HEMISPHERIC SYMMETRY AND ASYMMETRY OF PMRAFS AND ASSOCIATED POLAR CAP PATCHES

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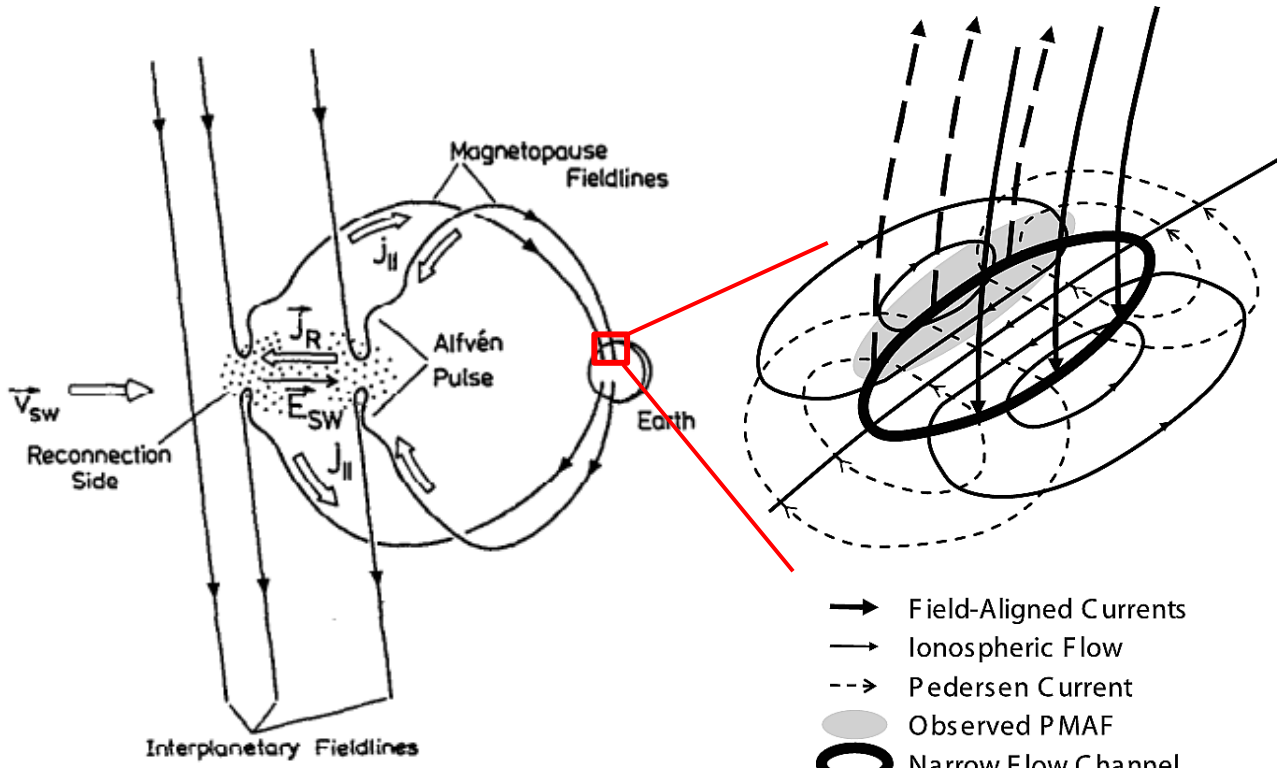
POPULAR IONOSPHERIC SIGNATURES OF DAYSIDE RX



