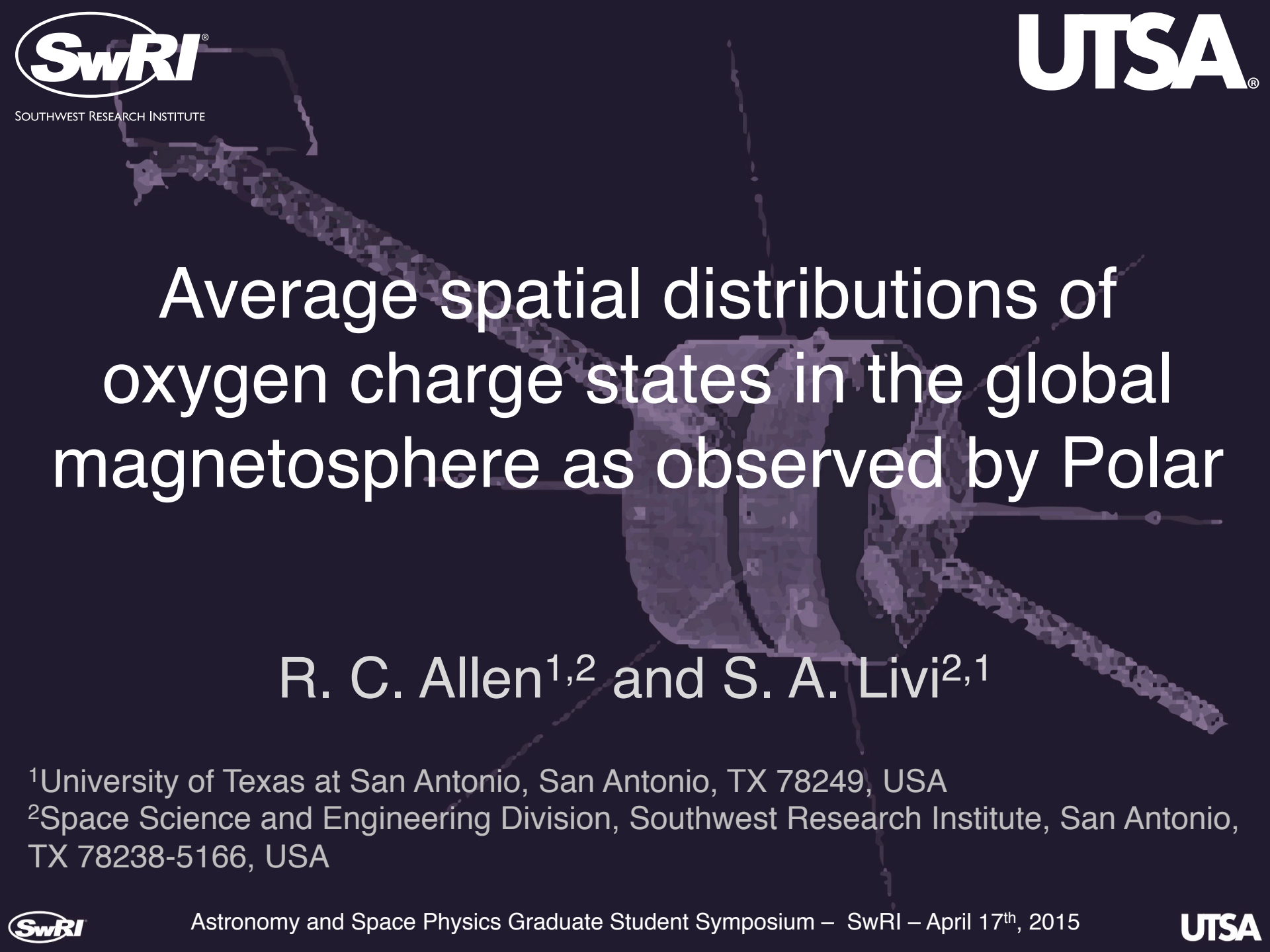

Average spatial distributions of oxygen charge states in the global magnetosphere as observed by Polar

