

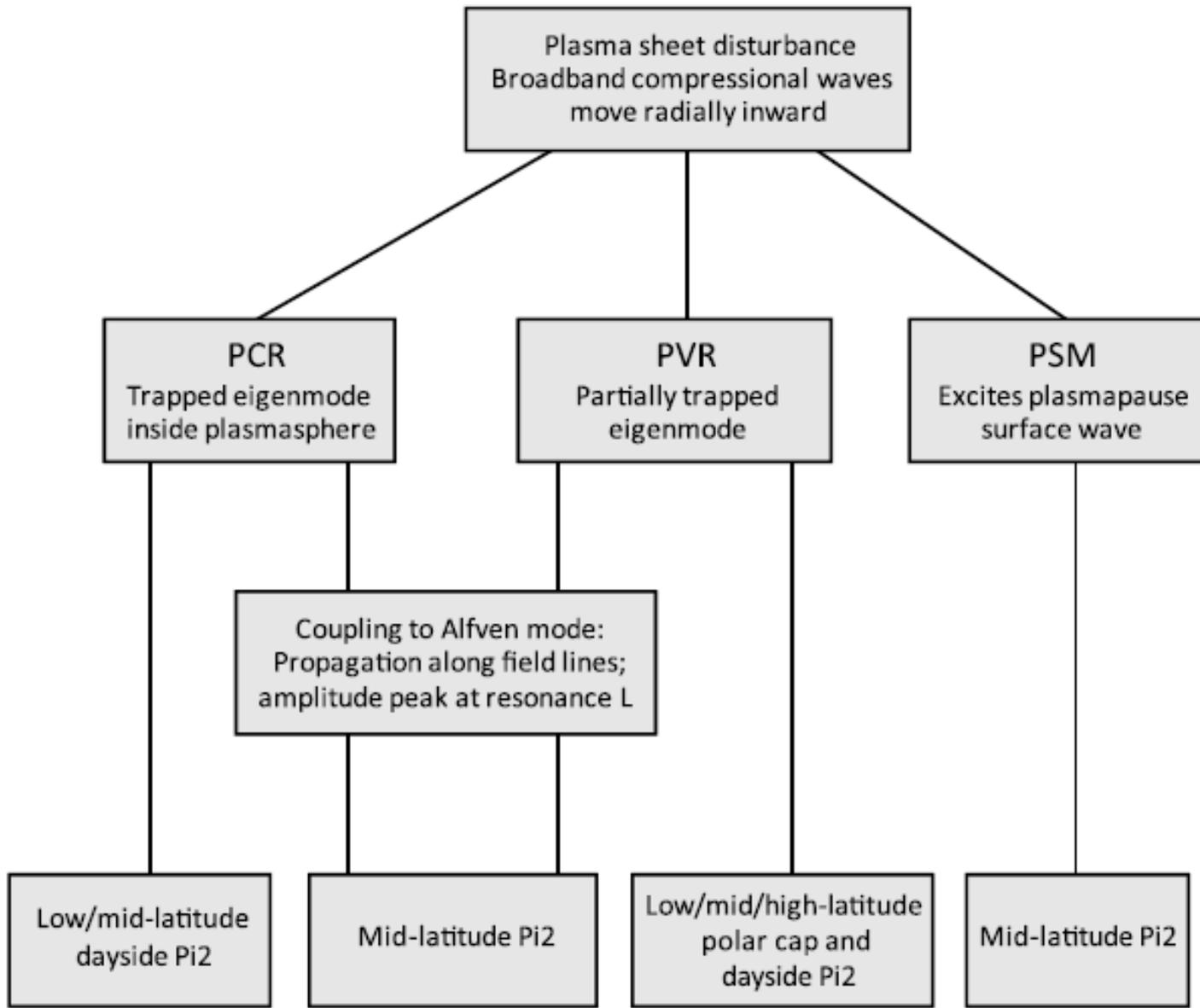
Nightside Pi2 wave properties during an extended period with stable plasmapause location and variable geomagnetic activity

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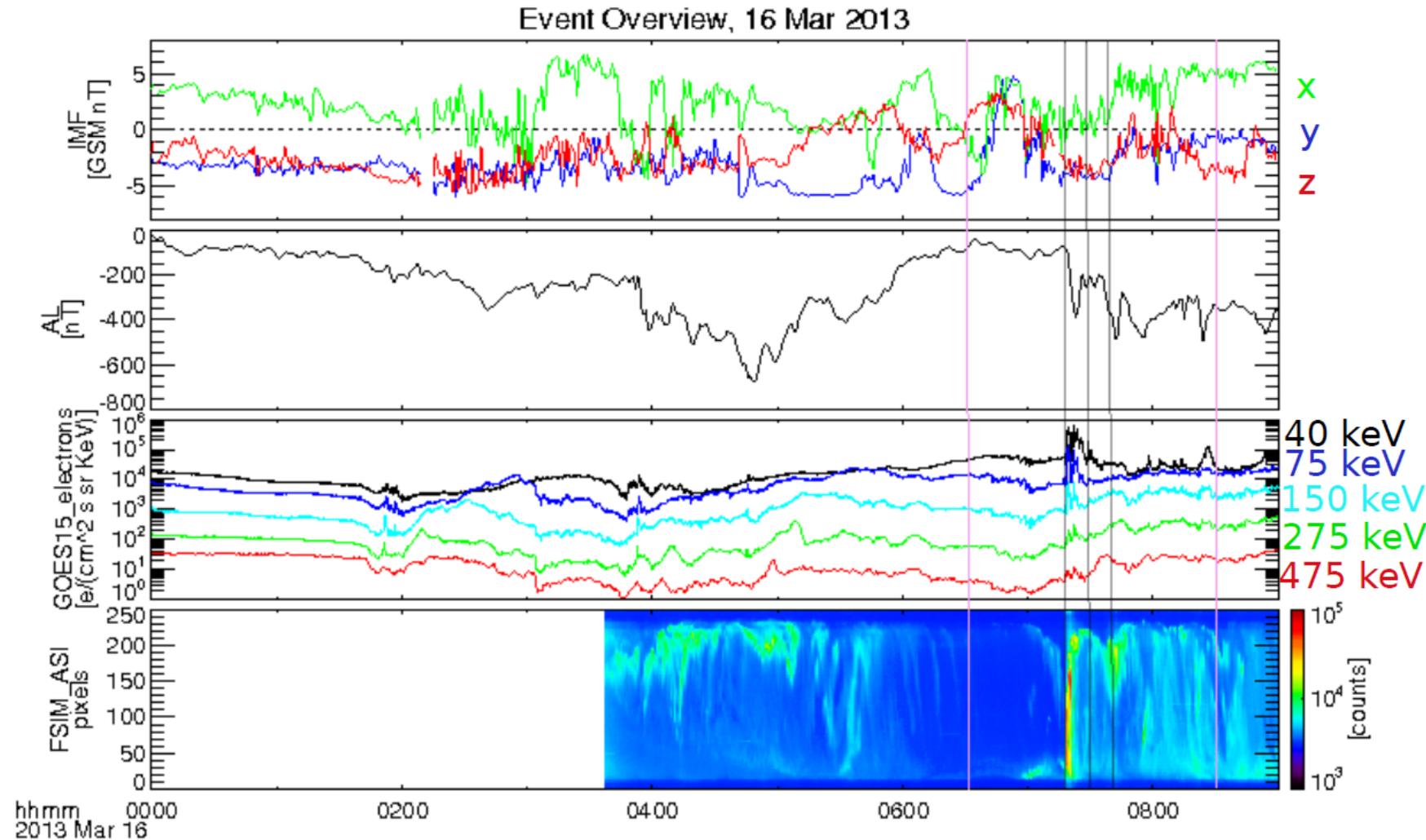


