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

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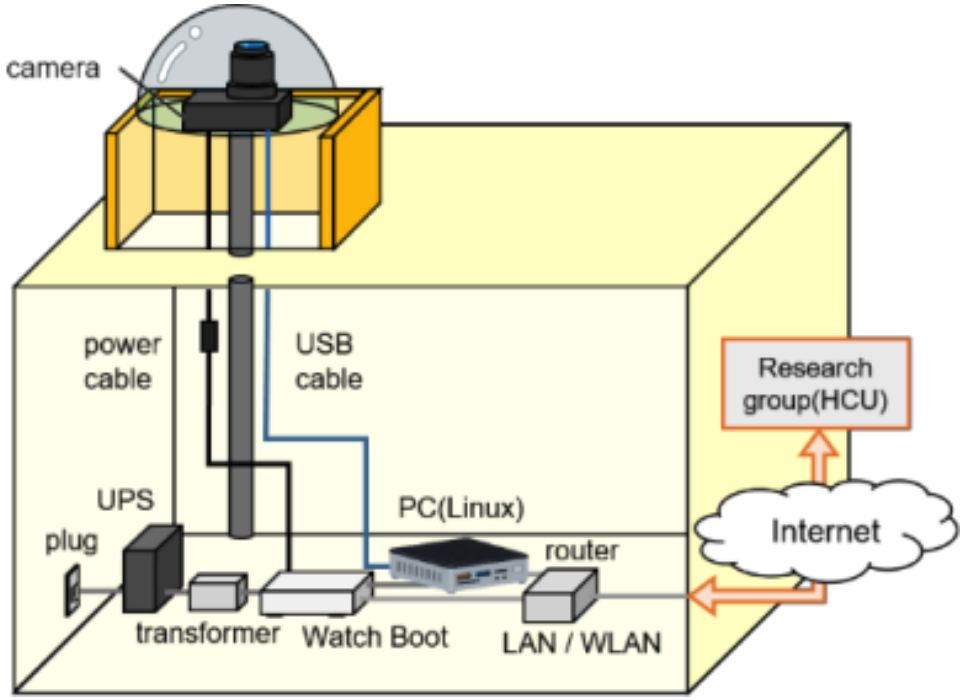
Motivation

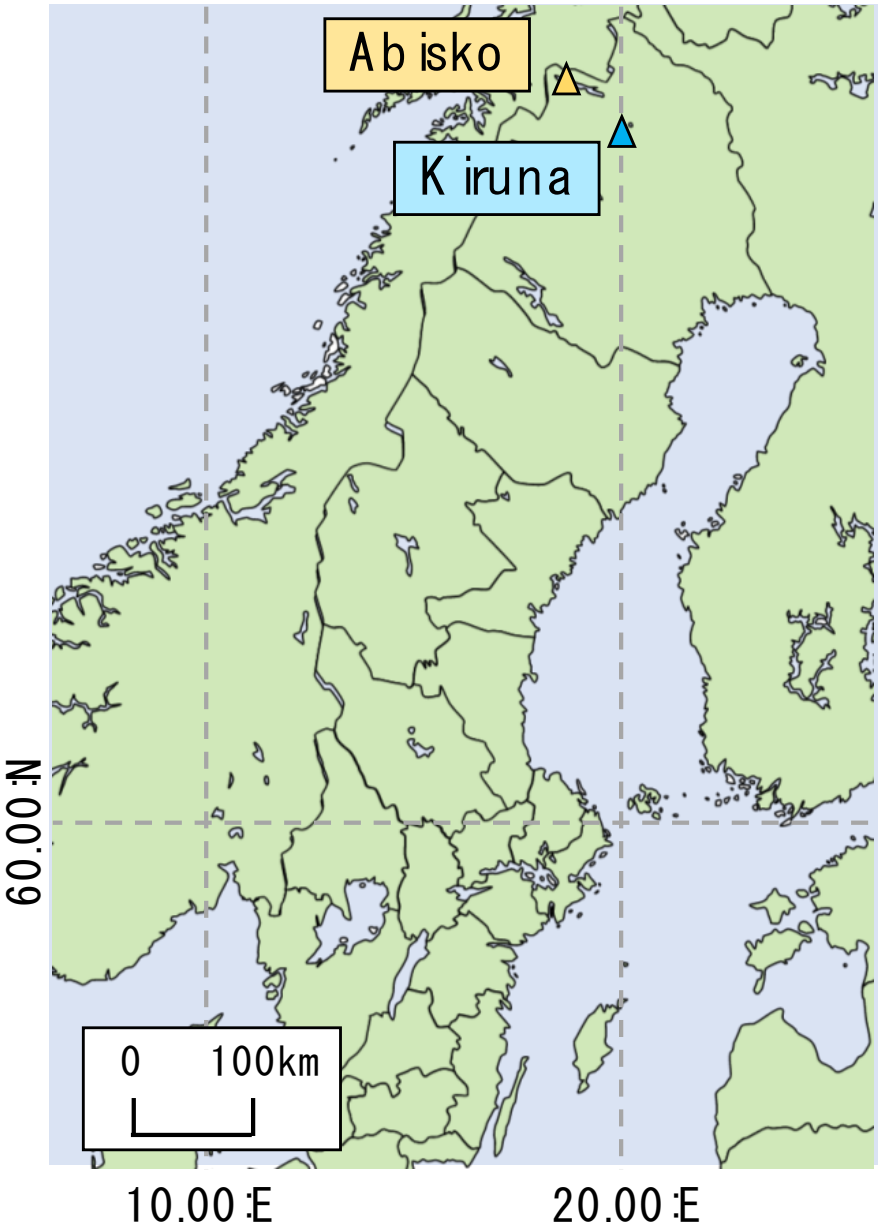
- Aiming last-minute warning instead of early warning of large auroral activity / large GIC
- Converting all-sky auroral data into simple numbers (all-sky index) to represent the degree of development of aurora toward breakup
- Make three indices from an image: diffuse aurora, auroral arc, and auroral arc activity.
- Combine with magnetometer data
- Combine/compared multi-station

