Improving nowcast capability through automatic processing of combined ground-based measurements

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While recent effort of the space weather forecast is mainly focused on the Sun and upstream interplanetary to have the early warning of the Sun, importance of the nowcast of condition at the Earth is also increasing for short-term but high accuracy pinpoint-warning. For example, the ground induced current (GIC) prediction benefits from such last-minutes prediction. This is why many geomagnetic stations started to calculate dB/dt to estimate the GIC change. However, effort of combining the optical aurora to have higher accuracy in warning is not yet established, partly the difficulty in characterizing the auroral image as a simple index (number).

In Kiruna, Sweden, we have set of relevant observations: magnetometer, all-sky camera, riometer, pulsation magnetometer, ionosonde, and infrasound, and all data are digitally archived since 2001 (some from earlier time). By adding different data, the last-minutes prediction of large geomagnetic activity should be improved. While such "prediction" has been manually done in the analog age, it is not a simple task to do it in automatic method.

As the first step, we started to program the automatic identification of "strong aurora" with "large fluctuation of magnetic field". While magnetic fluctuation can be done both dB/dt of last minutes using the 1-s averaged values, or standard deviation of magnetic field, automatic indexing of auroral image needs classification of colors, size, and intensity. We preliminary succeeded to extract strong aurora, and it actually turned out to be the most fluctuating period of the magnetic field. Application of past 15 years auroral data also agreed with the known variation of the geomagnetic activity.

We also list the future strategy in combining the other data.