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**Multi-Scale Modeling of the Plasma Flow and Magnetic Fields in the Entire Heliosphere**

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Numerical model of the solar wind (SW) interaction with the local interstellar medium (LISM), developed in UAHuntsville and implemented in the Multi-Scale Fluid-Kinetic Simulation Suite, treats ions with MHD equations while the transport of neutral atoms is performed kinetically by solving the Boltzmann equation. Pickup ions are treated as a separate fluid or kinetically. The evolution of SW turbulence is addressed on the differential equation level. Time-dependent, based on observational data, modeling of the SW in the entire heliosphere is critical for the space weather modeling and interpretation of the spacecraft data. We choose LISM properties using remote observations and appropriate numerical modeling which allows us to constraint them by matching the ribbon of the energetic neutral atom flux detected in different energy bands by the Interstellar Boundary Explorer. We used the Ulysses data to model the SW-LISM interaction during the period of the mission and matched rather well the timing of the termination shock crossing by Voyager 1 and Voyager 2. The SW boundary conditions include those provided by the interplanetary scintillation measurements and obtained by numerical modeling of the inner heliosphere from the Sun's surface to the Earth orbit. Numerical results are extracted as time series along real spacecraft trajectories and compared with in situ measurements.