Products and Applications of KSEM data on GK2A

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▶ Space Weather Products

The Korea Space wEather Monitor (KSEM) level 1 data (i.e., high energy particle flux, magnetic field along three axes, and satellite internal charging) are currently used to produce five types of level 2 data: the magnetospheric particle flux (MPF), geostationary electron flux prediction (GEP), satellite charging (SC) index, Kp index prediction (KIP), and Dst index prediction (DIP) (Table 6-1 and Figure 6-1). The algorithms for the GEF and DIP utilize additional data from the GOES series to improve prediction performance. Details of the algorithms are described in additional papers currently being prepared and soon to be submitted. We describe these algorithms briefly here.

Table 6-1. Summarized KSEM Level 2 products

Product	Period	Resolution	Application
Magnetospheric Particle Flux (MPF)	1hr	0.2 Re	Monitoring of Particle flux in magnetosphere
GEO Electron Flux (GEF)	1hr	1hr	Prediction of Particle flux prediction at geostationary orbit
Satellite Charging (SC)	1hr	1hr	Estimate Internal charging index of the satellite
Kp Index Prediction (KIP)	1hr	1hr	Prediction of Kp index prediction
Dst Index Prediction (DIP)	1hr	1hr	Prediction of Dst index prediction

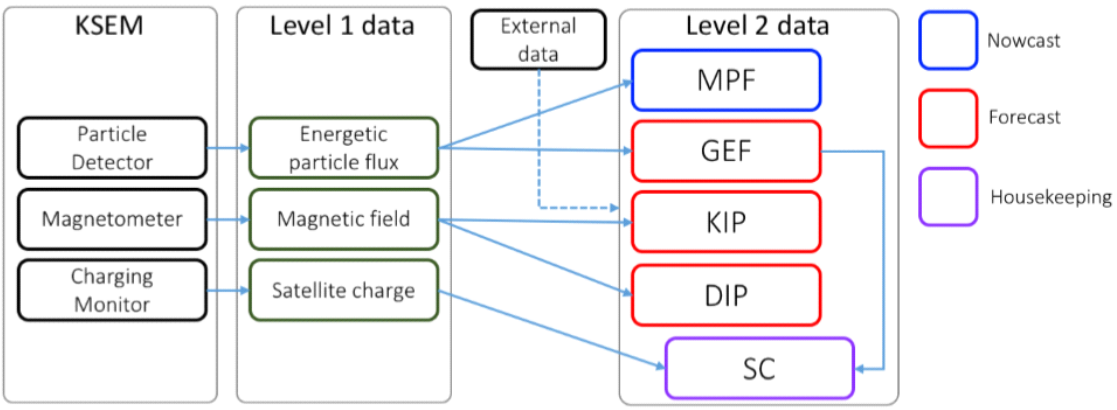

Figure 6-1. Schematic of KSEM data process.

☑ Magnetospheric Particle Flux (MPF)

The MPF is the estimated electron flux for the entire magnetosphere in five energy channels. It provides electron fluxes at L=2-7 in intervals of 0.2nT.

☑ Geostationary Electron Flux (GEF) Prediction

The GEF is the estimated electron flux at geostationary orbit in 16 energy channels. The GEF neural network algorithm predicts the electron flux over a geostationary orbit (GEO) up to 12hr in advance in 1 hr interval while maintaining sufficient accuracy.

☑ Satellite Charging (SC)

The SC is the estimated internal current caused by high-energy plasma around a spacecraft. It provides the charging index of a 0.2-2.0 mm thick aluminum shield at 0.2-mm increments and predicts the SC 1-24 hr in advance at 1 hr interval. The SC algorithm uses the GEF prediction values as input data.

☑ Kp Index Prediction (KIP)

The KIP predicts the Kp index 1-24 hr in 3hr intervals. The KIP algorithm consists of empirical formula and neural networks and uses magnetic field data of measurements on geostationary orbit.

