Monitoring Shortwave Fadeout (SWF) Across North America using SuperDARN HF Radar Observations.

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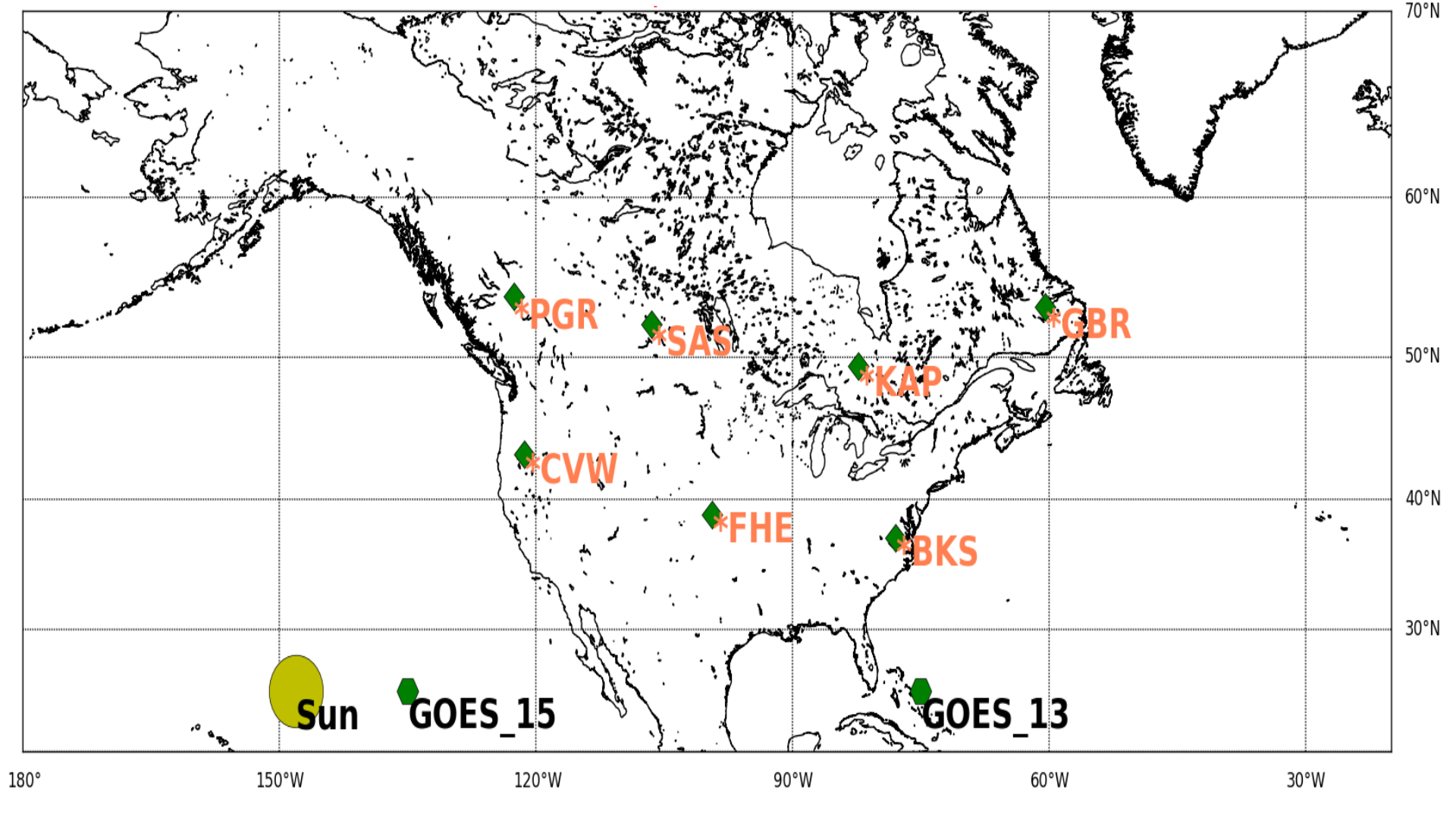
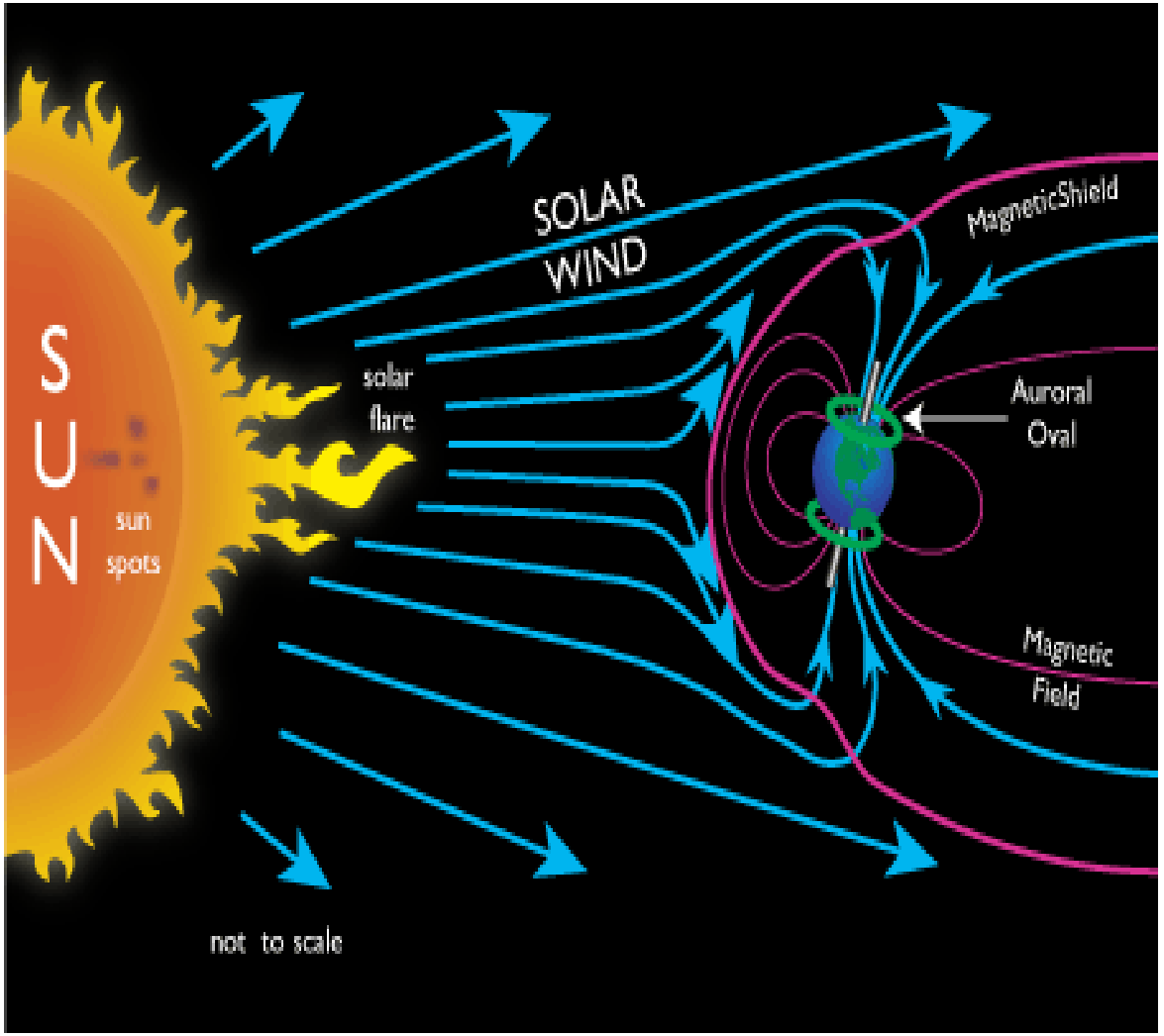
Monitoring North American Sector with SuperDARN Radar Network