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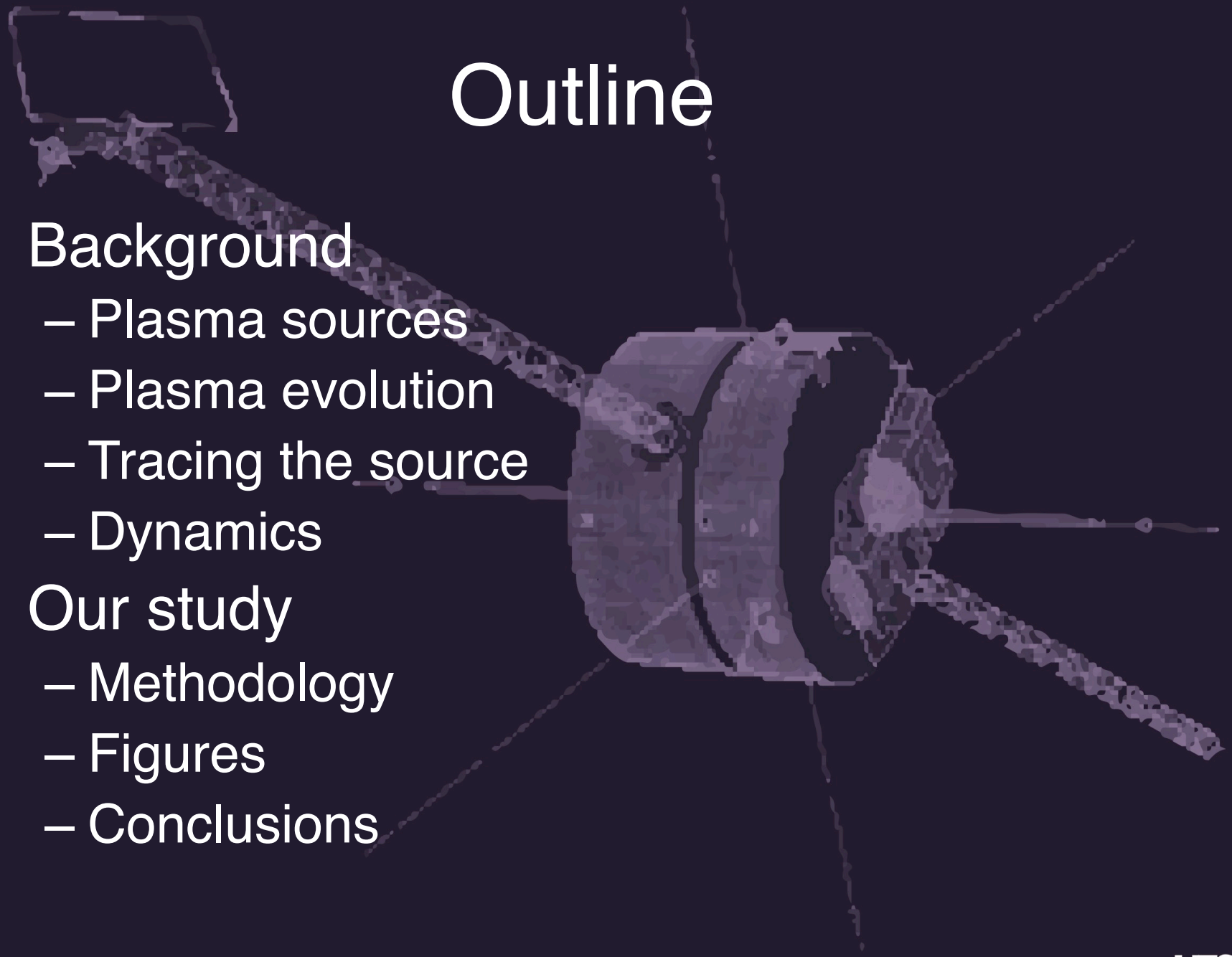
Outline



- Background
  - Plasma sources
  - Plasma evolution
  - Tracing the source
  - Dynamics
- Our study
  - Methodology
  - Figures
  - Conclusions

Background: Sources of Plasma

- Sources of Plasma
  - Ionosphere
    - Ionization of the upper atmosphere can result in abundances of low charge state ions.
  - Solar wind
    - The solar wind caries ions from the Sun that can penetrate into the magnetosphere of the Earth.

