# Variations of solar-wind speed obtained by 3-D MHD model incorporating flux tube expansion rate

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Existing global models of the solar-wind/IMF expanding to the Earth's orbit are basically grounded in the idea of source surface. It is widely accepted that the sector structure and the solar wind speed are primarily controlled by the magnetic field at the source surface and the so-called expansion factor. On the other hand, 3-D MHD model is still off from practical use because both of scientific and technical problems. One of the former problems is the reproduction of supersonic solar-wind.

From the viewpoint of the physics of the solar wind, it is observationally known that coronal heating and outward acceleration mechanisms are invoked to explain the supersonic evolution of the solar wind. Since the mechanism responsible for the heating/acceleration is still one of the primary subjects 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. However there are few MHD models considering or testing the effects of the expansion factor, which determines the solar-wind speed in the series of source surface models.

In this study we newly incorporate the flux tube expansion rate into the MHD equation system including 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. Photospheric magnetic field data provided by the Wilcox Solar Observatory is used as the inner boundary condition. Comparing simulation results and actual observations we discuss possible mechanisms for producing variations in solar-wind speed.