Prologue on Solar Flare

- Solar flare produces intense ultraviolet (EUV) & x-ray radiation.
- Strikes the dayside of the Earth, creating anomalies in the travelling radio waves through ionosphere, known as ShortWave Fadeout (SWF).
- Represents earliest space weather effects of a flare, with only an 8 min delay.



Shortwave Fadeout: What is it?

- ***What is a Shortwave Fadeout?***

  Shortwave fadeout (SWF) produces a sudden increase in radio-wave absorption that is most severe in the upper medium frequency (MF) and lower high frequency (HF) ranges.

  Often interrupts or interferes with telecommunications systems.

- ***Duration of SWF?***

  Fadeouts are characterized by sudden onset and a recovery that takes 30 minutes to 1 hours.

- ***Reason behind radio-wave absorption?***

  The physics behind the absorption is a sudden increase in the density of the D region due to the enhanced EUV and X-ray radiation.

Our objectives

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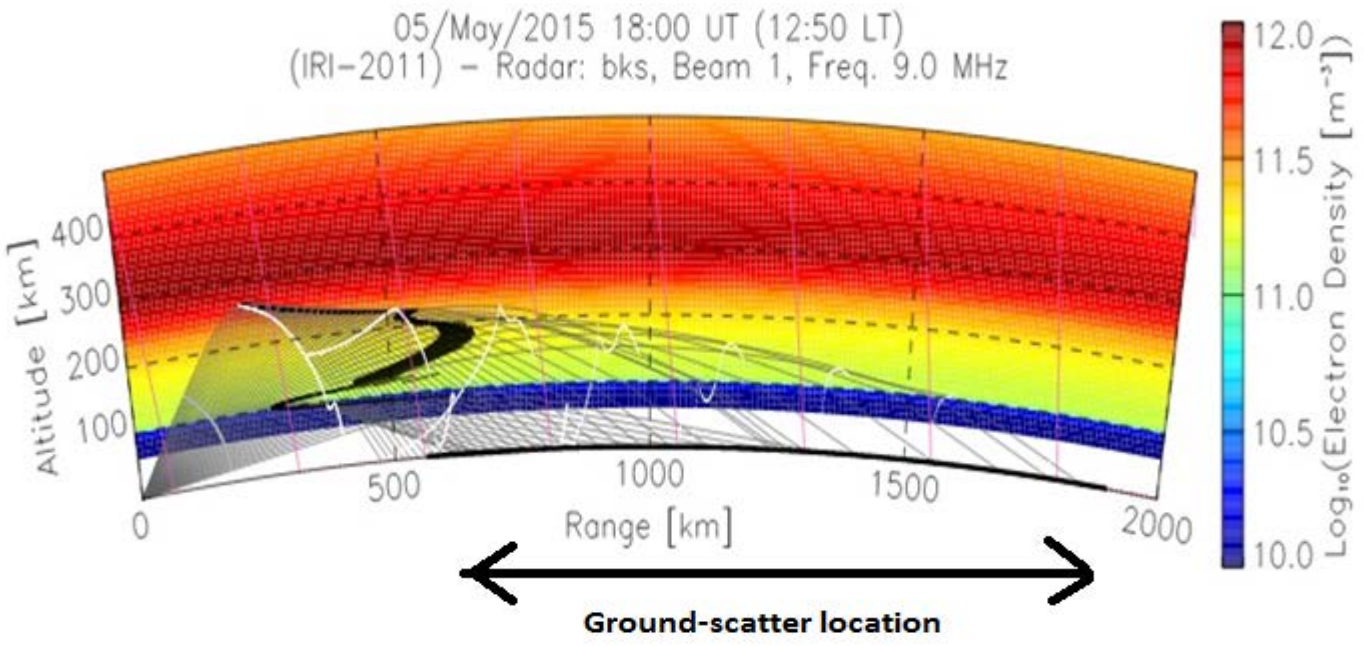
I. Identifying and characterizing SWF events in the SuperDARN observations.

