basic solar wind input parameters and coupling functions developed by other authors. This is done by the use of the model structure selection step in the NARMAX algorithm which selects terms for for the model by the use of an error reduction ratio (ERR). For nonlinear systems the ERR indicates the causal relationship between two signals. The best coupling functions were then compared to the coupling functions deduced by other authors.