[Keiling and Takahashi, 2011]

- Inner magnetosphere Pi2 waves:
 - Wave periods of ~40-150s
 - Several generation mechanisms
- May impact dynamics of injected particles, transport to small L [e.g., Turner et al., 2015]
- Global plasmasphere structure, driving conditions, ionosphere affect different Pi2 wave modes in different ways
- **We conduct case study “experiment” where plasmasphere structure is stable while other factors vary**

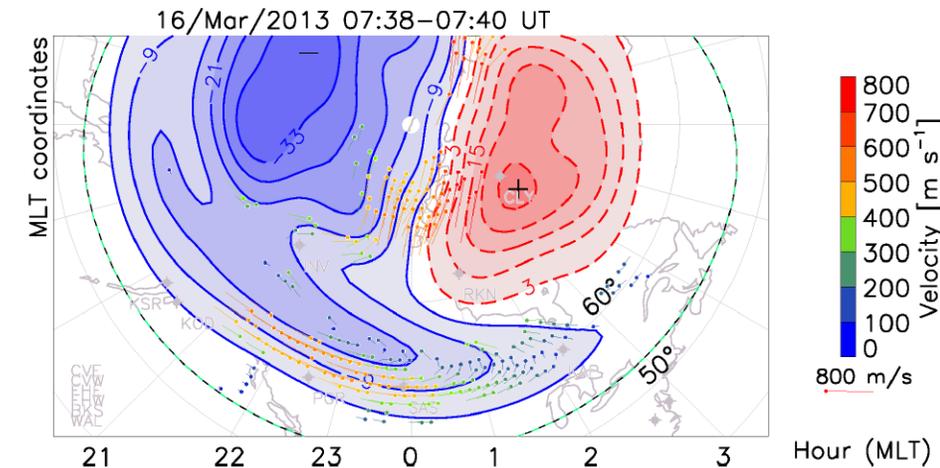
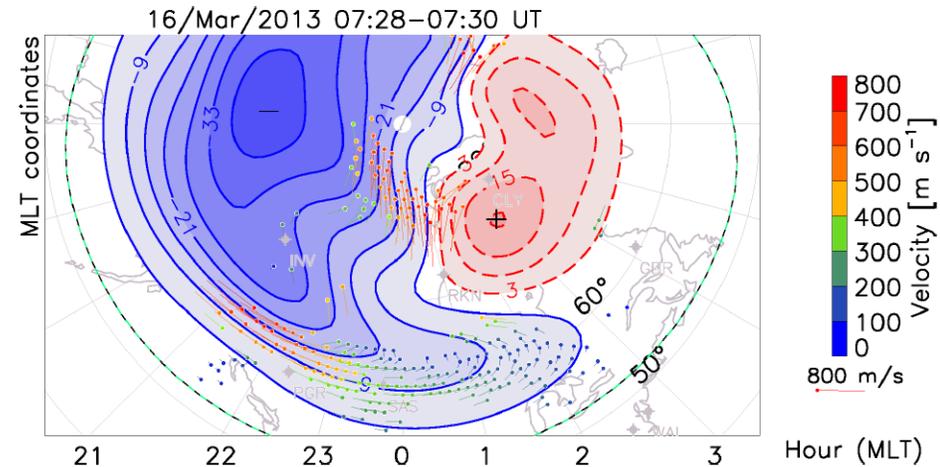
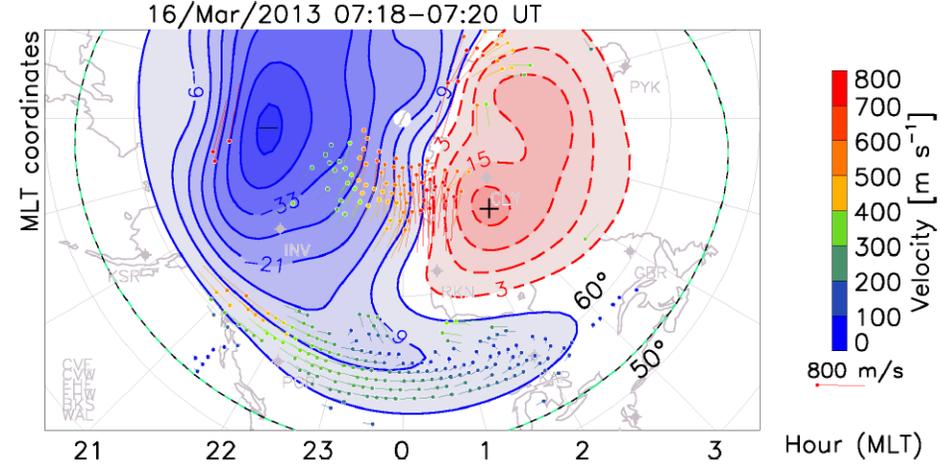
Event overview: 16 Mar 2013

- 16 Mar 2013, 0630-0830 UT
- A period of variable geomagnetic activity: IMF, auroral intensifications, AL index, particle injections



