1) What previously made measurements expanded in time and space domains would hold potential to answer critical science questions and/or contribute to community or system science? (Outline science questions, measurements, and rideshare opportunity).

Science Questions	Measurement	Rideshare Opportunity
What are the global magnetospheric energy inputs into the iomospher-thermosphere (IT) system?	- Precipitating energetic particles (electrons and ions - Global auroral imaging - Electric and magnetic fields	- Polar-orbiting satellites - Remote sensing from different vantage points (e.g. LEO, GEO)
How do atmospheric tides and waves affect the IT system?	- neutral winds - neutral temperature and density - IR emissions	- LEO satellites - Remote sensing

2) What novel measurements would hold potential for resolving key open science questions or lead to discoveries?

Science Questions	Measurement	Rideshare Opportunity
What are the spatial-temporal variations of auroral and Joule heating?	- Energy and pitch angle distributions of precipitating particles - Auroral imaging - 3D electric fields or ion drifts - 3D magnetic fields	Polar-orbiting satellites and distributed cubesats between 300 and 800 km
How do the high-latitude energy inputs impact the neutral winds, density, and composition distrubitions globally?	- Electric and magnetic fields - Auroral precipitation - Neutral winds - Neutral density - Neutral composition	Polar-orbiting satellites in a string-of-pearl configuration and at multiple local time planes
How do neutral winds modulate the magnetosphere-ionosphere-thermosphere coupling?	Concurrent measurements of neutral winds and ion drifts	Same as above
How does the IT system respond to atmospheric forcing?	Altitude profiles of neutral winds and density as well as plasma density and velocity	Lower inclination satellites between ~100 and ~300 km

3) What high-risk, high-reward science questions could take advantage of this opportunity? (Outline science question and rideshare opportunity)

Science Questions	Measurement	Rideshare Opportunity
How do small-scale electrodynamics affect the energy and momentum transfer between ions and neutrals?	- DC (< 1 Hz) and AC (> 1 Hz) electric and magnetic fields - High resolution neutral winds	Polar-orbiting satellites or cubesats/small sat between 300 to 800 km
How is magnetospheric energy input partitioned among the different scale sizes?	Same as above	Same as above