II. Analysing timing of SWF across the different SuperDARN radars in North American sector.

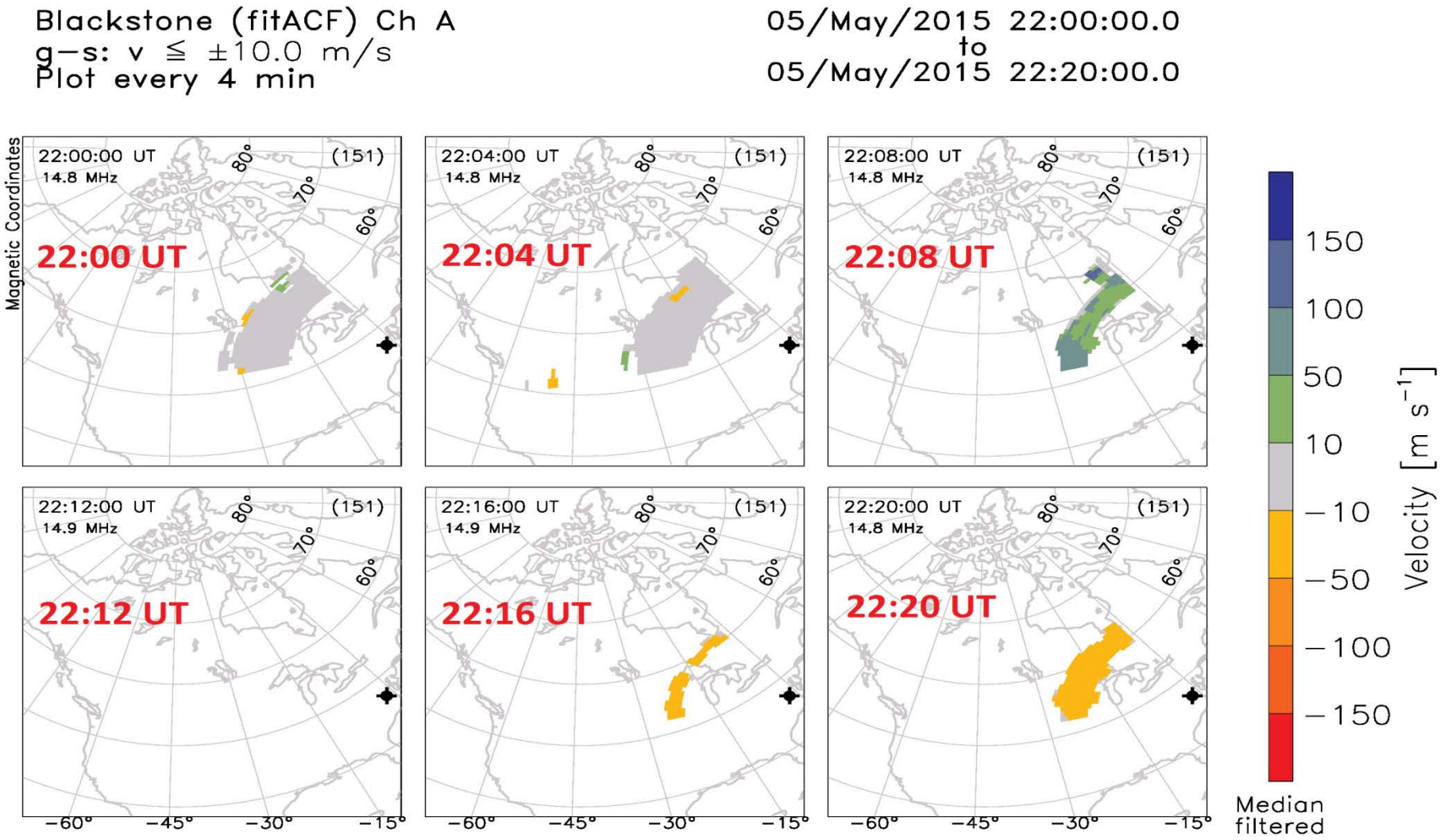
III. Develop a space weather monitoring capability related to SWF.

Why use SuperDARN Observation to Monitor SWF?

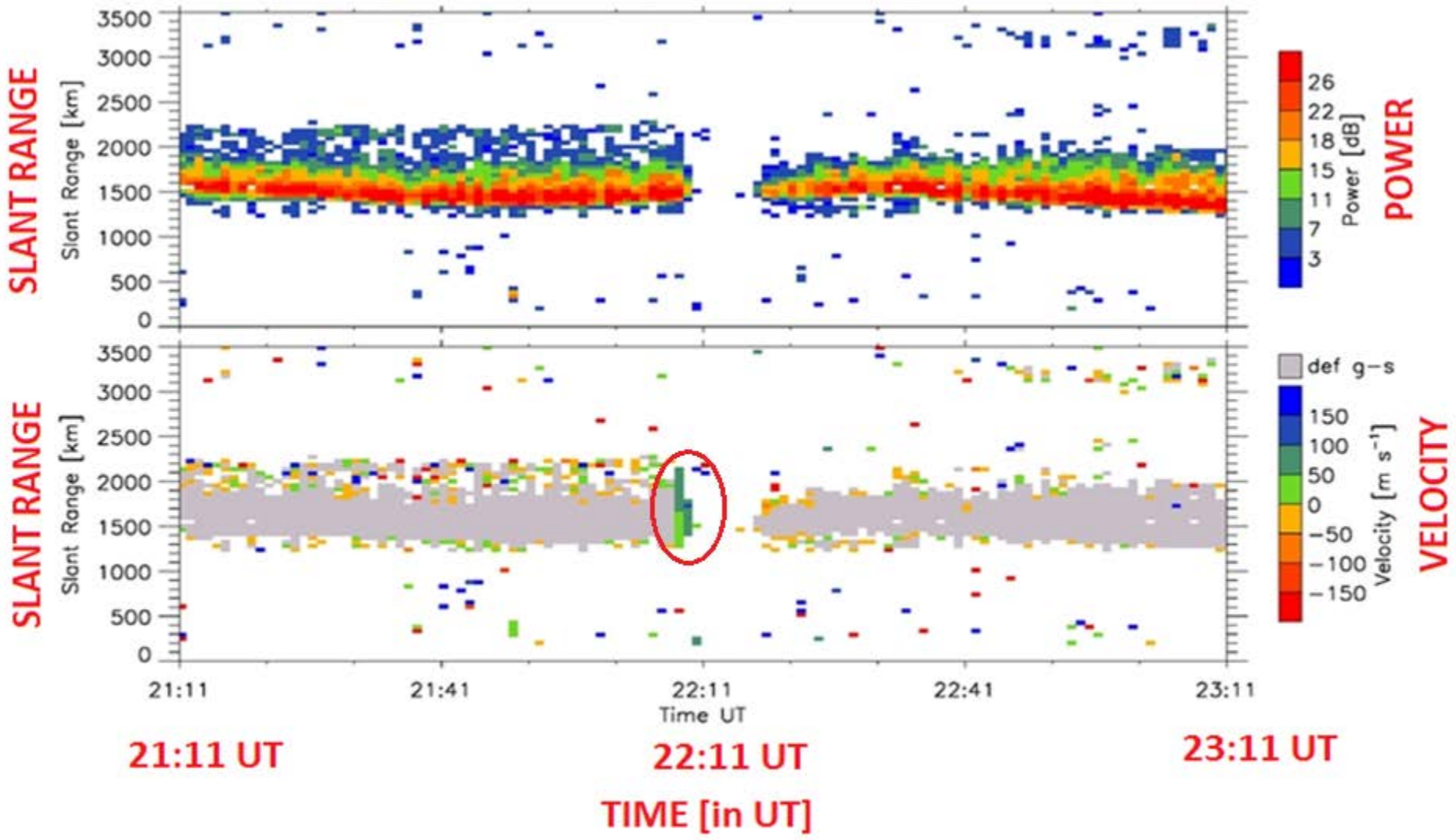


- It is a monostatic HF system operating at 8-18 MHz, that simulates a two way propagation link using ionospheric reflection.

