Dynamics of LSTIDs measured by auroral imaging and GPS TEC

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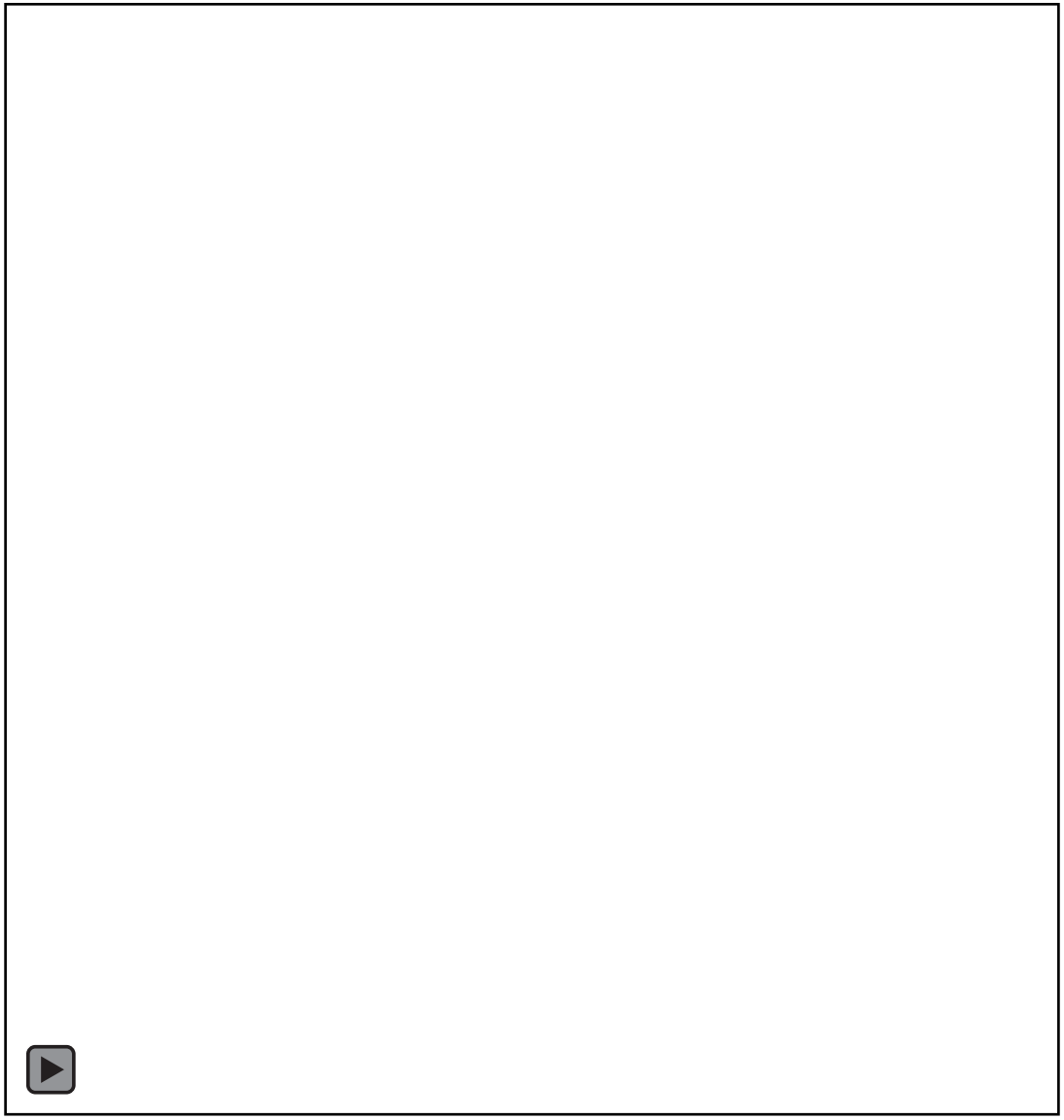
Mar 26, 2014 Substorm-LSTID event



