Remote sensing of the activities on both the front and the far sides of the Sun by Nozomi Lyman alpha observations

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The ultraviolet imaging spectrometer (UVS) on board the Nozomi spacecraft in a transfer orbit to Mars, continuously measured interplanetary Lyman alpha emission at 121.6 nm on the routine basis for the period of January 1999 – April 2002. There is a flow of interplanetary hydrogen and helium atoms in the heliosphere. This neutral hydrogen and helium flow is called the interstellar wind. These interplanetary hydrogen atoms induce resonant scattering of solar Lyman alpha emission. Approaching to the Sun, interplanetary hydrogen atoms suffer a loss whose main process is charge exchange with solar wind protons. Consequently, observations of interplanetary Lyman alpha emission provide us useful information about the solar wind proton flux. Using the Nozomi/UVS and SOHO/SWAN data, Summanen et al., [2002] and Nakagawa et al. [2003] showed solar cycle dependences of solar wind latitudinal anisotropies.

Another effective factor causing temporal variations of this interplanetary Lyman alpha emission is enhanced Lyman alpha radiation from the active regions on the Sun. Bertaux et al. [2000] showed that an excess of illumination from the active regions is clearly identified in the interplanetary Lyman alpha map constructed by the SOHO/SWAN data, including an excess resulting from active regions on the far side of the Sun. Since CME events from these active regions cause geomagnetic storms, earlier detection of the active regions on the far side of the Sun is significantly important for space weather forecast. Particularly, the estimation of both the location of the active regions and the scale of activity would be key parameters for space weather forecast.

In this study, we analyzed Nozomi/UVS Lyman alpha observation data obtained from the period between January and March 2000 and compared then with SOHO/EIT synoptic maps during this period that the intensity of Lyman alpha emission showed clear fluctuation with solar rotation cycle. The main results are summarized as follows: The enhanced interplanetary Lyman alpha region obtained from Nozomi/UVS and the active regions identified by SOHO/EIT show one-to-one correspondence with a correlation coefficient exceed 0.80. Changes of the activity on the far side of the Sun are detected by Nozomi/UVS observation. We will interpret these results.