Figure X shows the solar polar magnetic line-of-sight fields measured at WSO. The annual variation (due to the 7.16° tilt of the solar equator towards the ecliptic has been suppressed by a 20nHz filter. Modeling of the solar wind uses the photospheric line-of-sight measurements of the magnetic field as the inner boundary condition. At times where there is a significant axial magnetic dipole, the polar fields dominate the higher harmonics and the models predict an IMF that in most of the heliosphere (and certainly at high heliographic latitudes) is simply proportional to the open polar cap flux, proxied by the measured polar fields. This is clearly seen in Figure X where we have plotted the calculated radial magnetic field over the poles at 1 AU scaled by a factor of 38300±130 to match (for presentation purposes) the photospheric line-of-sight polar fields.

We have used the output from the WSA Potential Field Source Surface model (Arge et al. 2004; Nick Arge, personal communication, 2006) and an MHD model (Riley et al., 2001; Pete Riley, personal communication, 2007) to quantify how well the predicted IMF track the polar fields. When using WSO data as input, both models inappropriately apply the "saturation" correction specific to and only valid for MWO. Although wrong, this is not serious as the MWO correction (a factor of ~2) for data near the limb, such as the polar fields, is close to WSO correction (a factor of 1.8 to 1.86) deduced by Svalgaard et al. (1978) and Svalgaard (2006). The MHD calculations were also performed using NSO/SOLIS data (that do not require correction) giving the same results.

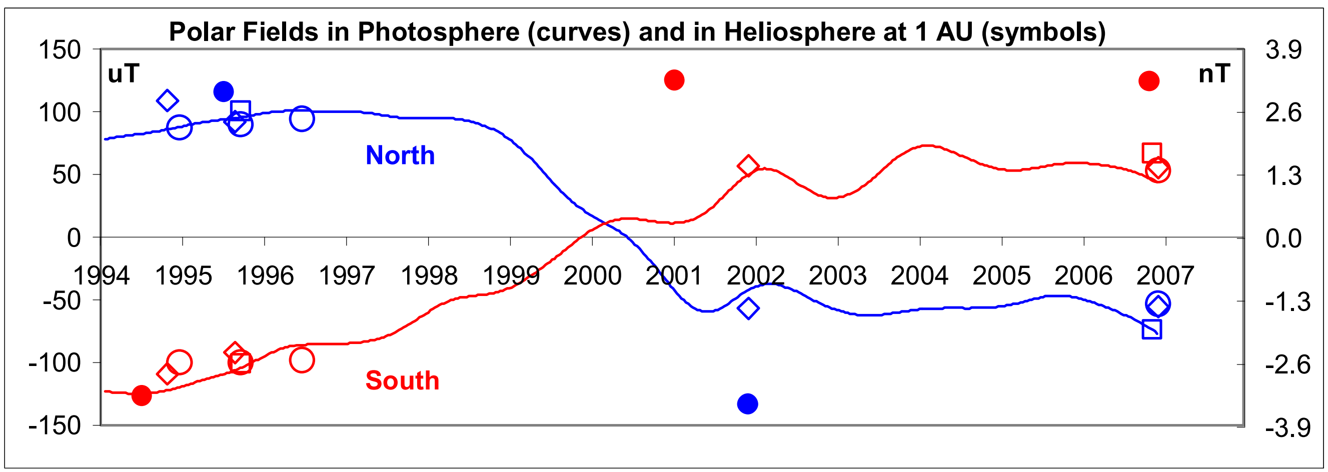

Figure X

Figure X: Curves: WSO polar fields (left scale, microTesla) 20nHz filter. The following use the right scale (nanoTesla) with a scale factor of 38300. Diamonds: WSA with WSO (MWO correction). Squares: MHD with WSO (MWO correction). Open Circles: MHD with NSO/SOLIS. Filled Circles: Ulysses $B_r r^2$ (average of all five = 3.27 nT).

These state-of-the-art models encode the generally accepted notion that the polar fields largely determine the strength of the IMF in most of the heliosphere, supplemented by some hand waving for the time of polar field reversal, where the polar fields go away, but the IMF does not.

The model calculations were made for Carrington rotations close to the times of polar passages of the Ulysses spacecraft. Once above 40° latitude, Ulysses has consistently measured a radial magnetic field (equal to the total field when above the poles) of 3.27±0.16 nT independent of time and of the polar field measured in the photosphere. This is shown in Figure X, where the filled circles are the Ulysses data. It seems hard to escape the conclusion that the polar fields do not determine the strength of the IMF.

The average radial component corresponds to a total field in the ecliptic of 3.27 / cos(45°) = 3.27 / 0.707 = 4.62 nT, which is what our analysis of the geomagnetic IDV-index shows to be the IMF strength at each solar minimum (corrected for a small residual sunspot number) since the 1850s.

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