



Comparing the solar magnetic field in the corona and in the inner heliosphere during solar cycles 21-23

I. I. Virtanen and K. Mursula

University of Oulu, Department of Physical Sciences, Oulu, Finland

We compare the open solar magnetic field estimated by the PFSS model based on the WSO photospheric field observations, with the inner heliospheric magnetic field. We trace the observed radial HMF into the coronal PFSS boundary at 2.5 solar radii using the observed solar wind velocity, and determine the PFSS model field at the line-of-sight footpoint. Comparing the two field values, we calculate the power n of the apparent decrease of the radial field. According to expectations based on Maxwell's equations, also reproduced by Parker's HMF model, the radial HMF field should decrease with $n=2$. However, comparison gives considerably lower values of n , indicating the effect of HCS in the PFSS model and the possible superexpansion. The n values vary with solar cycle, being roughly 1.3-1.4 at minima and about 1.7 at maxima.

Interestingly, the n values for the two HMF sectors show systematic differences in the late declining to minimum phase, with smaller n values for the HMF sector dominant in the northern hemisphere. This is in agreement with the smaller field value in the northern hemisphere and the southward shifted HCS, summarized by the concept of the bashful ballerina. We also find that the values of n during the recent years, in the late declining phase of solar cycle 23, are significantly larger than during the same phase of the previous cycles. This agrees with the exceptionally large tilt of the solar dipole at the end of cycle 23. We also find that the bashful ballerina appears even during SC 23 but the related hemispheric differences are smaller than during the previous cycles.