COMPARING CORONAL AND HELIOSPHERIC MAGNETIC FIELDS OVER SEVERAL SOLAR CYCLES

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Coronal magnetic field has long been modelled with the potential field source surface (PFSS) model (Altschuler and Newkirk 1969; Schatten et al. 1969). The PFSS model assumes a radial field at the photosphere, a current-free corona, and a spherical source surface where the field lines become open and radial. In large scales the PFSS model gives a good correspondence with observations and with more detailed models, but it creates a latitude dependent radial field, which contradicts observations.

The current sheet source surface model [1] is a more sophisticated coronal model. It introduces an extra layer called the cusp surface between the photosphere and the source surface where the field becomes open but not radial. The model also introduces a horizontal current sheet, eliminating the latitude gradient.

To validate model predictions we compare the model field polarity and strength to heliospheric measurements. We use photospheric synoptic maps from WSO, SDO/HMI, SOHO/MDI and SOLIS. For heliospheric measurements we use OMNI2 dataset, Helios 1 and 2, and Ulysses.

We study different methods of tracing the observed solar wind and heliospheric magnetic field back to the corona, and conclude that the ballistic method with constant speed is more realistic than Parker's profile, especially for slow solar wind. We discuss the effect of model parameters, and the difference between PFSS and CSSS model predictions. We find that the polarity match and the optimal source surface distance of the PFSS model vary with solar cycle phase. The polarity match is almost equal with both models, but the current sheet in CSSS model affects the strength comparison significantly. We also conclude that the most reliable way to optimize the parameters is to compare the field polarity, instead of magnitude, since the scaling of photospheric field is unknown [1].

[1] Zhao, X., & Hoeksema, J. T. 1995, Journal of Geophysical Researh, 100, 19
[2] Riley, P., Ben-Nun, M., Linker, J. A., et al. 2014, Solar Physics, 289, 769