EPSC Abstracts
Vol. 15, EPSC2021-103, 2021
https://doi.org/10.5194/epsc2021-103
Europlanet Science Congress 2021

Variability of the interplanetary magnetic field as a driver of electromagnetic induction in Mercury's interior

Sophia Zomerdijk-Russell[1], Adam Masters[1], and Daniel Heyner[2]
[1]Imperial College London, Department of Physics, London, UK
[2]Technische Universität Braunschweig, Braunschweig, Germany

Mercury's magnetosphere is a unique and dynamic system, primarily due to the proximity of the planet to the Sun and its small size. Interactions between solar wind and embedded Interplanetary Magnetic Field (IMF) and the dayside Hermean magnetosphere drive an electric current on the system's magnetopause boundary. So far, electromagnetic induction due to magnetopause motion in response to changing external pressure has been used to constrain Mercury's iron core size. Here we assess the impact a changing IMF direction has on the Hermean magnetopause currents, and the resulting inducing magnetic field. Observations made by MESSENGER during subsolar magnetopause boundary crossings in the first 'hot season', are used to demonstrate the importance of the IMF direction to Mercury's magnetopause currents. Our 16 boundary crossings show that introduction of external IMFs change the magnetopause current direction by 10° to 100°, compared to the case where only the internal planetary field is considered. Analytical modelling was used to fill in the bigger picture and suggests for an east-west reversal of the IMF, typical of the heliospheric current sheet sweeping over Mercury's magnetosphere, the inducing field at Mercury's surface caused by the resulting magnetopause current dynamics is on the order of 10% of the global planetary field. These results suggest that IMF variability alone has an appreciable effect on Mercury's magnetopause current and generates a significant inducing magnetic field around the planet. The arrival of the BepiColombo mission will allow this response to be further explored as a method of probing Mercury's interior.