Here we show the med-term results using data from Kiruna and Abisko. Abisko and Kiruna are about 88.7km apart in linear distance.

Basic Configuration of Camera System



	Kiruna	Abisko
Camera	Nikon D700	Nikon D5100
Shooting interval	60sec	30sec
ISO	1600	800
f-number	f/2.8	f/2.8
Shutterspeed	1sec	8sec
Image Size	720×479	2464×1632



Strong	Abisko	Kiruna
H	0.20-0.46	same
L	0.20-0.90	0.20-0.80
S	0.20-1.00	0.20-0.80

Arc	Abisko	Kiruna
H	0.20-0.46	0.18-0.46
L	0.10-0.90	0.10-0.80
S	0.00-1.00	0.15-0.80

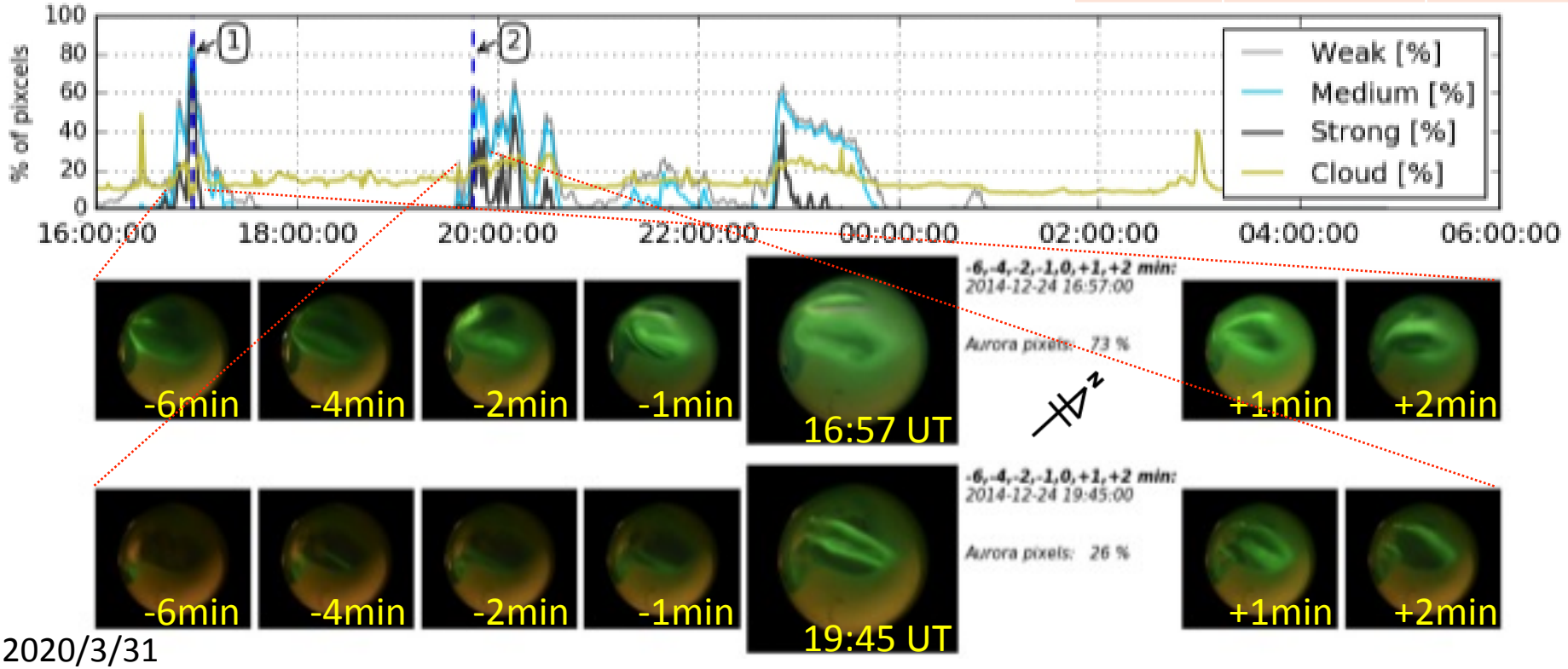
Weak	Abisko	Kiruna
H	0.16-0.50	same
L	0.05-0.90	0.05-0.80
S	0.00-1.00	0.10-0.80

