Prediction of Dst index Using Burton's Model and SUSANOO-CME for Space Weather Forecast

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The geomagnetic field disturbance is one of the essential parameters for the space weather forecast in terms of the indicator of disturbances of the Earth's magnetosphere. The magnetospheric condition strongly depends on the solar wind and IMF variation associated, for example, coronal mass ejection (CME) and/or co-rotating interaction region (CIR). Particularly, strong solar wind inputs cause a change of the ring current, resulting a magnetic storm that can be detected as a global change of magnetic field both in space and on the ground.
The disturbance field (Dst) index, which is a parameter that measures the magnitude of the ring current, is used in the space weather forecast to confirm the magnetospheric condition. Although there are some empirical models to estimate Dst index, they have been proposed to clarify the relationship between solar wind and magnetospheric condition for the past magnetic storm. In this study, we aim to adapt the empirical model to the prediction of Dst index for the space weather forecast. We also attempt to predict K index that commonly used as the criteria for geomagnetic disturbance alerts in Japan.
We apply the empirical model that has proposed in Keika et al. (2015). This model is based on Burton's model [Burton et al., 1975], which estimates the temporal variation of Dst index from the solar wind speed and southward component of IMF. In the extended Burton's model, the effects of the solar wind density are taken into the original model. Keika et al. (2015) also indicate that the extended Burton's model can well explain the extreme change of the magnetosphere such as the Carrington storm.
At first, we perform a few hours forecast evaluation using DSCOVR spacecraft data as the inputs. The estimated Dst index shows a good correlation with the real Dst index for both the main and recovery phases in the magnetic storm. However, the abrupt change such as sudden commencement at the beginning of magnetic storm cannot be reproduced due to the limitation of time resolution. We also calculate K index using the estimated Dst index and compare real K index provided by Kakioka Magnetic Observatory. The estimated K index overestimates comparing with real K index because the Dst index is derived from geomagnetic field variation observed at several low latitude stations. As a next step, we are performing a few days forecast evaluation using SUSANOO-CME data as the inputs. We will discuss the accuracy in this presentation.

