Upgrading of the 3D MHD solar wind model

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Toward the prediction of the solar wind coming to the earth's magnetosphere, we have been developing the 3D MHD solar wind model. The characteristics of the model that we have been reported in previous papers are summarized as follows:

(1) The use of an unstructured grid system enables us to treat the fine structure just above the solar surface and the global structure of the inner heliosphere simultaneously and seamlessly.

(2) Energy and momentum equations include parameterized source terms for the coronal heating and solar wind acceleration.

(3) Intensity of source terms is adjusted so as to reflect the expansion rate of the magnetic flux tube in the solar wind source region.

So far, by comparing model outputs with observations made by spacecrafts (SOHO and ACE), we have confirmed that the model succeeded in reproducing general features of the sun-solar wind system which include, in the close view of the sun, coronal holes and long loops suggestive of streamers, and in the global view, the pattern of high-speed and low-speed winds, CIRs, and the sector structure associated with it. However, the model is not still capable of meeting the strict quantitative evaluation. The problem here is twofold: the spatial (temporal) resolution and the absolute values of the physical quantities.

In this paper, we report simulation results advanced by the use of the higher-order grid and by the improvement of the inner boundary conditions and parameterization.