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Machine Learning Enhanced NARMAX Model Averaging for Forecasting of Geomagnetic Field Indices

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A massive amount of data are available in research areas of space weather and space climate. Investigation and research on exploiting and making use of the available observational data for better understanding and forecasting of future behaviour.

In this study, for the first time, we propose a machine learning enhanced NARMAX model averaging (MLE-NARMAX-MA) approach, which can produce an ensemble and transparent model that is more powerful and more robust than a single NARMAX model.

We apply the proposed MLE-NARMAX-MA method to build predictive models for space weather parameters forecasting. More specifically, we build mathematical models to characterise the relationship between solar wind parameters and geomagnetic filed indices, for example the dependent relationship of Kp index on a few solar wind parameters and magnetic field indices, namely, solar wind velocity (V), southward interplanetary magnetic field (Bs), solar wind rectified electric field (VBs), and dynamic flow pressure (P).

The proposed approach has the following properties. It makes use of the advantages of the NARMAX method and the strength of machine learning ensemble strategy. The proposed method cannot only be used for forecasting but also for understanding the interactions of system variables.