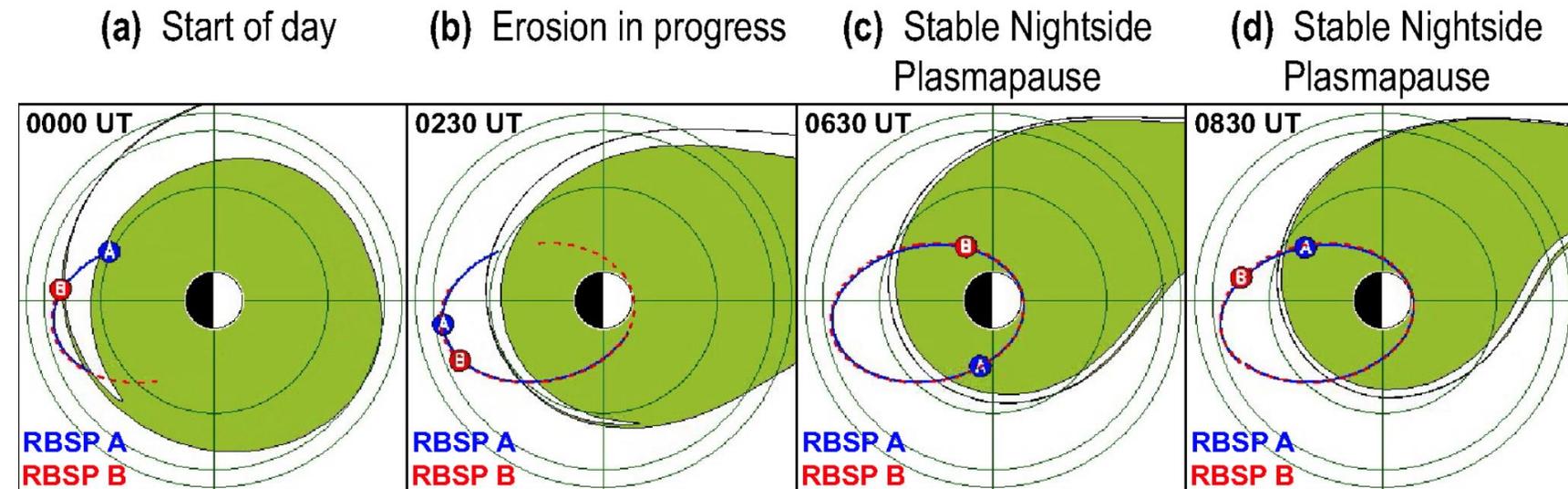
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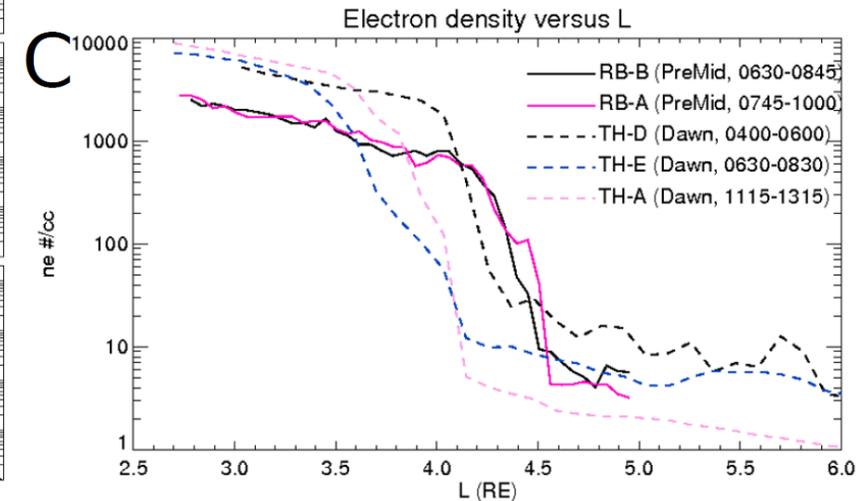
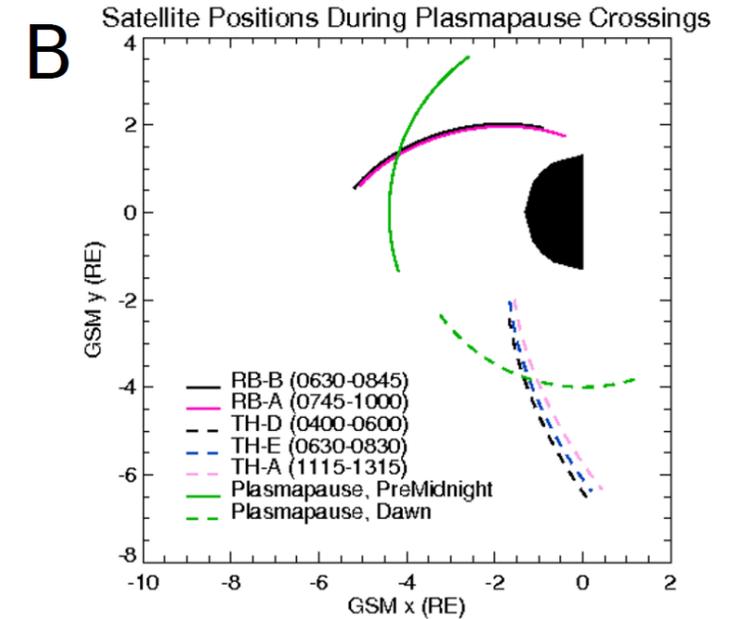
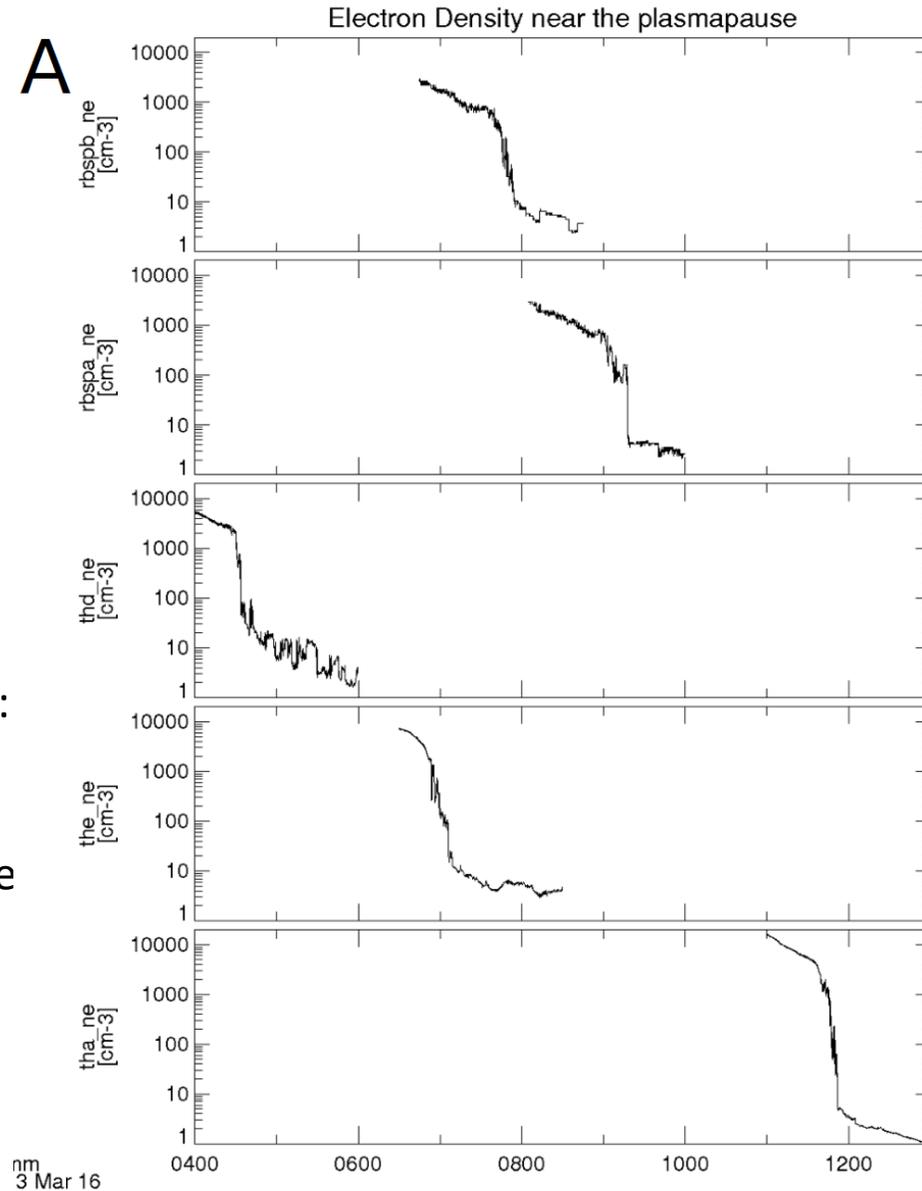