Cloud	Abisko	Kiruna
H	0.00-0.16	same
L	0.15-0.80	same
S	0.00-1.00	0.10-0.80

The used filters for H, L, S ranges

Abisko

Divided by total pixels each for normaliz

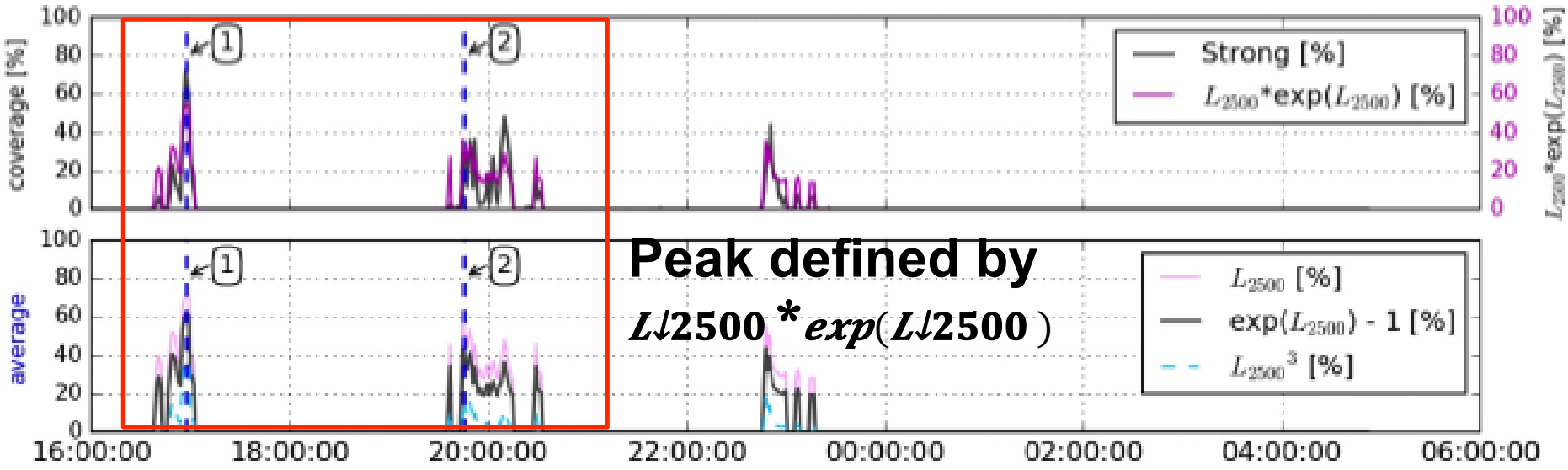


The products representing aurora activity

—	∑Luminocity(=L) for 2500 strongest pixels
_	∑_ exp(L) -1 for 2500 strongest pixels
—	**∑_L * exp(L) for 2500 strongest pixels**
- - -	∑ L^2 for 2500

Abisko

Divided by 2500 pixels each for normalization

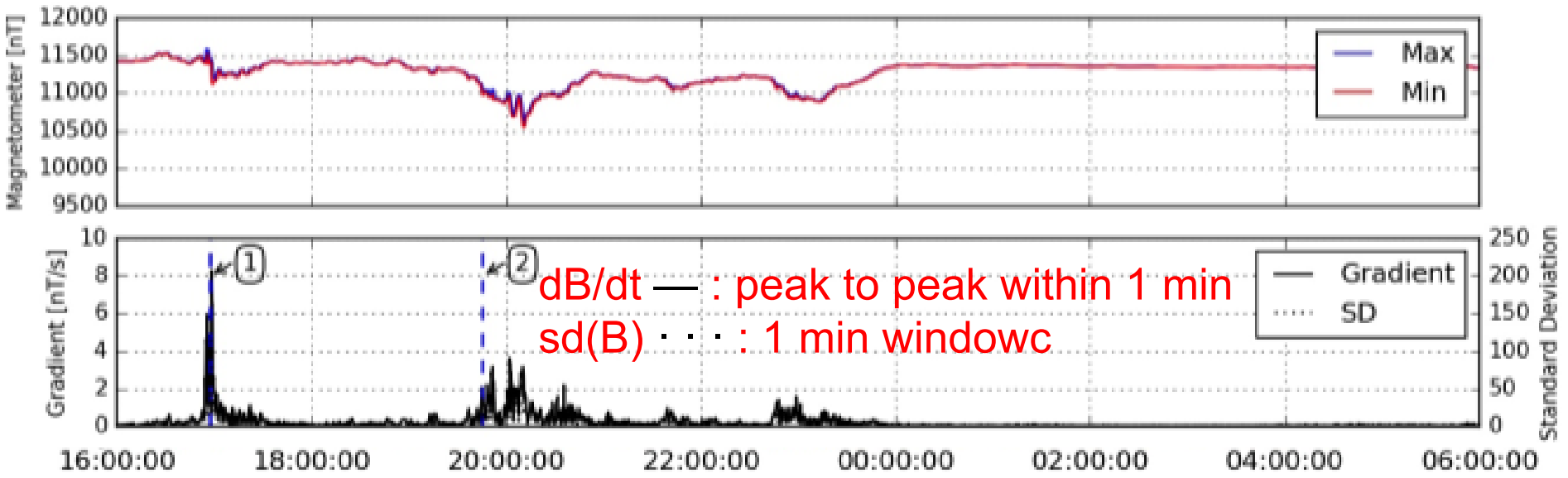


[1] M.Yamauchi, et al. “Improving nowcast capability through automatic processing of combined ground-based measurements,” European Geosciences Union (EGU) General Assembly 2018