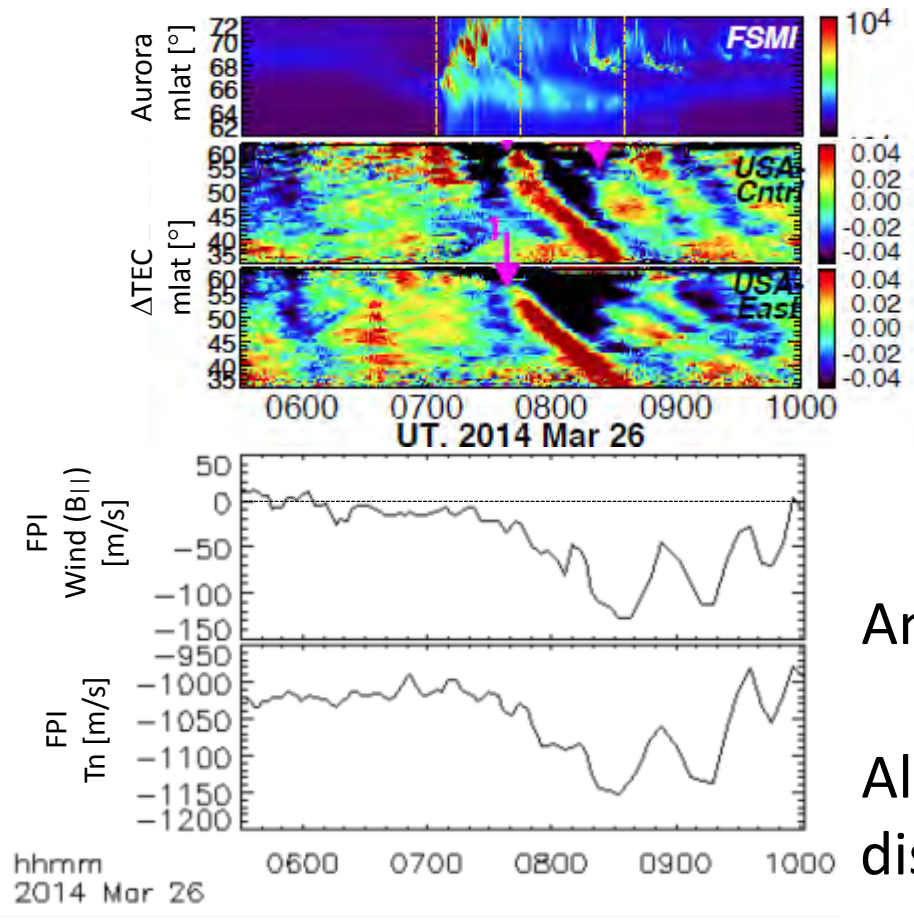
Large-scale traveling ionospheric disturbances (LSTIDs)

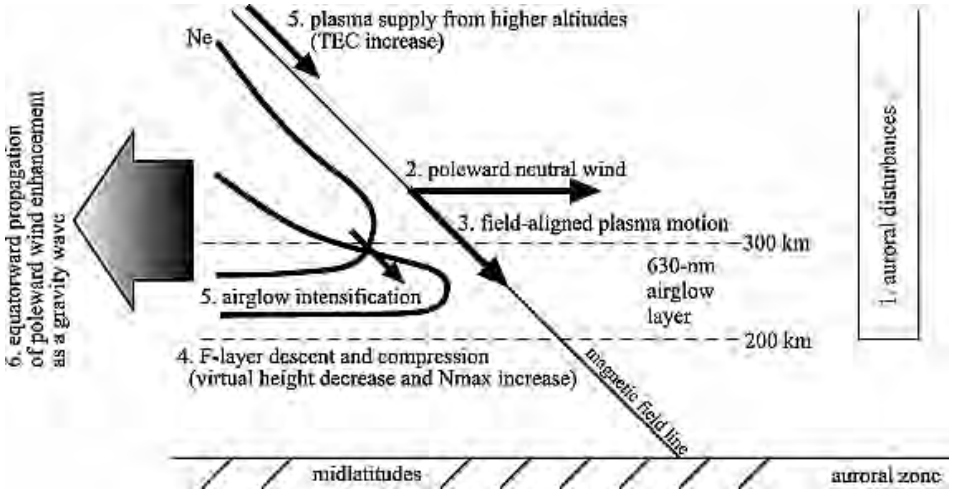
Ionosphere density disturbances of 1000 km horizontal scale and 400–1000 m/s propagation speed [Hunsucker, 1982]

An isolated substorm triggered LSTIDs.

