Validating Numerical WSA Solutions

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The main objective of the NASA-NSF SWQU supported A New-generation Software to Improve the Accuracy of Space Weather Predictions effort is to develop a new, data-driven time-dependent model of the solar corona and inner heliosphere. The Wang-Sheeley-Arge (WSA) is the base-line coronal model running operationally at the U.S. National Weather Service. It predicts solar wind speed and IMF polarity and provides boundary conditions for MHD solar wind models. The present WSA model relies on a spherical harmonic approach to produce the potential field solutions. This approach has some limitations, including low efficiency for high resolution runs. In the SWQU project, we are replacing the spherical harmonic solver with POT3D, a modern open-source potential field (PF) solver. It is designed to run on the latest high-performance platforms (such as GPUs), has a flexible grid, and can rapidly generate ultra-high resolution coronal magnetic field solutions. The WSA empirical specification relies not only on the coronal solution, but on parameters derived from the magnetic field solution, such as the expansion factor and mapping distance to coronal hole boundaries. It is important to confirm that the traditional and POT3D WSA implementations produce consistent coronal solutions and derived parameters. In this presentation, we report on the results of a detailed comparison between the WSA and POT3D coronal solutions, which includes the magnetic field solutions and solar wind speed specification at the outer boundaries of the models using the WSA solar wind speed empirical relationship.

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