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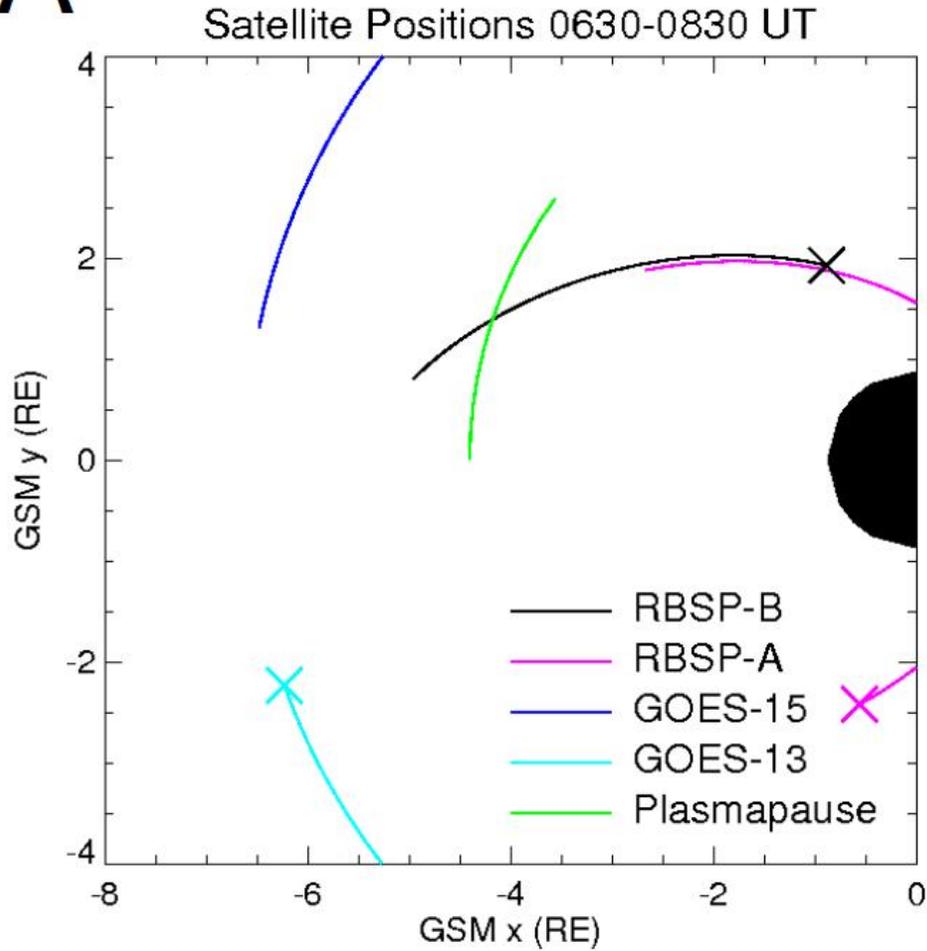
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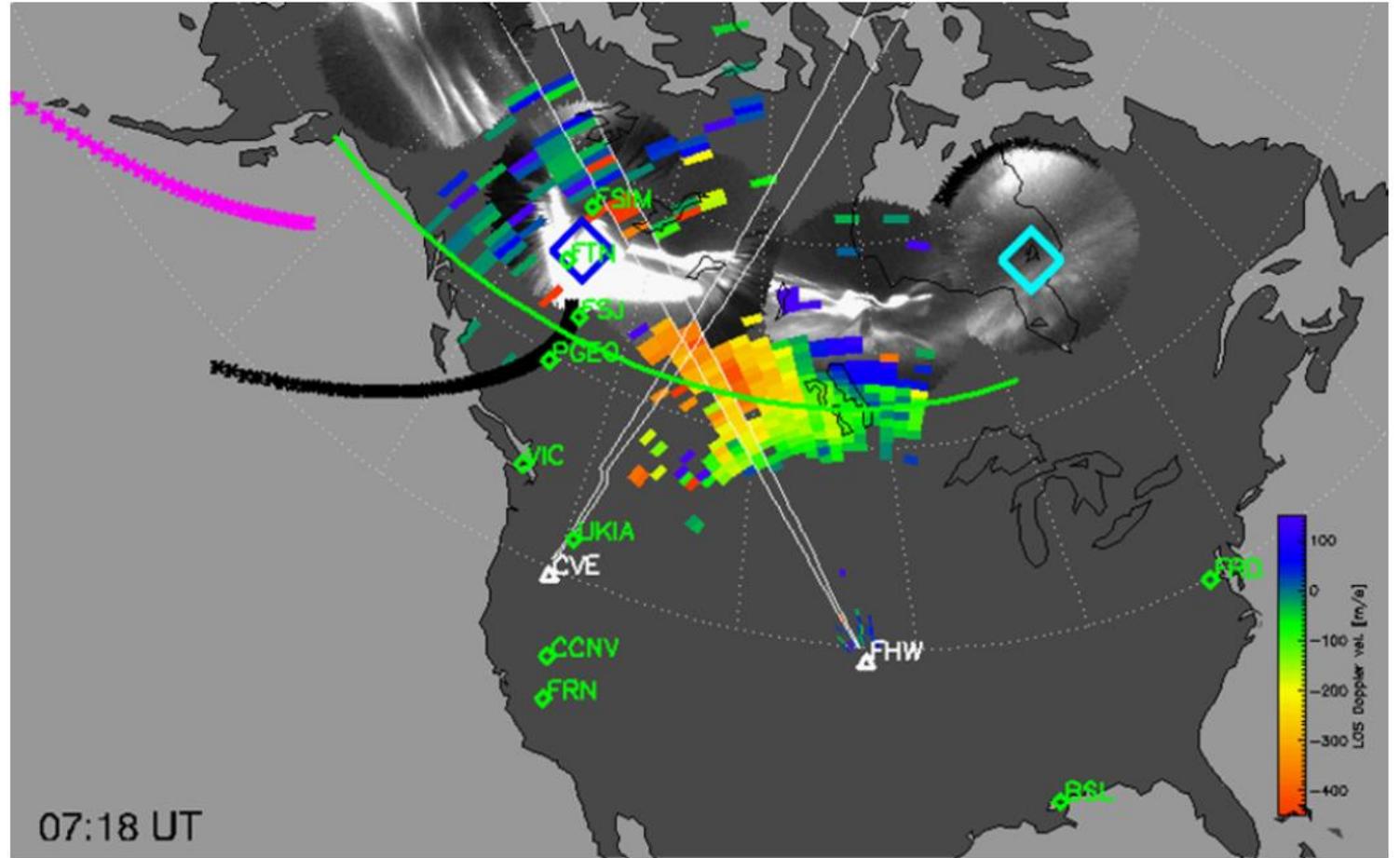