[Lyons et al., submitted to JGR]

Mar 26, 2014 Substorm-LSTID event





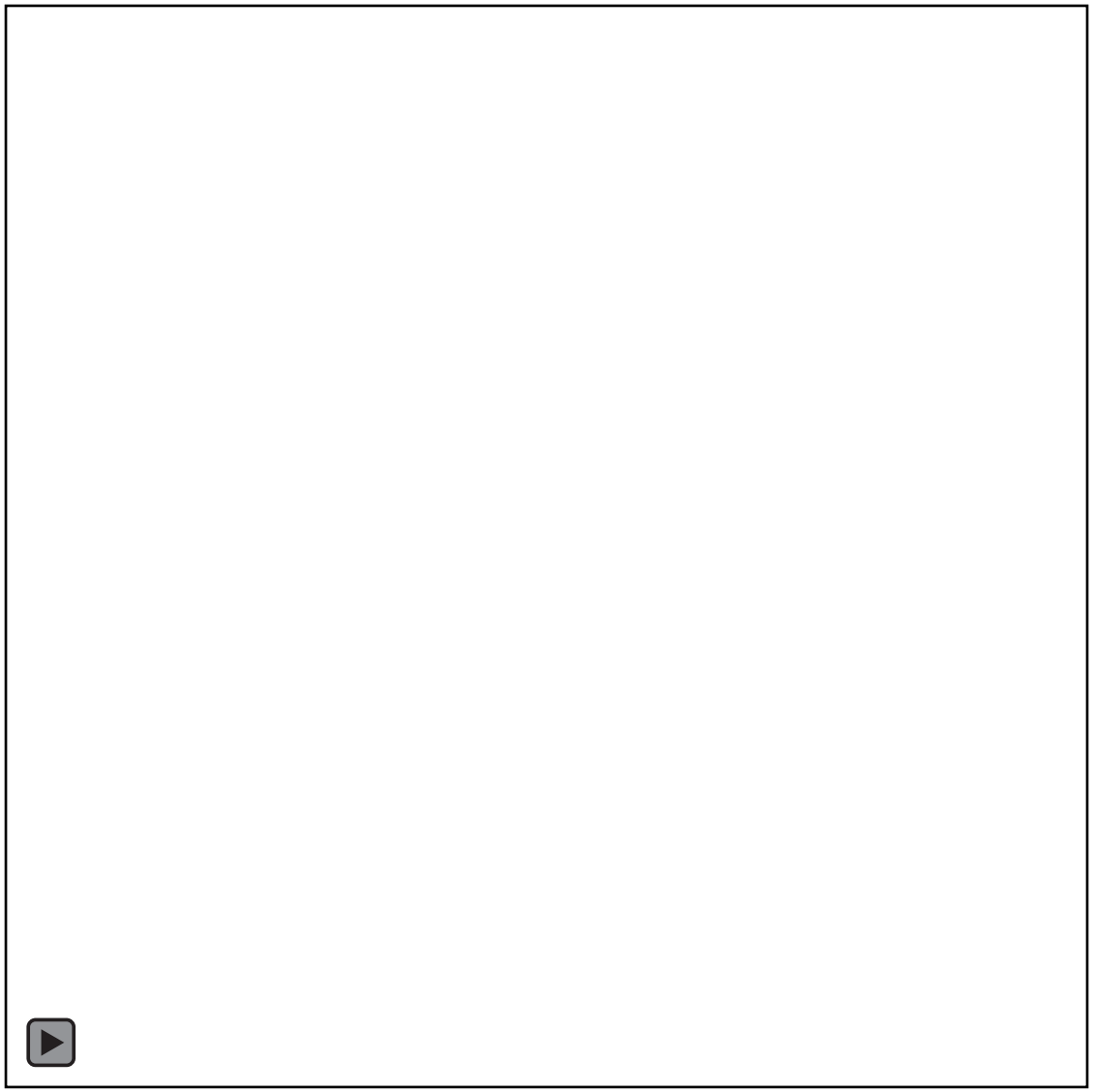
[Shiokawa et al., 2002]

An isolated substorm triggered LSTID.

