

SuperDARN: Looking ahead to RBSP

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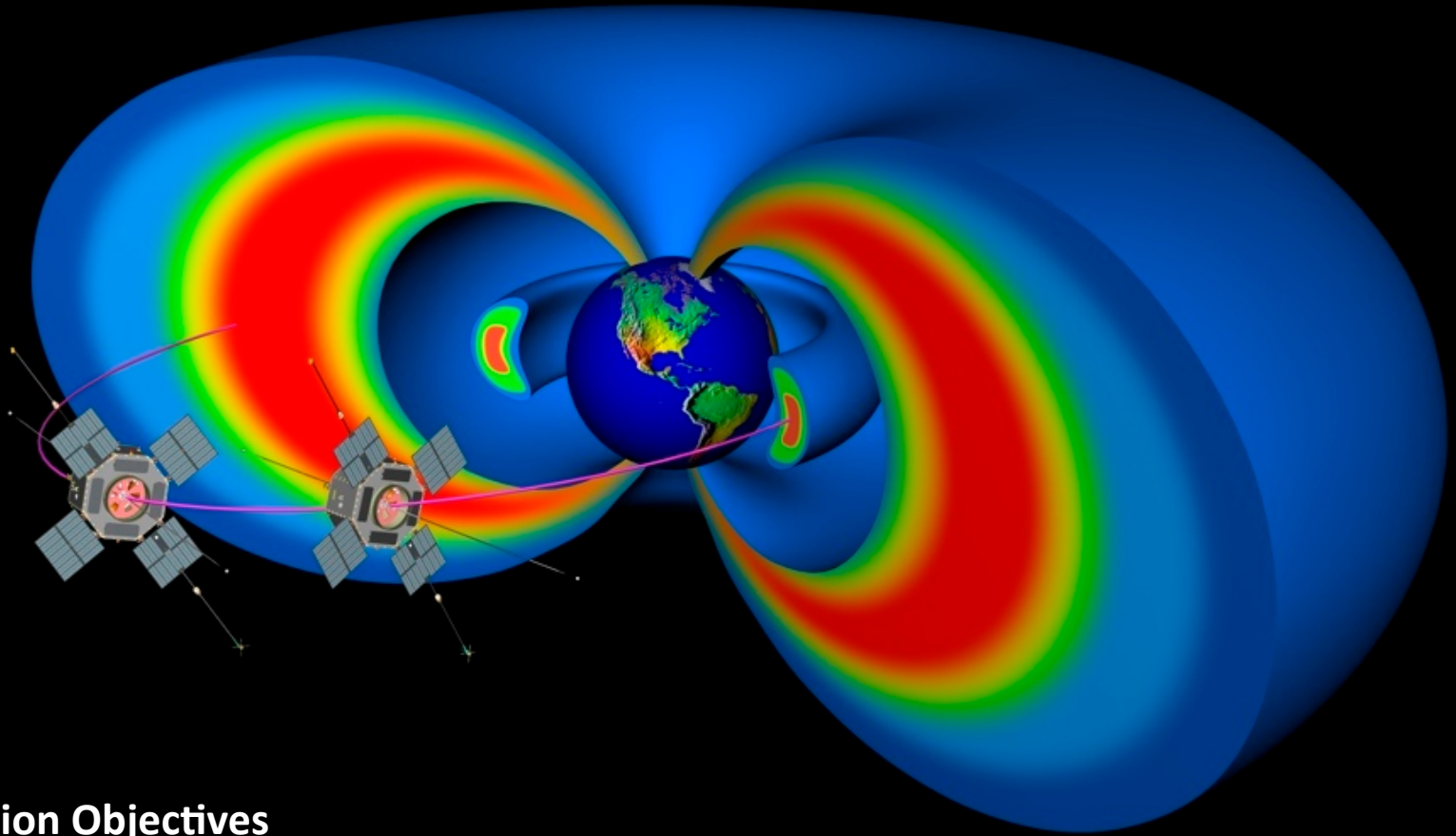
Tim Yeoman & Robert Fear

Department of Physics & Astronomy, University of Leicester, UK

Robin Barnes

JHU/APL, USA

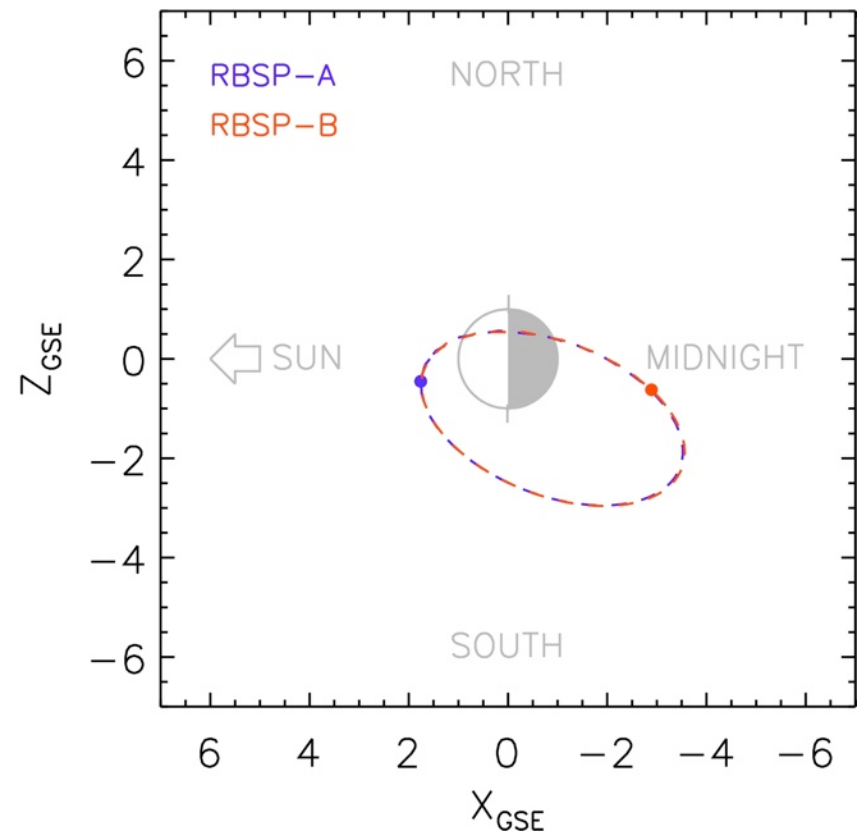
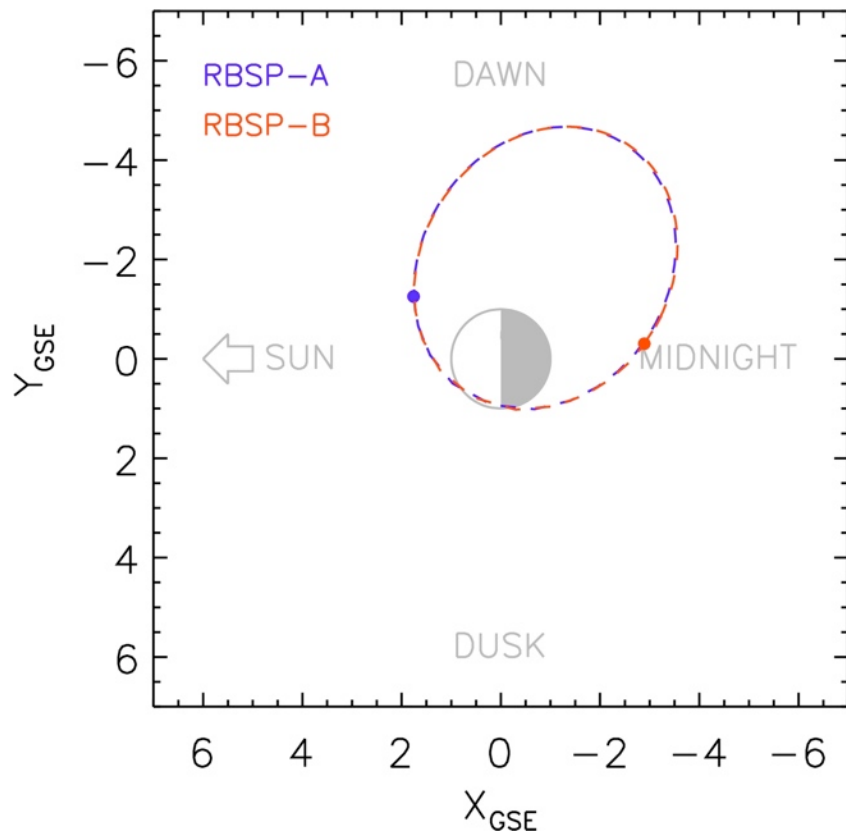




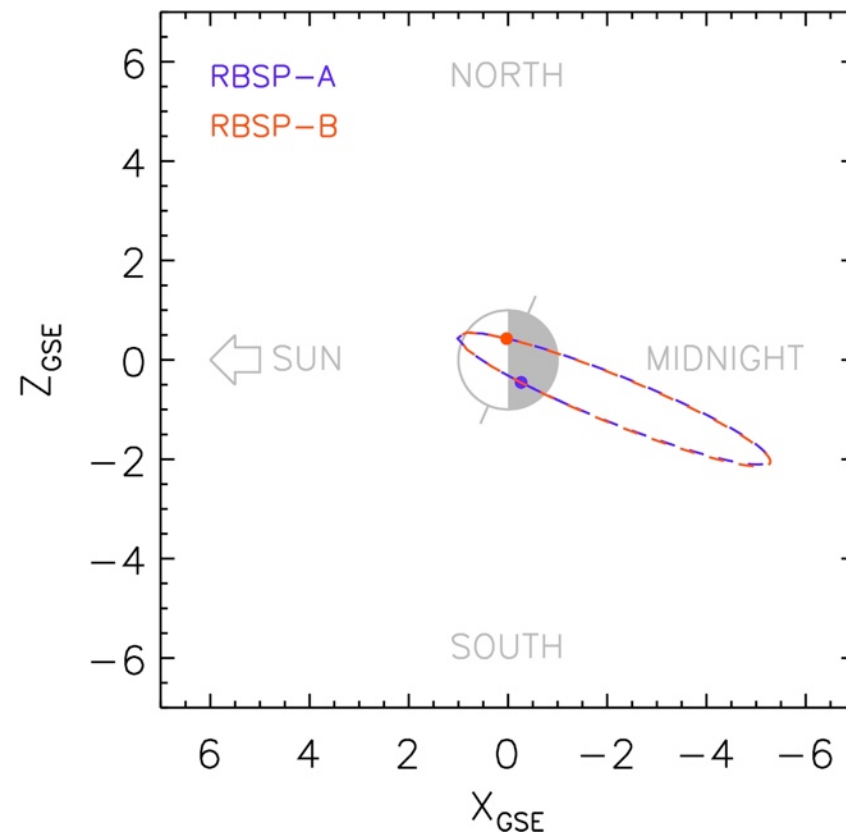
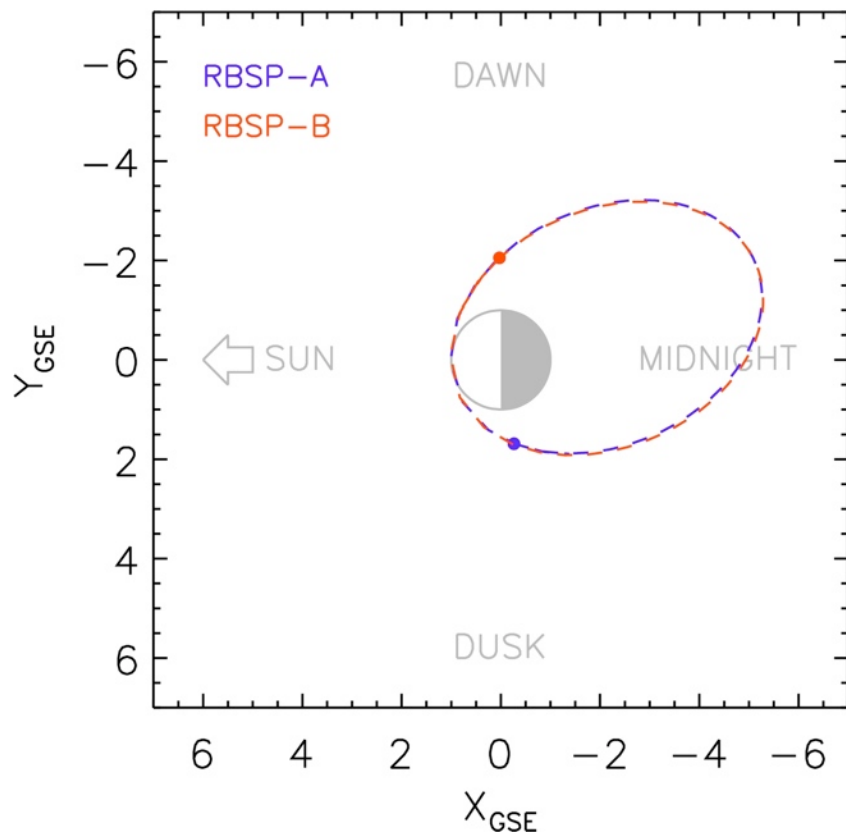
RBSP Mission Objectives