Locations of observations

A

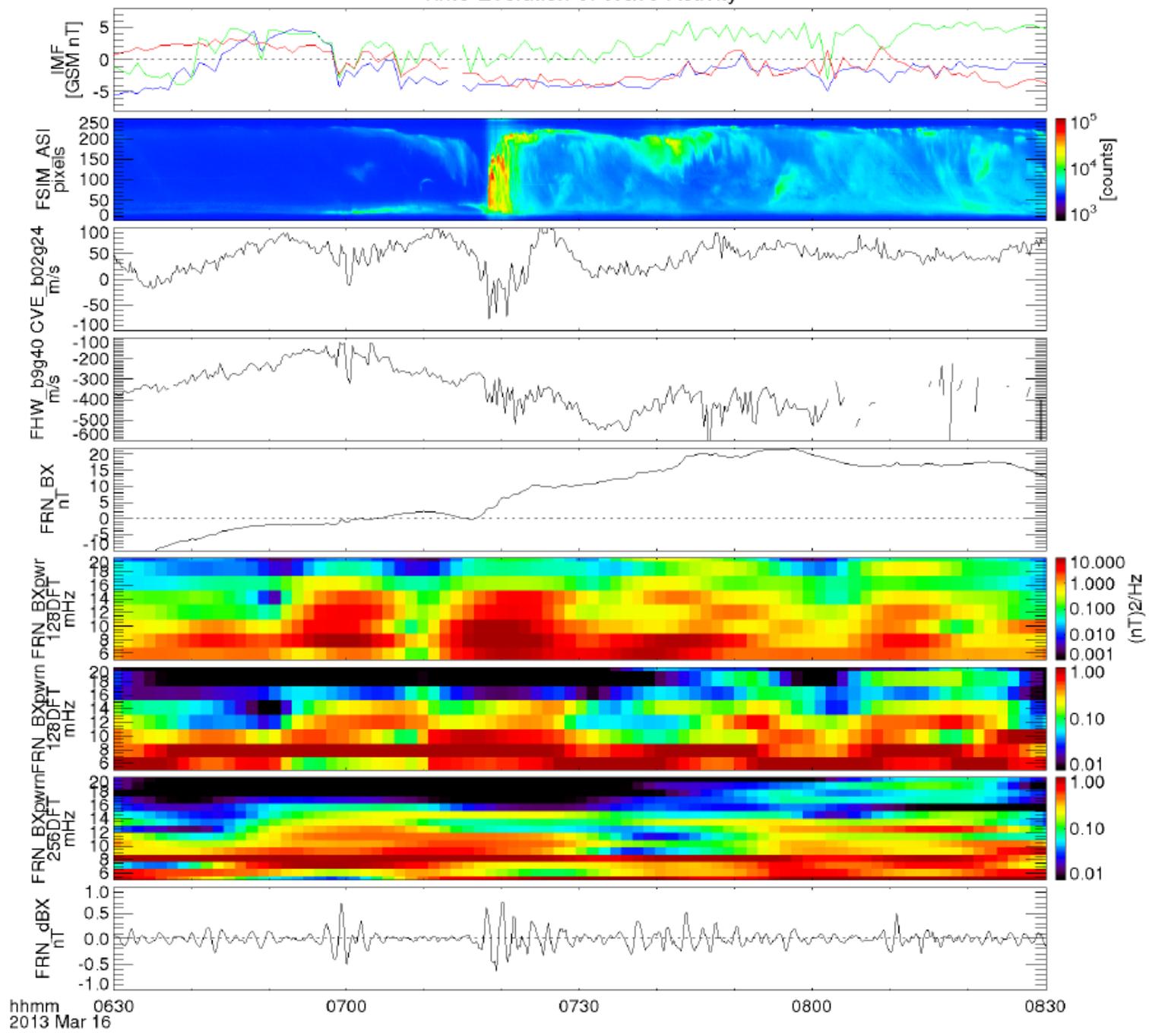


B



- Spacecraft and ground magnetometers distributed inside and outside plasmopause during period of interest
- We use global observations to distinguish between different Pi2 wave modes

