Global hybrid modeling of Mercury's solar wind interaction and preparing for in situ observations by BepiColombo

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We study Mercury's interaction with the solar wind in a global hybrid simulation model. In the model, solar wind ions are treated as macroscopic particle clouds moving under the Lorentz force, while electrons form a charge-neutralizing fluid. Ion velocity distributions evolve self-consistently according to the model calculation coupled with the evolution of the magnetic field by Faraday's law. The hybrid approach is ideal for studies of ion kinetic effects such as wave-particle interactions. Compared to Earth Mercury has a very compact-sized solar wind interaction region due to its moderate intrinsic magnetic field. Mercury is the closest planet to the Sun meaning that it experiences strongest solar wind and interplanetary magnetic field conditions of the solar system planets. All in all, Mercury has a unique magnetospheric solar wind interaction where dynamical processes occur at fast temporal scales. This makes the planet a highly interesting target for space plasma and space weather investigations on the BepiColombo double-orbiter mission by the European Space Agency and Japan Aerospace Exploration Agency. In this presentation, we discuss our global hybrid modeling approach to analyze Mercury's interaction with the solar wind in light of upcoming BepiColombo in situ observations.

References

[1] R. Jarvinen, M. Alho, E. Kallio, and T. I. Pulkkinen, "Ultra-low-frequency waves in the ion foreshock of Mercury: a global hybrid modelling study," *Monthly Notices of the Royal Astronomical Society*, **491**, 3, January 2020, pp. 4147–4161, doi:10.1093/mnras/stz3257.