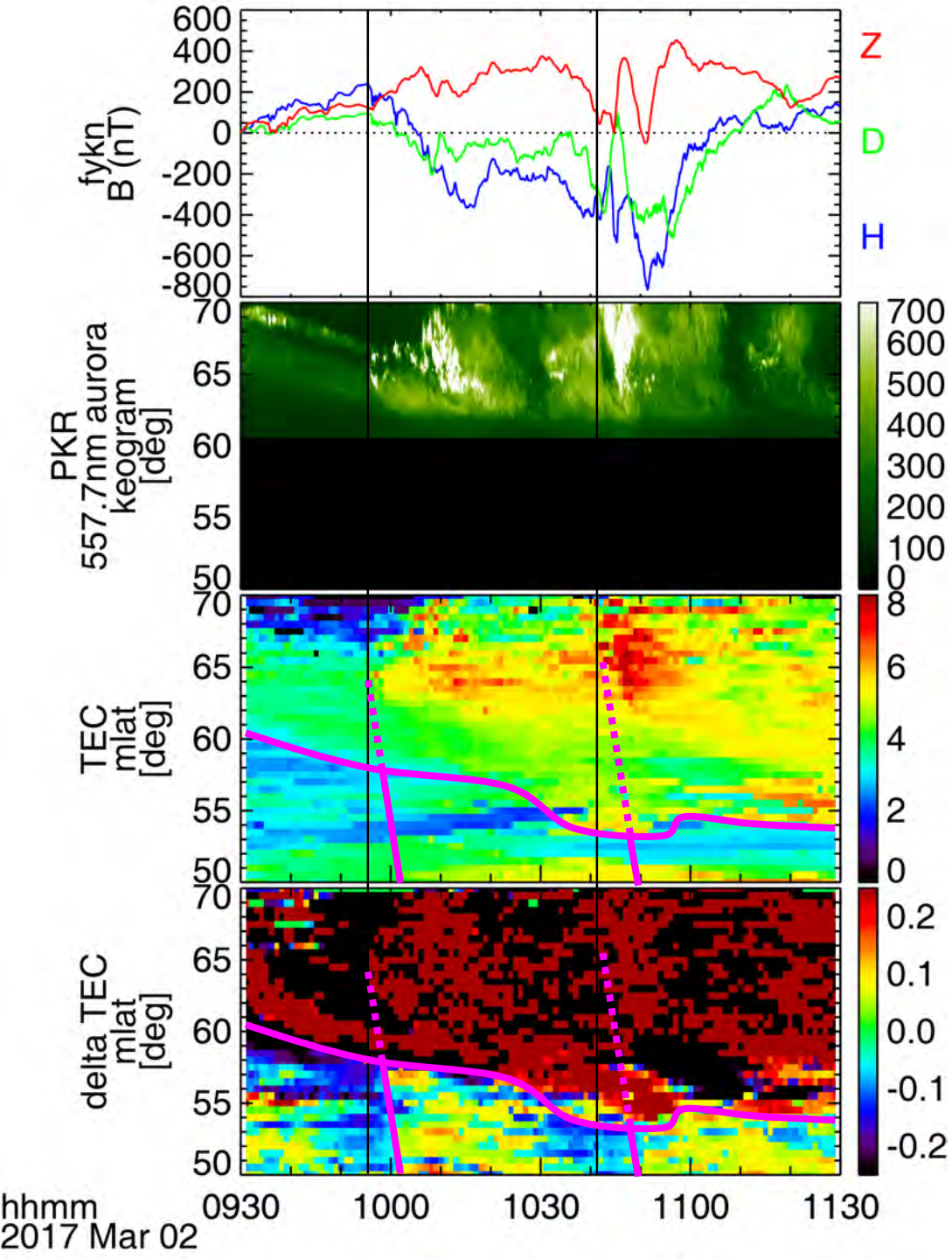
Also traveling atmospheric disturbances (TAD) occurred.

- Can we pinpoint the source region of the LSTIDs?
- How can we estimate magnetospheric energy input of this particular event?