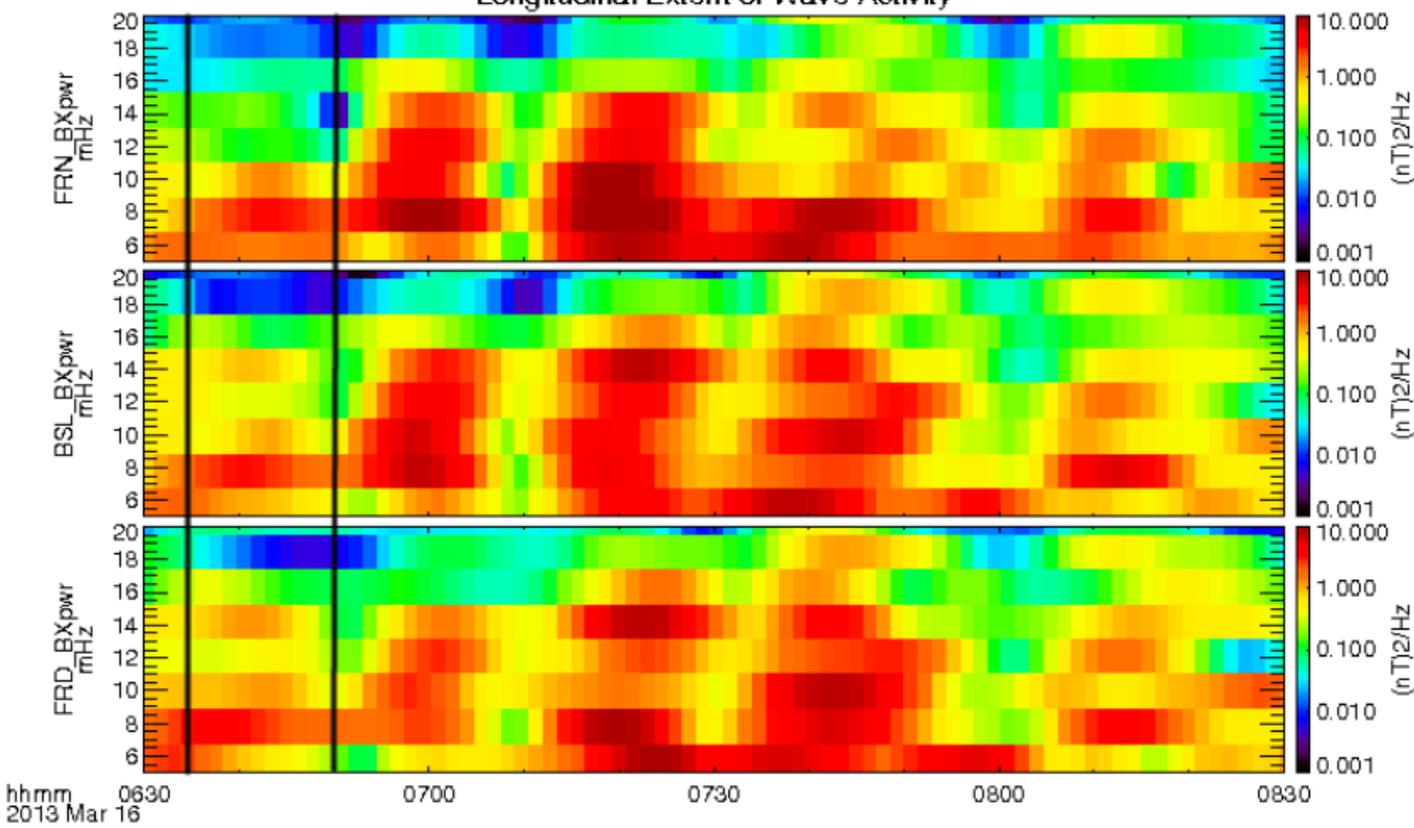
Time Evolution of Wave Activity



Pi2 waves, time evolution

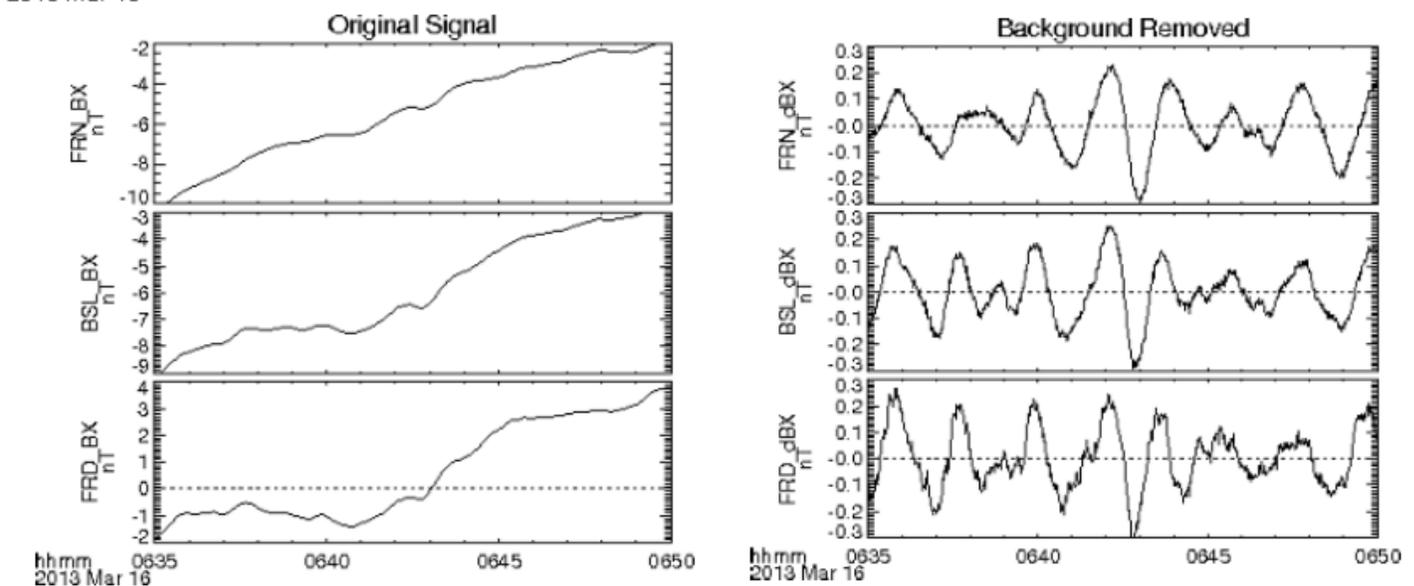
- Repeated bursts of Pi2 wave activity with similar frequency: 8 ± 0.5 mHz
- Seen in SuperDARN line-of-sight flows (corresponding to latitude/longitude just outside plasmapause, nightside), low-latitude ground magnetometer

Longitudinal Extent of Wave Activity

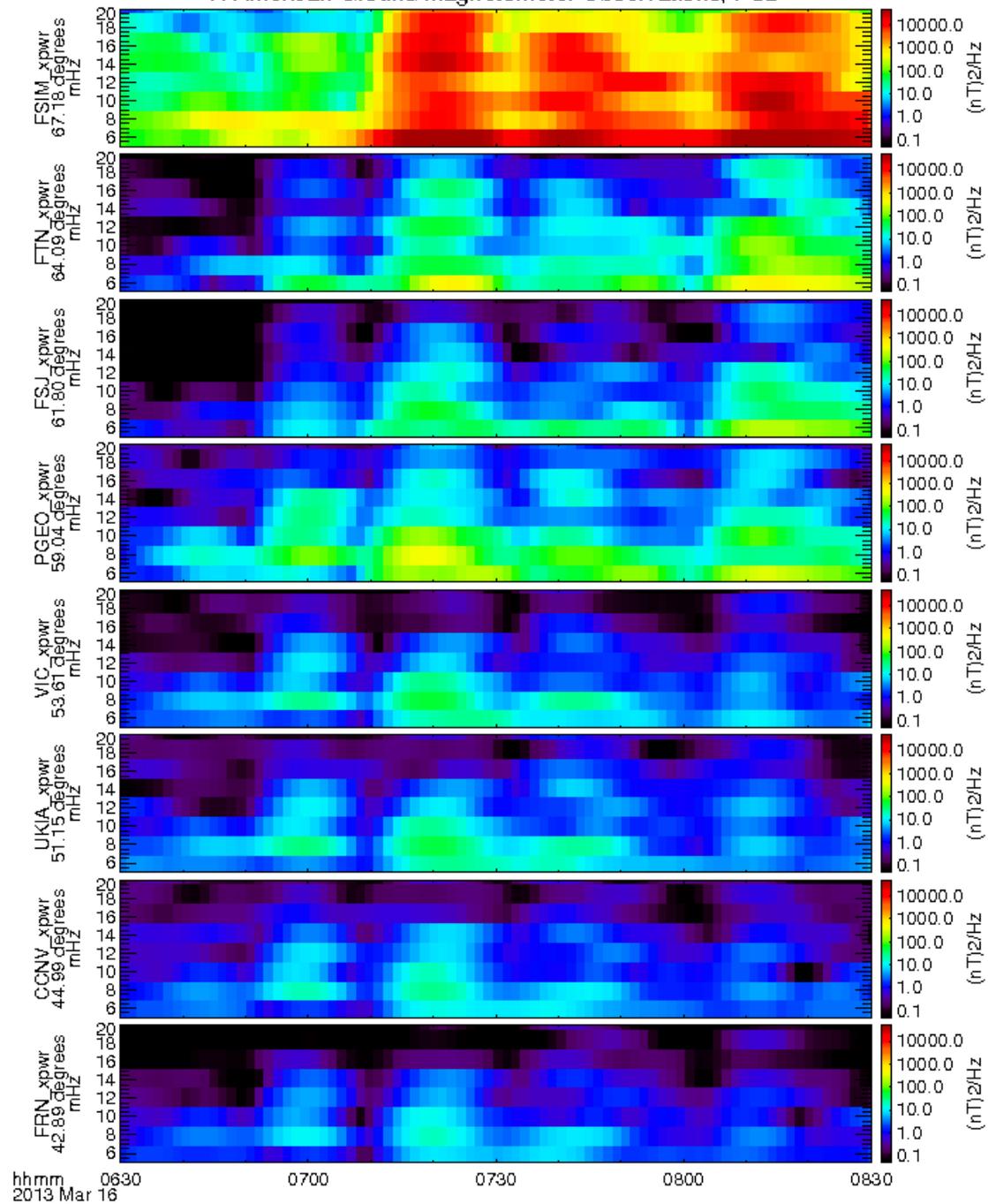


Pi2 waves, spatial variations

- These bursts of Pi2 waves are seen over several hours of MLT and low-latitude ground magnetometer stations
- Similar signals with very small time lags between stations indicate small azimuthal wave number