Glassmeier & Stellmacher, 1996

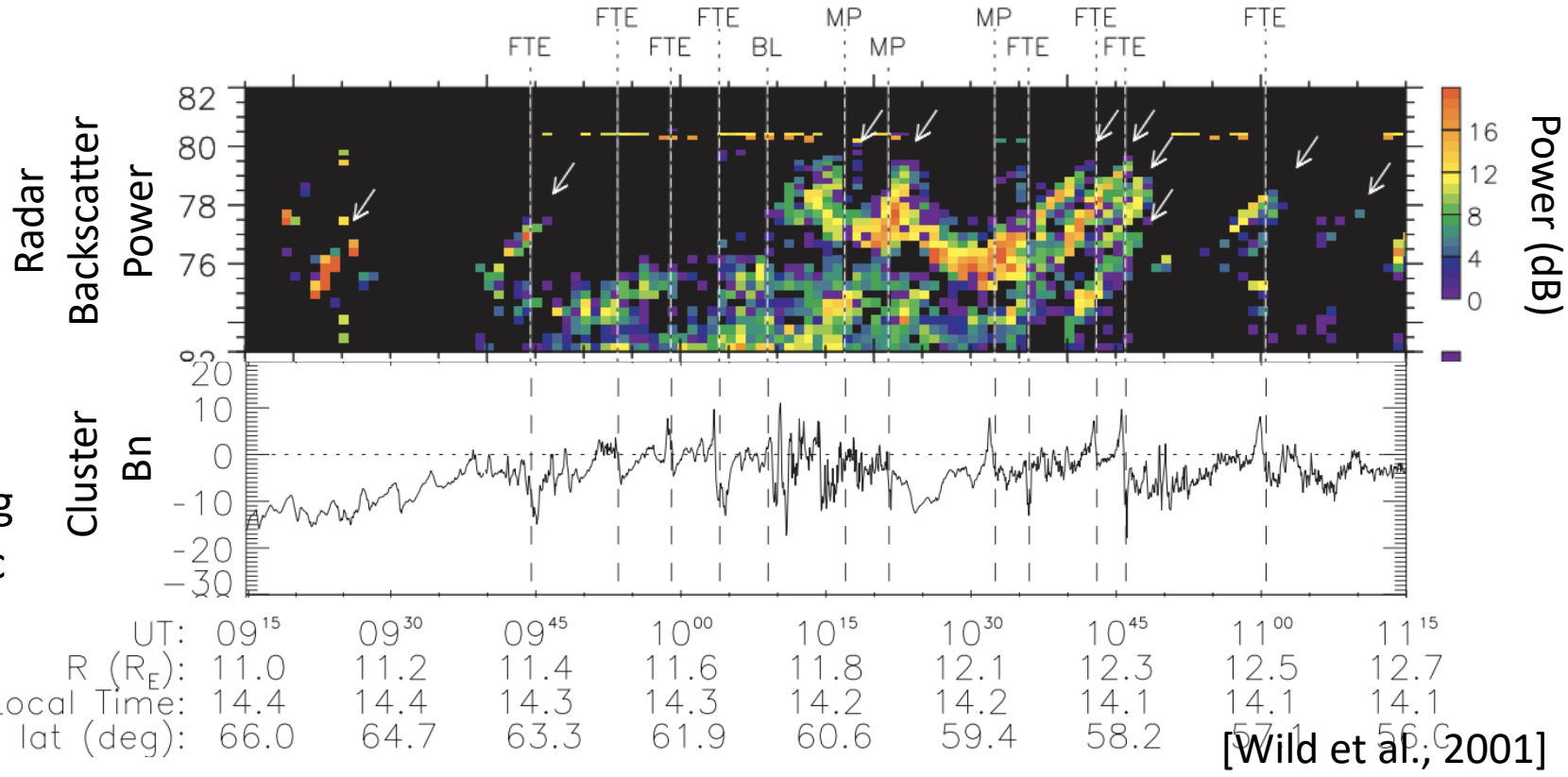
Oksavik et al., 2004

- How symmetric are Rx signatures between hemispheres?
  - Observing FACs requires s/c traversing two cusps simultaneously
  - Observing poleward-moving auroral forms requires darkness (for ground-based ASI)
  - Observing flow channels requires good backscatter echo coverage and radar looking in the flow direction

PMRAF AS AN IONOSPHERIC SIGNATURE OF DAYSIDE RX

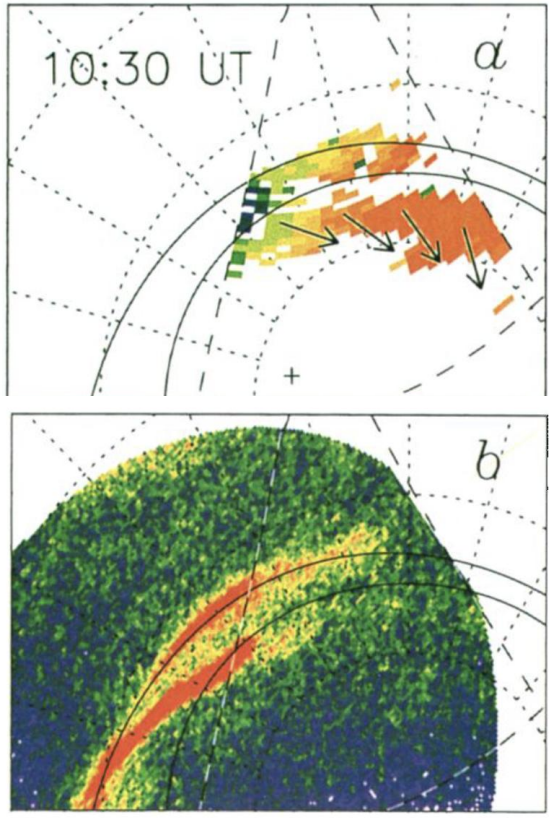
PMRAFs:

