R007-05
C 会場 ：9/25　AM1 （9:00-10:30）
10:00〜10:15

#渡部　温 [1), 徳丸　宗利 [1), 岩井　一正 [1), 藤木　謙一 [1)
[(1] 名大 ISEE

Optimization of the DCHB Model by using IPS and EUV Coronal Hole Observations

#Haruto Watanabe[1)],Munetoshi Tokumaru[1)],Kazumasa Iwai[1)],Kenichi Fujiki[1)]
[(1]Institute for Space-Earth Environmental Research, Nagoya University

The sources of the solar wind and its acceleration mechanism are not yet fully understood. Several models have been proposed to empirically link the topology of the solar coronal magnetic field to the solar wind velocity. The WS (Wang-Sheeley) model is based on the empirical relation between the solar wind speeds and the expansion rate of the coronal magnetic field. According to the WS model, the solar winds with lower speeds flow out from regions of the coronal magnetic field where the magnetic field expansion rate is larger. The WSA (Wang-Sheeley-Arge) model, which is an evolution of the WS model, has been employed for space weather forecast at NOAA. However, previous studies have shown that the empirical relation between the solar wind speed and the expansion rate doesn't fit in regions with pseudo-streamers, and thus the WSA model gives incorrect predictions there. The DCHB (Distance from Coronal Hole Boundary) model is another model to reproduce the solar wind speed from the coronal magnetic field properties. This model assumes that the solar wind speed is smaller as the source is closer to the boundary of the coronal hole. This model fits in pseudo-streamers; therefore, it is thought to provide a more accurate prediction of solar wind speed than that of the WSA model.

In this study, the parameters of the DHCB model were optimized for the data of solar wind velocity from IPS observations and examined how well the DCHB model reproduces the solar wind velocity. We calculated PCC (Pearson Correlation Coefficient) between the solar wind speeds reproduced by DCHB model and those obtained from the IPS tomographic analysis, and we determined the parameters which maximize the PCC as the optimal parameters. Unlike in-situ observations, IPS observations enable to determine the global distribution of the solar wind speed. Therefore, the DCHB model could be validated more effectively by using IPS observations.

In this analysis, we also used the PFSS (Potential Field Source Surface) model to estimate the structure of the coronal magnetic field and magnetograms from ADAPT (Air Force Data Assimilative Photospheric Flux Transport) as its lower boundary condition. Although the altitudes of the upper and lower boundaries of the PFSS model had been fixed in our previous studies, those altitudes were optimized in each CR so that the coronal hole (CH) shape estimated by the PFSS calculation best matches the EUV observations. Then, we evaluated the solar wind speeds by DCHB rigorously and compared with those obtained from the IPS tomographic analysis.

In consequence, during the solar minimum, the PCC was as high as 0.81. This high correlation is mostly attributed to the excellent reproduction of the bi-modal structure of the solar wind at solar minimum by the DCHB model: it is known that the high- and low-speed winds dominate at high and low latitudes, respectively, at solar minimum. It is also known that, at solar maximum, the high-speed wind almost disappears, and the low-speed wind dominates all latitudes. We found that the DCHB model reproduces the distribution of the low-speed solar wind originating from smaller coronal holes at low latitudes, even during such a maximum period.