N American Ground Magnetometer Observations, PSD

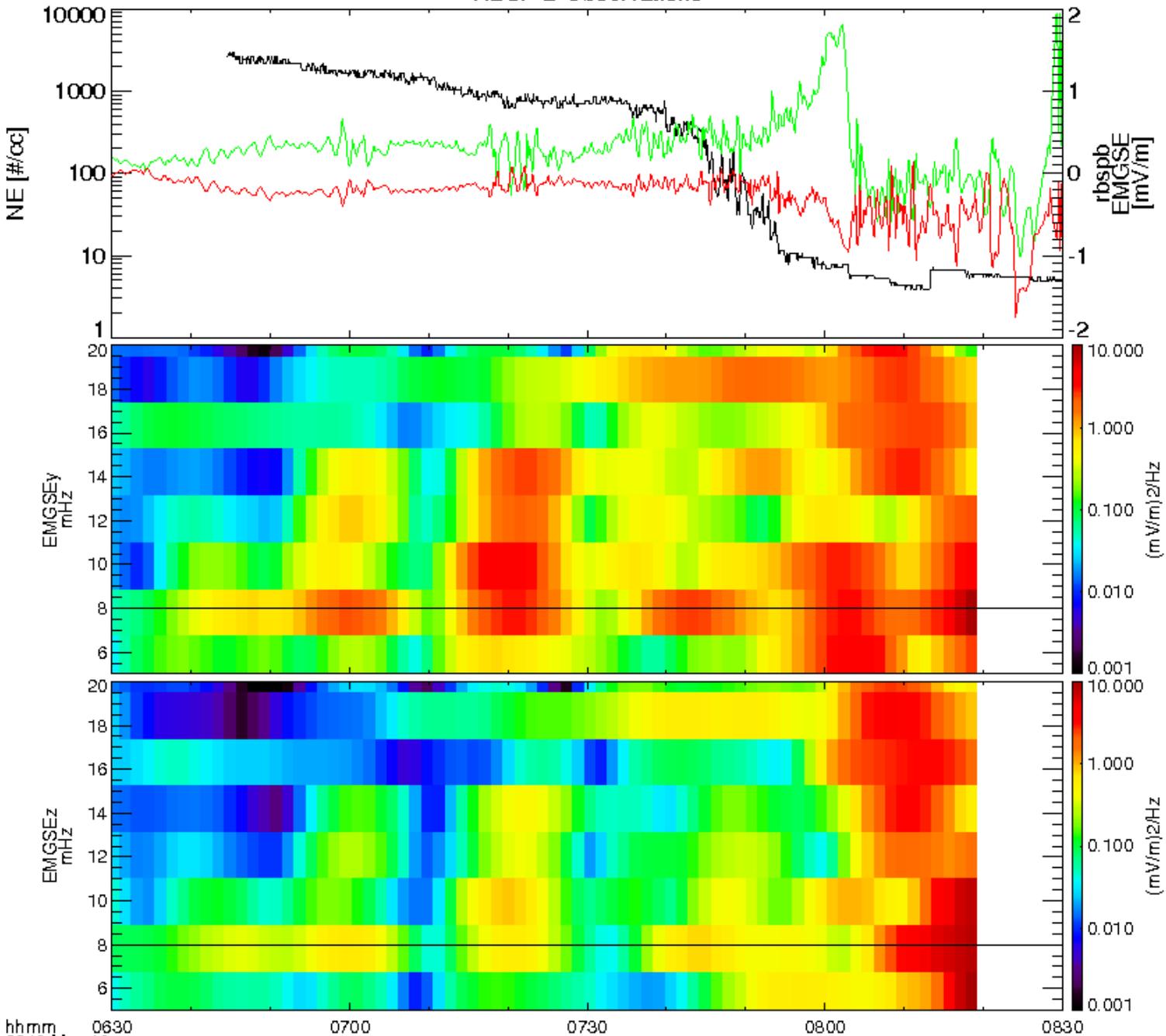


Pi2 waves, spatial variations

- These bursts of Pi2 waves are seen at a wide range of magnetic latitudes (~43-67 degrees), at least during the early part of the interval
- During later periods the signal is clearer at lower latitude stations, while higher latitudes have larger amplitude waves with a broader frequency spectrum
- Constant frequency over a wide range of latitudes, inside/outside plasmopause, and at range of times is consistent PVR