2017-3-2 substorm over Alaska



Continuous TEC latitudinal coverage at the auroral and subauroral latitudes



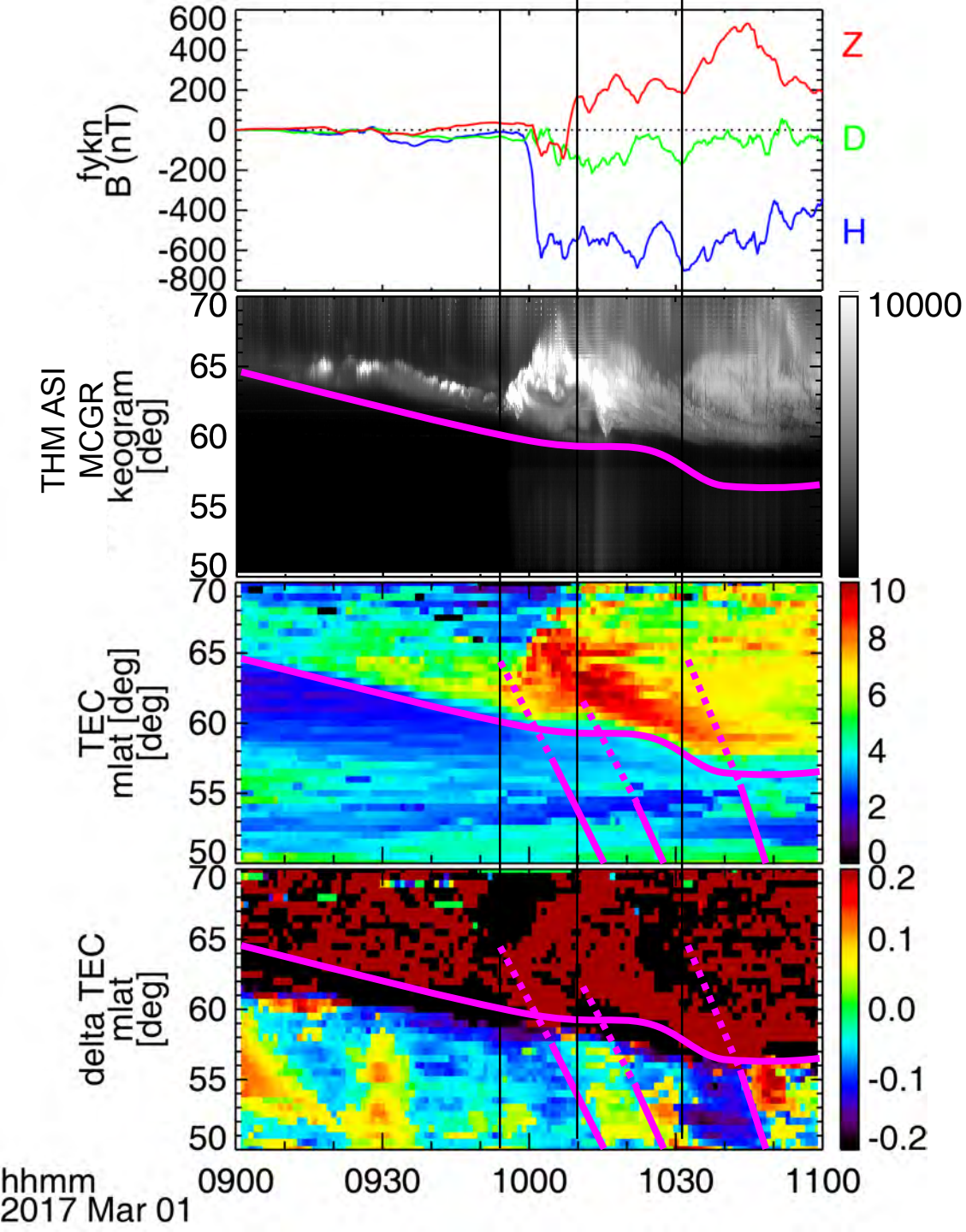
2017-3-2

Substorm with two major intensifications

Two TEC enhancements

Two LSTID pulses starting at the auroral equatorward boundary ~5 min after auroral brightenings