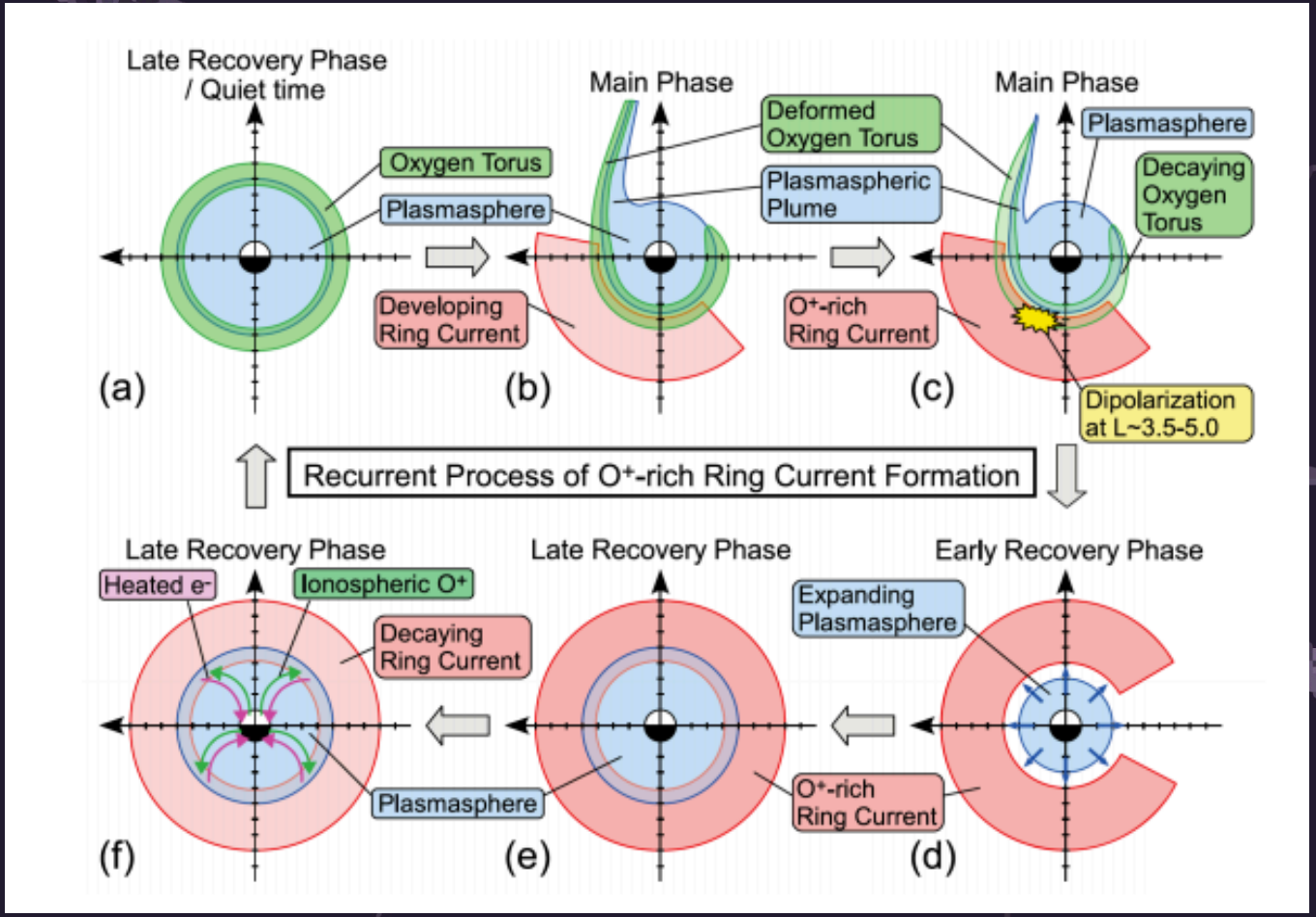
Background: Plasma Evolution

- Once injected into the magnetosphere, ions will undergo:
  - Convection on quasi-trapped drift orbits
  - Radial diffusion
- As the ions drift, they can also charge exchange.
  - Lowers the charge states
  - Leads to losses

Background: Tracing the Source

- Low mass ions (i.e., H) are observed in high abundance in both the solar wind and the ionosphere
  - It is difficult to differentiate the source of H^+ ions due to limited available charge states
- Higher mass ions (i.e., O) are observed in both the solar wind and ionosphere, however the charge states differ
  - Solar wind oxygen is primarily O^{6+}
  - Ionospheric oxygen is primarily O^+

Background: Dynamics



The oxygen torus and its participation in the formation of an O^+ rich ring current from *Nose et al.* [2011].

