Interplanetary scintillation observations of coronal mass ejections during November 3-11, 2004

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Solar activity greatly enhanced between October 30 and November 10, 2004 owing to appearance of eruptive active regions on the solar disk. In particular, the active region #10696 produced number of intense solar flares and fast coronal mass ejections (CMEs). Some of the CMEs, which were favorably directed, impacted the Earth's magnetosphere and significantly disturbed the space weather. This paper reports on interplanetary scintillation (IPS) observations made with the four-station system of the Solar-Terrestrial Environment Laboratory (STEL) of the Nagoya University during the high-solar activity period in early November, 2004. Traveling interplanetary (IP) disturbances (i.e. abrupt increases in flow speed and density fluctuations) were clearly detected from STEL IPS measurements between November 2 and 3 and between November 5 and 11. These are considered as interplanetary consequences cause by the flare/CME activities. Halo-shaped distribution of density fluctuation enhancements were observed by IPS between November 8 and 9, and this distribution suggested that the disturbance was directed to the Earth. As the active region approached to the solar limb, IP responses to the flare/CME activities were observed less prominently by IPS owing to the effect of observation geometry. The interesting point to note is that speed enhancements were evidently observed for the disturbance events in the latter period, while they were infrequently observed in the first period. It should be also noted that expansion of speed enhancements preceded that of density fluctuation enhancements. Similar tendency was found for the disturbance events during October-November 2003.