Three-dimensional MHD model of the solar wind-interplanetary space combining system

Aoi Nakamizo[1]; Takashi Tanaka[2]

[1] Earth and Planetary Sci., Kyushu Univ.; [2] Kyushu University

It is observationally known that the coronal heating and the solar wind acceleration are invoked to explain the supersonic evolution of the solar wind. Although the mechanism responsible for the heating and acceleration is still one of the primary subject of the physics of the solar wind, many MHD models have taken into account their effects by incorporating additional source terms corresponding to promising candidates such as thermal conductions, radiation losses and wave pressures.

The motive of this study is not only to clarify the acceleration process but also to discuss the formation of global structure of interplanetary space in relationship to the source region. We here introduced parameterized heat source function in the energy equation. Appling the unstructured grid system, we achieved the dense grid spacing at the inner boundary, which enable us to adopt realistic solar magnetic fields, and a size of simulation space of 1AU, which enable us to calculate the evolution of solar wind propagating to the Earth's orbit. Photospheric magnetic field data provided by the Wilcox Solar Observatory is used at the inner boundary.

The simulation results are summarized as:(1)The variation of solar wind speed is well controlled by the structure and strength of magnetic fields at and little above the solar surface and(2)Far above the solar surface, the interface between high and low speed flows evolves to a structure suggestive of CIR. Comparing the data from simulation with the actual solar wind data obtained by spacecrafts, we will discuss the future improvement of our model. Non-stationary phenomena such as CMEs are still beyond of this study.

Acknowledgement:Wilcox Solar Observatory data used in this study was obtained via the web site http://quake.stanford.edu/˜wso courtesy of J.T. Hoeksema.