- Poleward moving radar auroral forms: poleward-moving regions of enhanced backscatter power seen by HF radars
- Occur in conjunction with FTEs
- “Fossils” of ionospheric structuring that takes place at the ionospheric footprint of magnetopause reconnection

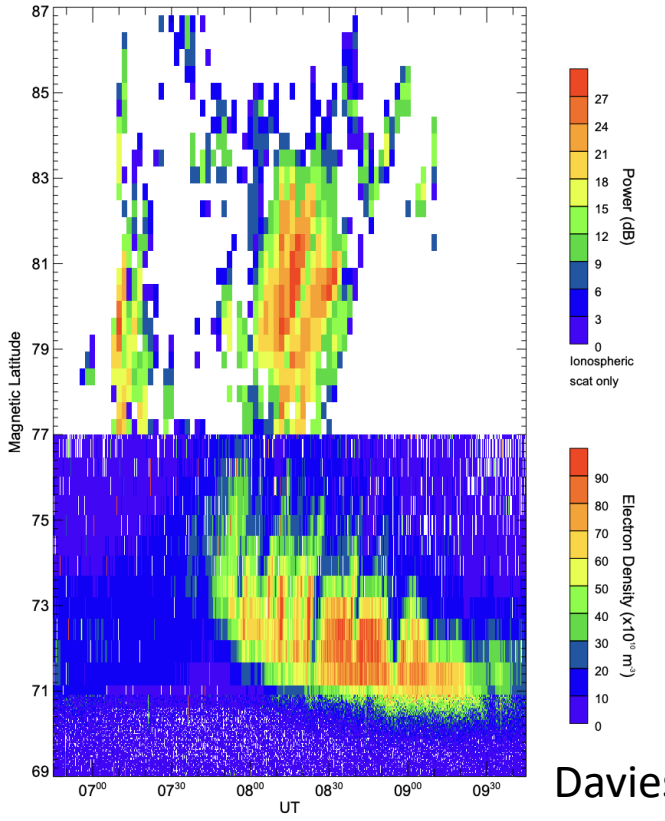


[Wild et al., 2001]

IONOSPHERIC STRUCTURE PRODUCING PMRAFS



Milan et al., 2000

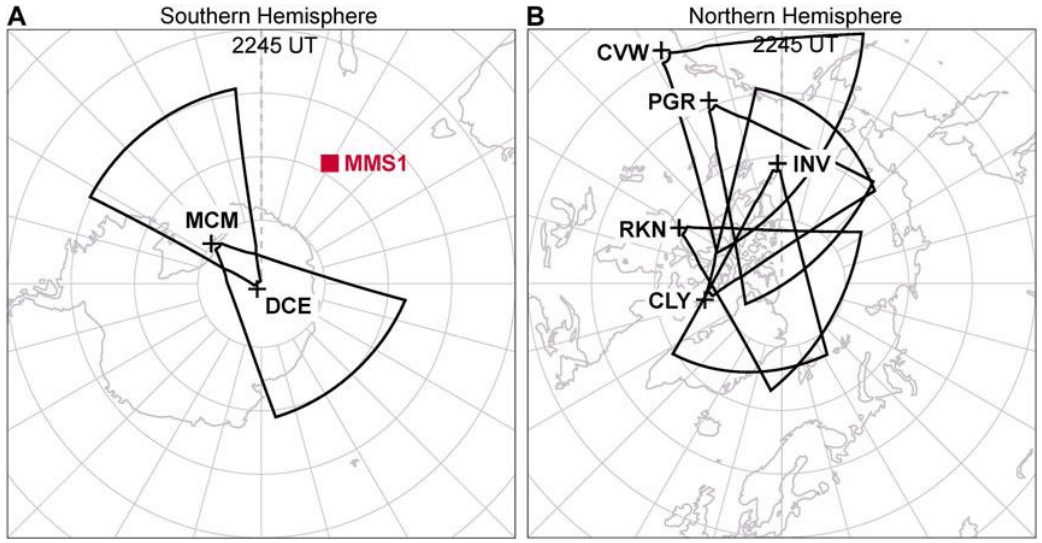


Davies et al., 2002

- PMRAFs as a continuation of the poleward portion of PMAFs where the intensity is faint.
- PMRAFs occurred poleward of ionospheric density modulation at the cusp.

