Study of the structure of solar wind velocities and density fluctuations using IPS tomography analysis

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Interplanetary scintillation (IPS) measurements are very useful tool to study the dynamics of solar wind acceleration and propagation because IPS measurements provide three-dimensional solar wind structures in a brief period of time. IPS measurement at 327 MHz performed in Solar-Terrestrial Environment Laboratory (STEL), Nagoya University, Japan, can observe solar wind velocities and density fluctuations between 0.2 AU and 1 AU. But, these velocities and density fluctuations are biased by the effect of line-of-sight (LOS) integration. In STEL, computer-assisted tomography (CAT) method is used to remove the effect of LOS integration and reconstruct accurate solar wind velocity map. On the other hand, a little analysis for density fluctuations using CAT method has been done because of the complexity of density structure.

In this study, we analyzed 3D structures of solar wind velocities and density fluctuations, using CAT method. In solar maximum, it is difficult to use an assumption that solar wind structure dose not change for a period of one carrington rotation in the CAT method. Therefore, we used time-series tomography (TST) method that makes an annual map using observed data for a whole year. We compared obtained data form the TST method with in-situ observations. The results show good correlations in velocity and weak correlations in density. We investigated the relation between densities and density fluctuations. As a result, these relations were not clear in the period analyzed here. A number of CMEs and decrease of high-speed winds may cause them. We examined the relation between solar wind velocities and density fluctuations. The result shows that the inclinations of a line representing their relation in the period are smaller than that in solar minimum.