Likely caused by auroral heating



2017-3-1

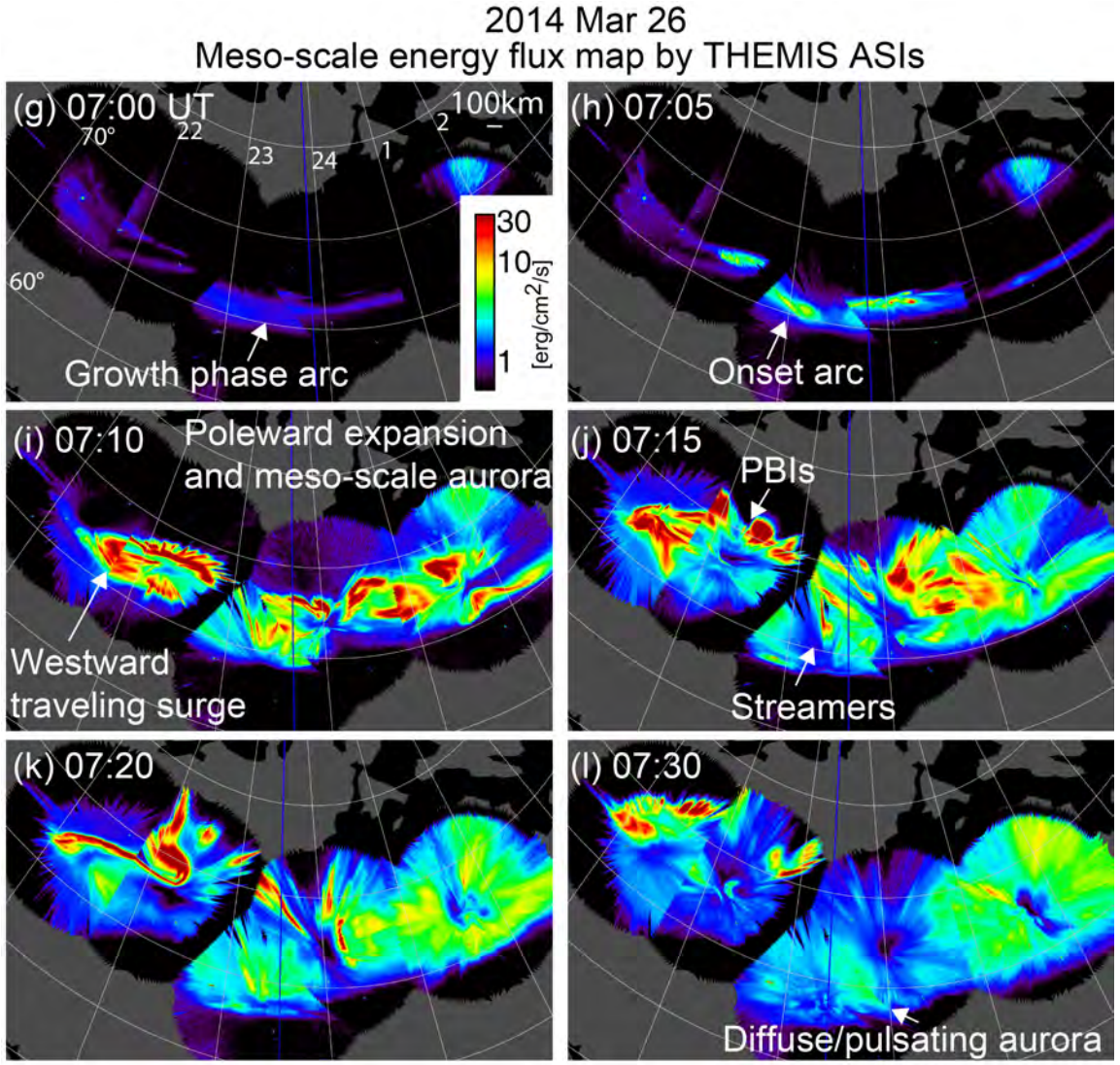
Substorm with three major intensifications

Two TEC enhancements

Three LSTID pulses. Two of them starting at the auroral equatorward boundary ~10 min after auroral brightenings

Likely caused by auroral heating

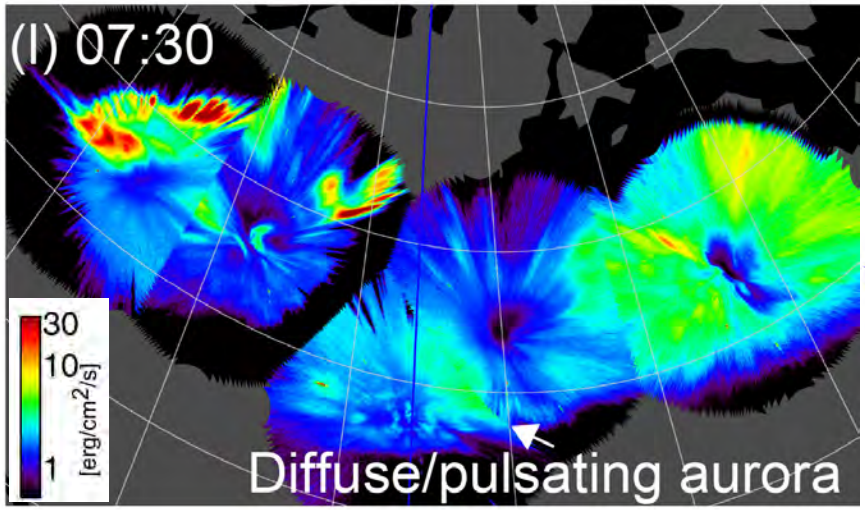
Time evolution of energy flux map (Substorm)