RBSP-B Observations

Pi2 waves, spatial variations



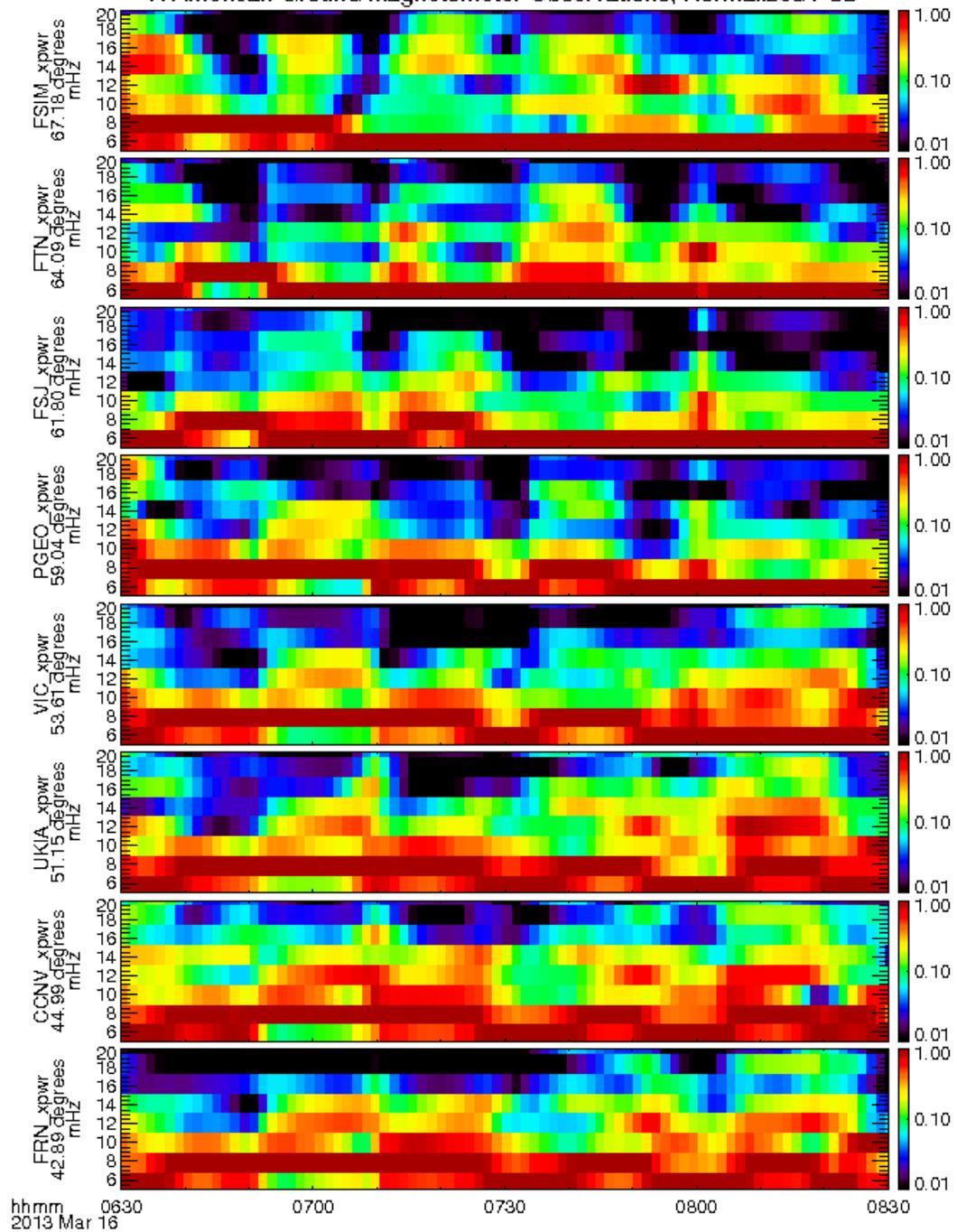
- In situ measurements from RBSP-B EFW also indicate the presence of these waves
- As with ground magnetometers, they are most clear at $L < \sim L_{pp}$
- GOES observations (backup slide) outside the plasmopause indicate wave activity with a broader frequency spectrum that overlaps 8 mHz

Summary

- Controlled experiment where nightside plasmapause does not evolve significantly, yet geomagnetic activity (IMF, auroral intensifications, substorms, ...) and ionosphere conditions (flows) are variable
- Observations of repeated bursts of Pi2 wave activity with very similar frequency are consistent with plasmaspheric virtual resonance
- Frequency of plasmaspheric virtual resonance is not affected by geomagnetic activity or ionospheric variability, though amplitude is affected by these factors

Future Work

- Comparisons with numerical simulations to explore how ionospheric conductivity, external driver affects the amplitude of these waves
- Examine dynamics of radiation belt/ring current during extended periods of discrete frequency ULF waves

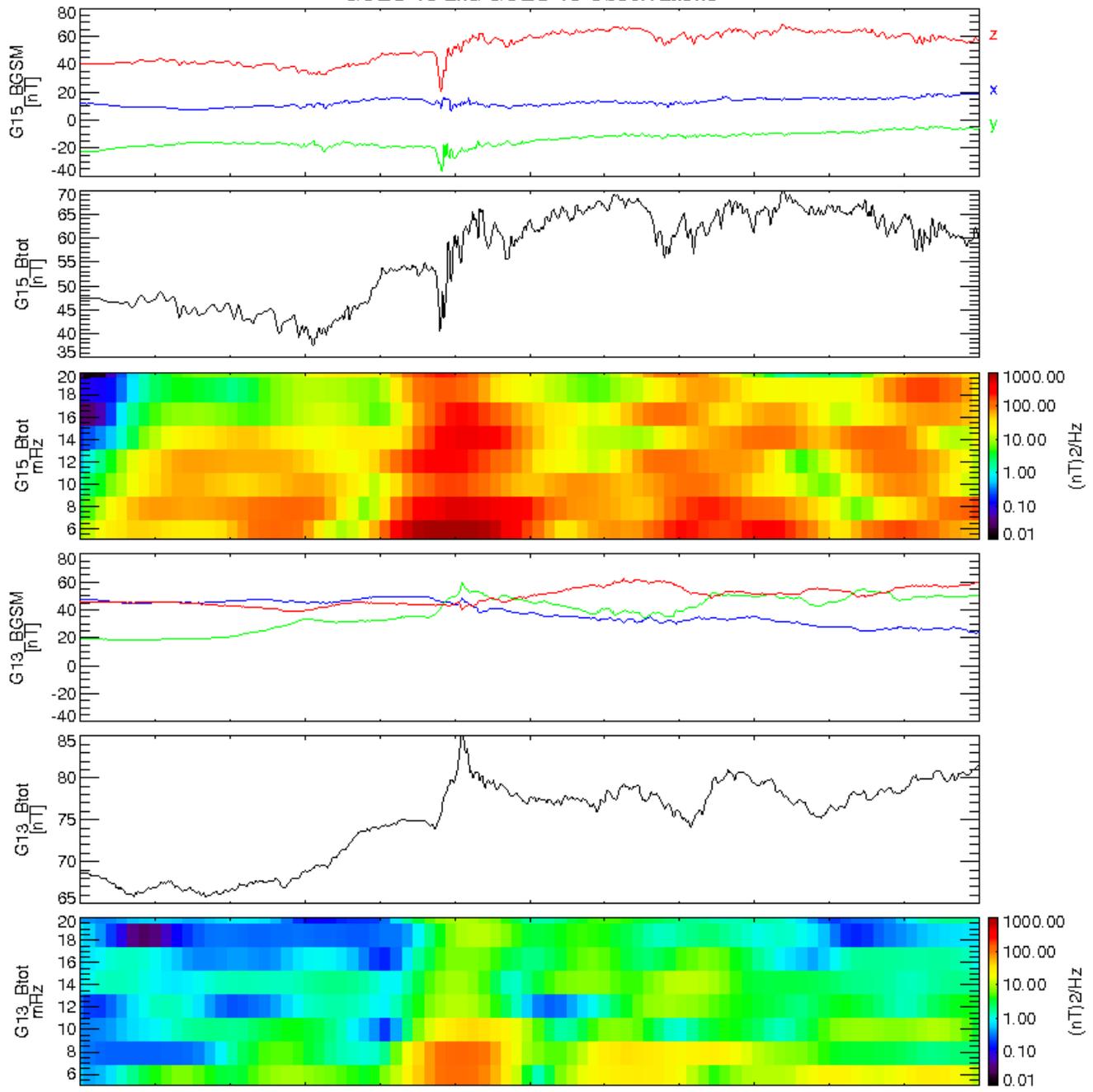


hh mm
2013 Mar 16

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GOES-15 and GOES-13 Observations



Pi2 waves, spatial variations