Evaluation of Aurora Activity Obtained from Abisko and Kiruna Ground Based Observation

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Available space weather forecasts mainly use data from the Sun and upstream interplanetary monitoring, to provide the early warning. Although the accuracy is improving, it cannot provide onset timing and actual strength of the substorm and its propagations better than 1 hour. A higher-accuracy forecast requires monitoring of the ionosphere (e.g., aurora and geomagnetic field). In this sense, it is also necessary to develop a value-based nowcast based on such monitoring. In EGU 2018, Yamauchi et al. has proposed simple index showing aurora and geomagnetic conditions using 1-minute resolution values from Kiruna. This study improved in the following directions:

1. We used 1-sec resolution data and optimized the indices above: By using 1-sec values, the products representing variation (standard deviation and peak-to-peak variation) can be obtained every minute and improved, whereas combination of $\sum L^2$ (or $\sum L \exp(L)$) and area of aurora found to be the best in representing the aurora activity, where $L$ is luminosity of each pixel defined by HLS color code. Using these values, we confirmed that the intensity of the aurora was different for the same magnetic variation between before and after the strongest aurora (substorm onset). Therefore, it is necessary to add a condition of "increasing trend" of both aurora and magnetic variation from the viewpoint of forecasting.

2. We compared the results from two different places (Abisko and Kiruna in Sweden) that are 89 km apart in linear distance. Our Abisko camera system (DASC, Digital All Sky Camera) is in operation since March 2014. When the aurora was observed at both sites, the shapes of the aurora at both sites are sometimes quite different at the same time. In addition, the timing of the brightest aurora ($\sum L^3$ or $\sum L \exp(L)$ is maximum) was different between both sites. These results confirm that the aurora had a three-dimensional structure, which has been known for many years.

3. Using superposed epoch analysis, we also took statistics of last 10 minutes before the largest aurora (in the index mentioned above) occurred.