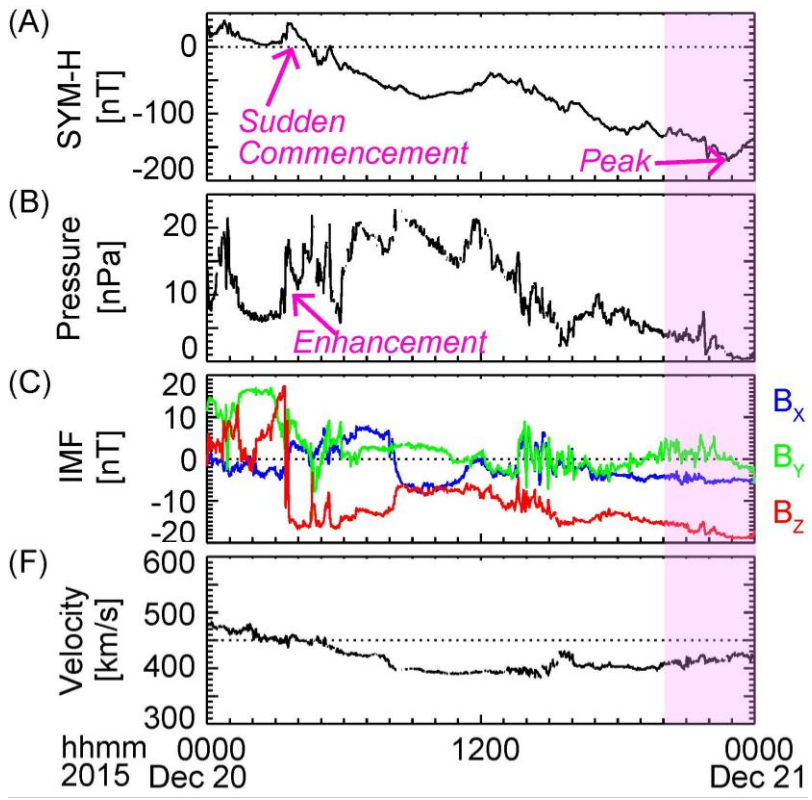
MOTIVATION

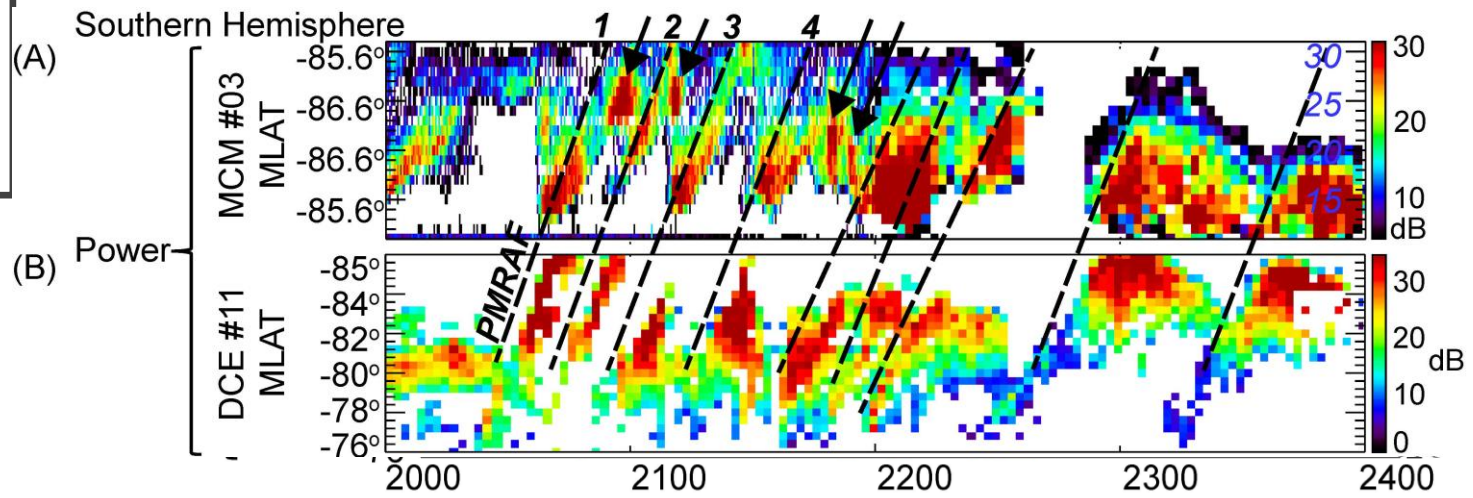
- How symmetric are Rx signatures between hemispheres?
  - What is the ionospheric structure that produces PMRAFs?
- Dataset



+ DMSP & Swarm & GPS (for probing ionospheric structure)

