Geophysical Research Abstracts
Vol. 15, EGU2013-3644-2, 2013
EGU General Assembly 2013

Global magnetosphere-ionosphere-thermosphere simulations - from science to space weather

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Earth's magnetosphere arises from the interaction of the solar wind and interplanetary magnetic field with the internal magnetic field of the Earth. Because the solar wind is highly variable the magnetosphere is very dynamic and host to numerous plasma processes. Since the magnetosphere is fairly accessible for in situ measurements it also serves as a laboratory for the collisionless plasma that makes up most of the cosmos.

Attempts to model the global solar wind - magnetosphere interaction go back to the 1980's and are usually based on the MHD equations. Contemporary models are much more complex and are coupled to other sub-models, such as ionosphere-thermosphere and ring current models. Furthermore, ever increasing computer power now allows us to produce many details and processes of the interaction.

Space weather forecasting critically depends on global models of the magnetosphere -ionosphere -thermosphere system. However, science-grade models are generally not well suited for operational tasks. In this talk I will address the most important issues that distinguish a science model from an operational model, such as relevance, robustness, efficiency, documentation, and verification. In particular, I will suggest programs that are needed to overcome the "valley of death," i.e. the rocky path from science to forecasting.