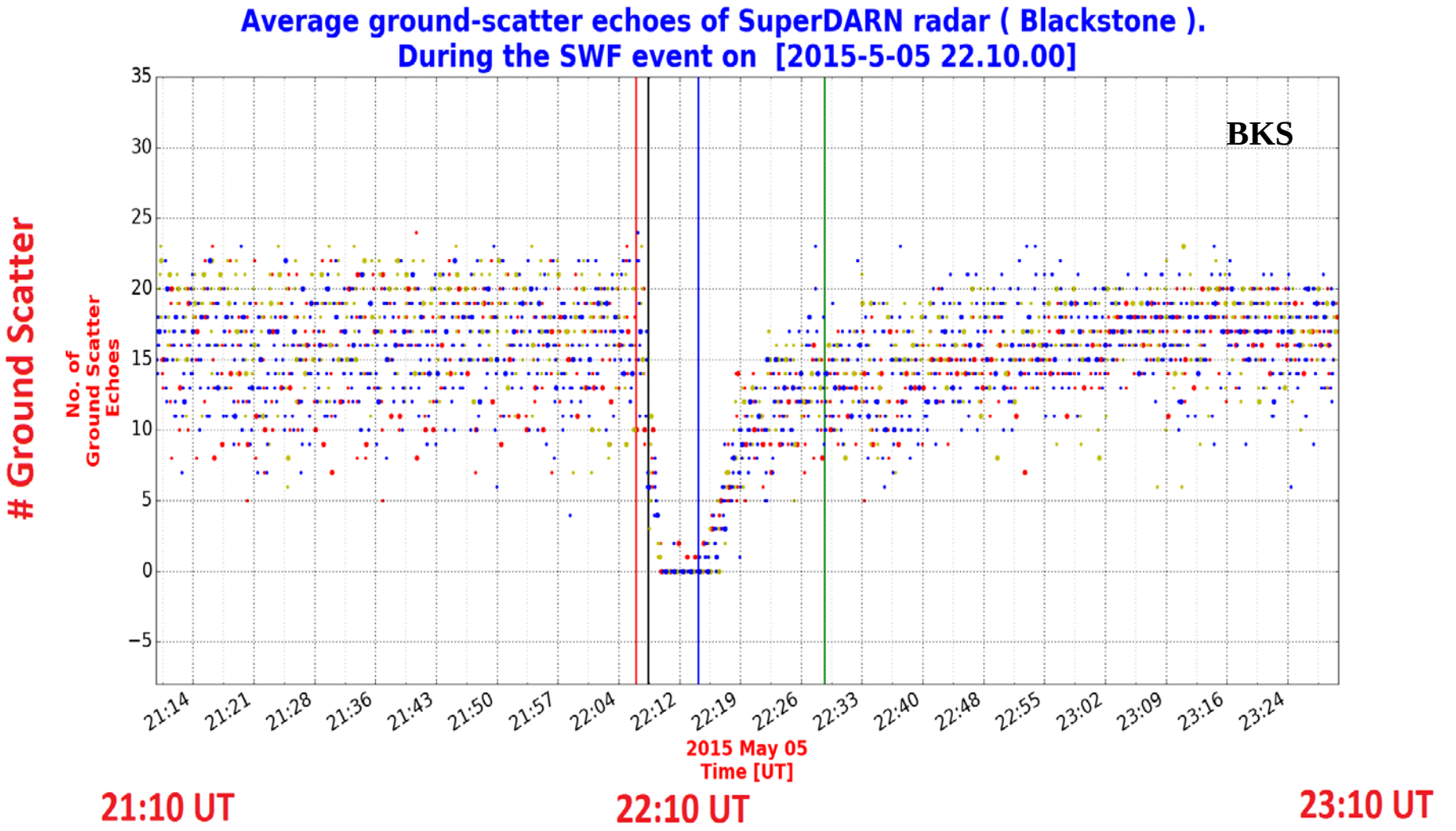
Impact of SWF on SuperDARN (HF Radar)



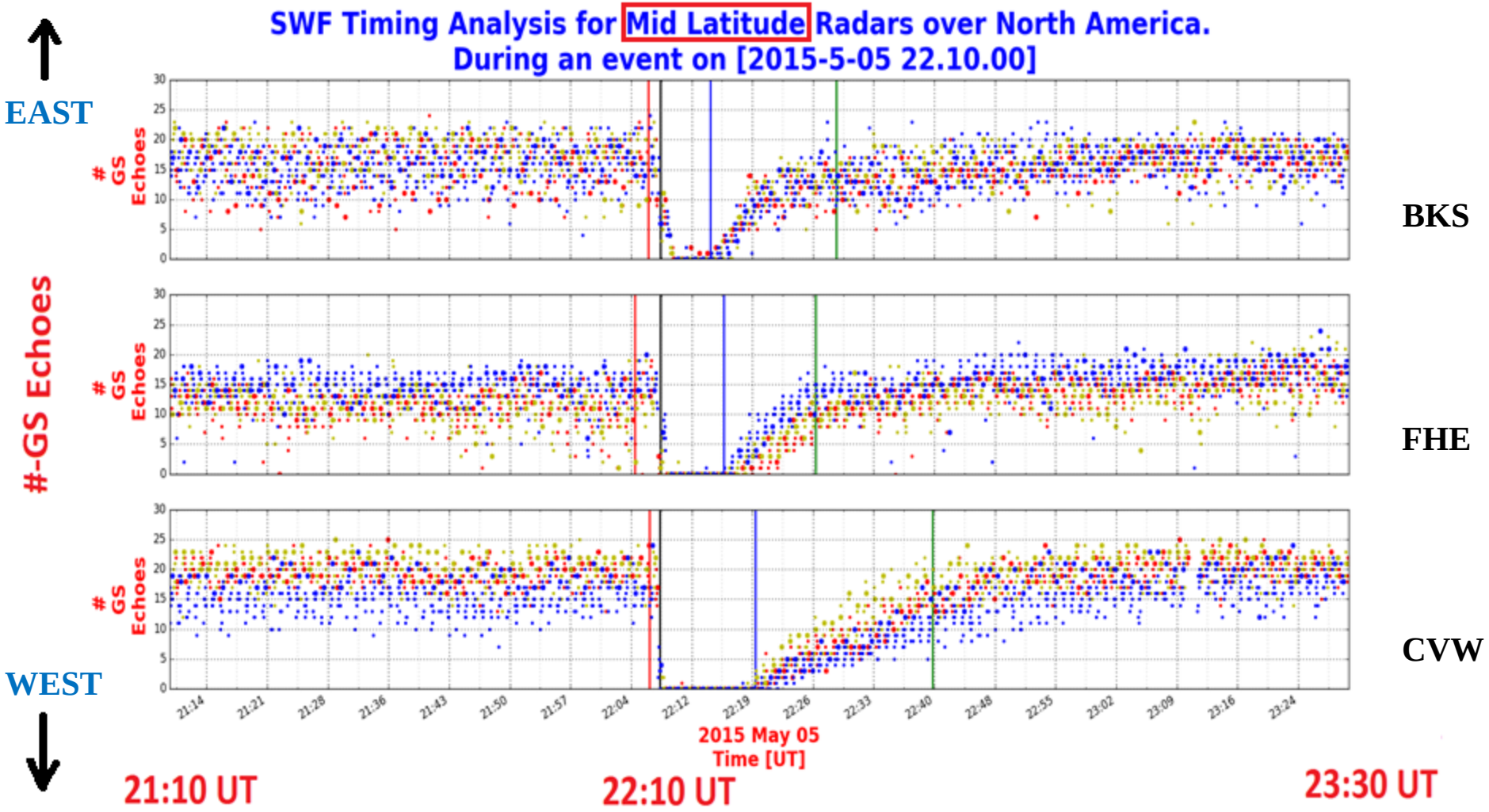
SuperDARN Range Time-Series data with a 'Velocity Flash'



