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Long-term variation in distribution of solar wind density fuluctuations for 1997-2009

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Interplanetary scintillation (IPS) observations made with the 327-MHz multi-station system of the Solar-Terrestrial Environment Laboratory (STEL) are analyzed to investigate distribution of solar wind density fluctuations(Delta Ne) and its evolution during 1997-2009. The computer assisted tomography (CAT) method is used in the present study to deconvolve line-of-sight integration of solar wind speed and g-value data obtained from IPS observations. The results show that the high-(low-) latitude region is dominated by small (large) Delta Ne plasma, which corresponds to the fast(slow) solar wind. The solar wind speed data show a clear change associated with the solar cycle, and this is in good agreement with our earlier study (Tokumaru et al., 2010). In contrast, the Delta Ne data don't show such a solar cycle change, and they shows a gradual increase in fractional area of small Delta Ne region throughout the period. This trend is observed for all latitudes, and is distinct after 2005 for low latitudes. It is found that all IPS data obtained here except for those in 2000 are generally consistent with the empirical relation; Delta Ne ~ $V^{-0.5}$, (where V is the solar wind speed) reported by Asai et al.(1998). The important point to note is that a marked reduction in Delta Ne occurs in 2009 for the low speed wind, V $<$350 km/s. Since number of IPS data for this speed range may be insufficient to conclude, we need to confirm this reduction in Delta Ne from further observations.

Keywords: solar wind, interplanetary scintillation, solar cycle, Sun's magnetic field, turbulence