Modeling and forecasting the background solar wind with data-driven physics-based models

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The quasi-steady solar wind flow is a key component of space weather, being the source of corotating density structures that perturb planetary atmospheres and affect the propagation of impulsive perturbations (such as CME). Fast and slow wind streams develop at different places in the solar atmosphere, reflecting the global distribution of the coronal magnetic field during solar cycle and its consequences for heat and mass transport across the corona. I will present recent advances on global solar wind simulations that provides robust and fully physics-based predictions of the structure and physical parameters of the solar wind based on a multi-1D approach (MULTI-VP, ISAM). Such advances relate to the driving the models with time-dependant magnetogram data, to the inclusion of transient heating phenomena, and to switching from a fluid to a multi-species description of the solar wind. The model was also driven by daily synchronic magnetograms (ADAPT) for a full solar rotation and the simulation results were compared to UVCS plane-of-sky data. The simulations produce a large range of synthetic observables (e.g multi-spacecraft in-situ measurements, white-light and EUV imagery) meant to be compared to data from current and future missions (e.g Solar Orbiter and Parker Solar Probe), and to establish physical connections between remote observation of the solar surface and corona and the interplanetary medium.