UNIVERSITY OF CALGARY

# Statistical Study of Whistler-mode Waves during Substorm Injections

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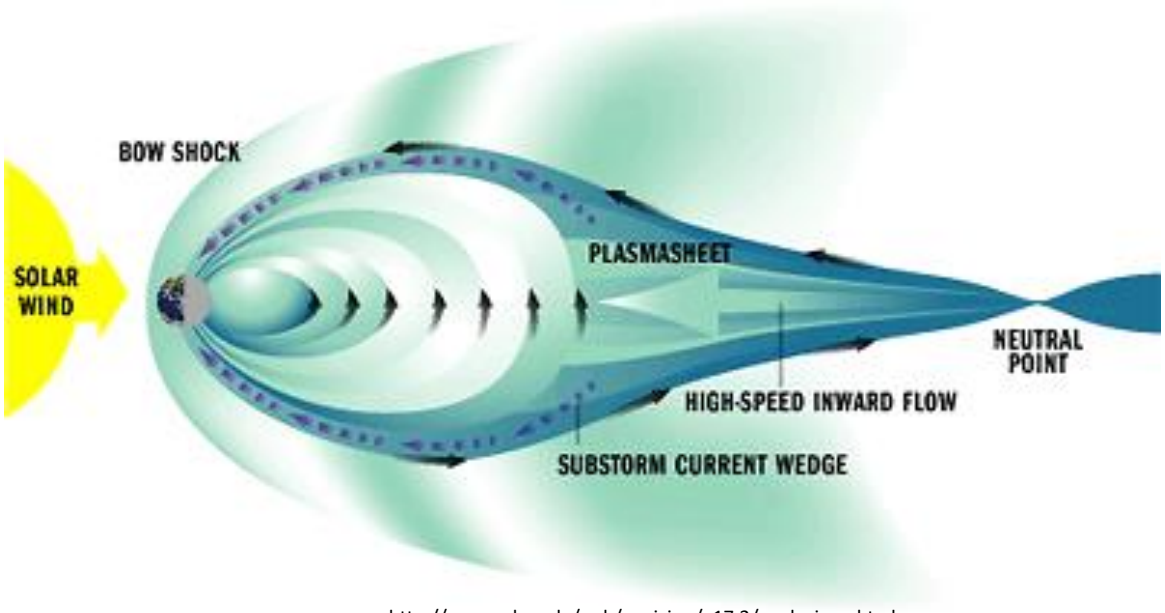
# Substorm Injection

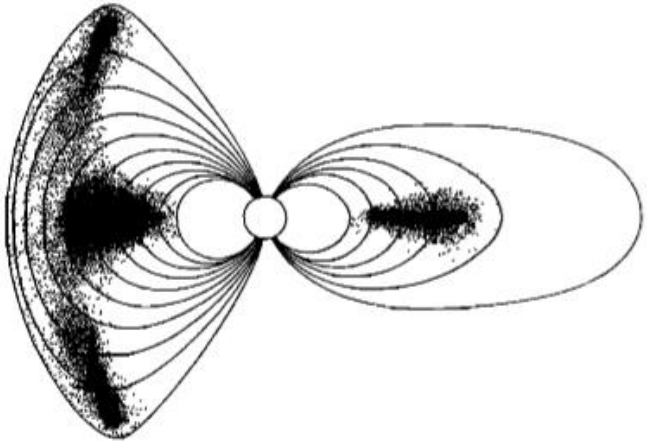
- Substorms occur when the magnetosphere suddenly releases vast amounts of stored solar wind energy to produce a dramatic increase in flux levels over a large energy range(e/ion)




http://www.sdsc.edu/pub/envision/v17.2/explosions.html

# Wave Generation

- Anisotropy in $e^-$ flux distribution as a result of substorm injection generates waves(Whistler mode chorus)
- Waves can scatter $e^-$ and cause precipitation into the atmosphere