- Discover which processes, singly or in combination, accelerate and transport radiation belt electrons and ions and under what conditions
- Understand and quantify the loss of radiation belt electrons and determine the balance between competing acceleration and loss processes
- Understand how the radiation belts change in the context of geomagnetic storms

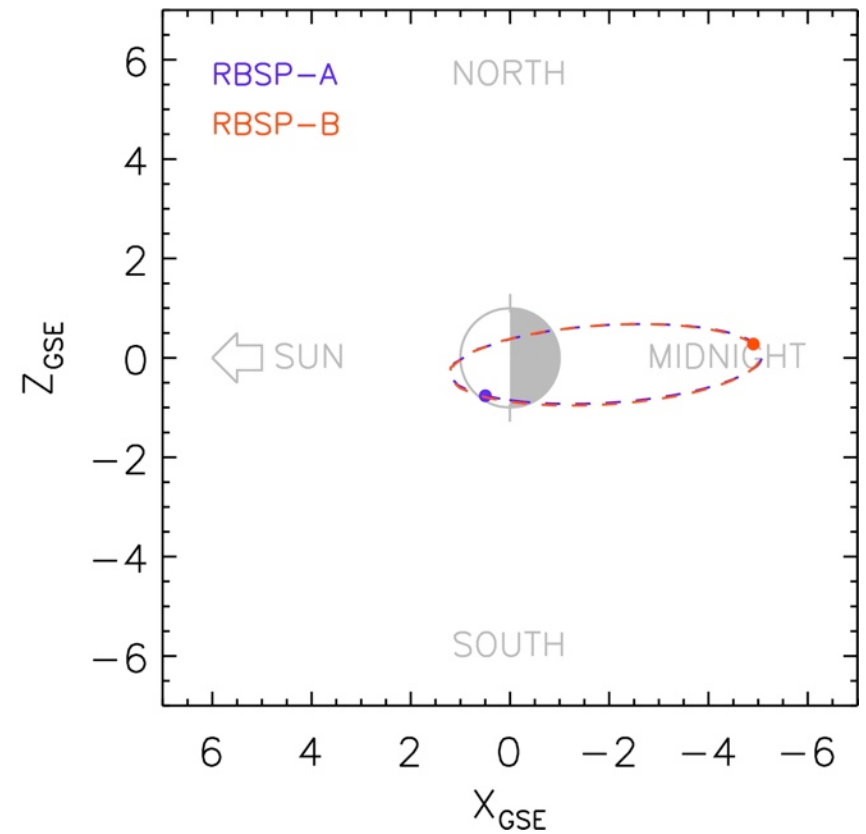
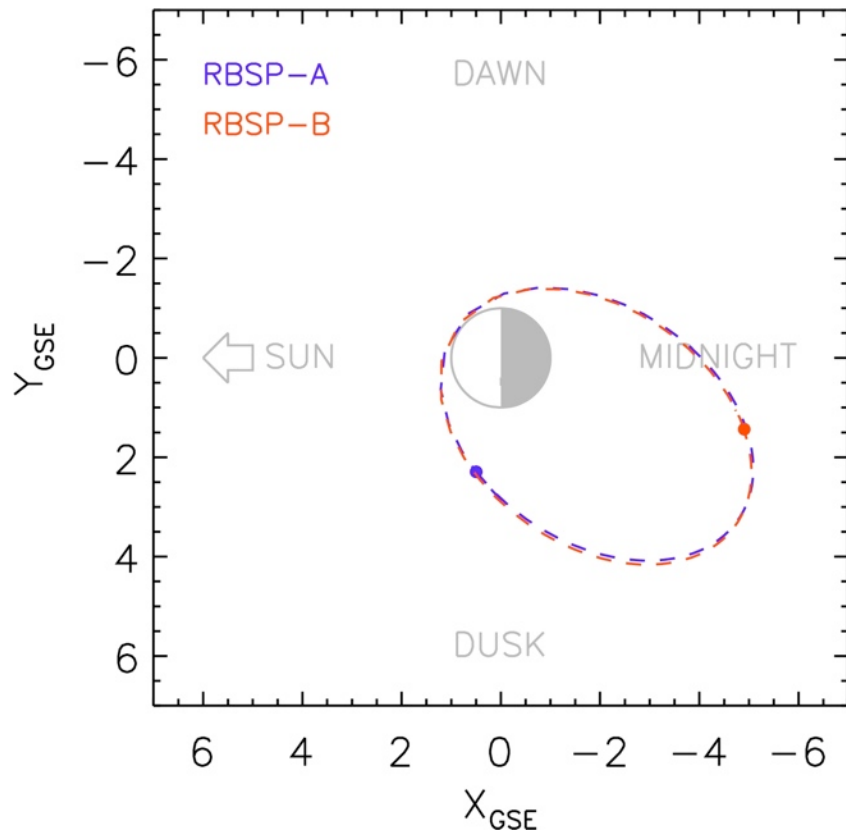
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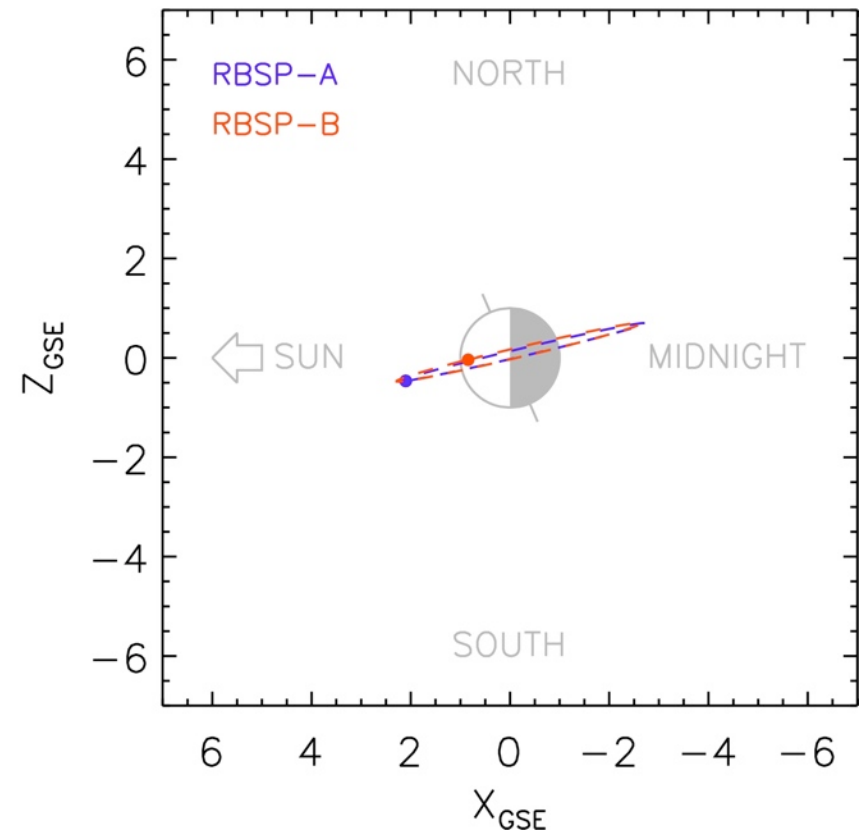
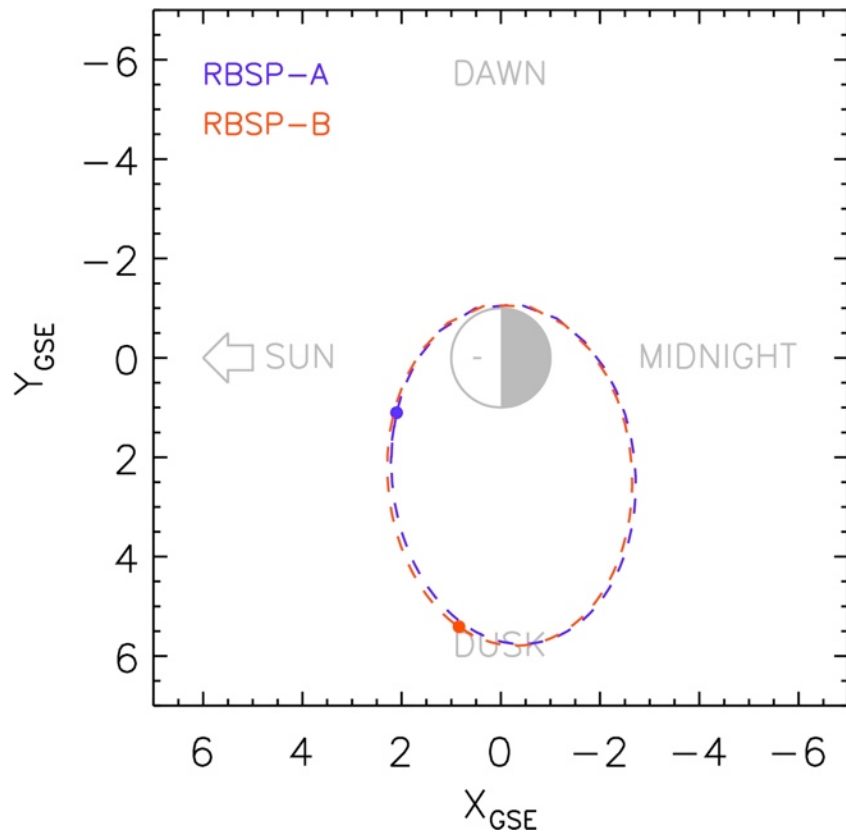
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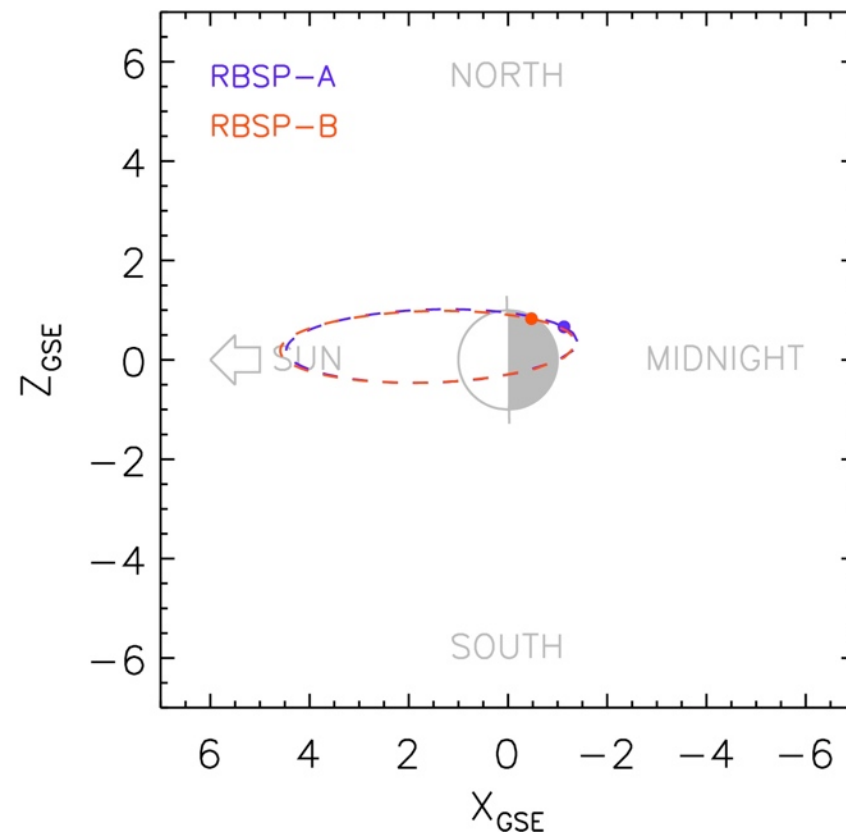
