Tethered Satellites as an Enabling Platform for Operational Space Weather Monitoring Systems

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1. The Near-Earth Space Environment varies over spatial and temporal scales, covering many orders of magnitude.
2. Cross-scale coupling between physics processes often plays an important role in the interaction, evolution, and interaction of each other.
3. Plasma waves and instabilities imply spatiotemporal complexity, which presents a challenge to separate temporal evolution from spatial propagation and deformation.

**Example Technique Proven**

- Direct Measurements of E||B in an auroral acceleration region
- Systematic Multipoint measurements of plasma density

**The Science Question**

**What mechanisms are involved in control of E||B?**

**The Space Tether Solution**

Space tethers can make simultaneous multiple measurements with a fixed separation in distance.

- Proven during TSS-1R
- Found asymmetries in density gradients within a large plasma bubble. Important for scintillation.

**Example Technique Proven**

- TSS-1R Orbiter data before and after a uniform time delay of 2.5 s is applied, thus aligning them with most of the prominent density structures at the satellite.

**Enabling Technology**

**For Space Weather Tethers**

- Tethers for CubeSats
  - Enables CubeSat with miniature plasma and/or field sensors
- ISS & CubeSat launches
  - Enables launch tethered CubeSat into low altitude orbit
- Sounding Rocket Tethers
  - Enables unique observations of plasma environment (e.g., E||B, plasma turbulence)

**References**