Predicting the Solar Wind Using Empirically-driven Data-constrained Heliospheric MHD Model

Kim, Tae iD ; **Hegde, Dinesha Vasanta** iD ; **Singh, Talwinder** iD ;
Jones, Shaela iD ; **Arge, Charles** ; **Pogorelov, Nikolai**

The Sun emits a stream of charged particles called the solar wind, which is the primary driver of space weather and geomagnetic disturbances. Modeling and observations complement each other to help us identify and understand the physical processes governing the solar wind dynamics on different scales. Numerical models of the solar wind have greatly improved in recent years with advances in computational infrastructure and by employing data-driven or data-assimilative approaches. Designed primarily for modeling the partially ionized space plasma using adaptive mesh refinement technique on Cartesian or spherical grids, the Multi-scale Fluid-kinetic Simulation Suite (MS-FLUKSS) is arguably one of the most sophisticated numerical codes for simulating the solar wind flow. To inform potential users and interested members of the space weather community, we present a brief summary of the current state of the solar wind models developed in the MS-FLUKSS framework, with an emphasis on the 3D heliospheric MHD models driven and constrained by remote/in situ observations and empirical coronal models such as the Wang-Sheeley-Arge model. We also discuss potential scientific and operational applications of our solar wind models on prediction of space weather (e.g., high speed streams, coronal mass ejections, and interplanetary shocks) throughout the solar system.

Publication: AGU Fall Meeting 2021, held in New Orleans, LA, 13-17 December 2021, id. SM53B-08.

Pub Date: December 2021

Bibcode: 2021AGUFMSM53B..08K