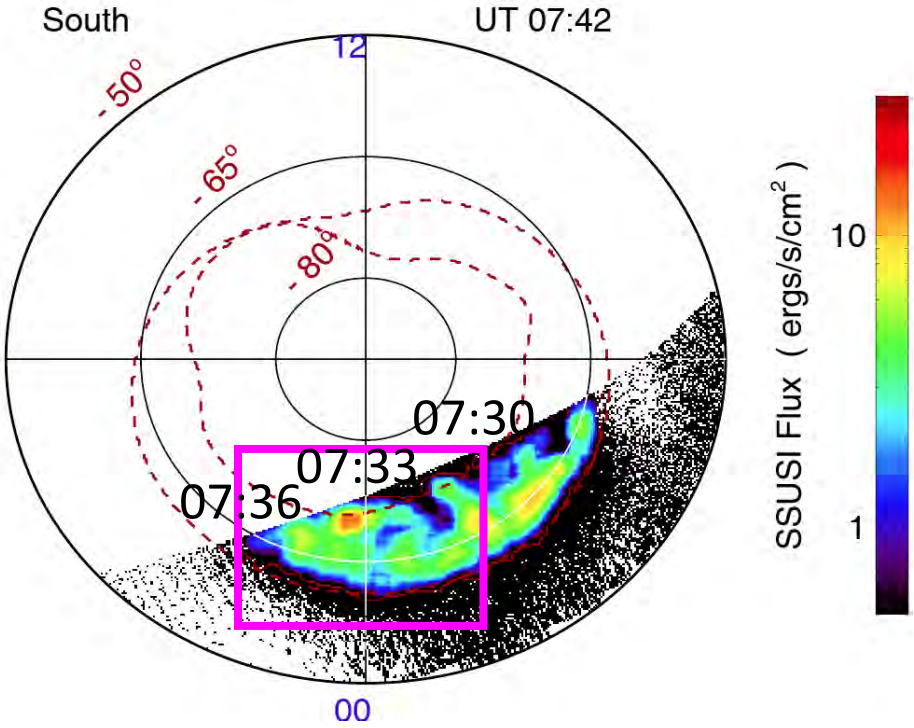
[Nishimura et al., submitted]

Validation

THEMIS ASI



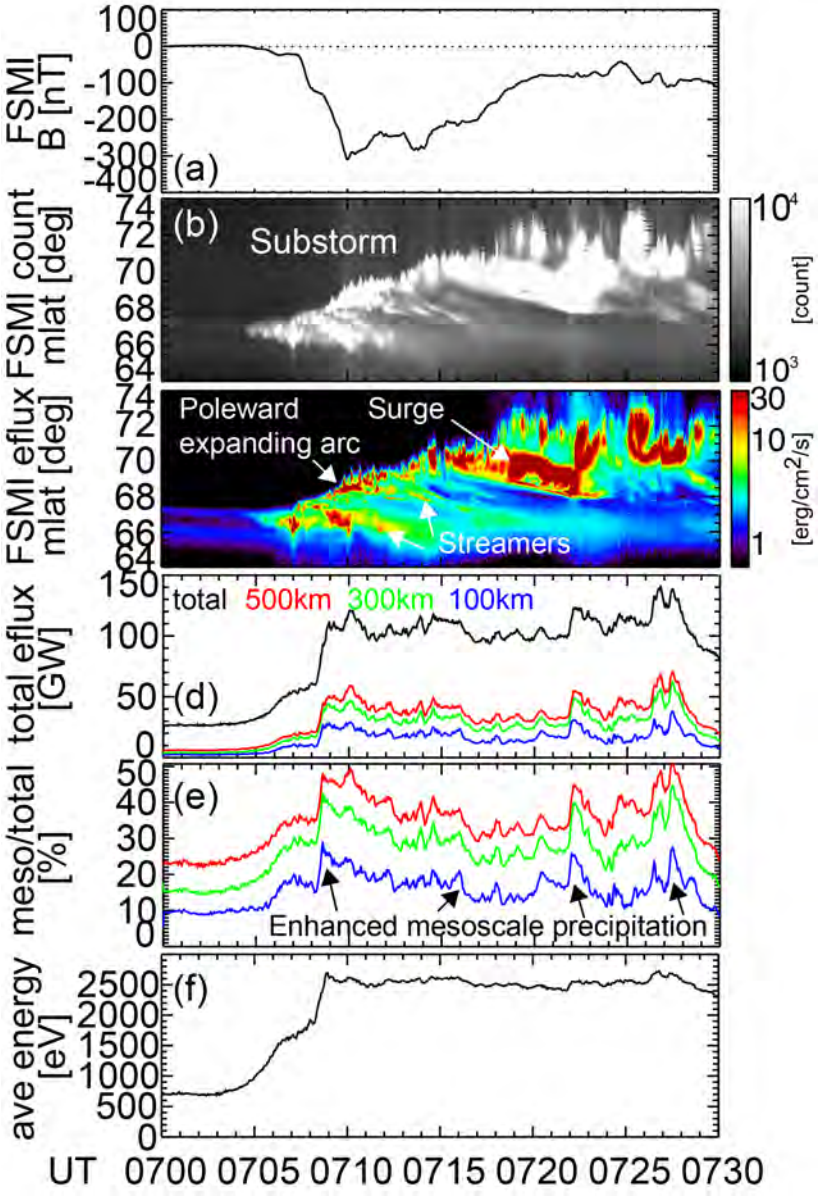
DMSP SSUSI



The energy flux magnitude and distribution are overall consistent with the SSUSI data.