Schematic representation of the regions in which chorus is generated

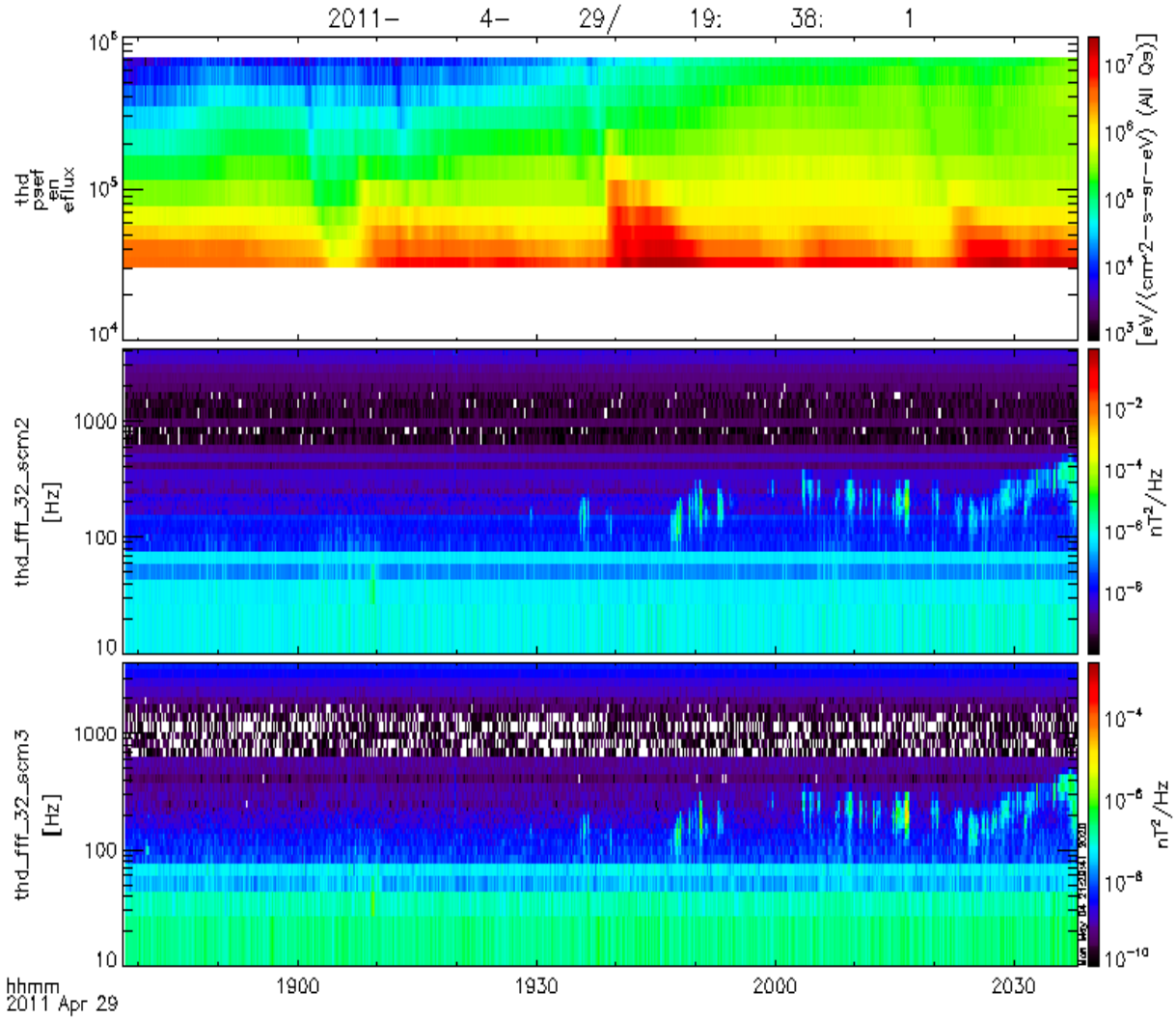
BT Tsurutani, EJ Smith - Journal of Geophysical Research, 1977

# THEMIS

- The Time History of Events and Macroscale Interactions during Substorms, or **THEMIS,** is a constellation mission consisting of 5 satellites in different orbits together with a ground array of magnetometers and auroral cameras located in North America.
- The outer-most satellites will be as far away as 30 Re. In the tail science phase the apogee of P3, P4, and P5 are approximately 12 Re.

