

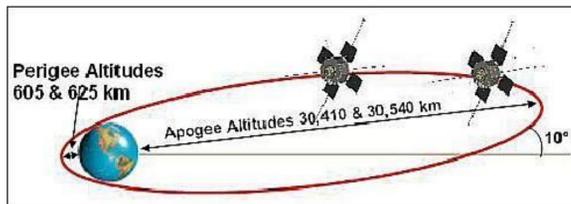
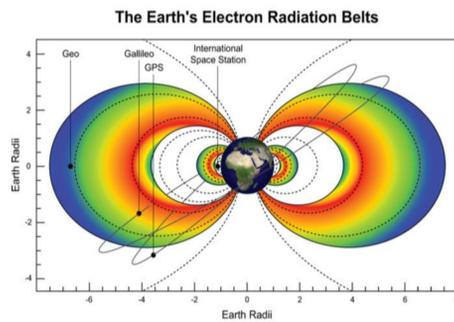
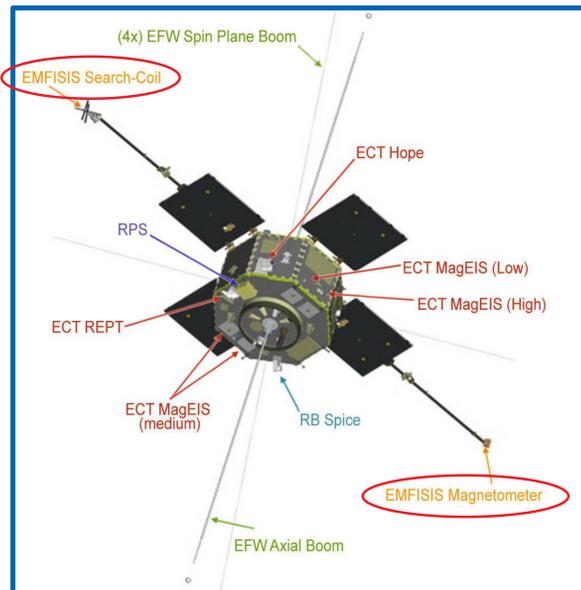
Variations of Whistler Mode Waves with Geomagnetic Conditions and Magnetic Local Time

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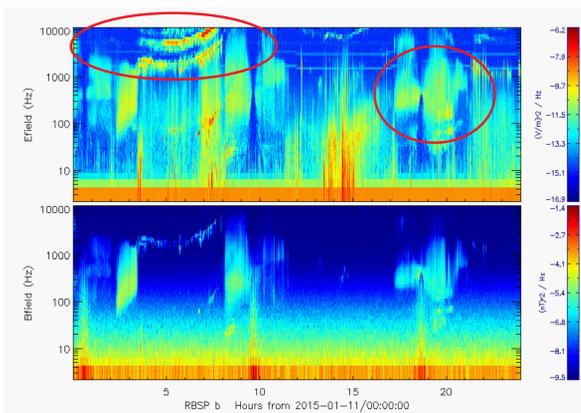
ABSTRACT

The Van Allen probes spacecraft measure plasma waves in the Earth's inner magnetosphere with unprecedented accuracy and temporal resolution. Many studies have identified one particular mode of plasma wave – whistler mode chorus – as playing a significant role in both the energization of electrons to radiation belt energies and electron loss from the outer radiation belt to the atmosphere. However, almost all of these studies have been based on statistical models from heavily averaged data. The Van Allen Probes' data is uniquely capable of observing both peak and average wave power at high time resolution. This project will use this novel capability to investigate variations of whistler-mode wave properties with respect to geomagnetic activity index and magnetic local time.