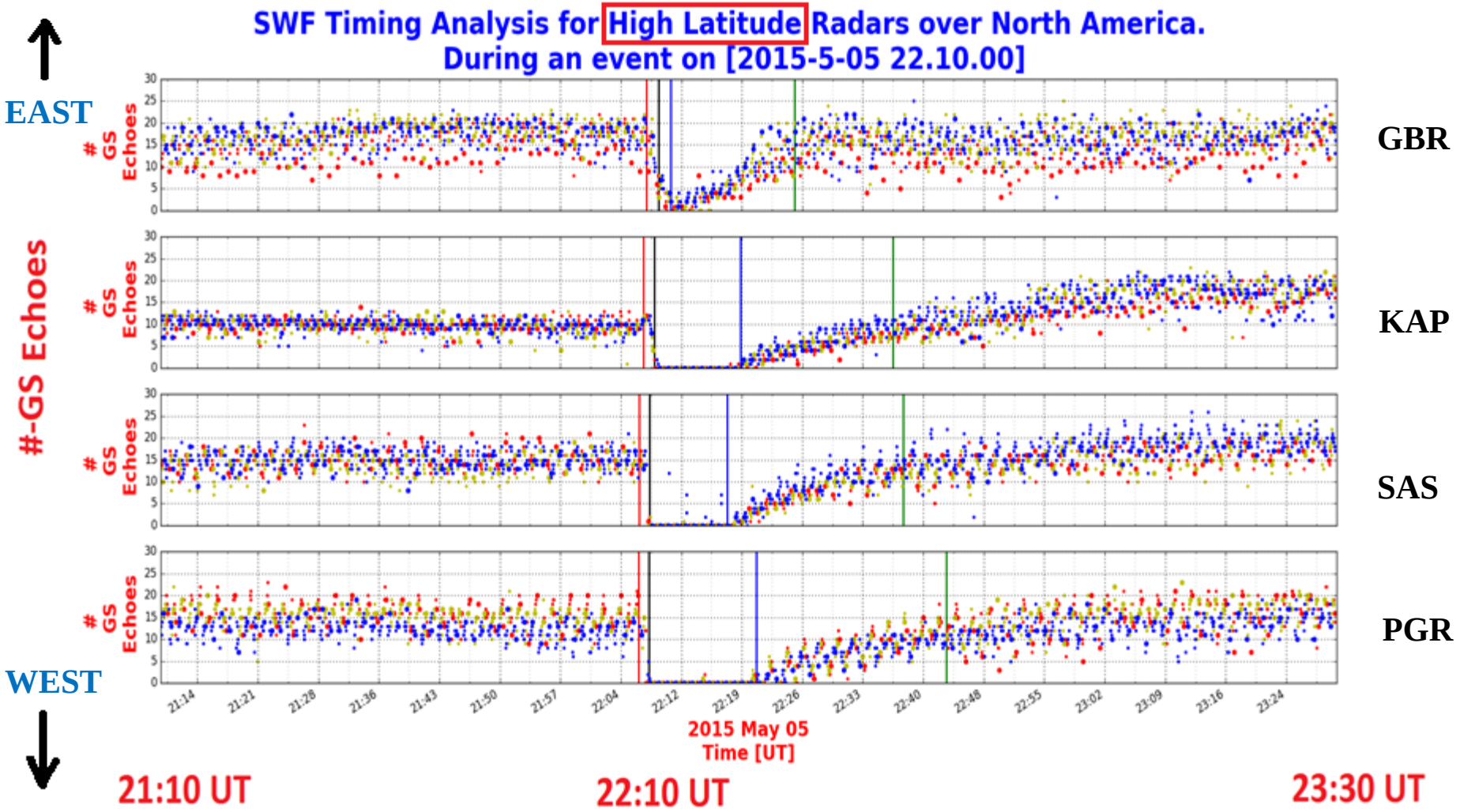
Example of characterization of SWF event based on ground-scatter echo analysis



