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The Effect of a Latitudinal Dependent Solar Wind Speed on Cosmic-Ray Modulation in a Fisk-type Heliospheric Magnetic Field

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Abstract: The Fisk model for the heliospheric magnetic field (HMF) was developed in an attempt to connect the structure of the magnetic field at large heliocentric distances to processes in and above the photosphere. A Fisk-Parker hybrid model that is valid for the whole heliosphere (Burger and Hitge 2004, ApJL, 617) and the whole solar cycle (Kruger 2006, MSc dissertation, North-West University) was developed for a constant solar wind speed. In Kruger's model the HMF is Parker-like at the highest latitudes, becomes Fisk- like at intermediate latitudes, and becomes Parker-like again in the region swept out by the wavy current sheet. We have generalized the Fisk-Parker hybrid model for a solar wind dependent on latitude, as observed by *Ulysses*. The radial component of this HMF depends on the latitudinal gradient of the solar wind speed (Schwadron 2002, GRL, 29; Schwadron and McComas 2003, GRL, 30). We solved the three-dimensional steady state Parker transport equation for the entire model heliosphere to study the effect of this field and compared it with the hybrid field for a constant solar wind. We find that the effect of the latitudinal dependent solar wind speed is relatively small. We also compared our results with a pure Parker field. As expected, the results are very similar since the average Fisk-type field is very similar to a Parker field. This result is in contrast to that of Burger and Sello (2005, ASR, 35) who use a simplified two-dimensional version of complex three-dimensional HMF of Schwadron and McComas (2003). Burger and Sello (2005) report significant global effects that are not present when the full three-dimensional field is used.