Improving predictions of the background solar wind using coronal and solar wind observations as constraints

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The intensity and arrival time of coronal mass ejections (CMEs) can be significantly influenced by the background solar wind they encounter as they propagate outward from the Sun into the interplanetary medium, and solar energetic particles (SEPs) race ahead of CME shock fronts along magnetic field lines largely determined by the background solar wind. Predicting the background solar wind is therefore critical for improving forecasts of CMEs, SEPs, and high-speed streams. Modeling of the solar wind is challenging in general, as it is highly dependent on global photospheric magnetic field maps, which serve as the boundary conditions to coronal models that drive solar wind models. Unfortunately, less than half of the Sun's photospheric magnetic field is reliably measured from any given vantage point and thus it is common for the maps used to drive coronal and solar models to have highly dated observations in them. Efforts to mitigate this problem include using flux transport models such as the Air Force Data Assimilative Photospheric Flux (ADAPT) model, which evolves the field forward in time using well know transport processes occurring on the Sun. ADAPT also generates an ensemble of solutions that attempts to realistically account for the uncertainties in its specification of the global photospheric magnetic field state. In some instances, ADAPT has retrospectively included far-side active regions to further improve its representation of the global photospheric magnetic field. In this talk, we discuss how coronal (e.g., coronal holes and inferred coronal magnetic fields) and in situ solar wind observations in combination with ensembles of ADAPT driven WSA model solutions can be used as constraints for identifying which ADAPT input map provides the best overall representation of the state of the global photospheric magnetic field and hence the most reliable background solar wind solution.

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