Physics and Space Sciences Special Colloquium

Lightning, Thunderstorms, and the Global Electric Circuit from Satellites

Satellite platforms survey electrified weather across the globe. Lightning flashes emit optical pulses that are detected by staring imagers and used to identify thunderstorms. Lightning-free Electrified Shower Clouds (ESCs) also can be inferred from passive microwave measurements.

Thunderstorms and ESCs have broad impacts on the Earth system. One example is the production of conduction (Wilson) currents that power the Global Electric Circuit (GEC). Electrified weather produces a mean integrated current of 1 - 2 kA globally, and its geographical distribution leads to a distinct diurnal cycle in the fair-weather electric field (the Carnegie curve).

The total mean current is computed from Tropical Rainfall Measuring Mission (TRMM) and Global Precipitation Measurement (GPM) satellite observations of convective clouds using a passive microwave electric field retrieval algorithm. This approximation produces an excellent agreement with the Carnegie curve. However, the complex charge structures that often accompany stratiform clouds and frequently produce inverted-polarity Wilson currents provide a challenge for the retrieval.

Stratiform clouds also are known for producing expansive lightning flashes that propagate horizontally across considerable distances. These flash structures can be identified using optical lightning measurements. Thus, lightning imagers such as the Lightning Imaging Sensor (LIS) on TRMM and the International Space Station, and the Geostationary Lightning Mapper (GLM) on the GOES-R satellite will be useful for identifying and characterizing electrified cloud regions. These observations will help diagnose the broad impacts that thunderstorms have on the Earth system.

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Meet and Greet	Colloquium
3:00—3:45PM	4:00 – 5:00PM
OPS Room 202	OPS Room 140

Light refreshments will be provided