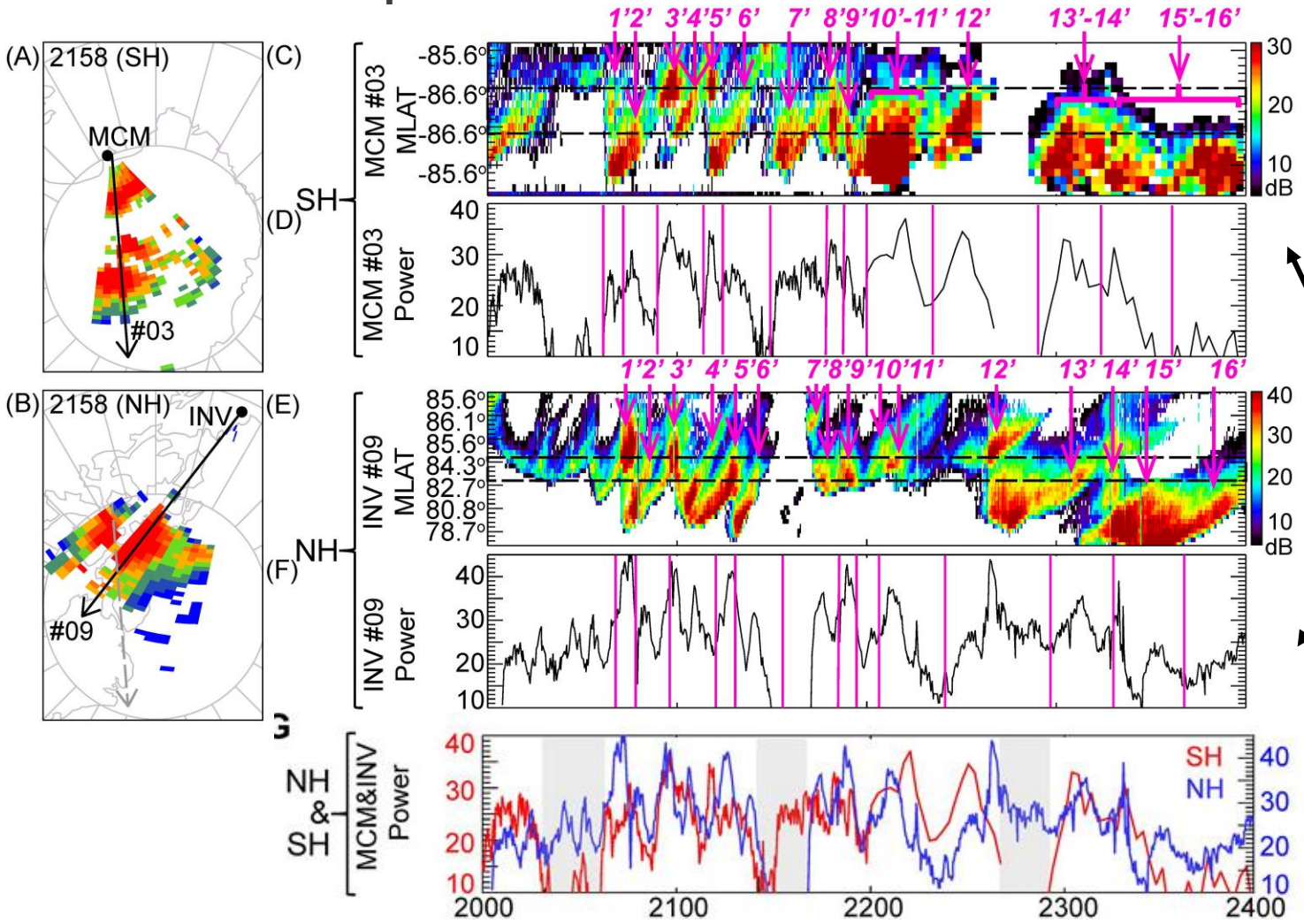
EVENT OVERVIEW





- Event occurred during an intense geomagnetic storm.
- IMF was quasi-steady and close to being due southward throughout the interval of our interest.
- PMRAFs occurred repetitively on time scales of ~10 min, and propagated from the dayside to nightside polar cap over long distances.