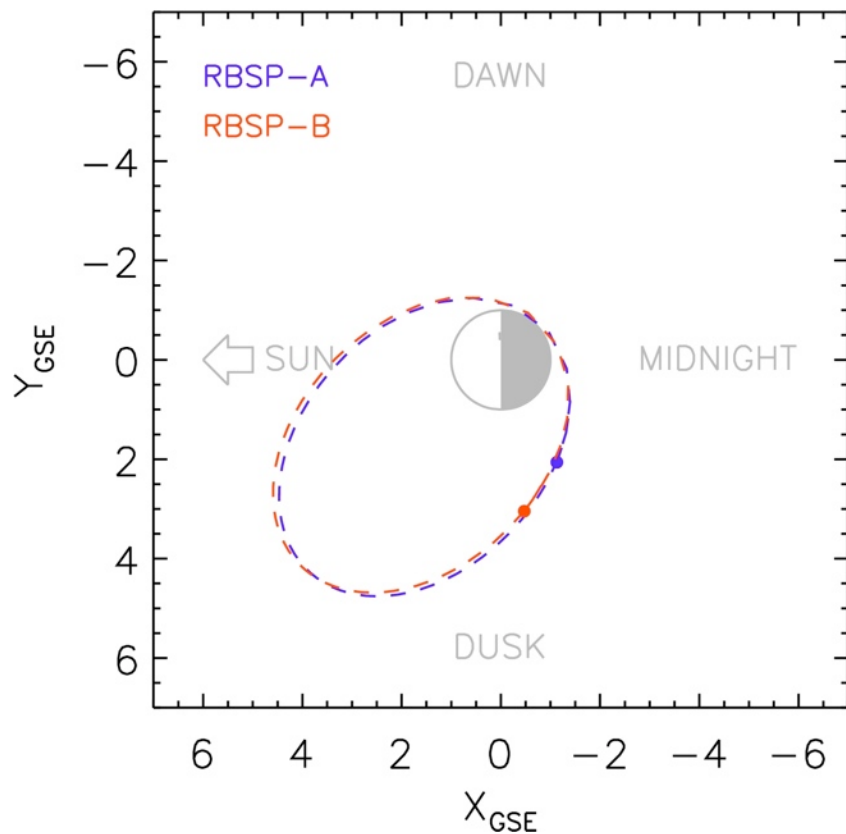
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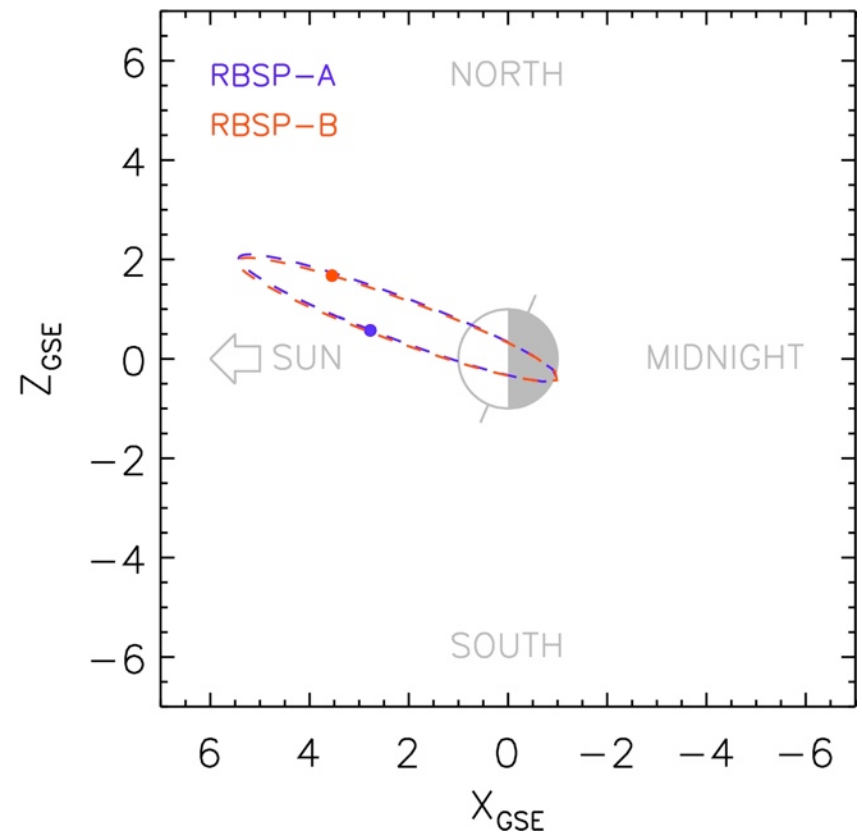
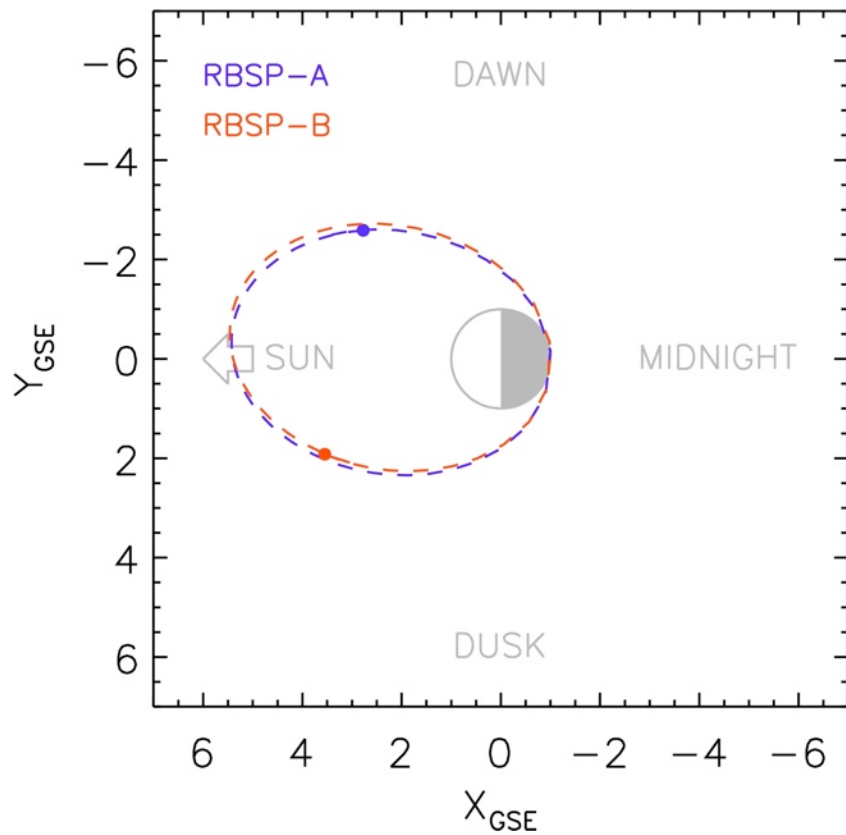
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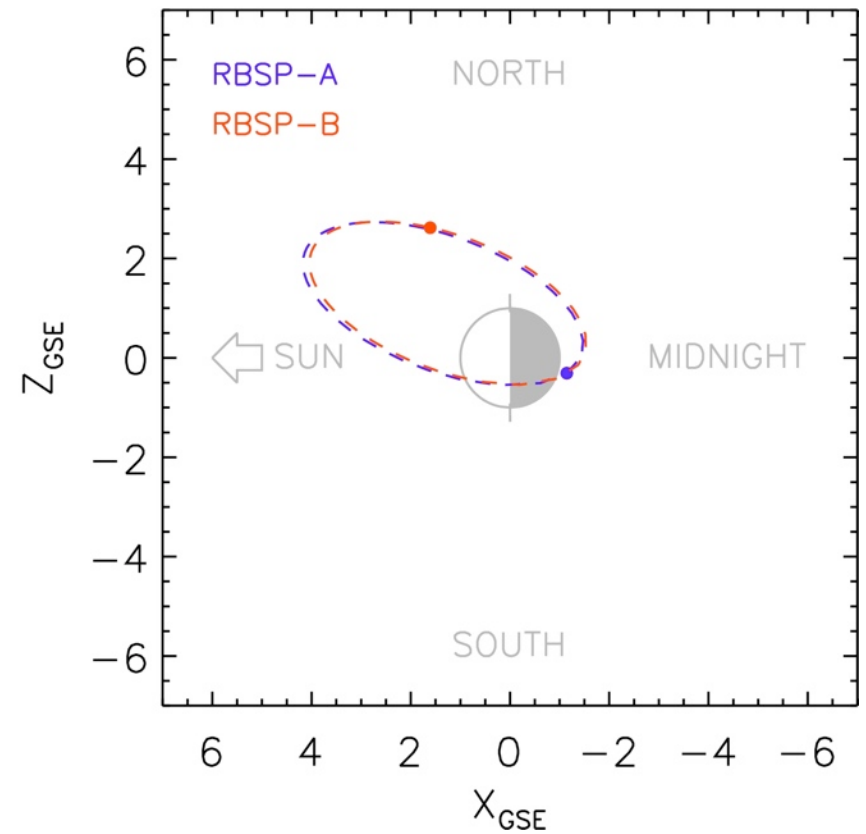
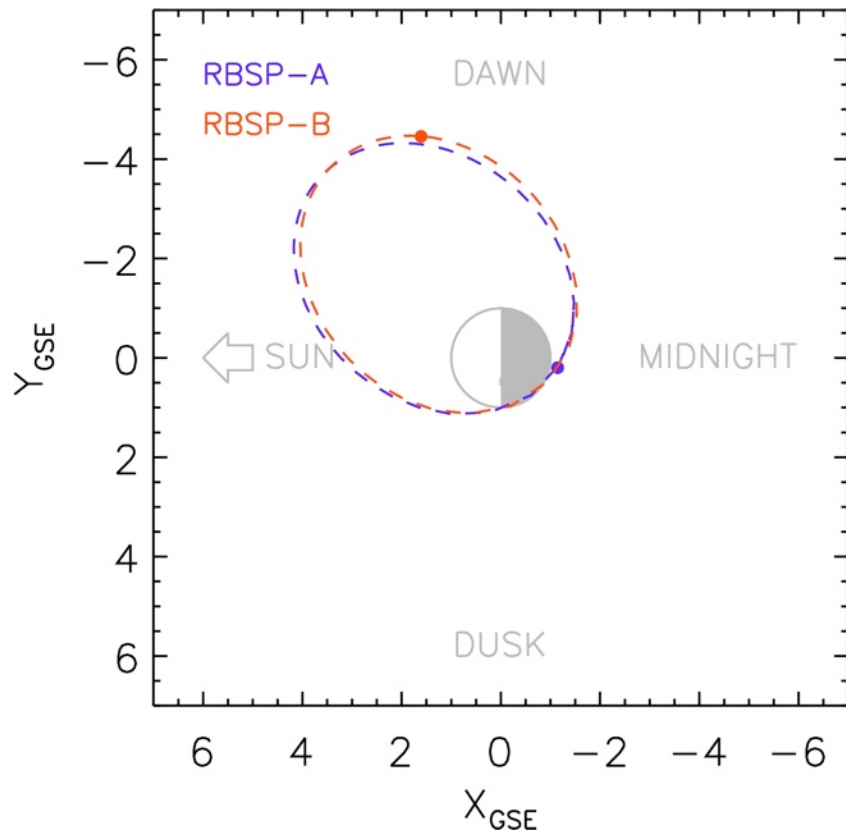
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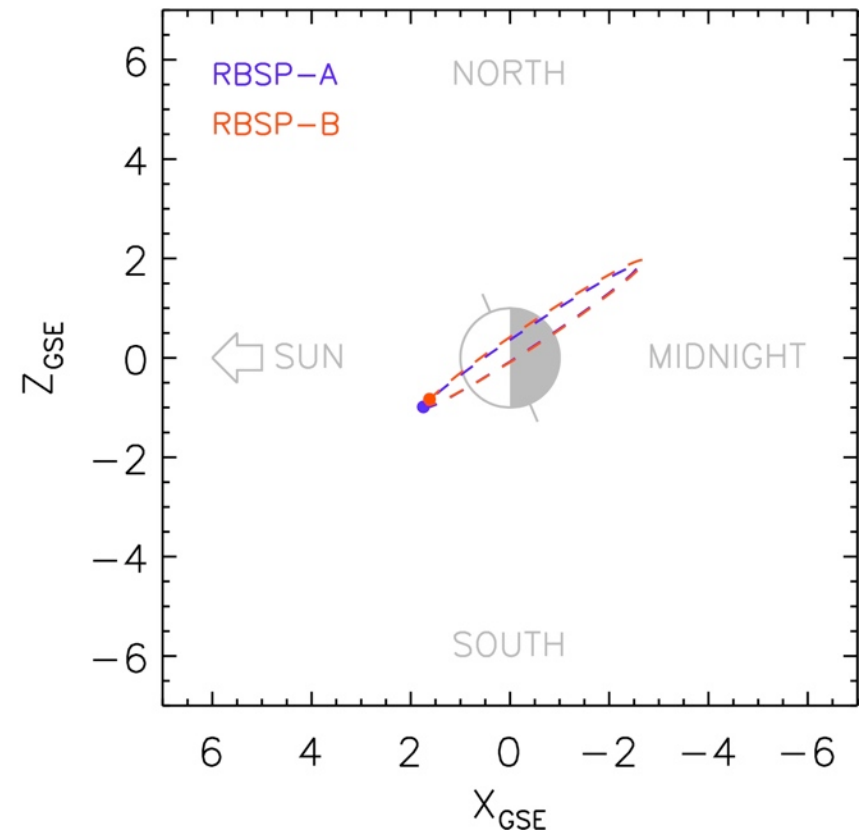
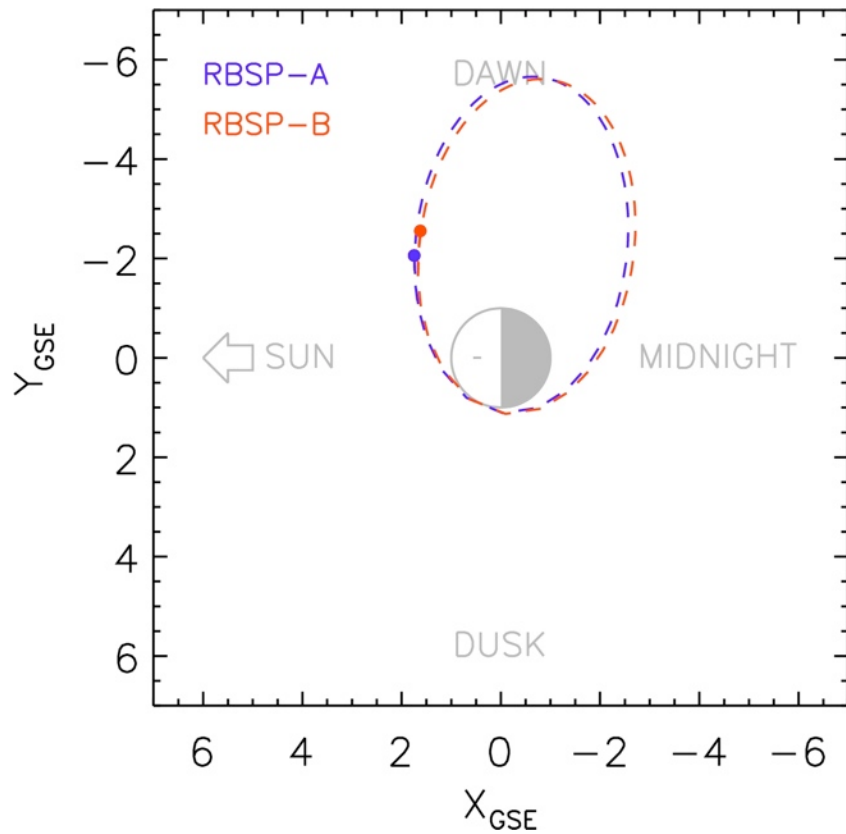
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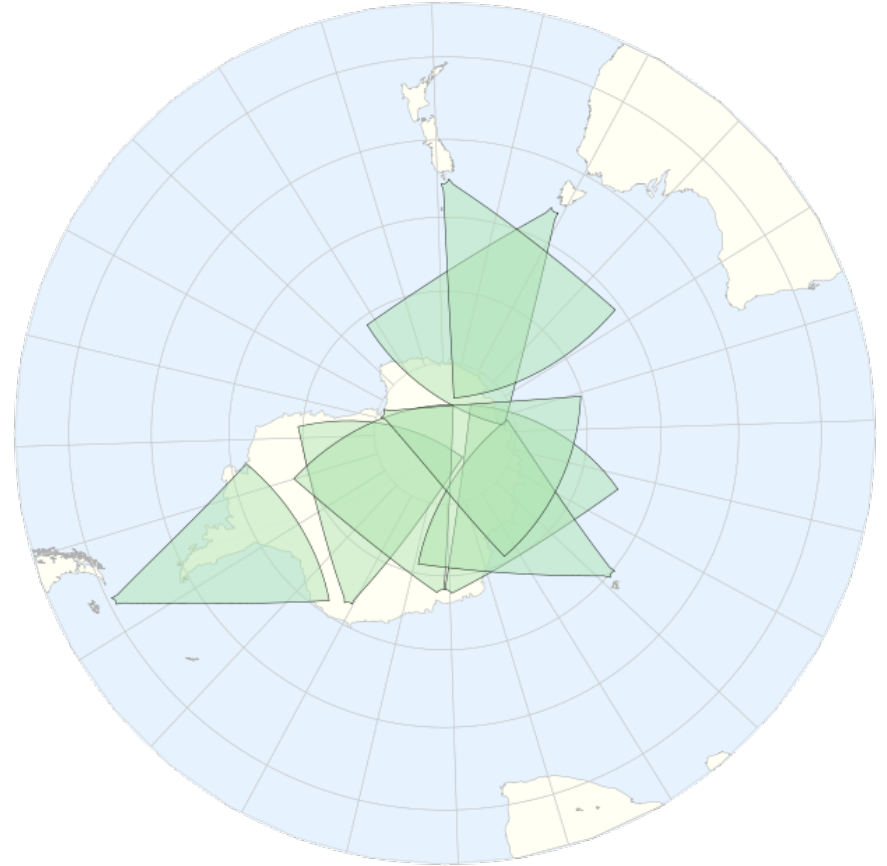
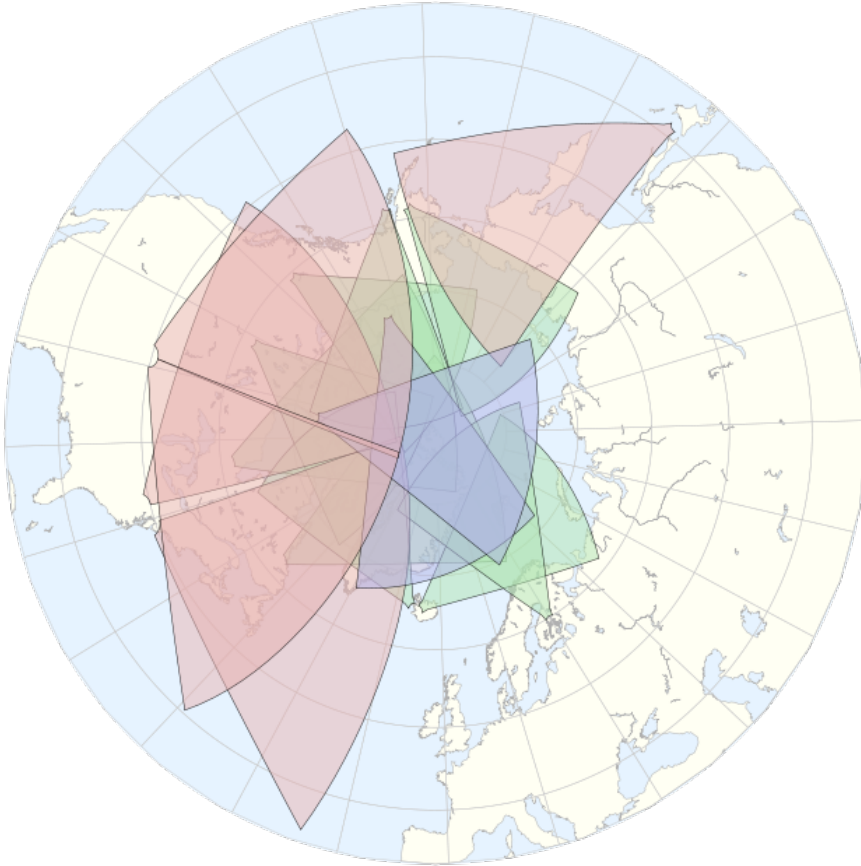
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GEOMAGNETIC COORDINATES



