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Simulating and cataloguing the solar wind

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I will present a set of accurate simulations of the background solar wind from the surface of the Sun up to 1 AU (and beyond), and of CME propagation through the heliosphere covering a time interval between 2007 and 2017. These simulations were performed in the scope of the HELCATS FP7 project and are the base of its SIMCAT catalogue.
The methodology for simulating the background solar wind relies on a new numerical solar wind model (MULTI-VP) that takes a coronal magnetic field map as input, and computes a collection of solar wind profiles spanning a region of interest of the solar atmosphere (up to a full synoptic map) at any instant desired in quasi - real time, taking into account the full magnetic flux-tube geometry (expansion, inclination and amplitude of the field) and keeping a good description of the plasma heating and cooling mechanisms. We used this model to estimate full sets of inner boundary conditions for ENLIL (at 21.5 Rsun, see https://stormsweb.irap.omp.eu/doku.php?id=windmaptable), in order to produce detailed maps of the background solar wind in the heliosphere and calibrate them against spacecraft data.
The simulations of CME propagation (using ENLIL) were optimised by continuous assimilation of HI data and by exploiting the techniques and CME catalogues developed in the HELCATS project (together with other community-led efforts). They provide an accurate and extremely comprehensive database of CME simulations (about 3457 CMEs were simulated) that can be readily used for studying the propagation of CMEs in the interplanetary medium, the formation of shocks and their potential link to energetic particles, or planetary space weather applications.