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North-south asymmetry in global distribution of the solar wind

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Interplanetary scintillation (IPS) observations made between 1985 and 2011 were used to investigate north-south (NS) asymmetry in global distribution of the solar wind. IPS data show that marked NS asymmetry occurs in the solar maxima, i.e. during the polarity reversal of Sun's magnetic field, and also show that the NS asymmetry of polar fast wind frequently occurs after the cycle 23 maximum. The fast wind from the north pole was dominant in cycle 23, but that from the south pole became dominant in cycle 24. The NS asymmetry revealed from IPS observations is found to be generally consistent with Ulysses observations. We compare IPS observations with magnetic field data of the Sun. As result, we find that there is good correlation between IPS data and B/f values calculated from the potential field analysis of Kitt Peak observations. While the quadrupole component determined from Wilcox observations exhibits a similar pattern of the NS asymmetry after cycle 23 maximum, we find no significant correlation between quadrupole and IPS data. Therefore, the NS asymmetry of the global solar wind distribution is ascribed to the magnetic field property of the source surface, which includes multiple pole components of the potential field.

Keywords: solar wind, interplanetary scintillation, solar cycle, Sun's magnetic field, heliosphere, space weather