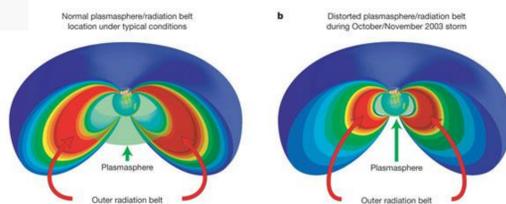
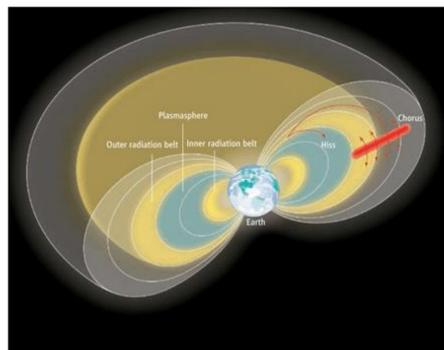
PLASMASPHERIC HISS

- Incoherent whistler-mode emission
- Confined to the interior of the plasmasphere
- Believed to originate from chorus waves propagating to lower L where they become trapped within the plasmasphere
- Observed in plasmaspheric plumes during geomagnetic storms contributing to scattering loss of outer electrons



CHORUS

- Discrete, coherent whistler-mode emission
- Occurs in two distinct bands above and below one-half electron gyrofrequency
- Significant in the local acceleration and loss of electrons from the radiation belt to Earth's atmosphere
- Form outside of the plasmasphere



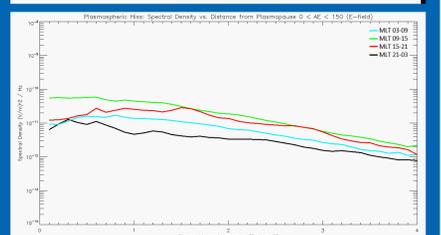
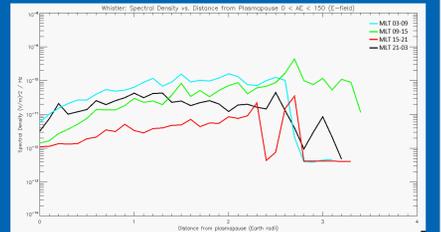
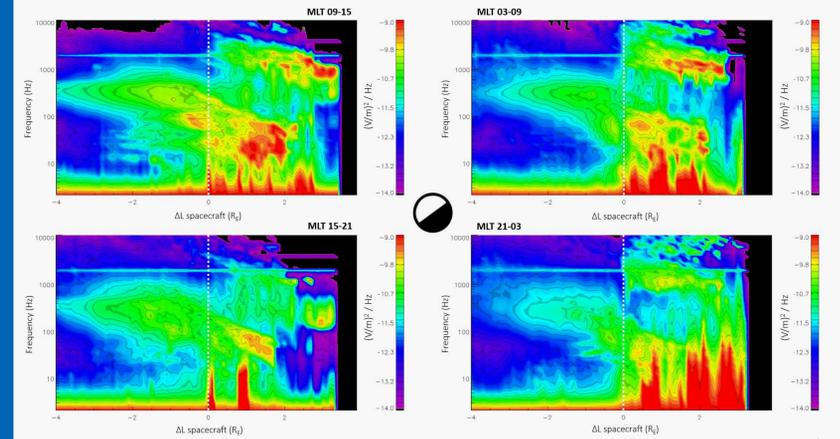
OUR WORK

An investigation into how whistler-mode waves vary with:

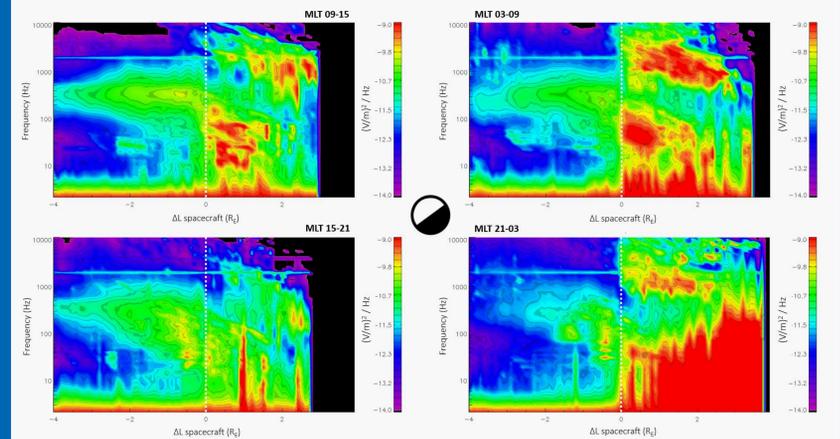
- AE:
- Auroral electrojet index
 - Measure of geomagnetic activity at a given time
 - AE 0-150 (low activity), AE 150-300 (moderate activity), AE > 300 (high activity)

