

ADVANCED DATA ANALYSIS METHODS AND THEIR APPLICATIONS TO MAGNETOSPHERIC PHYSICS

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I will present results of several techniques adopted from terrestrial weather and climate research.

Singular Spectrum Analysis (SSA), is a data-adaptive, nonparametric method for spectral estimation and it can be used to reconstruct data in the large gaps of the solar wind parameters and IMF by inferring smooth modes of their co-variability with various geomagnetic indices.

Data assimilation aims to combine optimally numerical models of physical system and sparse measurements to estimate the full state of the system or model parameters. I will discuss unique challenges and opportunities for efficient data assimilation by Kalman filter in the state-of-the-art numerical models of high complexity, such as radiation belt model (VERB) and coupled LFM-RCM model of Earth's magnetosphere.

Finally, I will make a case for pursuing data-driven low-order dynamical models as opposed to the high-complexity first principles models, that can simulate and predict spatio-temporal variability of selected observables of Earth's magnetosphere.