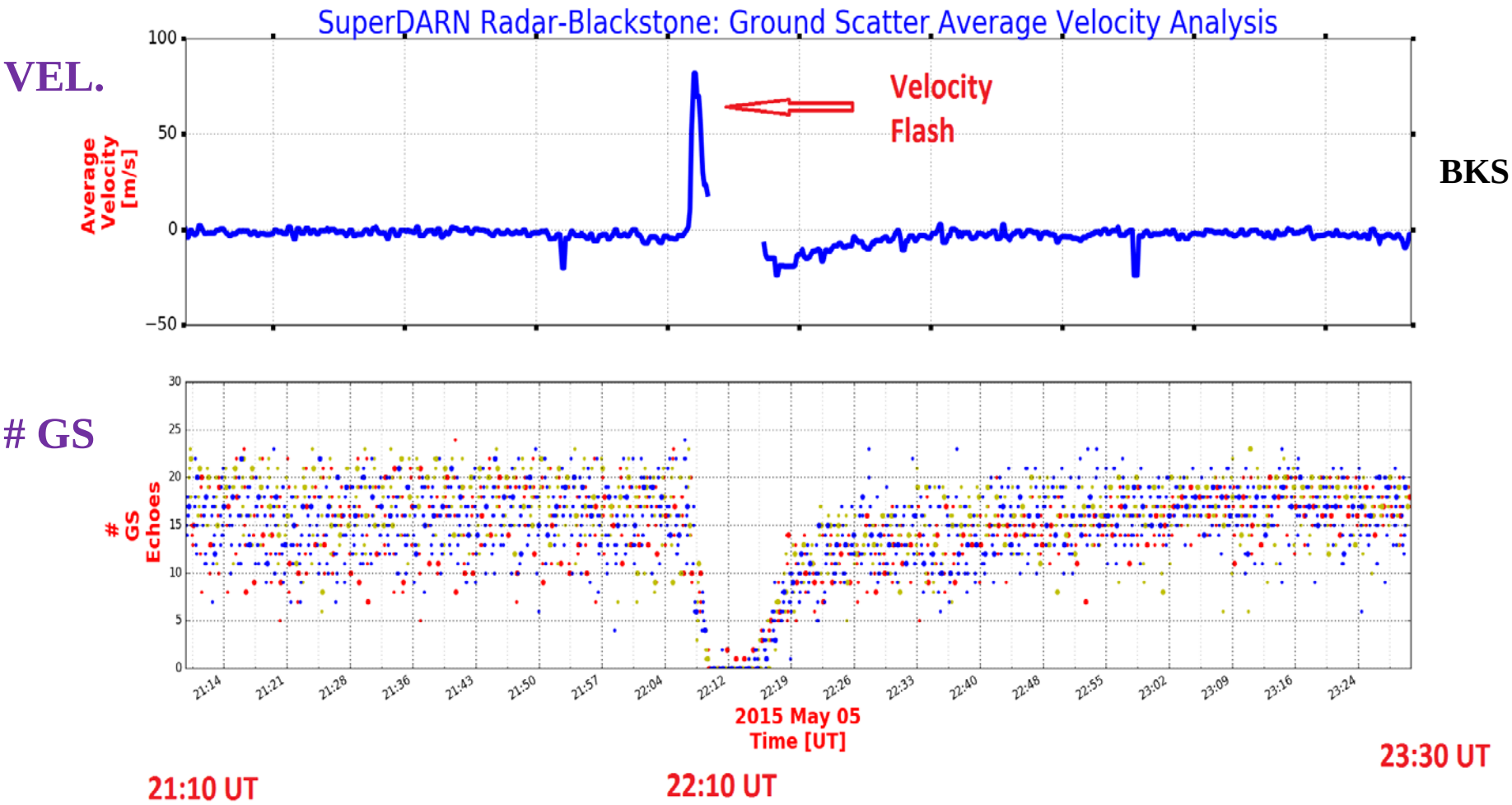
Stack RT plot of different Mid-latitude radars – Sun is due West



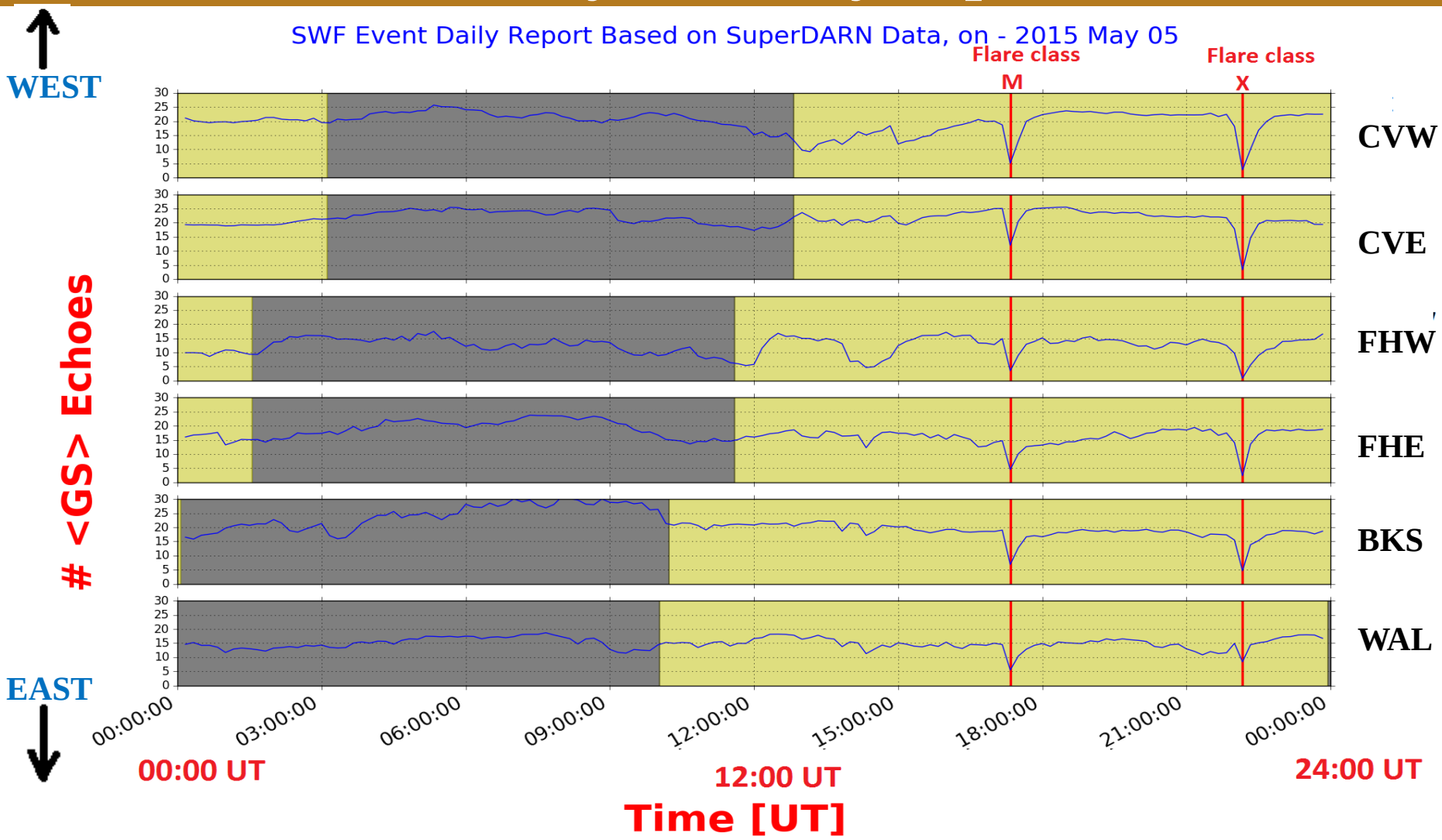
Stack RT plot of different High-latitude radars – Sun is due West



