Geophysical Research Abstracts
Vol. 20, EGU2018-8827, 2018
EGU General Assembly 2018

Comparing solar wind models in preparation for Solar Orbiter

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The flow of plasma that crosses the transition region to enter the corona and feed the background solar wind is largely determined by energy exchanges between the chromosphere and the corona. To study these exchanges we develop and compare the results of simulating the formation of the solar wind using fluid and gyrotropic kinetic-fluid approaches. One advantage of the latter is that, for computationally tractable costs, it can solve explicitely the heat flux transfer between the different layers of the solar atmosphere. It can also take into account the anisotropies that develop rapidly in the collisionless corona, in both temperature and heat flux along and perpendicular to the magnetic field. We investigate the different mechanisms by which energy could be transfered between the chromosphere, corona and the solar wind for realistic values of the plasma density below and above the transition region and for different phenomenological heating functions defined along realistic coronal magnetic field topologies. The magnetic field in our models come from either magnetostatic or magneto-hydrodynamic simulations. Applying this technique on multiple tubes allows us to reproduce the aspect of the open solar corona in 3-D and to produce coronal images. We also present preliminary results that investigate the effect of including multiple species as well as solving the ionization processes in the chromosphere and the low corona. The aim of this on-going project is to develop a multi species model in preparation for Solar Orbiter and Parker Solar Probe to study the origin of the slow and fast solar winds.