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Validity of planetary space weather predictions

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Abstract

Planetary plasma environments are highly influenced by the solar wind input. There are several methods, tools and services to predict the space weather conditions at a given target. In this paper we discuss their validity.

1. Introduction

In order to study solar wind interactions with planetary plasma environments ideally we would need simultaneous measurements in the pure solar wind and inside the planetary plasma environment. When there is only one spacecraft around the planet, it cannot perform such simultaneous observations, thus the prediction of solar wind properties and solar events to the different planetary objects becomes important.

2. Methods and their validity

There are several solar wind prediction methods. These apply either remote solar observations or in-situ solar wind measurements as an input. The propagation from the observation site to the target can be performed either through the ballistic or the MHD method. The prediction results can then be validated by in situ measurements onboard the planetary spacecraft while these are located in the solar wind. Besides this 'empirical' validity, we also discuss the 'theoretical' validity based on the assumptions that these models apply [1].

3. Tools and Services

The Europlanet Planetary Space Weather Services [2] provide ballistic solar wind propagation results as well as 1D and 3D MHD predictions. The propagation can be perfored from any planetary body to another. These services are very suitable for comparative studies and fast event search.

4. Summary and Conclusions

The accuracy of planetary space weather predictions is highly sensistive on the input data quality and the separation between the observation site and the target position. Due to the large spatial variability of the solar source, latitudinal effects cannot be neglected.

References

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[2] Andre N. et al.: Virtual Planetary Space Weather Services offered by the Europlanet H2020 Research Infrastructure, Planetary and Space Science, Vol. 150, pp. 50-59, 2018.