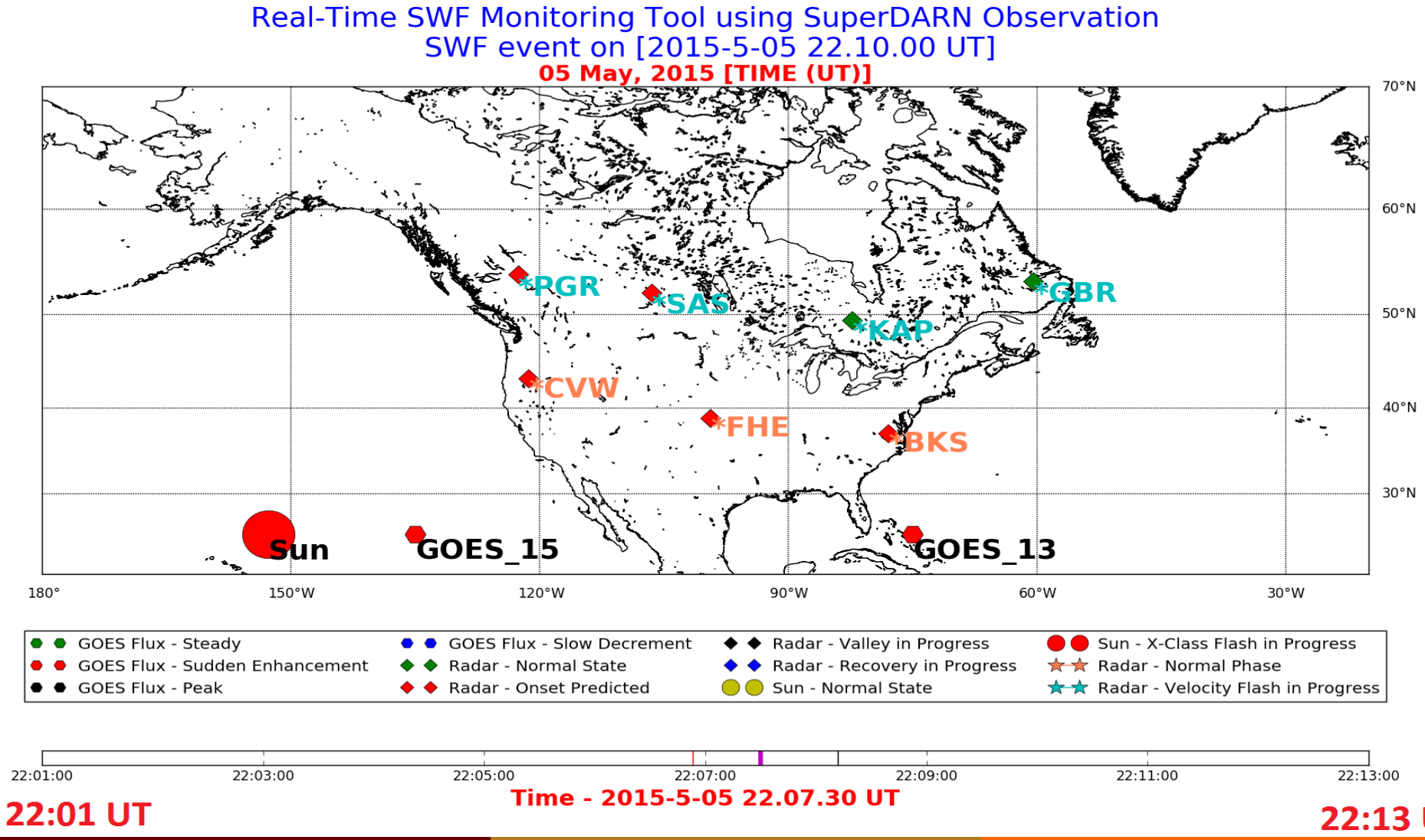
Velocity Flash as a Precursor



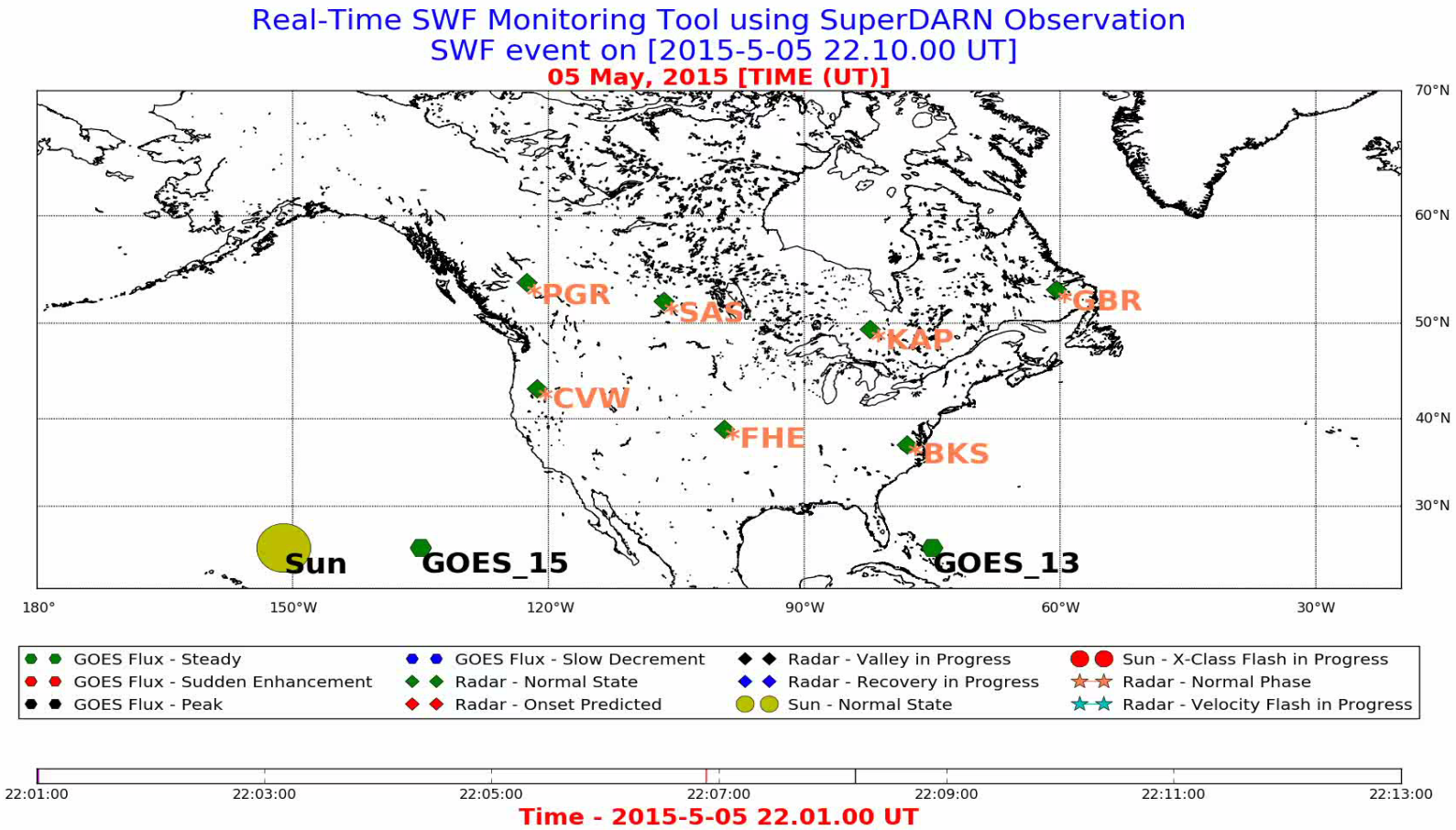
Automated SWF event Detection – Daily Summary Report



