Reconstruction of global solar wind structure from 1975 to 2016

*Ken'ichi Fujiki[1], Munetoshi Tokumaru[1], Kazumasa Iwai[1]

1. Institute for Space-Earth Environmental Research

We have been observing solar wind velocity with multi-station interplanetary scintillation (IPS) method at the frequency of 327 MHz since 1985 at Institute for Space-Earth Environmental Research (ISEE, formerly STE), Nagoya University, Japan. The global structure of the solar wind, which changes drastically in a solar activity cycle, are successfully reconstructed by using a computer-assisted tomography (CAT) in each Carrington rotation. However, the IPS observation was stopped for safe operation in winter due to snowfall, and interrupted by lightning, typhoons, and other troubles, which caused data gap on the reconstructed solar wind velocity map. To investigate the long-term variation of solar wind structure, we interpolated the IPS data gap on velocity map from 1985 to 2016 and extrapolated it back to 1975 when a routine observation of solar magnetic field was begun at Kitt Peak National Solar Observatory. The interpolation and extrapolation of the solar wind structure were made by using an empirical relationship between solar wind velocity (V) and flux tube expansion rate (f) in the corona (WSA2000 model). In this study, we fitted the WSA2000 model by using the solar wind velocity obtained by ISEE-IPS observation and flux tube expansion rate calculated by potential field approximation using synoptic solar magnetogram. As a result, we reconstructed a solar wind butterfly diagram from 1975 to 2016. Then to test the reconstruction we compared the solar wind butterfly diagram to satellite observations. In this presentation, we report how the solar wind structure since 1975 varied with solar activity cycles.

Keywords: solar wind, interplanetary scintillation, global structure