Methodology

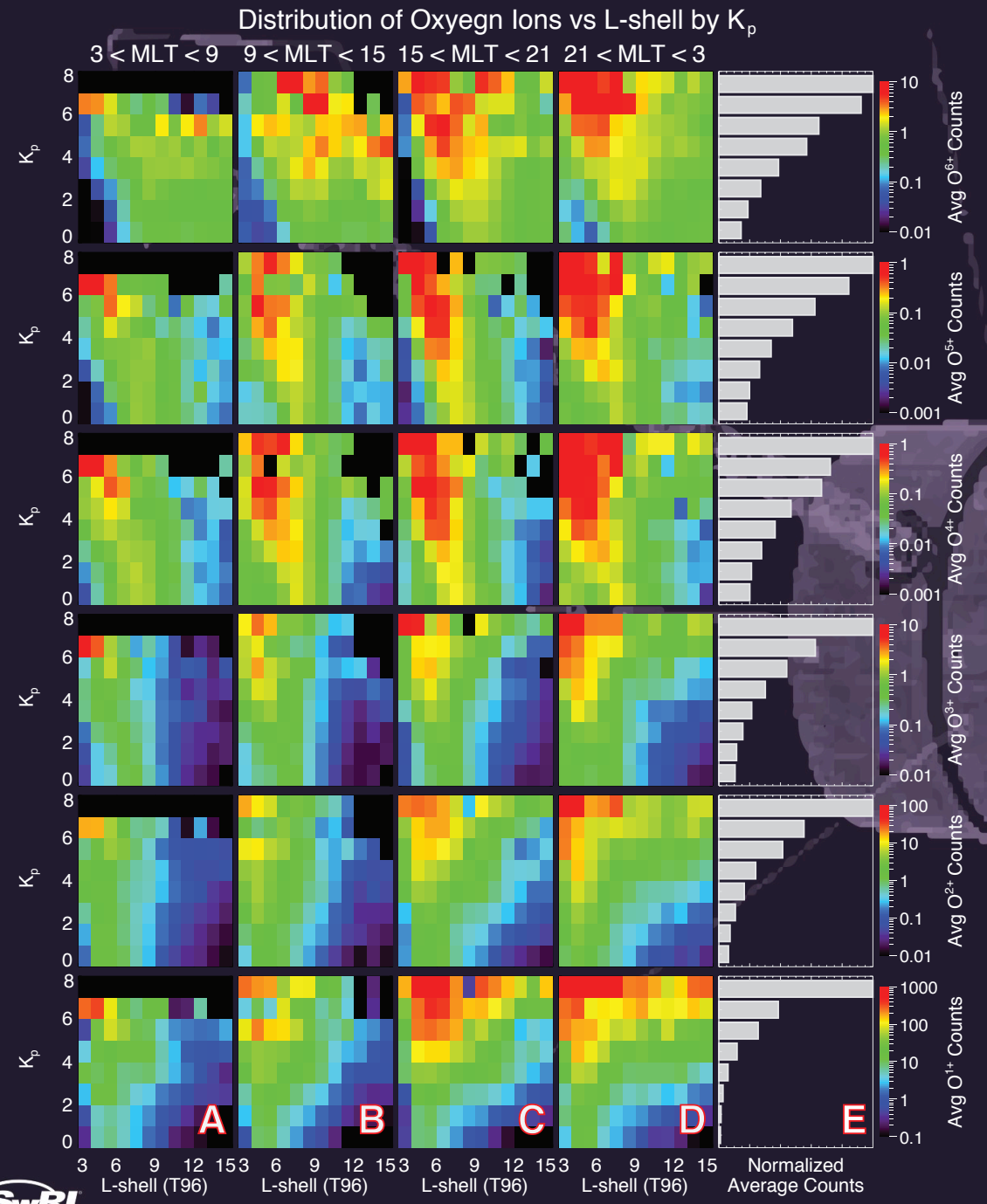
Science question: What are the dominant drivers of plasma injection into the Earth's magnetosphere?

Satellite: Polar
Instrument: CAMMICE/MICS

To have full m/q resolution we lose resolution in energy. So, we are unable to compute fluxes, and are limited to counts.

