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Charting new solar territories: fair winds for Parker Solar Probe and Solar Orbiter

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The solar wind flow is a key component of space weather, being the source of corotating density structures that perturb planetary atmospheres and affecting the propagation of impulsive perturbations (such as CME). Wind streams with different properties (speed, density, composition, waves) develop at different locations according to the global distribution of the magnetic field and to the heating and acceleration processes occurring in the solar corona. Parker Solar Probe (PSP) and Solar Orbiter (SO) will approach them closer than ever before, and sample the wind flows at different phases of their propagation throughout the heliosphere.
I will present and ensemble of numerical models and tools that aim at computing robust predictions of the state of the solar wind from the surface of the Sun to about 90 Rsun, hence providing detailed contextual information about the coronal plasma crossed by Parker Solar Probe (PSP) and Solar Orbiter (SO) during their perihelia. The modelling pipeline takes a coronal magnetic field map as input (past data or forecast), computes a collection of solar wind profiles spanning a region of interest of the solar atmosphere in quasi-real time (based on model MULTI-VP) and their propagation up to $\sim$1 AU. The model keeps a good description the plasma heating and cooling mechanisms and produces a full set of bulk physical parameters of the solar wind based solely on physical principles (wind speed, density, temperature, magnetic field, phase speeds) up to a few days in advance. Several diagnostics (magnetic connectivity, synthetic white-light and EUV imagery, in-situ time-series) are produced systematically, effectively linking remote observations with orbital measurements. The model moreover provides a unique data-driven platform for testing coronal heating and wind acceleration scenarios.
I will show and discuss our results for the first PSP perihelion, highlight future directions for synergies with SO (as well as other future instruments) and contributions to space weather applications.