Development of prediction system of Mercury's magnetosphere for any solar wind parameter

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The Launch of the Bepi-Colombo is a big news for all scientists studying space environment of Mercury. Observations by previous satellite 'MESSENGER' found the Mercury's magnetosphere to be analogous to the Earth's, while several issues have been remained. One of the important issue is each distribution of heavy ions' components originating the Mercury's exosphere. The Larmor radii of heavy ions are not negligible to the magnetospheric size, and kinetic effects of such ions will be important in Mercury's magnetosphere. Until 2025, Bepi-Colombo's arrival, developing the Mercury's magnetospheric model which can be used for the prediction system for any solar wind parameter is target of our work. Comparison of different types of models, such as MHD(ideal/multi-fluid), Test Particles, Hybrid, and PIC simulations, is a good approach to know a global structure of Mercury's magnetosphere and kinetic effects of exospheric ions, as is starting the SHOTS (Studies on Hermean magnetosphere Oriented Theories and Simulations) team's activities. In this study, first we performed over 1000 cases of MHD simulation solving an interaction with solar wind plasma and offset dipole of Mercury, and tracing trajectories of heavy ions in the electric and magnetic fields obtained from MHD simulation. In the realistic IMF case which comes from Parker's spiral, global configurations of magnetosphere are drastically changed from pure northward IMF case and become more complicated structures which include stronger north-south and dawn-dusk asymmetry. IMF-Bx also affects to the intensity ratio of north and south cusp pressure, while the location cusp didn't change largely. IMF-By component 'twist' the cusp region to longitudinal direction. The heavy ions' trajectories basically obey the global structure of magnetic field, so that the ions' precipitation concentrate on the 'magnetic cusp' defined from MHD simulations, but the precipitation region is wider and diffusive compared to the MHD cusp. In the presentation, we will discuss the comparison of MHD and heavy ion precipitation pattern. The identification of global structures and ions' precipitation region especially the cusp is important not only on the understanding of magnetospheric physics itself, but also making a proposal to the observational plan of spacecraft such as Bepi-Colombo.