StormDARN: $> 50^\circ$ Mlat

SuperDARN: $> 60^\circ$ Mlat

PolarDARN: $> 70^\circ$ Mlat

Non-storm mapping

P _{SW}	DST	IMF B _y	IMF B _z
2 nPa	-20 nT	0 nT	-3 nT

Weak storm mapping

P _{SW}	DST	IMF B _y	IMF B _z
4 nPa	-80 nT	0 nT	-3 nT

Full-storm mapping

P _{SW}	DST	IMF B _y	IMF B _z
6 nPa	-120 nT	0 nT	-3 nT

GEOGRAPHIC COORDINATES

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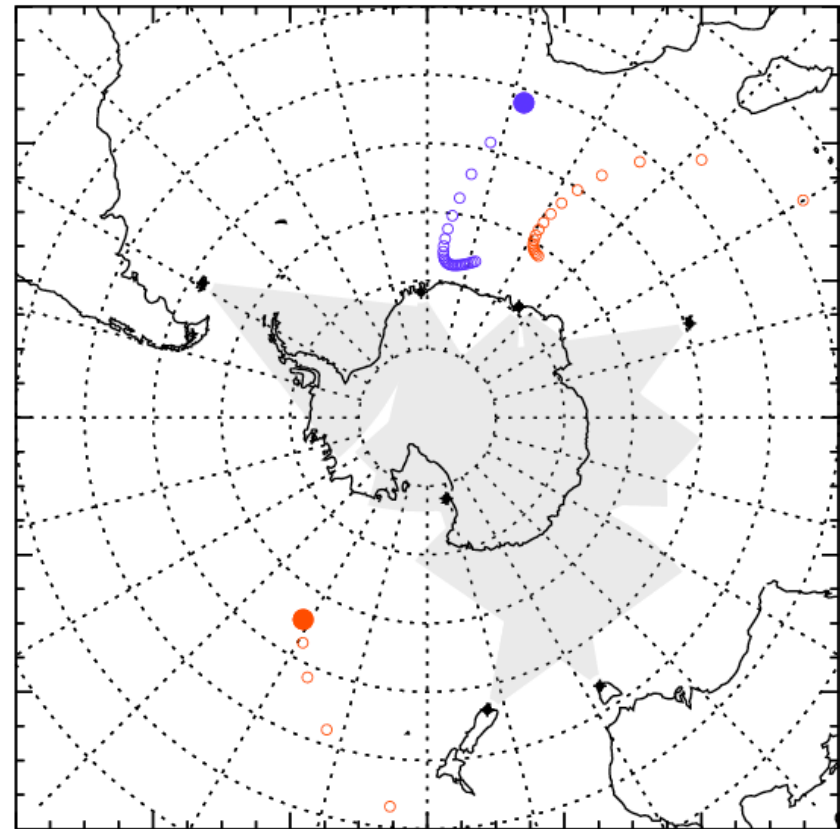
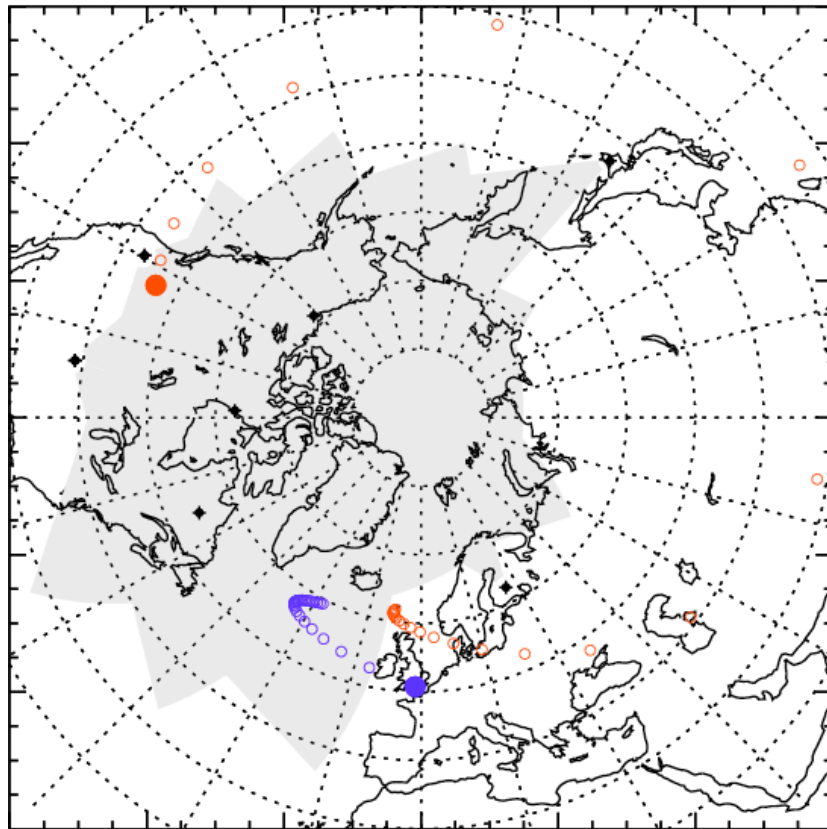
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09:04:30 23 Sep 2012