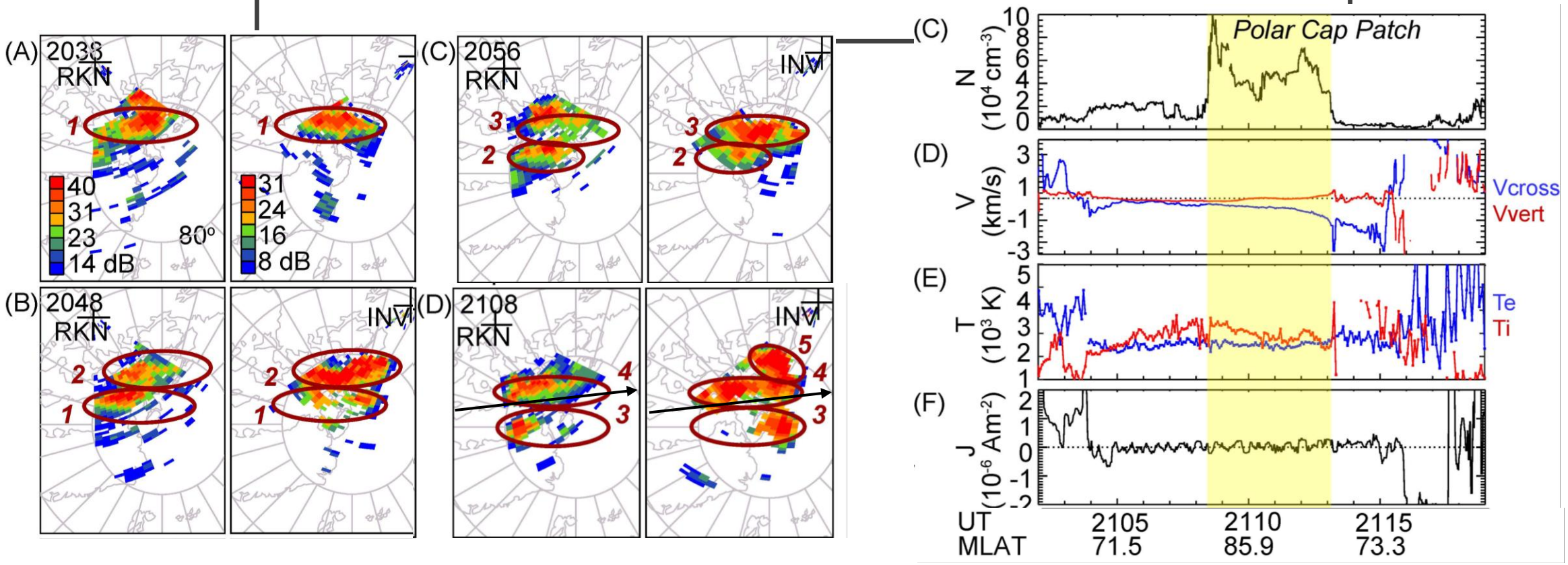
TEMPORAL REPETITION



PMRAFs exhibited highly correlated temporal repetition based on

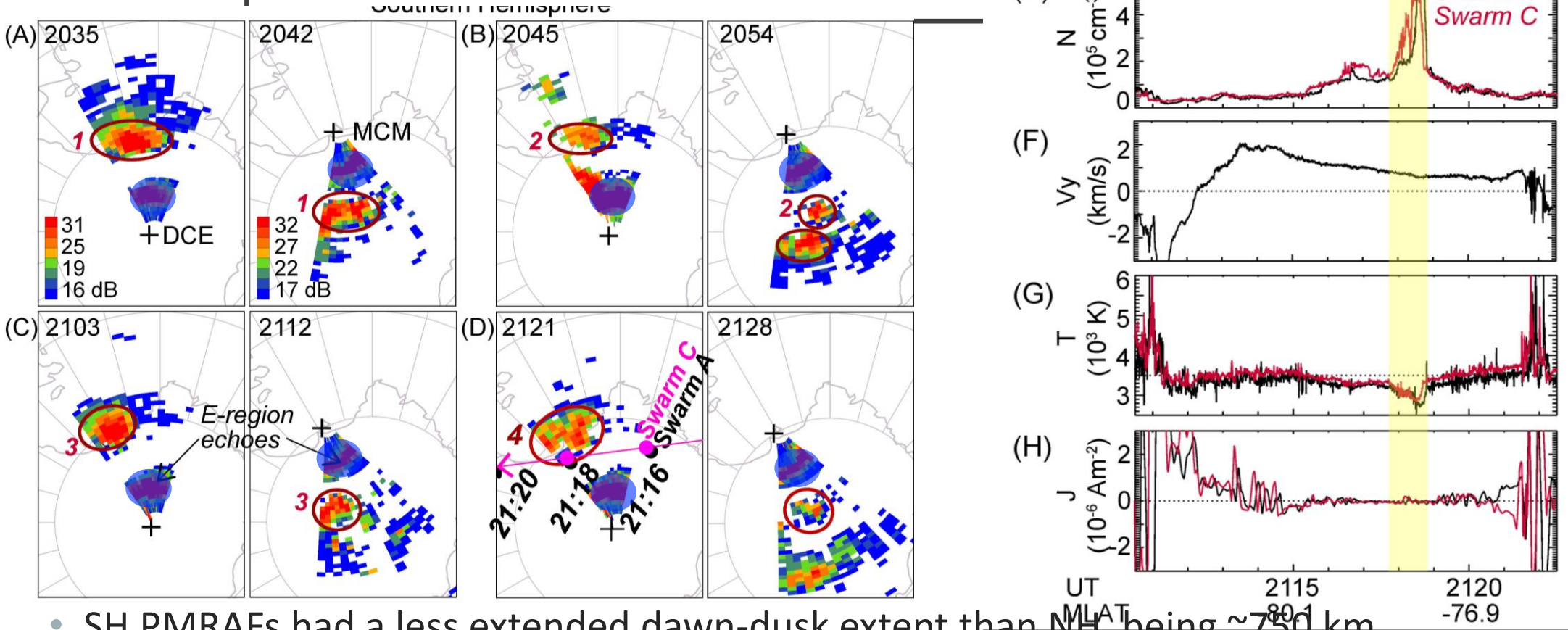
- Number of PMRAFs (by counting poleward moving traces)
- Temporal variation of radar backscatter power

