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Global observations of evolving 3D solar wind structure

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Abstract. Mapping observations of interplanetary scintillation (IPS) and Thmoson scattered whitelight enable to gain a global view of the evolving solar wind structure, which is hardly accessible to in situ measurements using a limited number of spacecraft. This capability has been greatly enhanced owing to use of the computer-assisted tomography (CAT) method. From comparison between IPS and photospheric magnetic field observations, we have identified the solar wind sources, which are consistent with plasma outflows observed by Hinode. We have also found a coronal parameter which is closely related to the terminal wind speed, and this result show excellent agreement with the nonlinear Alfven-wave-driven solar wind model. It has been revealed from our IPS observations over three cycles that the global distribution of solar wind speeds changes systematically depending on the solar activity. An excellent correlation between fast/slow wind areas and polar magnetic field is demonstrated here. The important point to note is that the solar wind speed distribution for the current minimum significantly differs from that for the previous minimum. This difference is considered as a consequence of weaker polar fields in the current minimum. Rapid evolution of the 3D solar wind structure, associated with CMEs, has been investigated from the combined analysis of IPS and whitelight observations. The results reveal global features of interplanetary CMEs and a drastic change in the expansion speed between the sun and the Earth orbit, providing important implications for the propagation dynamics of CMEs in the solar wind.