

Operational Space Weather Models & Supporting Data

The improvement and transitioning of research models to operations permit more reliable forecasts of the geomagnetic environment.

Wang-Sheeley-Arge Model:

The Wang-Sheeley-Arge (WSA) model is a combined empirical and physics-based representation of the quasi-steady global solar wind flow that is used to predict the background solar wind speed and the interplanetary magnetic field (IMF) polarity at Earth. It uses photospheric magnetic field data from three ONR-supported solar observatories (i.e., Wilcox, Mount Wilson, and Kitt Peak) as input to a magnetostatic model of the coronal expansion. Real-time solar wind predictions are routinely made available and current to NOAA/SEC forecasters and to the broader research community via an SEC web page. The model has been substantially improved recently (e.g., Figure 1) through the incorporation of an upper coronal model and the development of a significantly better empirical relationship used to assign solar wind speed near the Sun. The next upgrade planned for the WSA prediction scheme is the replacement of the simple 1-D modified kinematical model currently used to describe the

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References:

Arge, C. N., D. Odstrcil, V. J. Pizzo, and L. R. Mayer. in press, 2003. Improved Method for Specifying Solar Wind Speed Near the Sun, Proc. of the Tenth Internat. Solar Wind Confer.

Arge, C. N., S. Wahl, J. Chen, S. Slinker, and V. J. Pizzo. 2002. Implementation and Verification of the Chen Prediction Technique for Forecasting Large Nonrecurrent Storms, Proceedings of the COSPAR Colloquia Series. 14:393-396.

Wang & Sheeley Model:

<http://www.sec.noaa.gov/ws/>

Chen Model: <http://www.sec.noaa.gov/chen/>

solar wind flow out to Earth with the more advanced Zeus-3D magnetohydrodynamic (MHD) code.

Fig. 1 - Comparison of real-time ACE solar wind speed data (solid black line) with WSA model predictions (colored dots) for Carrington Rotation 2005. The three sets of predictions (i.e., red, green, and blue dots) are based on data from, respectively, Wilcox (WSO), Mount Wilson (MWO) and Kitt Peak (NSO) solar observatories. The vertical bars associated with the colored dots are uncertainty estimates of the solar wind speed predictions, which are determined by calculating the predicted solar wind speeds for the expansion factors located 2.5 degrees above and below the sub-earth point.