RBSP-A

RBSP-B



GEOGRAPHIC COORDINATES

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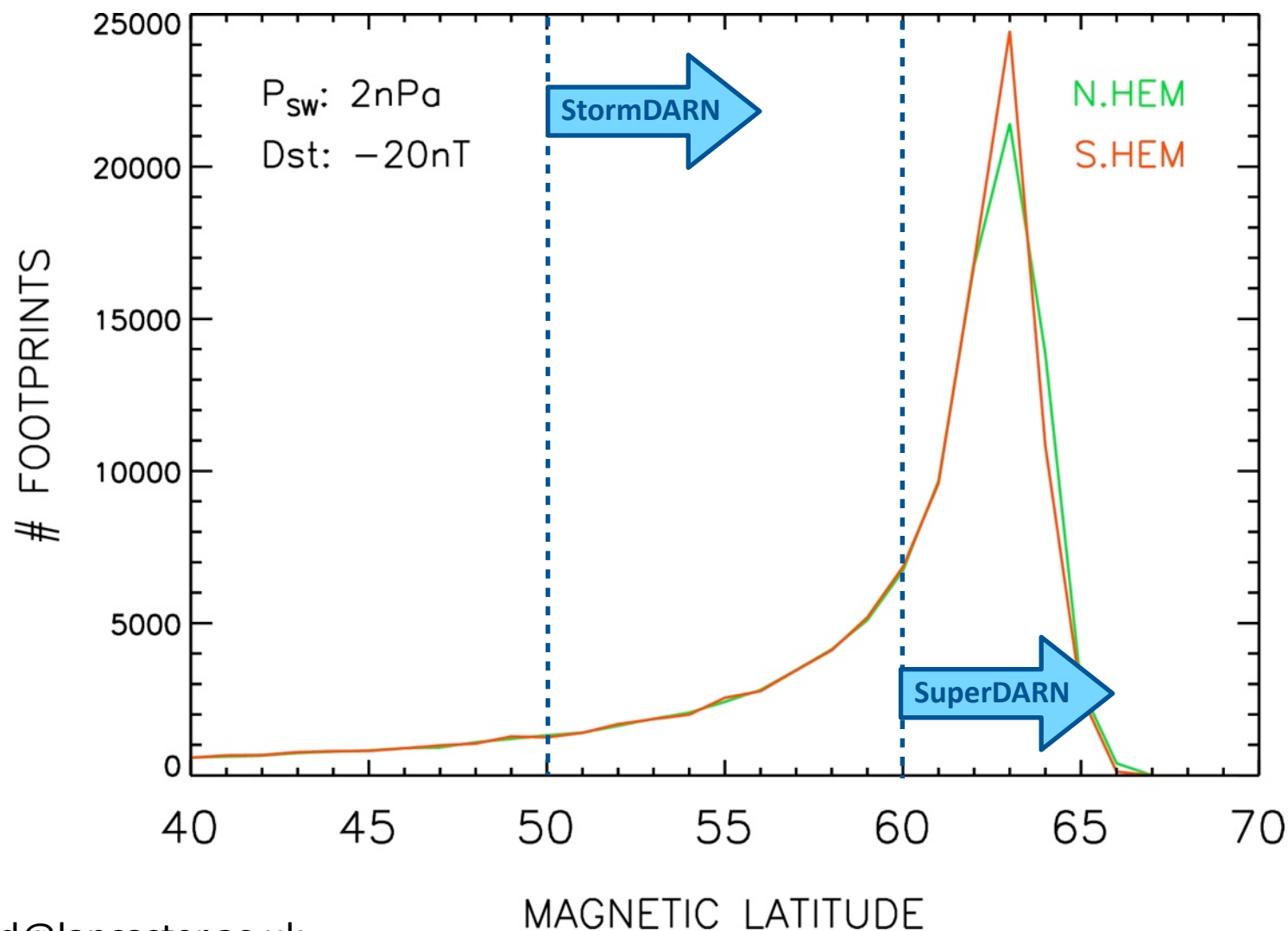
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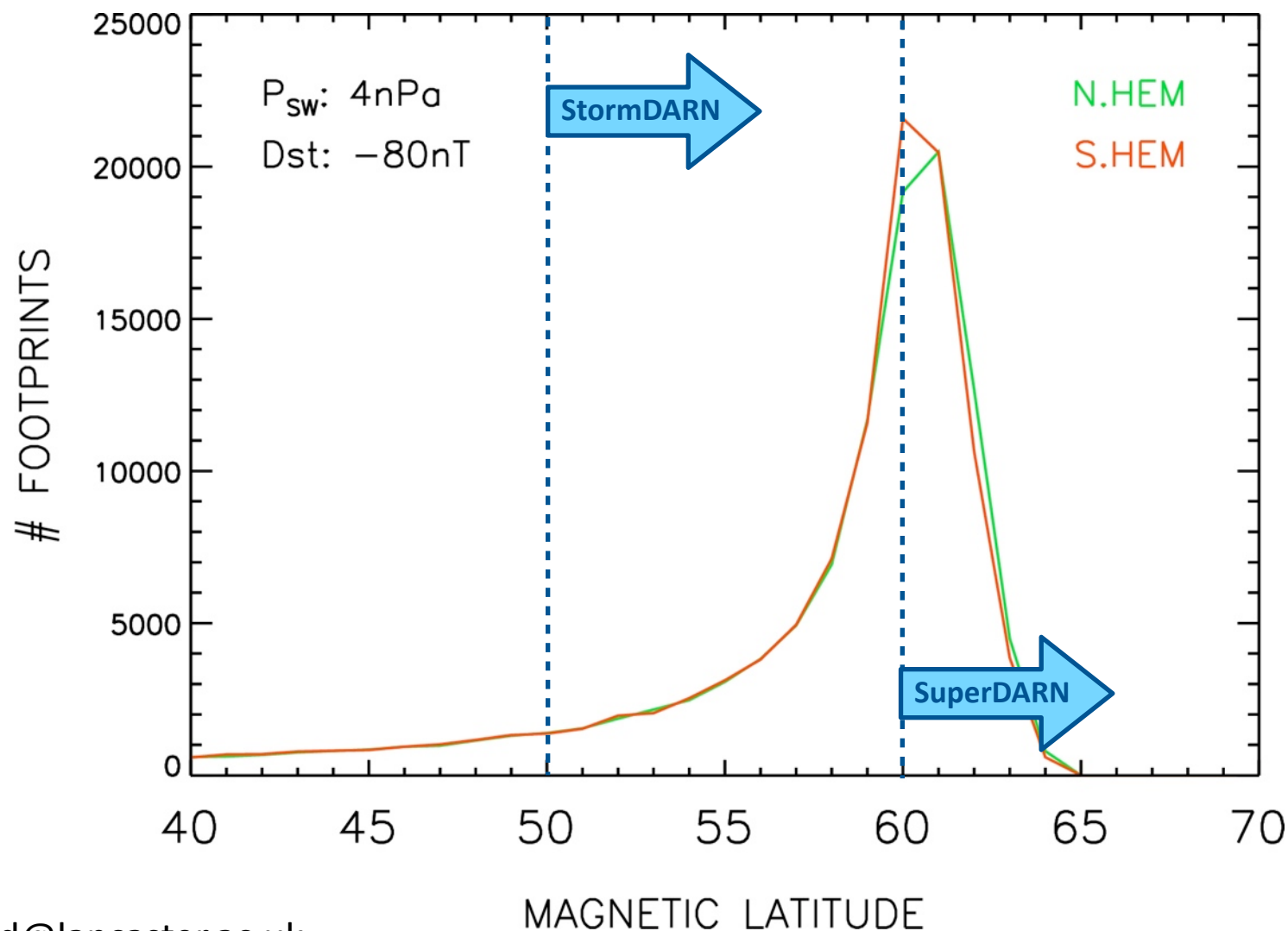
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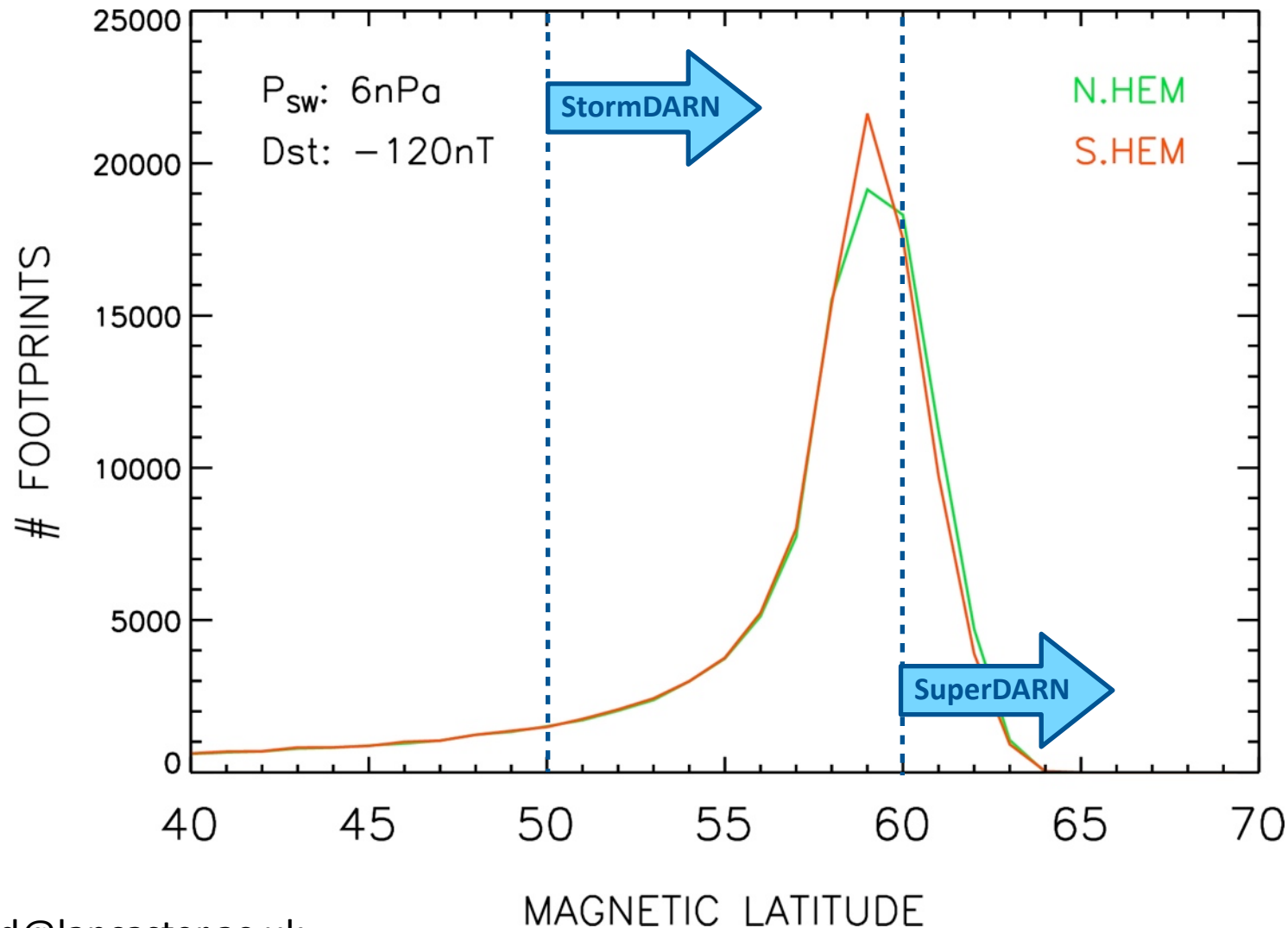
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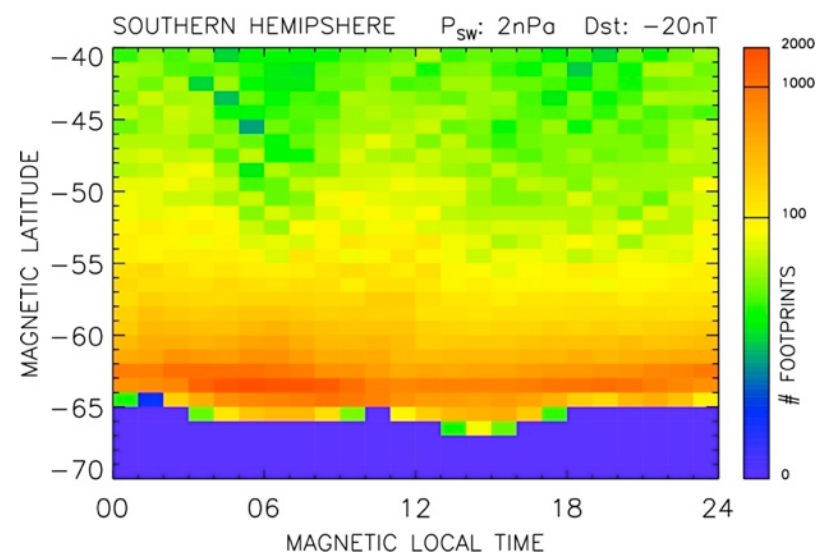
