



System Approach to Space Weather: Advance in Physical Understanding and Forecast

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The methodologies, developed in the field of System Science, are valuable in the studies of so complex physical objects for which models based on first principles are not developed yet. The traditional approach, starts from the first principles and knowledge about simple physical processes, advances to understanding of more complex processes and at the final stage conjugates them into an ultimate model of the complicated physical object. In some sense, the system science advances our knowledge in opposite direction. It builds on the knowledge of generic complex system behaviour. Applying advanced data analysis methods, it investigates the evolution of the overall system to provide information about the underlying physical processes involved in system dynamics. The Solar Terrestrial system is one example of a physical systems that still lacks a comprehensive physical model deduced from the first principles.

The difficulties that currently do not allow for the development of such a model for the whole magnetosphere, and for its regions, such as radiation belts or ring current, are discussed, as well as the negative effects of these difficulties on the forecasting by some of the first principles based models. Using the evolution of radiation belts and ring current as example, it is shown how the system approach can advance our physical knowledge and provide a reliable forecasting tool.