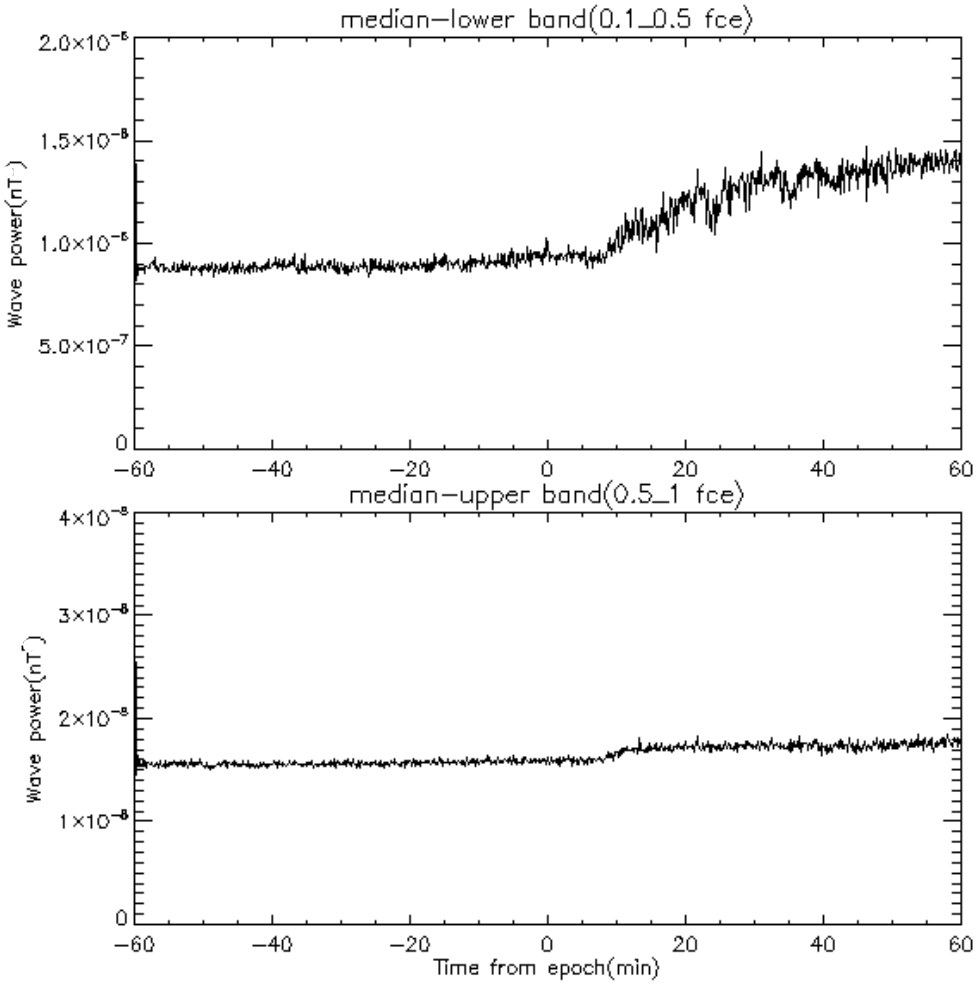
http://themis.ssl.berkeley.edu/orbits_more.shtml