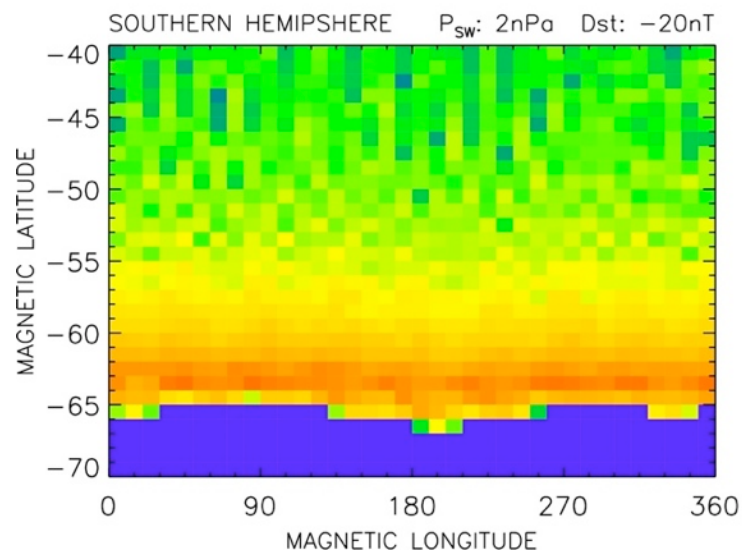
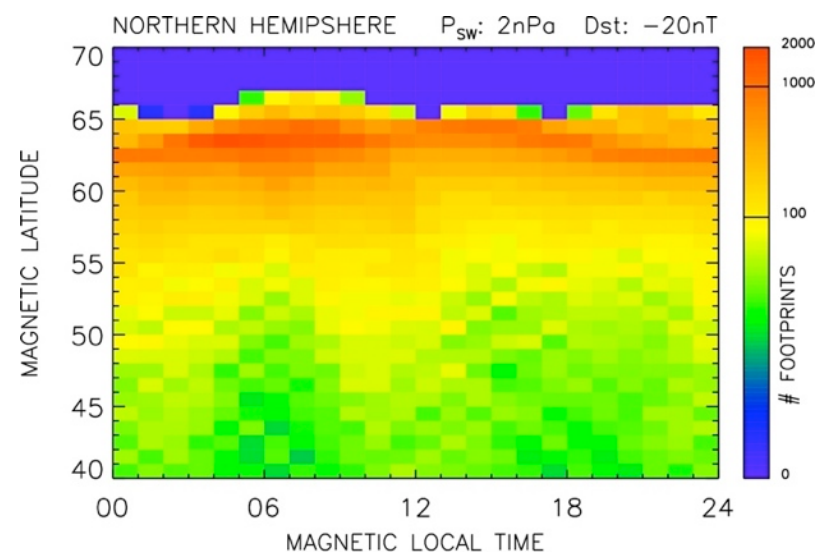
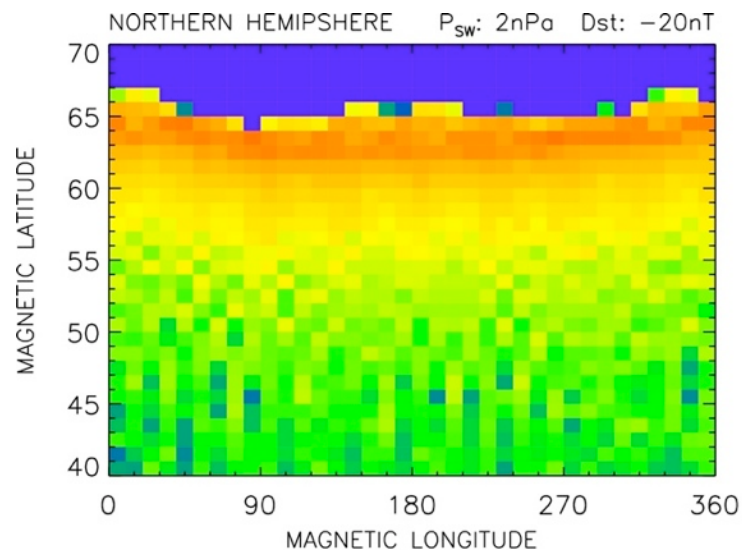
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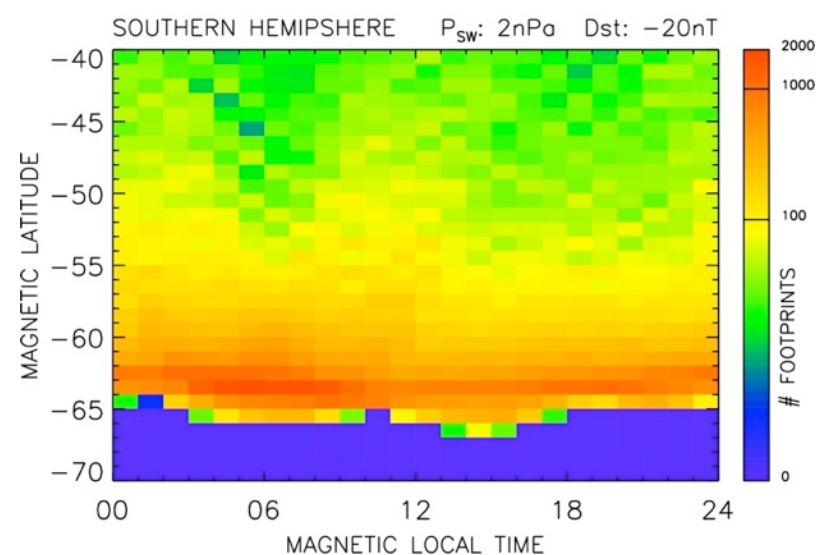
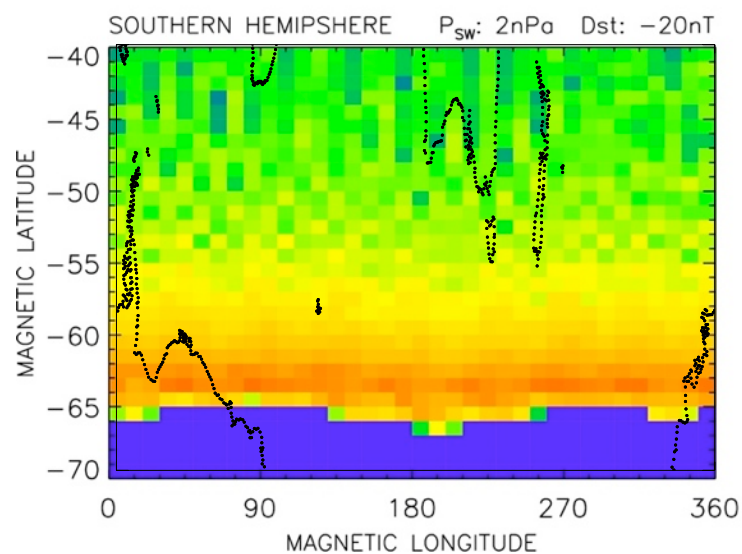
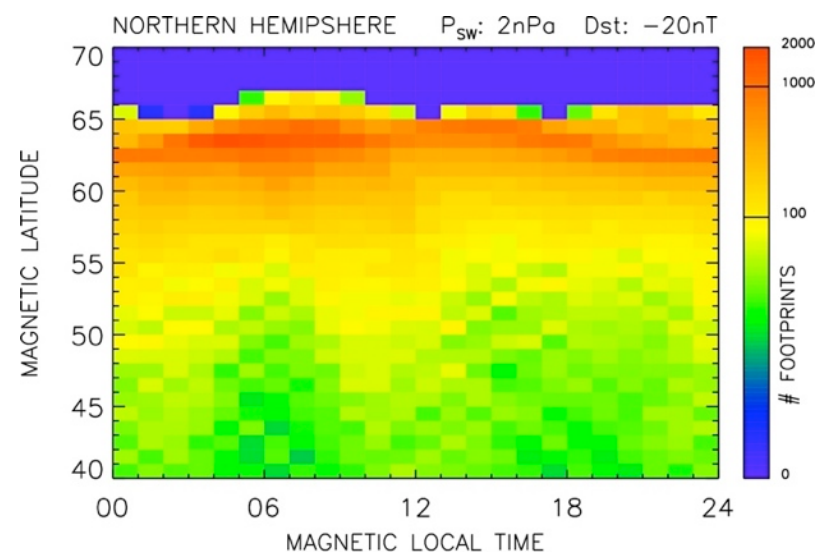
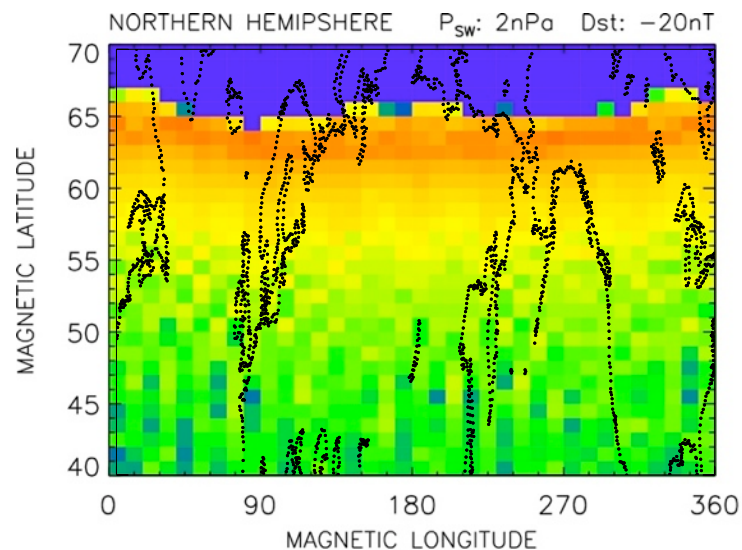
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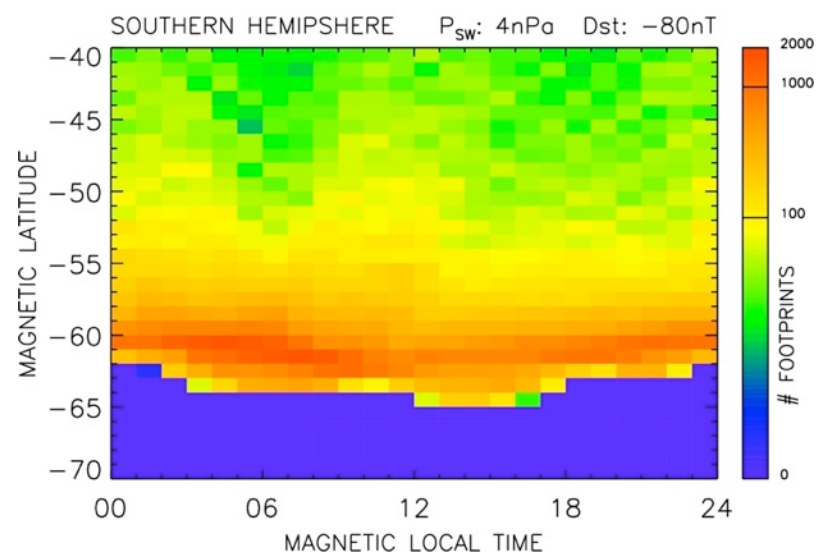
