

The response of the induced Venusian magnetosphere to a CME: kinetic hybrid results and Venus Express observations

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The solar wind - Venus interaction presents a fascinating case study, as its size and composition are not too dissimilar to its terrestrial counterpart. However, the lack of any significant intrinsic magnetic field creates notable differences. Several spacecraft have visited Venus (e.g. Pioneer, Venus Express), and these observations paired with the development of numerical models have resulted in a well-rounded understanding of the Venusian solar wind interaction and the structure of its induced magnetosphere. However, open questions remain, particularly during extreme solar wind events like CMEs. Such difficulties are amplified by the challenges of combining in-situ and simulated data. We investigate the interaction of Venus and a CME using both Venus Express observations and kinetic hybrid runs. Venus Express (VEX) observations are between 4-6/11/2011 in which the spacecraft observed the passage of a CME resulting in the largest (to our knowledge) magnetic barrier VEX observed. To study the global impact from this event we performed a 3-D kinetic Hybrid run for the Venus-CME event and a comparatively “quiet” day. To match the observed and simulated orbital paths, we optimised the model based on the draping field pattern and exploited the initial cylindrical symmetry of the model solution. As expected, a more optimal solution was achieved for the ambient initial conditions, however a strikingly good result was obtained for the dayside during the CME passage. Here we present a synergetic study utilising both Venus Express observations and Kinetic Hybrid simulations to determine the global impact from this Venus-CME encounter. In addition, we investigate the feasibility of modelling such extreme events, and the practicalities of comparing simulated and in-situ data.