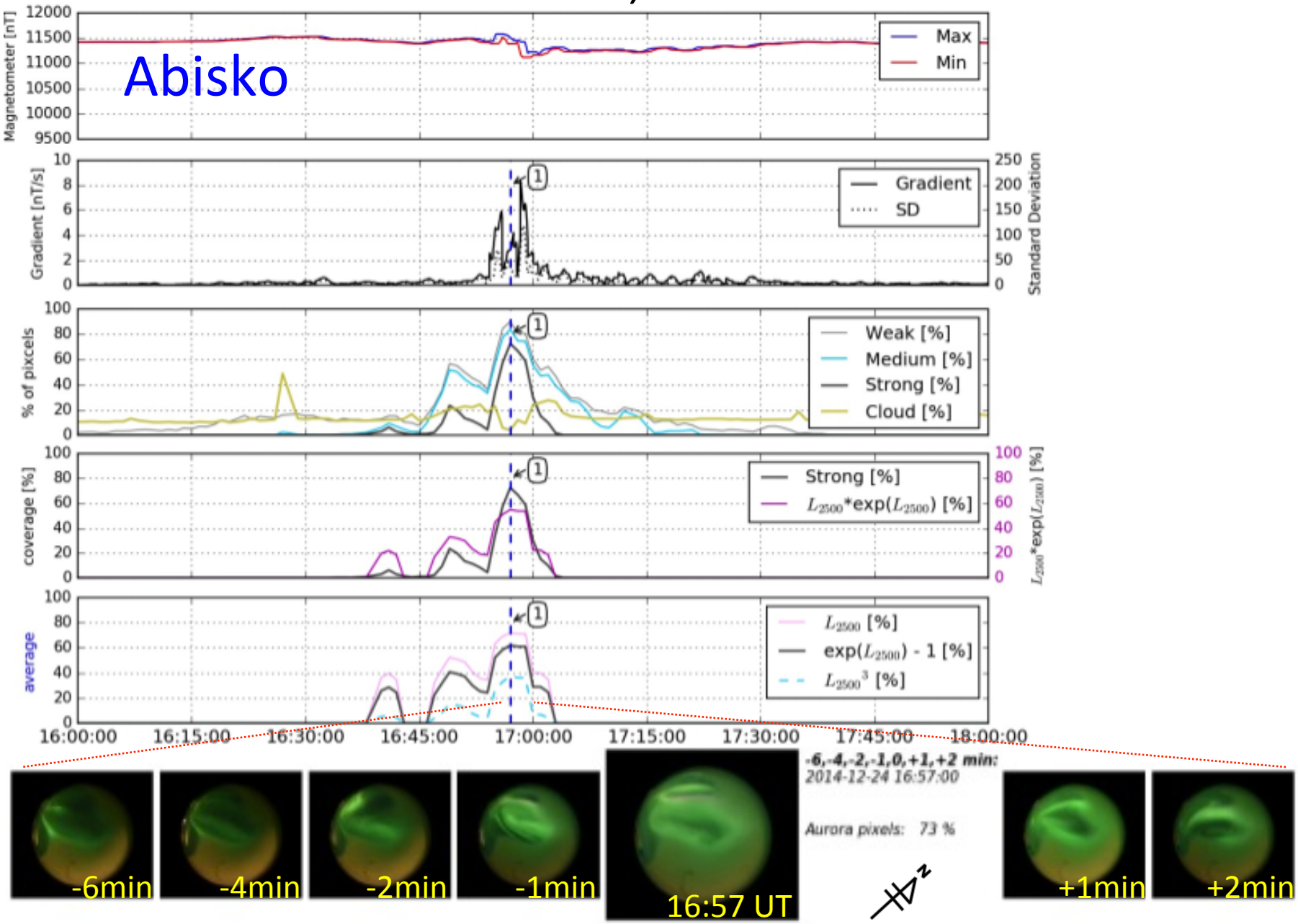
The products representing variation

Max[nT]	60 seconds maximum
Min[nT]	60 seconds minimum
Gradeint	Maximum and minimum slope
SD	Standard Deviation