Using all times in which CAMMICE was operational we constructed distributions of O^{+} through O^{6+} in L-shell and MLT.

These distributions were broken up into bins of K_p, B_z, and AE for analysis.



The K_p index is a proxy for geomagnetic activity.

All charge states:

- Increase in abundance with increasing K_p.
- Higher abundances in the midnight and dusk sectors.

Higher charge states:

- Peak and maintain abundance for higher L-shells.

Low charge states:

- Peak abundance exists at lower L-shells.
- Populations broaden for higher K_p.

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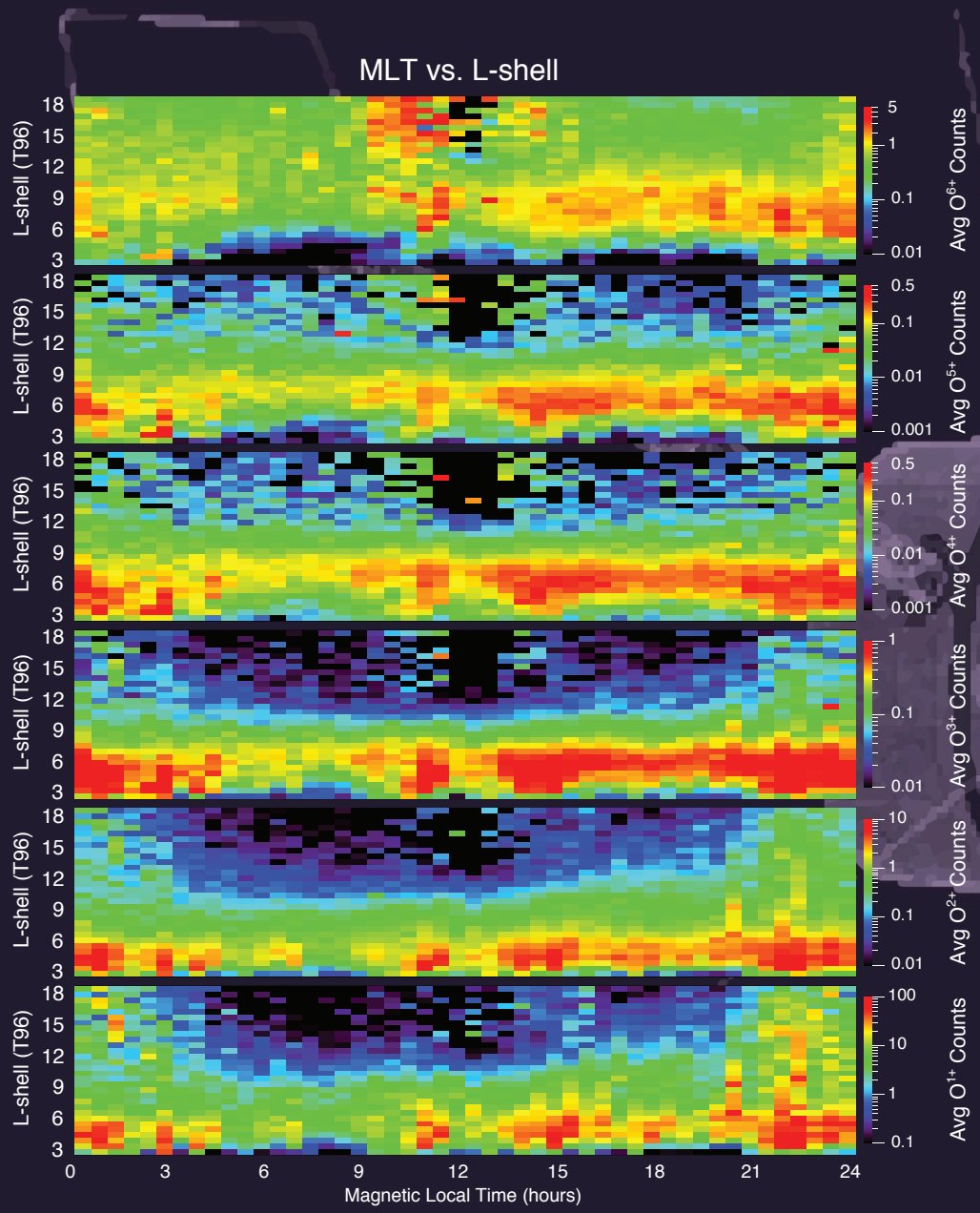


MLT vs. L-Shell distributions averaged over entire Polar mission.