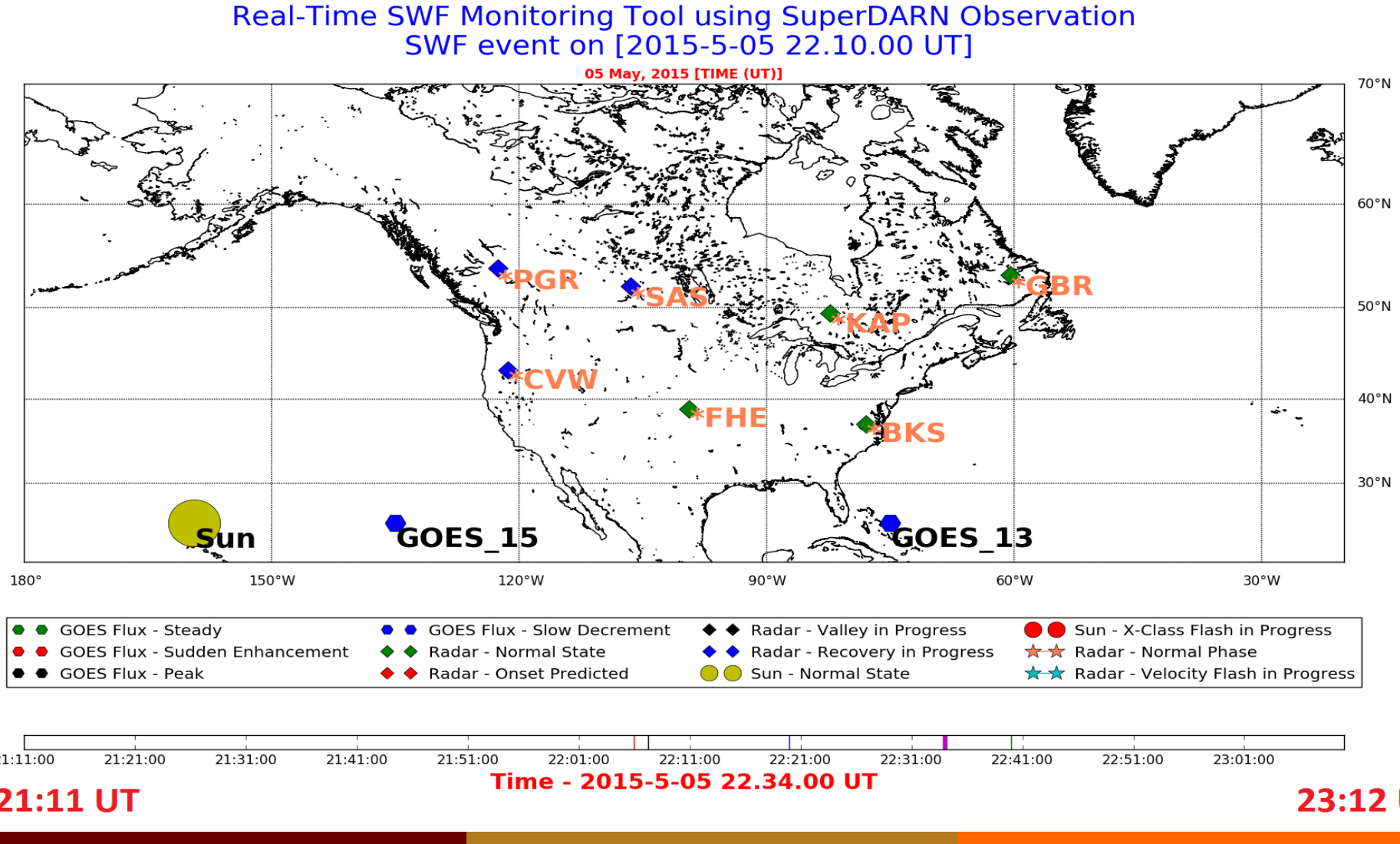
Snapshot of SWF Event across North America



Retrospective View of Automated Real-time SWF Monitoring System



End of Event – Away from Sub-solar Point



Summary and Conclusion

- Characterize SWF events based on depth of blackout and duration of the event phases using SuperDARN HF radar observation.
- SWF has more impact near to sub-solar point.
- Automated event detection tool search for SWF patterns in SuperDARN database.
- Automated SWF monitoring tool uses the knowledge of SWF characterization seen in SuperDARN ground-scatter.
- Tools also take help of GOES X-Ray imager data for flare confirmation.
- Future work : A web-based real-time SWF monitoring tool is in development.

Questions?

THANK YOU!!!

Retrospective View of Real-time SWF Monitoring System – Fast Mode