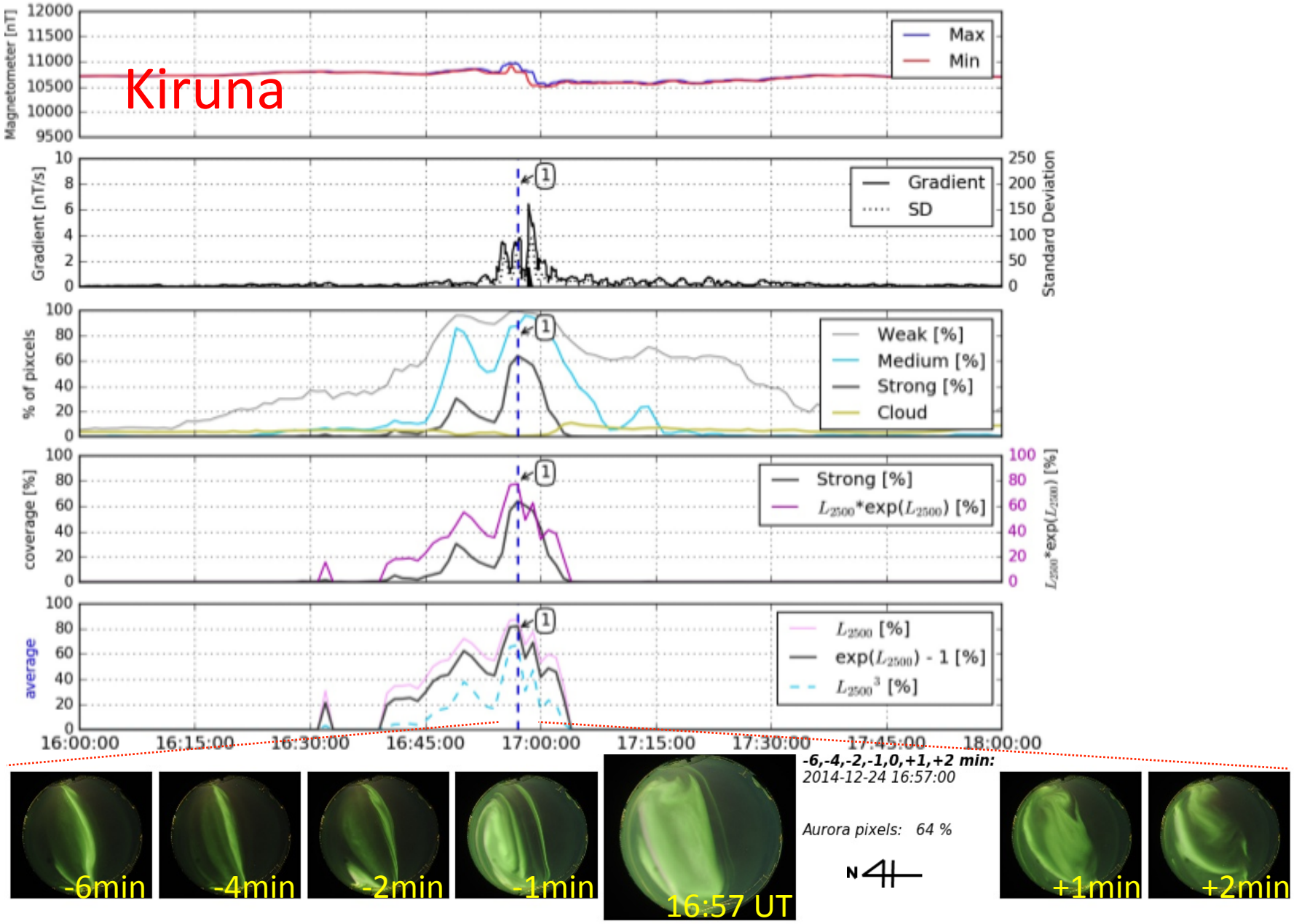
Abisko



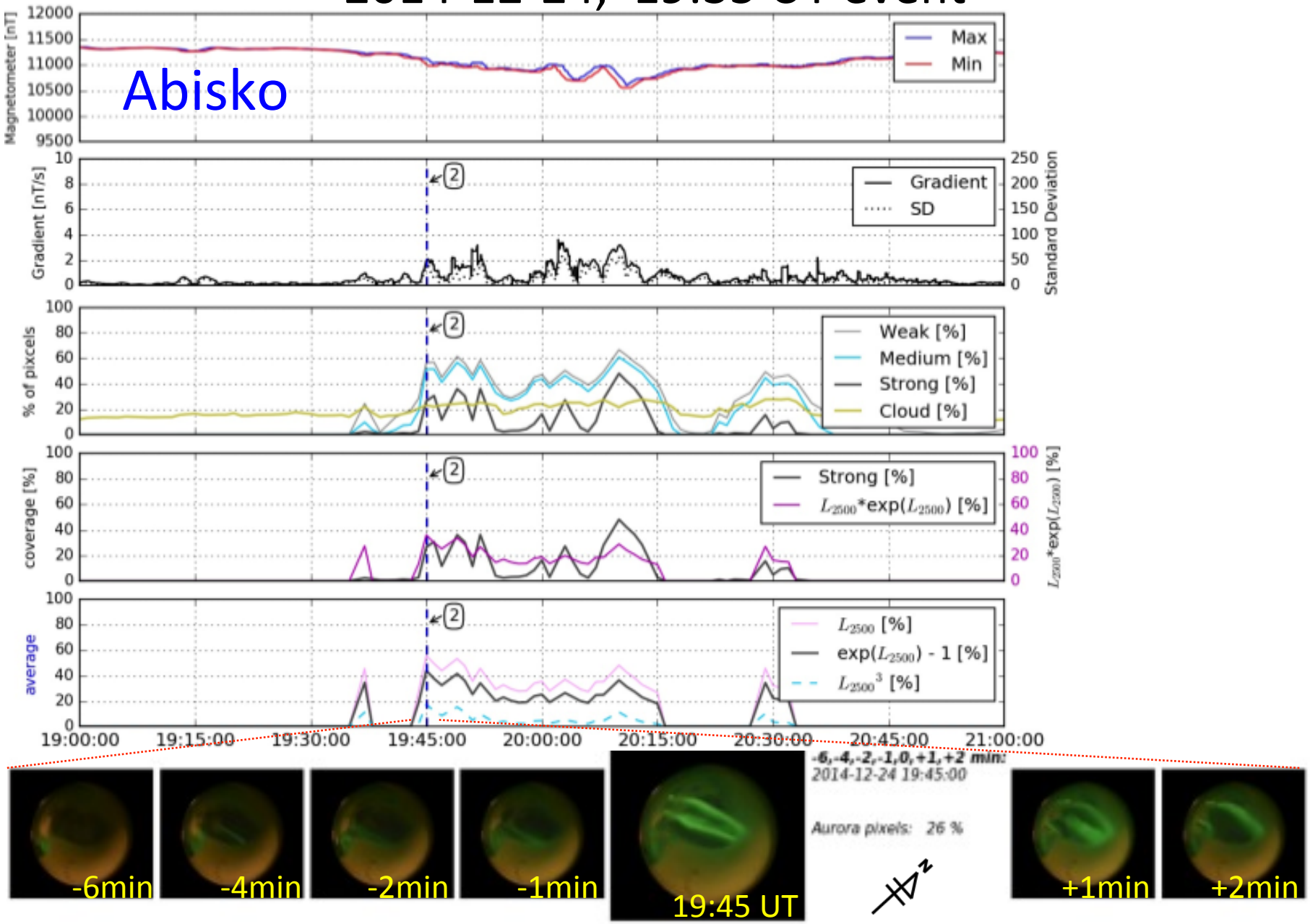
2014-12-24, 17 UT event



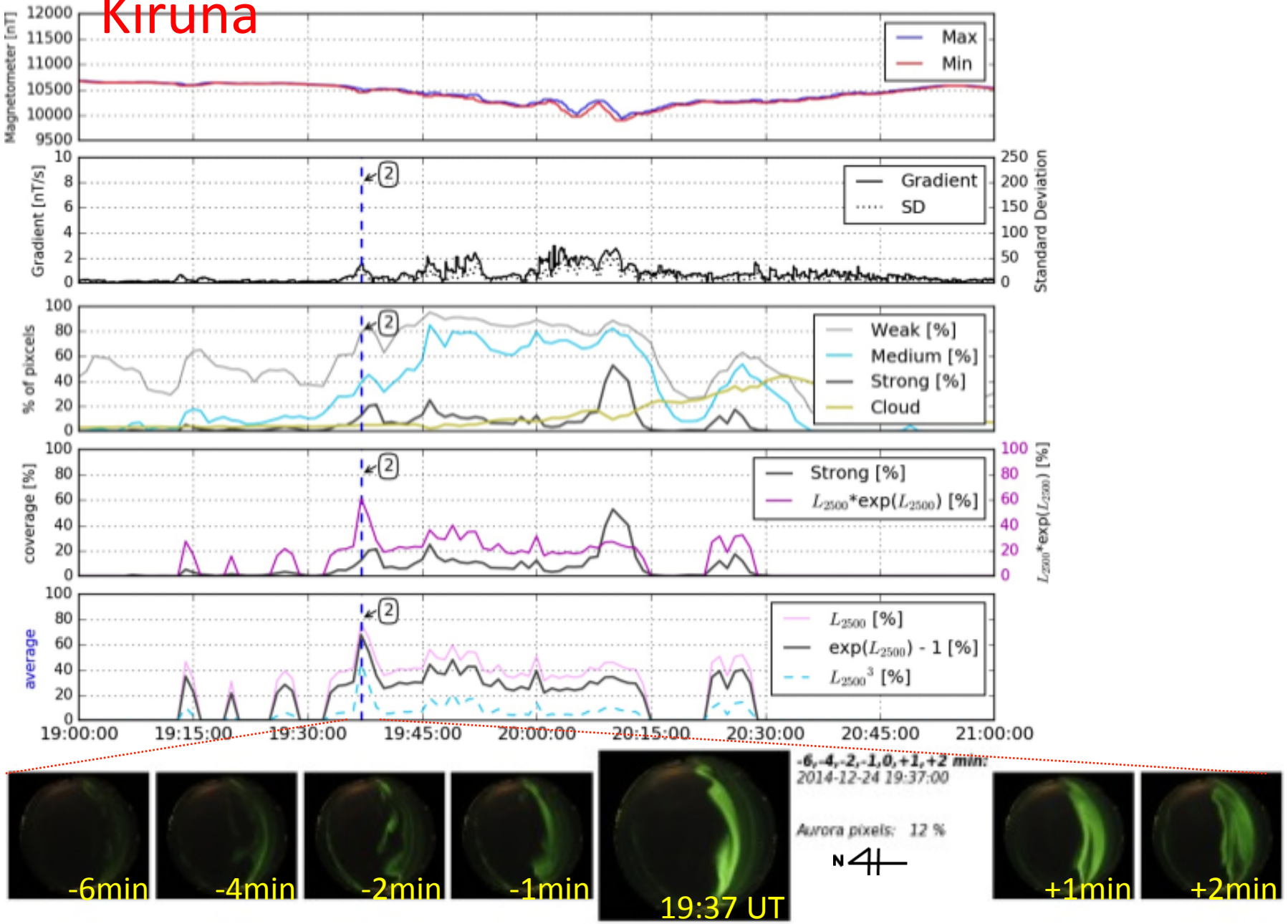
2014-12-24, 17 UT event



2014-12-24, 19:35 UT event



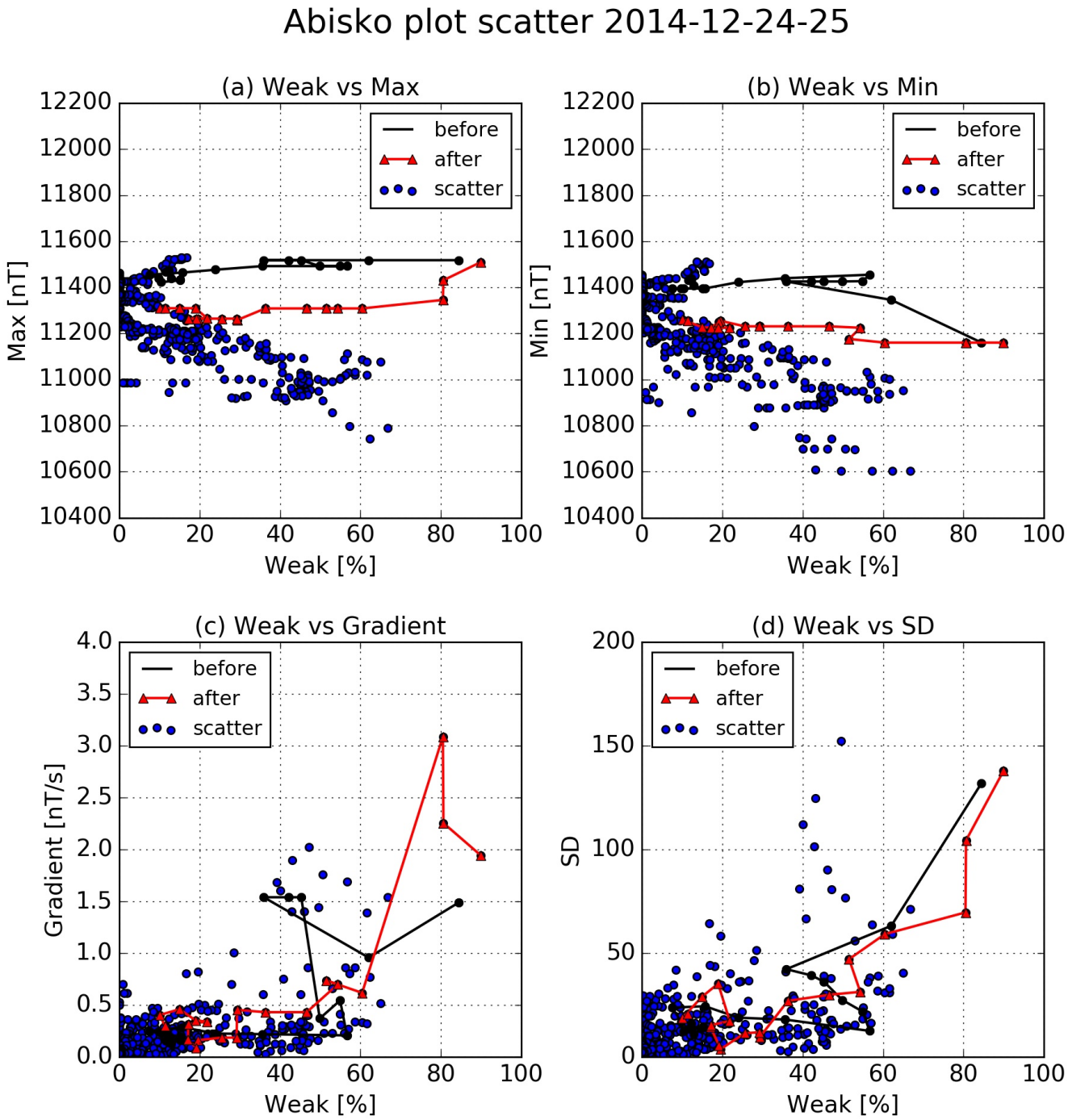
2014-12-24, 19:35 UT event