Higher charge states:

- Peak and maintain abundance for higher L-shells.
- Peak at high L-shells in the dayside magnetosphere, related to injection and possible magnetosheath data points.

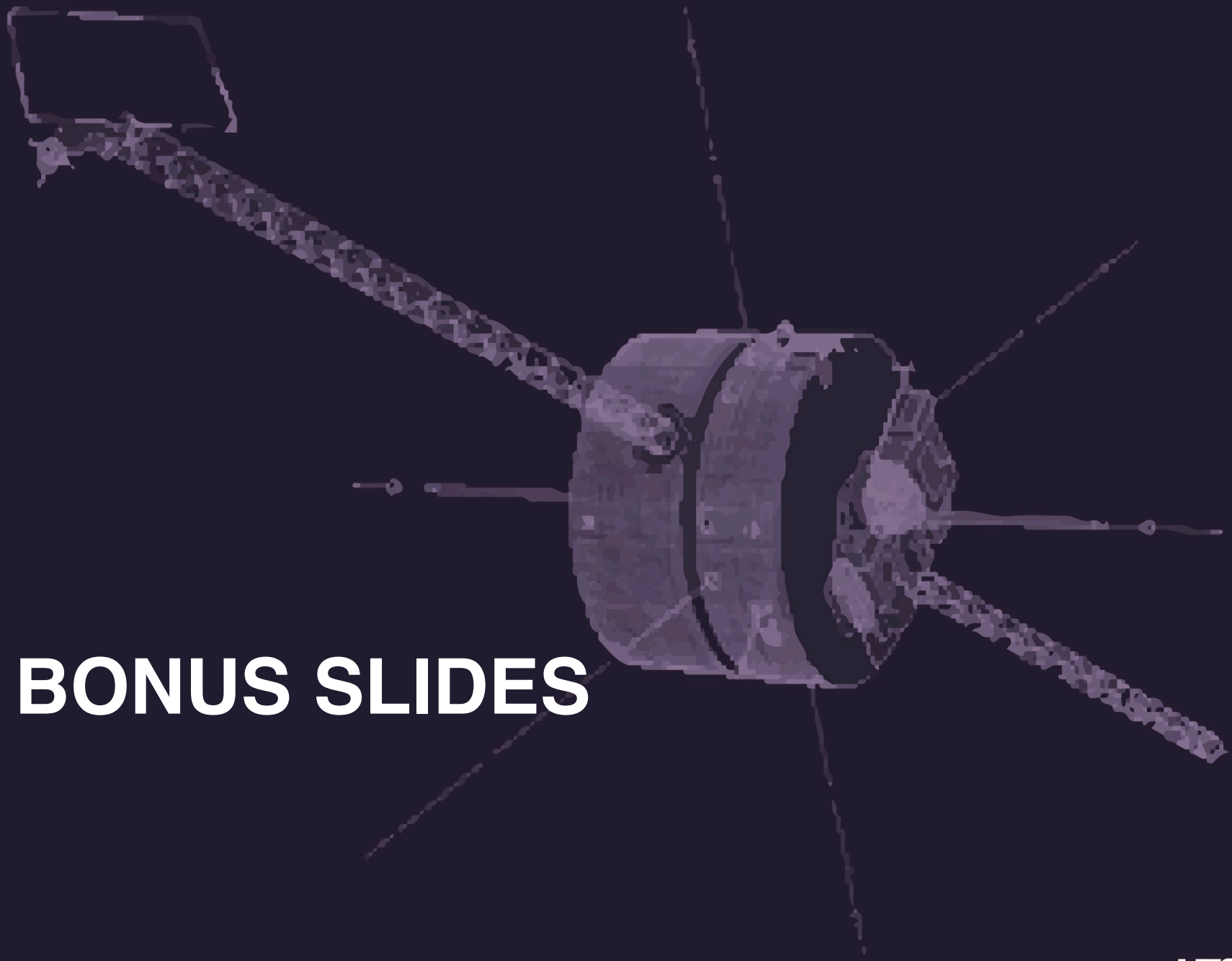
Low charge states:

- Peak abundance exists at lower L-shells.

