Project Details

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Project Title:
Integrated Real-Time Modeling System for Heliospheric Space Weather Forecasting

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Summary:
Heliospheric space weather forecasting is lagging behind the atmospheric one and until recently there was no physically based model able to predict arrivals of coronal mass ejections (CMEs) faster than real time. This is caused by huge spatial domain, lack of suitable observations needed to initialize models, and computational challenges posed by number of coupled processes at various spatial/temporal scales. Heliospheric forecasting is in infancy and requires basic research to increase understanding. Urgent societal needs are expressed in National Space Weather Program. Until recently these needs were satisfied only by a real time monitor, ACE spacecraft at L1-point which provides 20-40 min warnings of CMEs approaching geospace. Desired lead time of 1-3 days can only be achieved by following their propagation from Sun though heliosphere. Due to various dynamic interactions, numerical simulation is needed.

Within our previous AFOSR/MURI, NASA/LWS and NSF/CISM projects we developed the WSA-ENLIL-Cone modeling system that met above needs by proper combination of available observations with analytic, empirical, and numerical models. This hybrid system does not simulate CMEs origin but uses appearance in coronagraphs, fits geometric/kinematic parameters and launches a CME-like structure into the solar wind computed using WSA coronal model. This system was validated at NSF Center for Integrated Space Weather Modeling and implemented at NASA based multi-agency Community Coordinated Modeling Center (CCMC). Run-on-Request service at CCMC exposed the modeling system to community (>50 users,