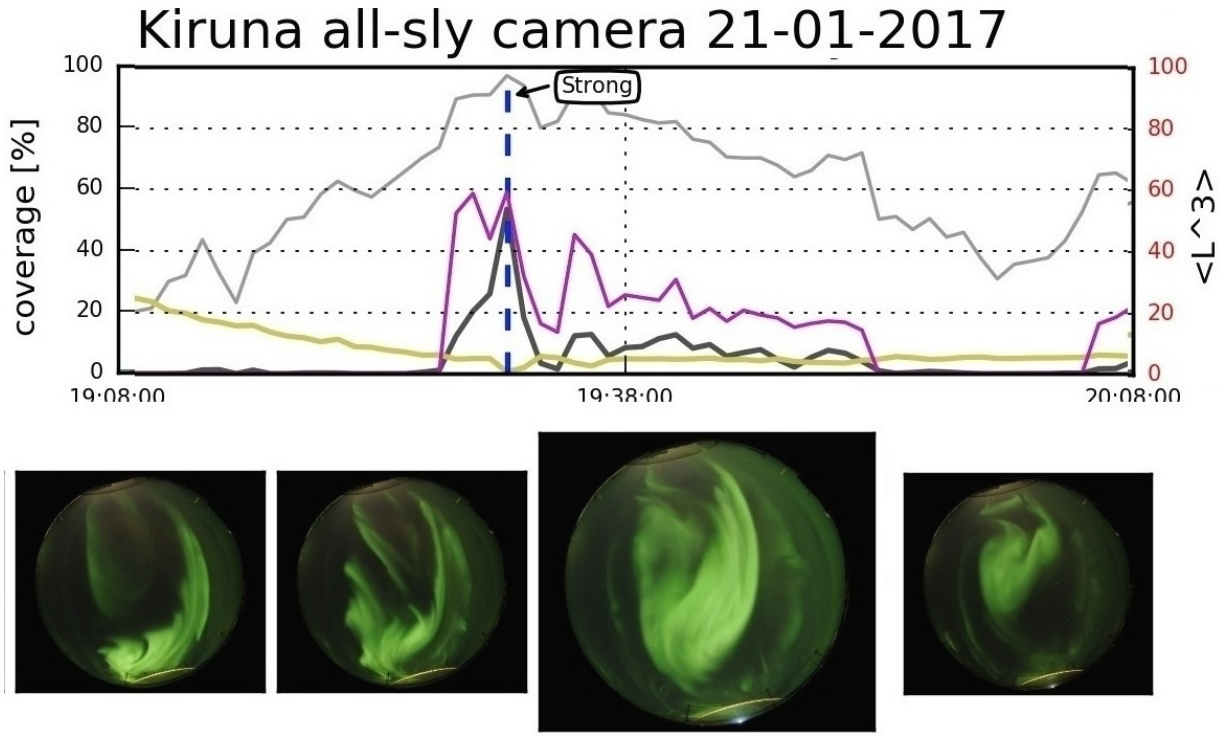
The auroral indices (Weak) VS magnetic fluctuation (Max, Min, Gradient, SD)

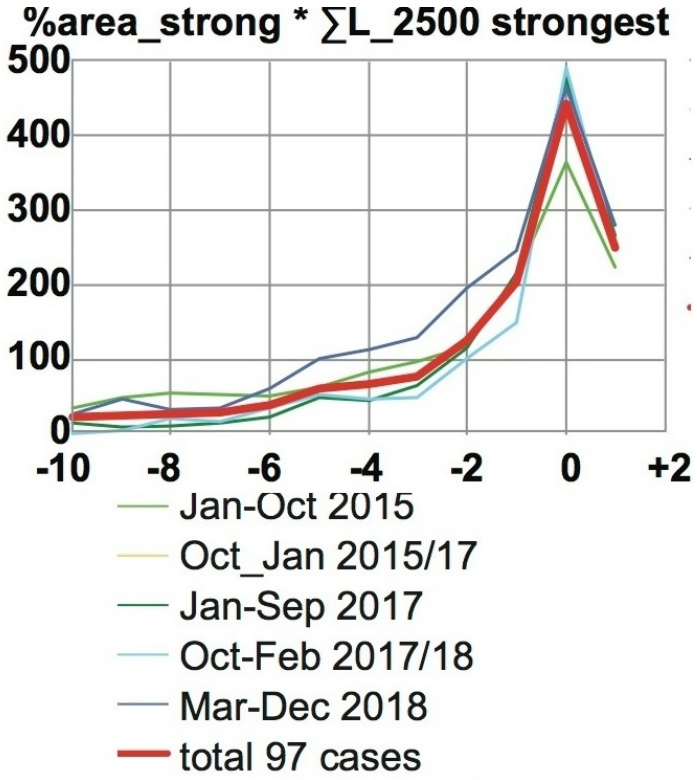
20 points before the peak

20 points after the peak



Best ways of defining indices?





Diffuse: area of weak arora (% occupancy)
Auroral arc: area of strong aurora (% occupancy)
Activity: ∑L^3 for strongest 2500 pixels

Summary

1. As expected both Kiruna and Abisko show similar geomagnetic fluctuations and aurora spread for most of the time (e.g., first event on 24 Dec)
2. But sometimes two station only 90 km apart show notable difference in both morphology and timing
3. As expected there was a negative correlation between auroral coverage and value of B, but it does not apply to the period around onset.
4. Before onset, the occupancy the aurora area quickly increases whereas auroral activity (L^3) is also rapidly increasing. => will provide clues to the nowcast.