Geophysical Research Abstracts, Vol. 7, 10559, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10559

Density fluctuations in near-Earth solar wind: comparison of direct and IPS observations

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Observations of the SURA transmitting facility signals (operating frequency range 4.6–9.3 MHz) on board of the NASA WIND spacecraft by the WAVES instrument (apogee up to 250 Earth radii) provide valuable information on the inhomogeneous structure of near-Earth solar wind (SW) [1]. A plateau in the spectrum of amplitude fluctuations of received signals exists usually at scintillation frequencies of about 0.3–3 Hz for periods when the s/c is located out the Earth bow shock. Most realistic reason of formation the plateau feature is interplanetary scintillation (IPS) due to wave scattering of sounding signal on SW clouds with 40–200 km scales.

Summary table of IPS spectra characteristics together with additional information on the spacecraft position and geophysical conditions for more than one hundred of SURA-WIND sessions in 1996–2004 is presented. Data analysis was performed in frame of weak scattering approach for two alternative models of random media between spacecraft and Earth's magnetosphere: 1) "undisturbed" solar wind out of the Earth's bow shock, 2) magnetosphere streamlined by plasma flow in the transition region between Earth's bow shock and magnetopause. The modeling estimations of SW clouds parameters for power law fluctuation spectrum were compared with results of direct measurements (in situ) of velocity and density of solar wind by the SWE instrument of the WIND spacecraft (http://lepmfi.gsfc.nasa.gov). The conclusion that the transition region of solar wind makes the main contribution to the observed interplanetary scintillations of the SURA signals [1] is confirmed. The results of this work can be used for development of mechanisms of turbulent structure forming in

the streamlining SW flow coupling with the Earth’s magnetosphere.

This work was supported by INTAS through the Grant N 03-51-5727

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