- MLT:
- Magnetic local time
 - Gives spacecraft position relative to the sun
 - MLT 03-09 (dawn), MLT 09-15 (day) MLT 15-21 (dusk), MLT 21-03 (night)

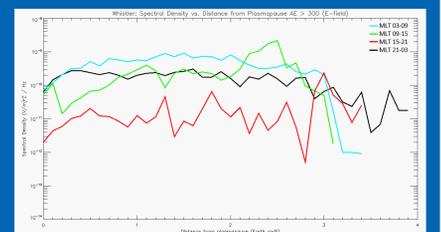
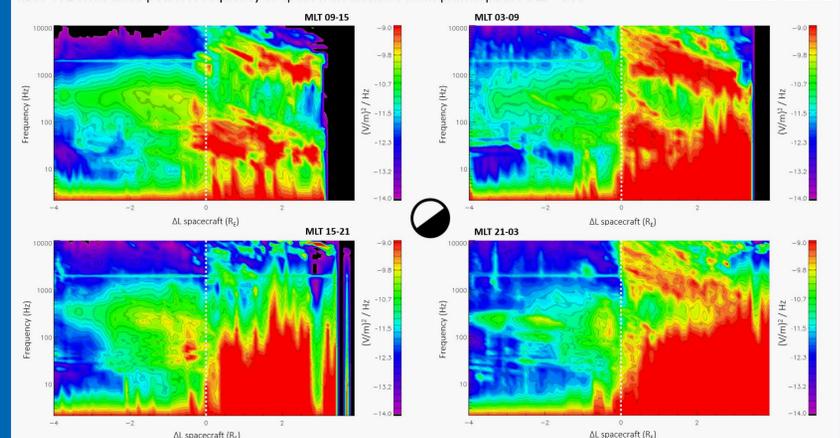
RBSP-A E-field wave power: Frequency vs spacecraft distance from plasmapause AE < 150 2012.10.02 - 2015.05.01



RBSP-A E-field wave power: Frequency vs spacecraft distance from plasmapause 150 < AE < 300 2012.10.02 - 2015.05.01



RBSP-A E-field wave power: Frequency vs spacecraft distance from plasmapause AE > 300 2012.10.02 - 2015.05.01



CONCLUSIONS

- Theoretical models of strongest hiss found at or near plasmapause confirmed explicitly by actual data
- Mysterious local maxima in B-field hiss spectral density plot at quiet geomagnetic activity (~1.5 R_E)
- Earthward propagation of average hiss power with increased geomagnetic activity
- Further confirmation of greatest chorus power found in dawn MLT sector
- Noon time (MLT 09-15) hiss has greatest spectral density regardless of activity index while night time (MLT 21-03) has least spectral density
- Hiss nearly constant over MLT, but varies with activity index
- Chorus power varies by orders of magnitude with both MLT and activity index
- At greater ΔL values in E-field data, chorus spectral density plots may be including unwanted wave power from time domain structures

FUTURE WORK

- Introduce new parameters to further explore whistler-mode wave variability (magnetic latitude, solar wind driving conditions, etc.)
- Develop a method for removing time domain structures that dominate lower E-field frequency bands (f < ~1000 Hz) where ΔL > 0
- Further investigate the mysterious local maxima in B-field hiss spectral density plots

REFERENCES

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- Thorne R.M., 2010. Radiation belt dynamics: The importance of wave particle interactions. *Geophysical Research Letters* 37: L22107