# Case Study



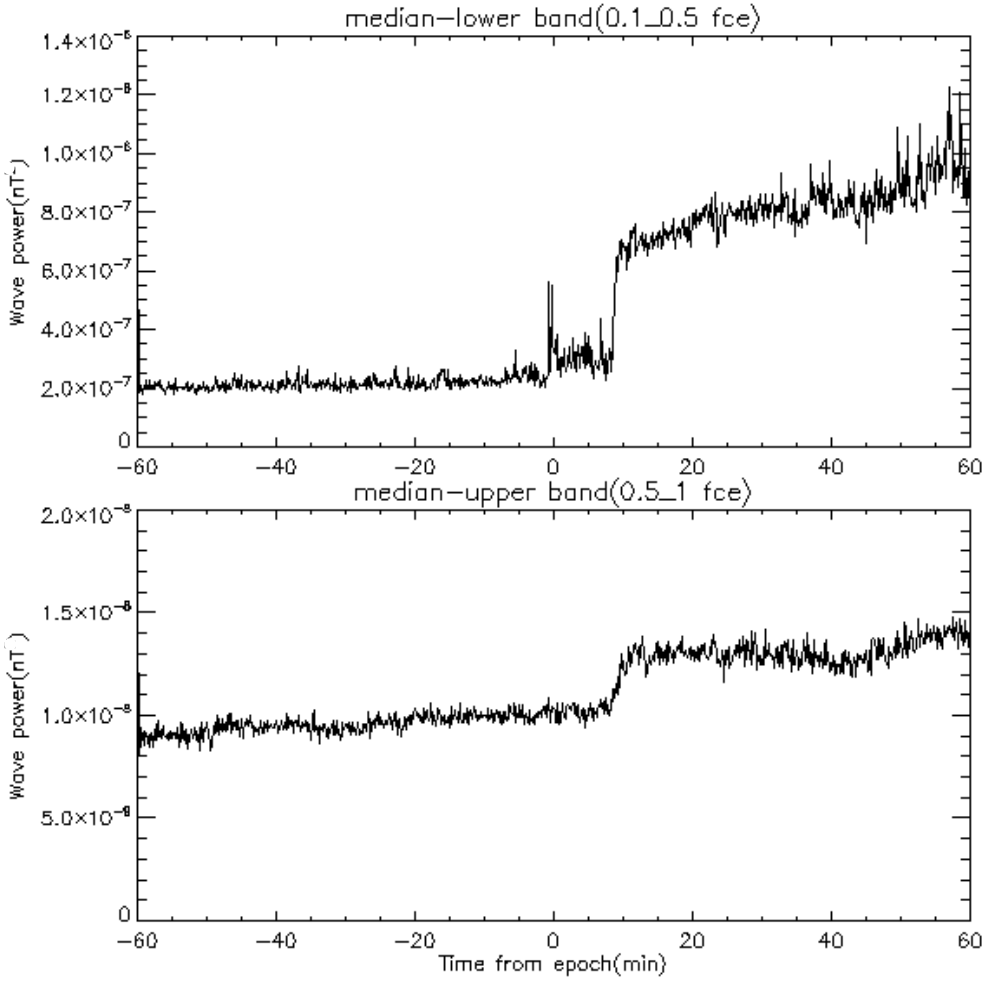

- Top: THEMIS SST data (Solid Sate Telescope) → electron flux enhancement at the onset (19:38:01)
- Bottoms: THEMIS SCM data (Search Coil Magnetometer)→ wave generation after onset

# Superposed Wave Power




- Integrated wave power in Lower/Upper band chorus
- 423 Selected injection events:
  - 2011-2014, probe ‘d’
  - THEMIS in tail phase
- Median over all 423 events

# Superposed Wave Power




- Now we limited the events to L-shell < 8
- This is median over 136 left injection events

# Future steps

- Increase the number of events
- Calculate diffusion rates based on the measured wave power
- Compare diffusion rates with strong diffusion