☑ Dst Index Prediction (DIP)

The DIP is the estimated Dst index, and the algorithm consists of empirical formula and neural networks that use magnetic field data measurements on geostationary orbit. The algorithm uses magnetic field data from measurements on entire GEO orbit. With a single spot measurement, it must use the latest 24-hr data that could have different values in the present. The DIP algorithm predicts the Dst index 1-14 hr in 1 hr intervals.

☑ KSEM Contribution to Space Weather monitoring network

KSEM level 2 products are designed for space weather monitoring and forecasting.

The longitudinal location of the GK2A is 128.2°E, while those of the GOES-East/West satellites are 75°W and 135°W, respectively. A combination of these three geostationary satellites data can make it possible to monitor solar wind dynamic pressure for almost 13 hours every day (Figure 6-2).

The GK2A is located on almost the opposite side of GOES-East, so they can simultaneously observe to provide real-time information on the configuration and temporal variation of each half side the geomagnetic environment. This can facilitate further quantitative studies and provide a better understanding of the interaction and dynamics of the geomagnetic field and interplanetary magnetic field (IMF).

Empirical magnetosphere modeling is a key for studying the magnetic field response to solar wind and tracing plasma waves and energetic particles around the Earth. The reliability of empirical magnetosphere models is intrinsically dependent on obtaining as much in situ data on conditions and fluctuations as possible.

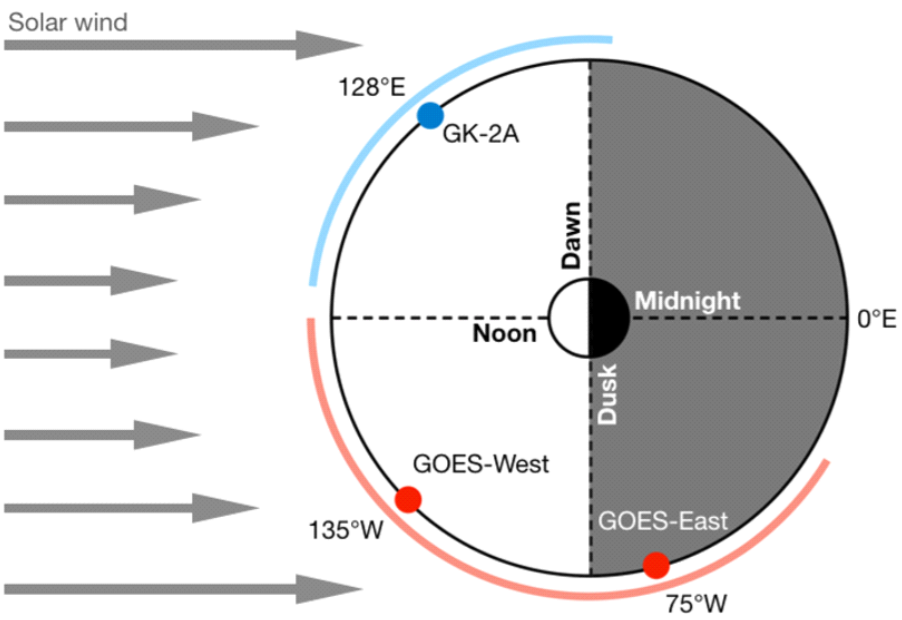

Figure 6-2. Schematic of GK-2A and GOES satellites orbital positions.
Two GOES satellites separated by approximately 4hr local time provide an indicator of solar wind dynamic pressure during ~10hr each day (red circles). With GK-2A, under the same conditions (blue circle), the total monitoring duration of dynamic pressure could be expanded by more than half a day.

✧ Reference : Daehyeon Oh, Jiyoung Kim, Hyesook Lee, Kun-Il Jang, Satellite-based In-situ Monitoring of Space Weather: KSEM Mission and Data Application, Technical Paper J. Astron. Space Sci. 35(3), 175-183 (2018) https://doi.org/10.5140/JASS.2018.35.3.175