SPATIAL STRUCTURE (NH)



- NH PMRAFs had a dawn-dusk elongated cigar shape that extended ~1600 km.
- NH PMRAFs were collocated with polar cap patches.

SPATIAL STRUCTURE (SH)



- SH PMRAFs had a less extended dawn-dusk extent than NH, being ~750 km.
- SH PMRAFs were also collocated with polar cap patches.

HEMISPHERIC SYMMETRY/ASYMMETRY

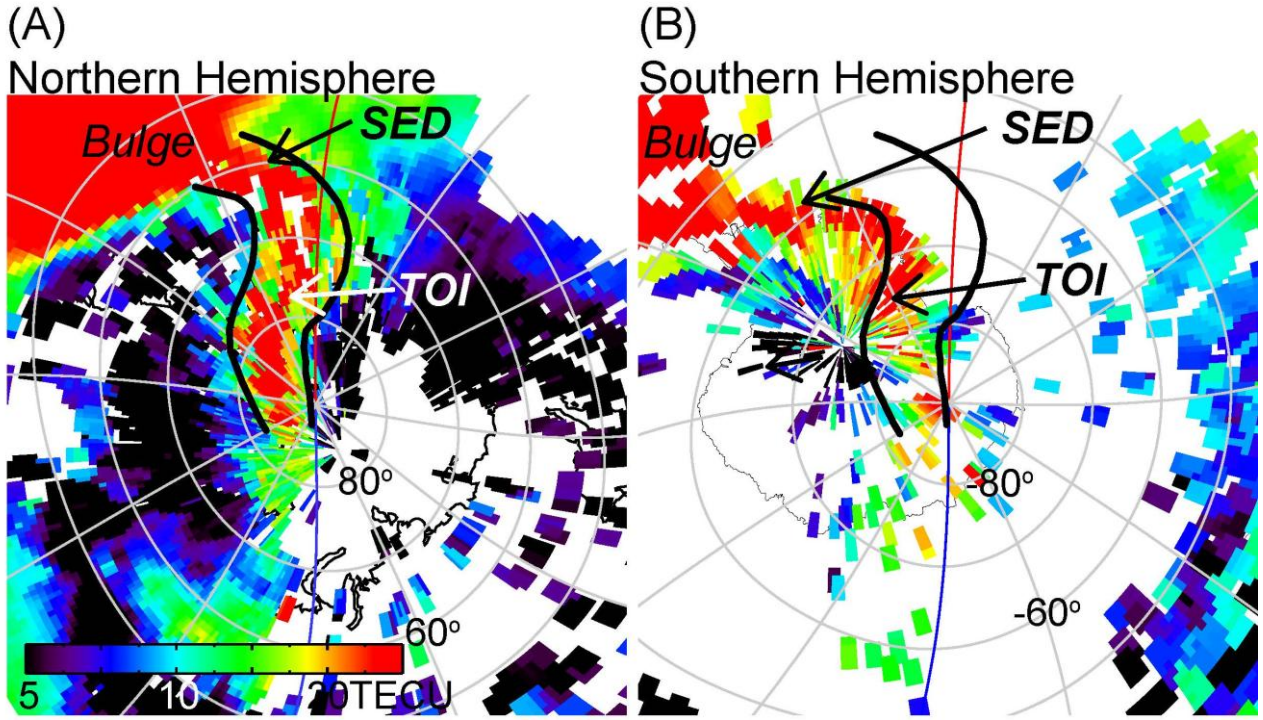
Symmetric temporal repetition

- PMRAFs produced at a similar rate, or even in close synchronization, in the two hemispheres.
- Interpretation: Produced by pulsed ionospheric flows associated with bursty reconnection.