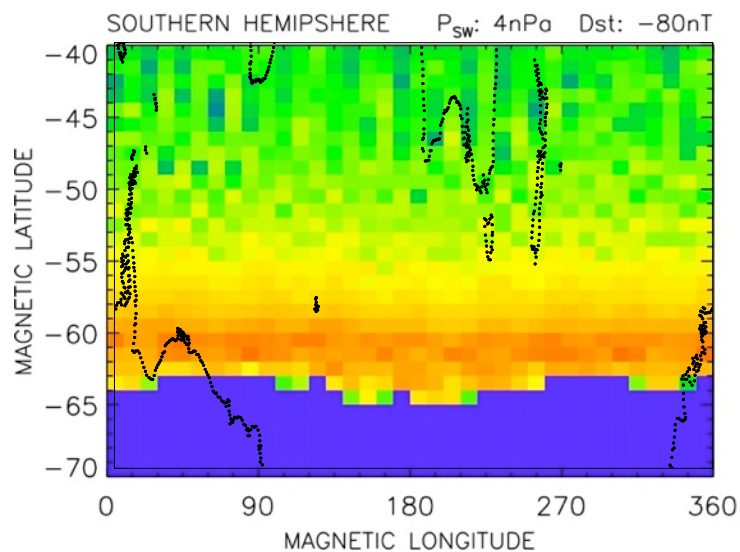
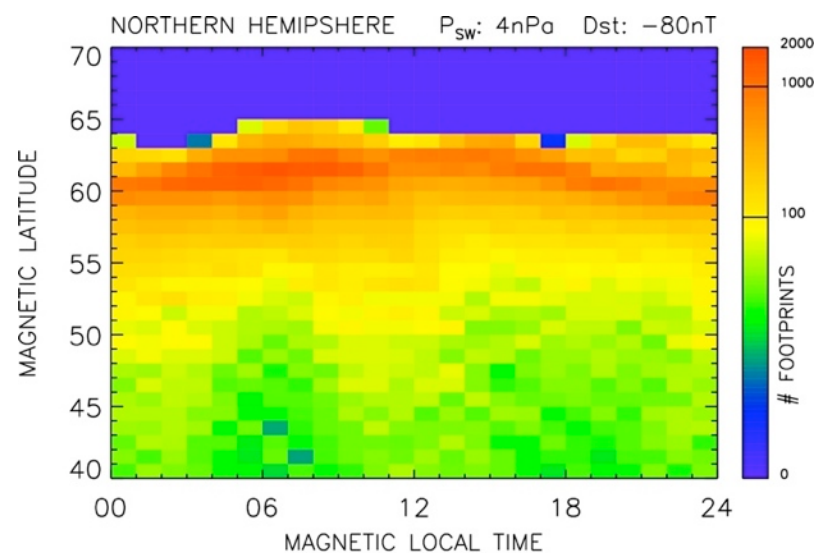
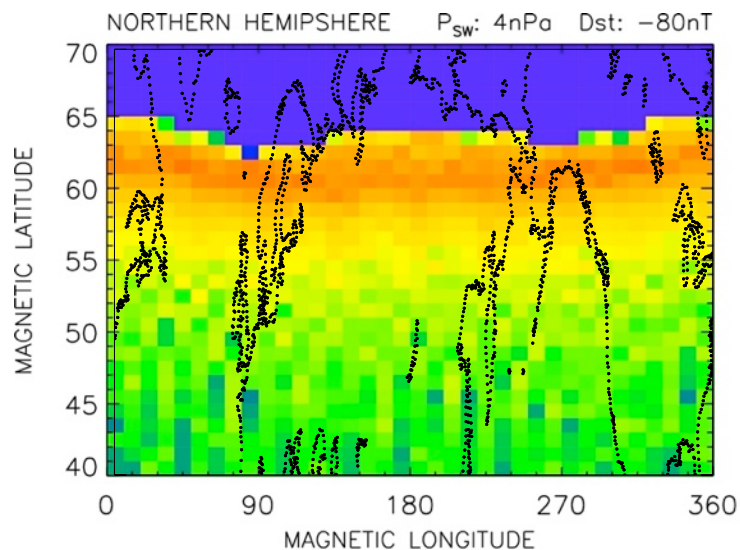
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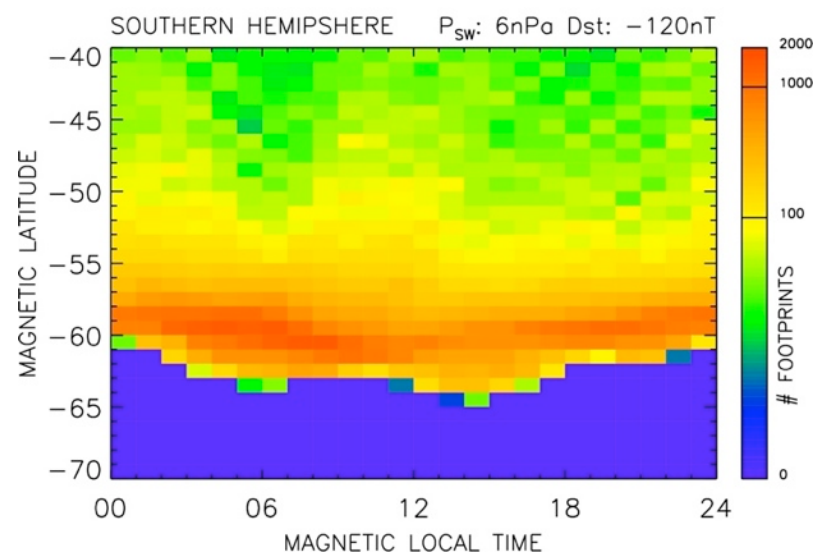
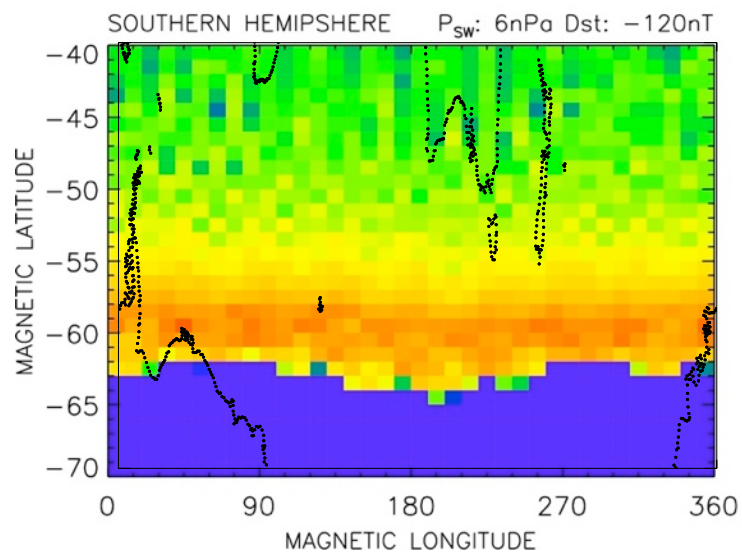
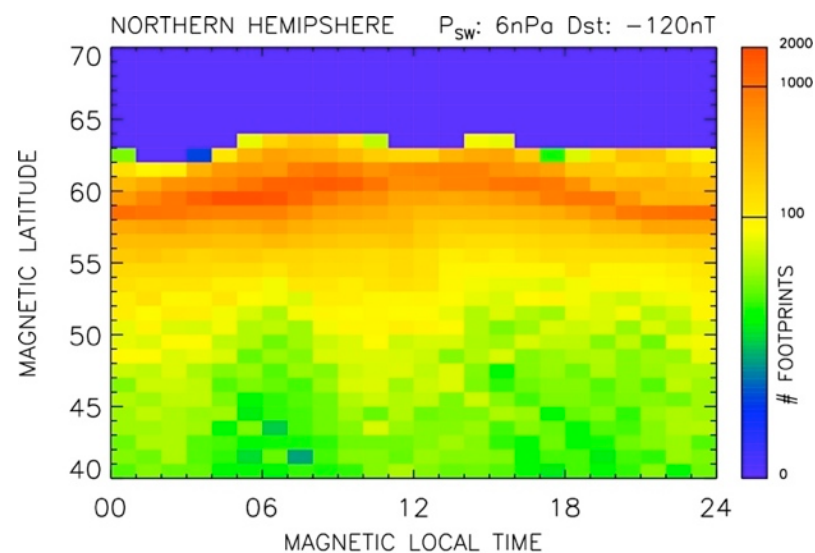
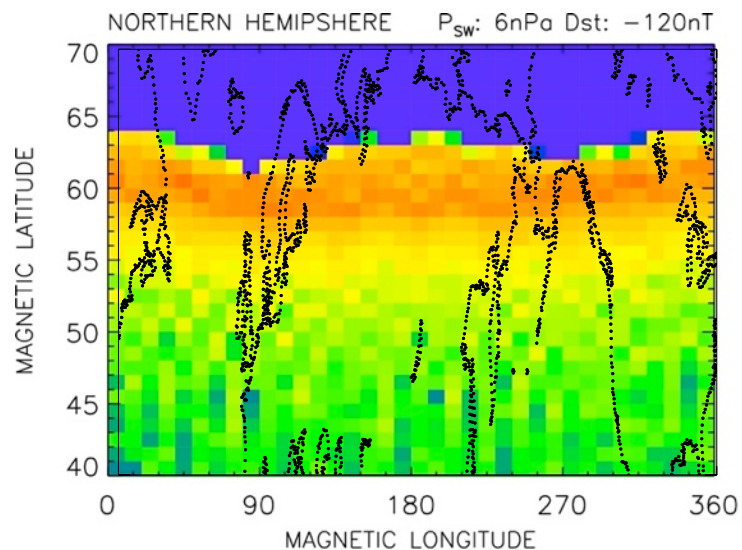
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SuperDARN-RBSP Science Opportunities