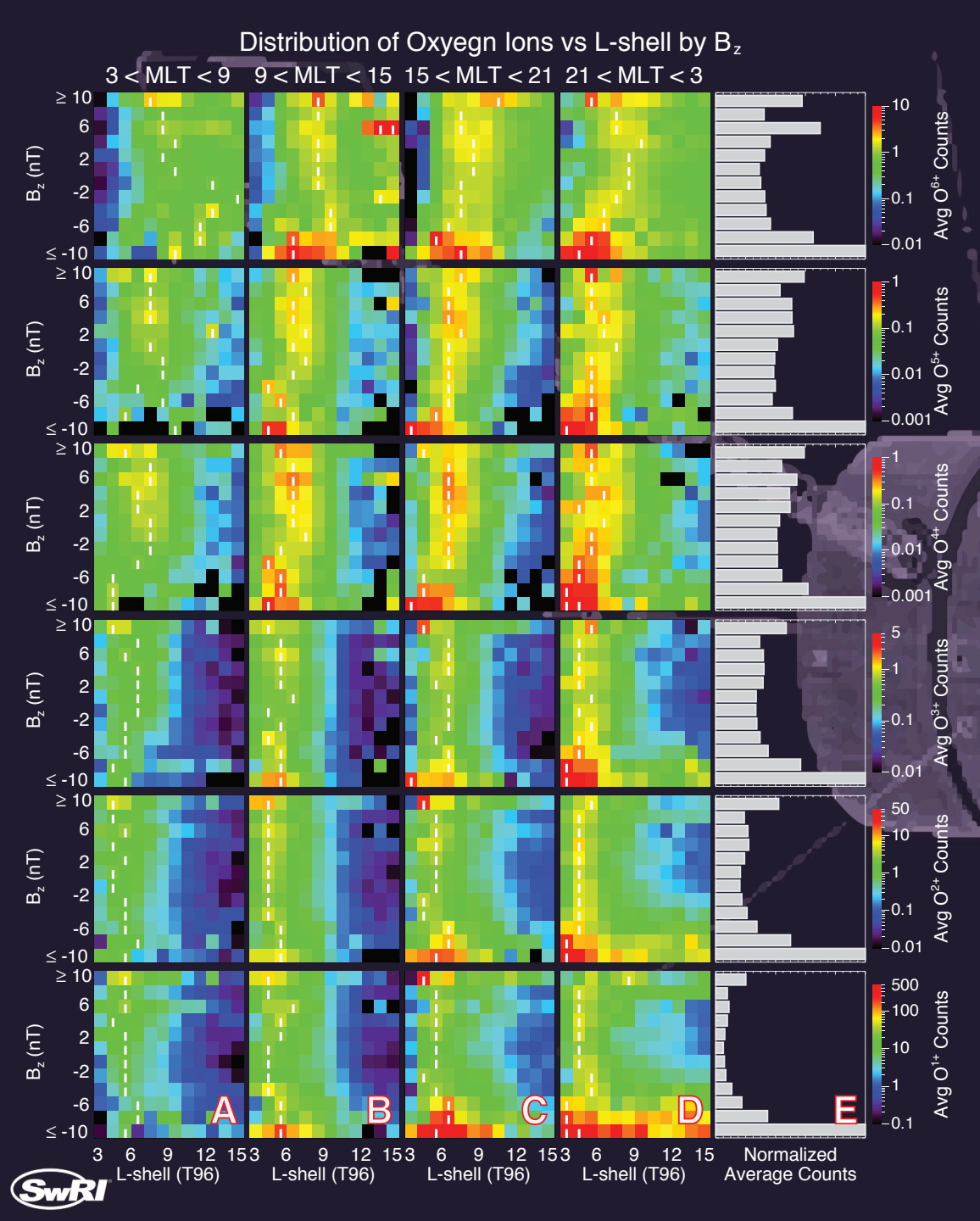
Conclusions

Counts vs L-shell by K_p	Higher abundances in the midnight and dusk sectors during storms.
	Presence of all charge states at higher L-shells during geomagnetically active times.
	The abundance of all charge states of oxygen observes a correlation to the K_p index (geomagnetic activity).
Counts vs MLT by L-shell	O^{6+} observes a pre-noon high L-shell enhancement in counts suggesting a high L-shell injection region or bad mapping.
	All charge states observe pre-noon, post-noon, and midnight enhancement in abundance for low to mid L-shells suggesting regions of either energization and/or injection.
	The L-shells of peak abundance move inward for lower charge states.