Asymmetric spatial structure

- PMRAFs spatial sizes are drastically different.
- Interpretation: Due to asymmetrically distributed source population of high-density plasma?

HEMISPHERIC SYMMETRY/ASYMMETRY



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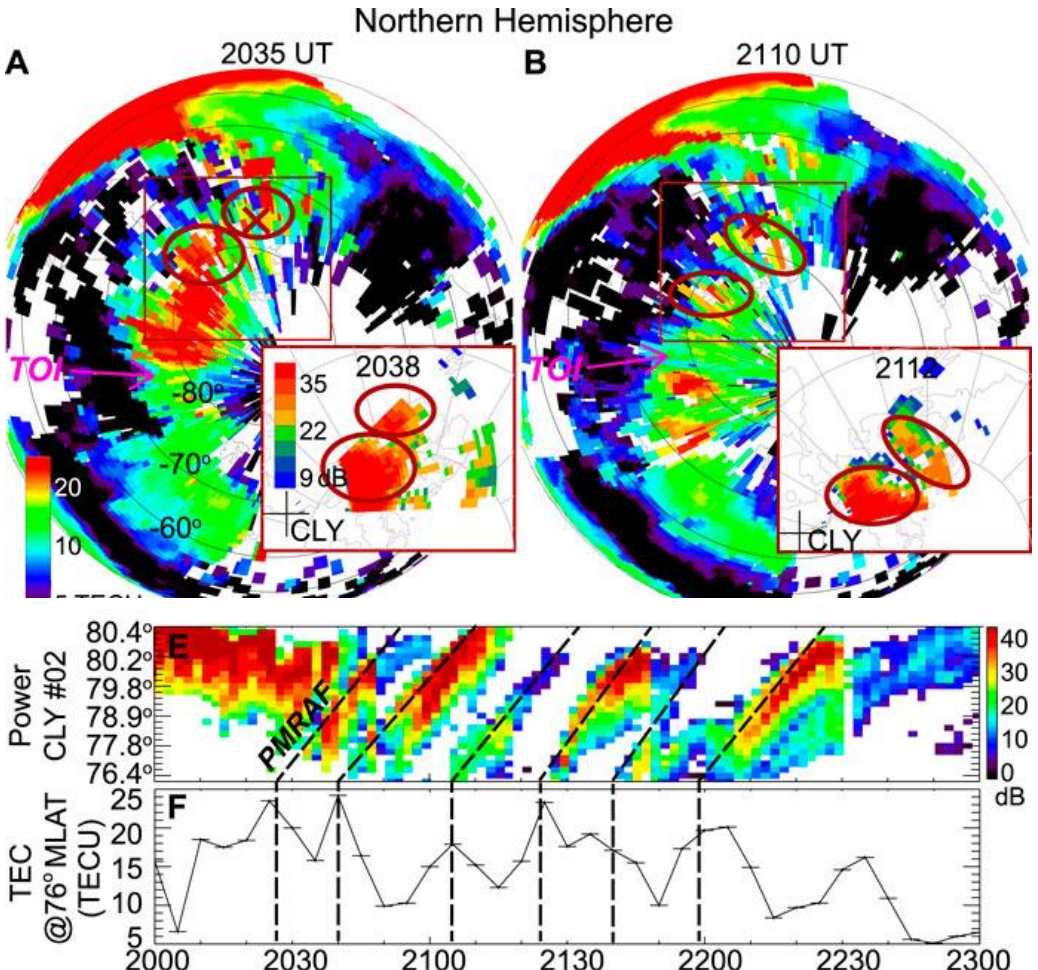
IONOSPHERIC STRUCTURE PRODUCING PMRAFS



- TOI extended from the dayside ionosphere at 50°–60° MLAT into the polar cap and towards the nightside.
- TOI not spatially smooth but contained localized structures.
  - Patches within TOI occurred at similar time and location to the PMRAFs.
  - Time evolution of TEC shows a series of peaks, and each peak coincides with a passage of a PMRAF.

SUMMARY

- PMRAFs were one-to-one collocated with polar cap patches embedded in a Tongue of Ionization.
- PMRAFs produced at a similar rate, or even in close synchronization, in the two hemispheres.
- PMRAFs spatial sizes are drastically different.
- The interesting symmetry and asymmetry of PMRAFs suggests that both magnetopause reconnection and local ionospheric conditions play important roles in determining the degree of symmetry of PMRAFs/patches.