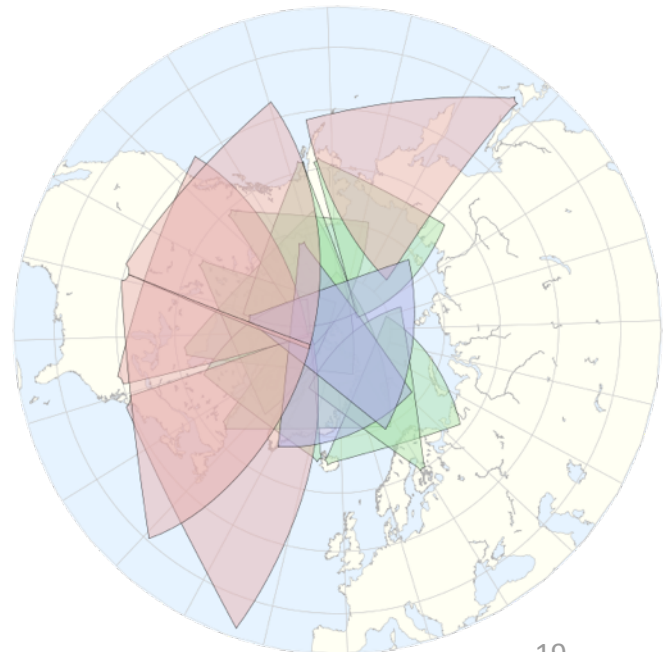
The combination of RBSP and SuperDARN offer the opportunity of studying the coupled inner magnetosphere and ionosphere-thermosphere as a system.

- **Science examples:**

- Direct comparison of magnetosphere pressure gradients (RBSP) and field aligned and ionospheric currents (SuperDARN)
- Stormtime global convection and substorm electrodynamics (SuperDARN) vs. in situ electric fields and particles (RBSP)
- Storm effects in the ionosphere
- ULF wave activity and storms

- **Key SuperDARN data products:**

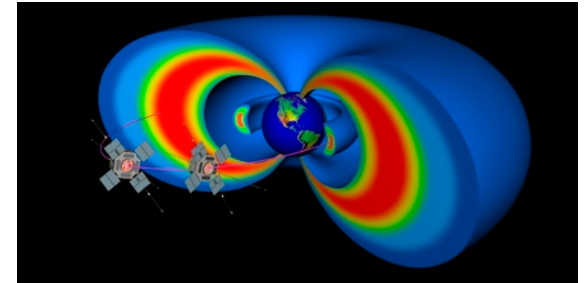
- Global electrodynamics
- Storm conditions
- Convection
- Cross polar cap potential
- Location of OCFLB
- Mesoscale convection structures



SuperDARN-RBSP Science

ULF wave activity and storms: SuperDARN can measure ULF wave fields, frequency, ionospheric electric field, azimuthal structure locally and globally. m up to ~ 100 , (attenuation factor of ~ 50 in ground magnetometer data) whilst RBSP measures energetic particles and chorus waves.

- **Pc3-5 band (1000 - 10s):** Direct measurement on a global scale from all radars. Ionospheric and ground scatter can provide information (direct measurement of electric field and Doppler shifts due to wave modulation of the reflection height). Covered by existing THEMIS mode or similar.
- **ULF EMIC 10 - 0.2 s:** Direct measurement at the lower end of the frequency scale (all radars), Raw data analysis in the middle (partial array coverage), spectral width broadening as a diagnostic at the upper end of frequency scale (all radars).
- **VLF whistlers:** 100 Hz- 5 kHz no measurements from SuperDARN



SOME QUESTIONS

What are the key SuperDARN measurements required by the RBSP community, for radar operations planning?

- Storm quantification and alerts (together with magnetometers)?
- HF absorption as a low altitude precipitation indicator?
- Global convection response to storms, mesoscale convection?

ULF waves

- Azimuthal structure?
- Integrated wave power in defined frequency bands?
- Global measurement or latitude/MLT distribution?
- Combined data products with ground magnetometer measurements?