Smaller-scale structures and their time evolution can be seen in the ground-based imaging.

Large-scale vs. Meso-scale



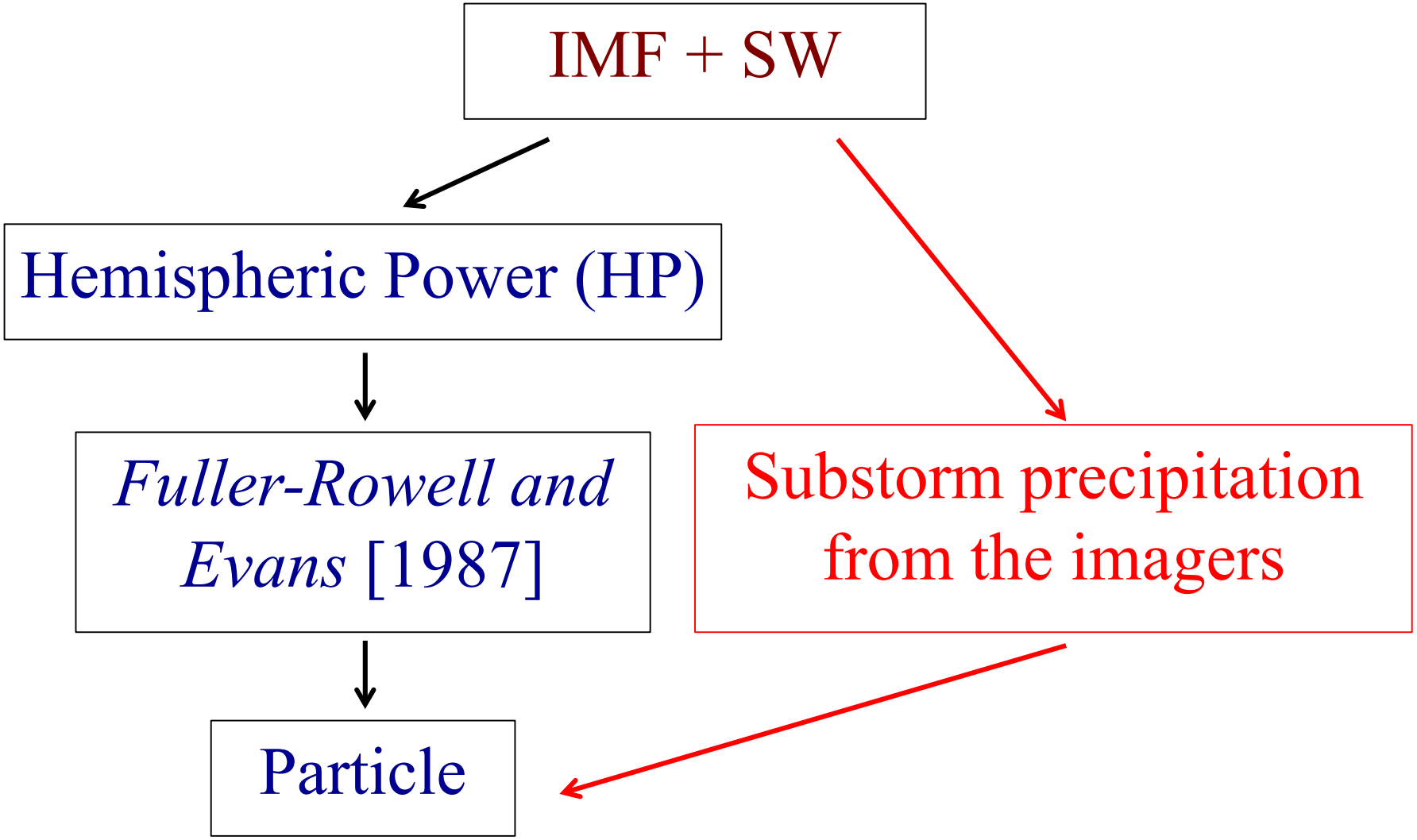
~20-50% of the total energy flux are carried by meso-scale structures.

Critically important to include meso-scale precipitation for total energy budget.

The characteristic energy is nearly constant.

Next steps

LSTID simulation: collaboration with GITM [Yue Deng et al.]



Role in mid-latitude scintillation: jointly with BC