Thank you!



BONUS SLIDES



B_z is a proxy for the extent of reconnection.

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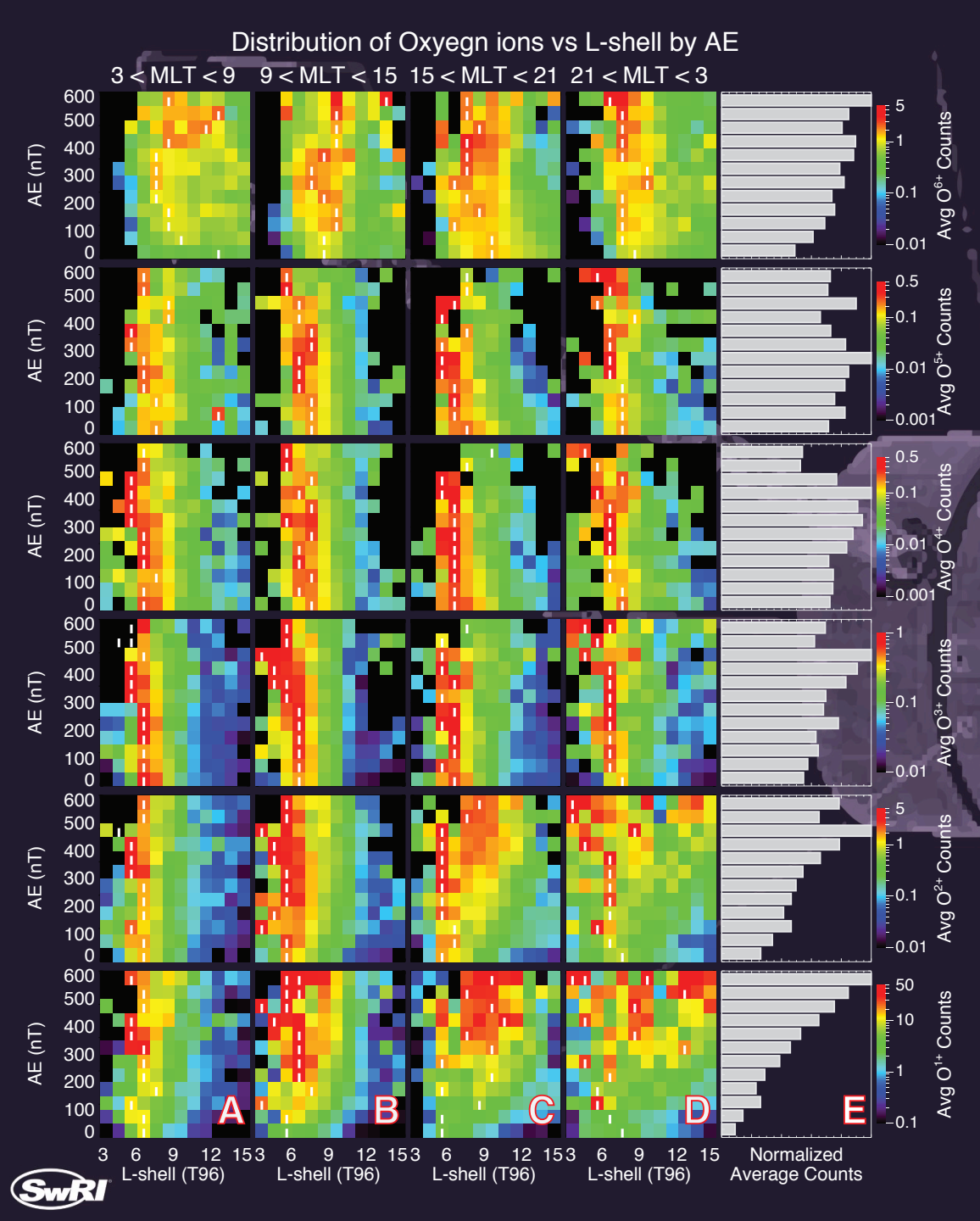

AE is an index of substorms occurrence.

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