CME Arrival-time Validation of Real-time WSA-ENLIL+Cone Simulations at the CCMC/SWRC

*Alexandra M. Wold[1], M. Leila Mays[2,3], Aleksandre Taktakishvili[2,3], Lan Jian[3,4], Dusan Odstrcil[2,5], Peter MacNeice[3]

1. American University, 2. Catholic University of America, 3. NASA Goddard Space Flight Center, 4. University of Maryland College Park, 5. George Mason University

The Wang-Sheeley-Arge (WSA)-ENLIL+Cone model is used extensively in space weather operations worldwide to model CME propagation, as such it is important to assess its performance. We present validation results of the WSA-ENLIL+Cone model installed at the Community Coordinated Modeling Center (CCMC) and executed in real-time by the CCMC/Space Weather Research Center (SWRC). The SWRC is a CCMC sub-team that provides space weather services to NASA robotic mission operators and science campaigns, and also prototypes new forecasting models and techniques. CCMC/SWRC uses the WSA-ENLIL+Cone model to predict CME arrivals at NASA missions throughout the inner heliosphere. In this work we compare model predicted CME arrival-times to in-situ ICME shock observations near Earth (ACE, Wind), STEREO-A and B for simulations completed between March 2010 - January 2017 (over 1500 runs). We report hit, miss, false alarm, and correct rejection statistics for all three spacecraft. For hits we compute the bias, RMSE, and average absolute CME arrival time error, and the dependence of these errors on CME input parameters. We compare the predicted geomagnetic storm strength (Kp index) to the CME arrival time error for Earth-directed CMEs. The predicted Kp index is computed using the WSA-ENLIL+Cone plasma parameters at Earth with a modified Newell et al. (2007) coupling function. We also explore the impact of the multi-spacecraft observations on the CME parameters used initialize the model by comparing model validation results before and after the STEREO-B communication loss (since September 2014) and STEREO-A side-lobe operations (August 2014-December 2015). This model validation exercise has significance for future space weather mission planning such as L5 missions.

Keywords: coronal mass ejections, simulations, space weather

