Movin' on the ISS: Status of the post-relocation Lightning Imaging Sensor and future plans

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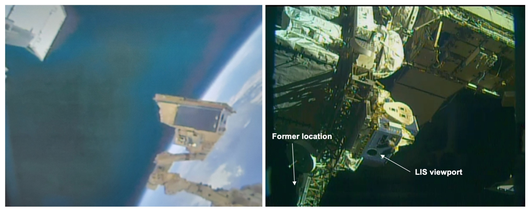
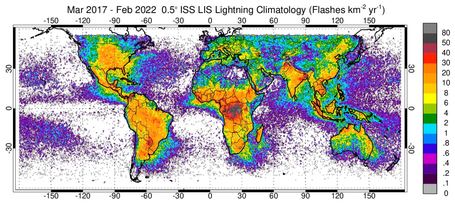
The Big Move

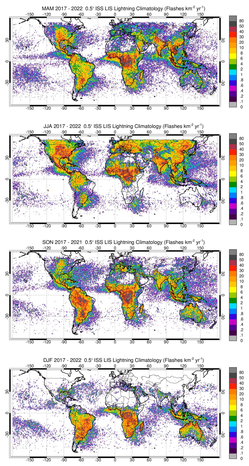
- On 7 July 2022, the International Space Station Lightning Imaging Sensor (ISS LIS) was relocated to make room for the incoming Earth Surface Mineral Dust Source InvesTigation (EMIT) mission.
- The 5th Space Test Program Houston (STP-H5) payload, which houses the LIS instrument, was moved via robotic arm from site 8 to site 3 on the 1st EXpedite the PRocessing of Experiments to Space Station (ExPRESS) Logistics Carrier (ELC-1).

STP-H5/LIS being carried by robotic arm during relocation

STP-H5/LIS in new site on ELC-1 (site 3)







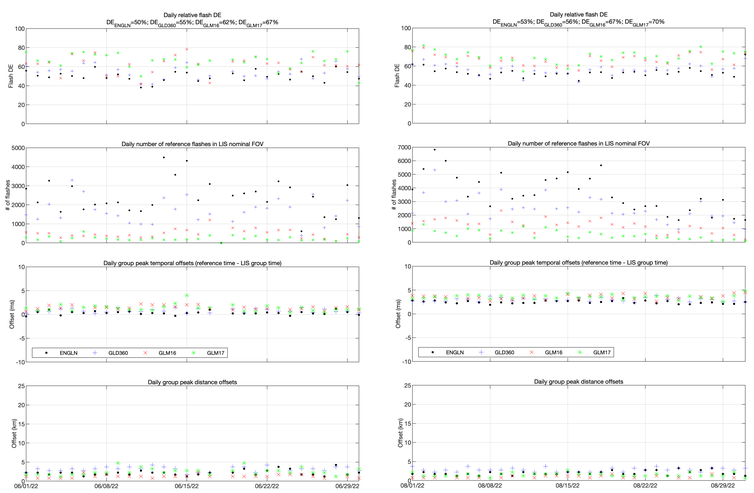
Five-year global and seasonal climatologies.

Work is ongoing to account for instrument sensitivity differences and accurately merge ISS LIS with TRMM LIS & OTD.

This was an approximately 180-deg yaw flip, requiring updates to the ISS LIS geolocation and viewtime processing. These updates were validated against reference datasets, such as ground-based lightning detection networks operated by Vaisala and EarthNetworks, as well as Geostationary Lightning Mappers (GLMs). The move allows ISS LIS to operate through December 2023.

Before (Jun 2022)

After (Aug 2022)

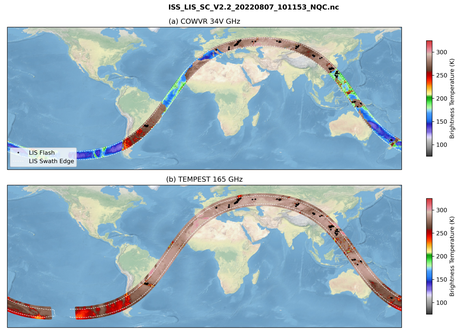


Pre- and post-relocation performance very similar.

The ~3-ms offset bias seen shortly after the relocation was temporary and instrument is back to usual ~1-ms offset (not shown).

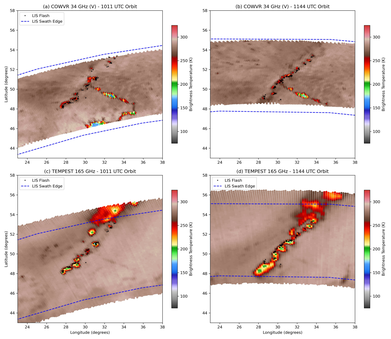
LIS suffered numerous outages during 9/13-10/18/22 due to ELC-1 power issues

The Return of TRMM (Kind Of)

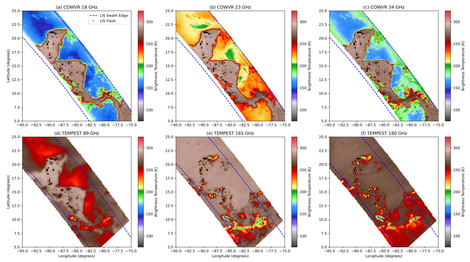


The STP-H8 Air-Sea Atmospheric Profiling (ASAP) mission has operated on the ISS during 2022. This mission contains two microwave radiometers (COWVR & TEMPEST) spanning the frequency range 18-182 GHz.

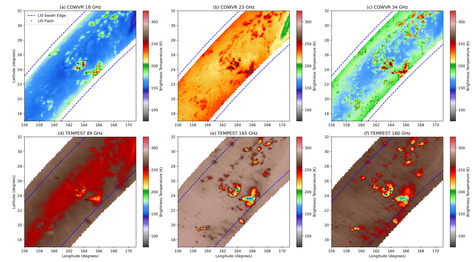
The radiometers have excellent swath overlaps with LIS, and show accurate geolocation and realistic brightness temperatures relative to LIS flashes.



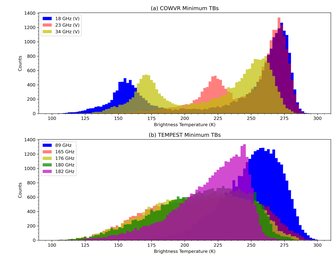
Storm Evolution between Orbits



ASAP/LIS Land Example



ASAP/LIS Ocean Example



Minimum TBs near Thunderstorms (JJA '22)

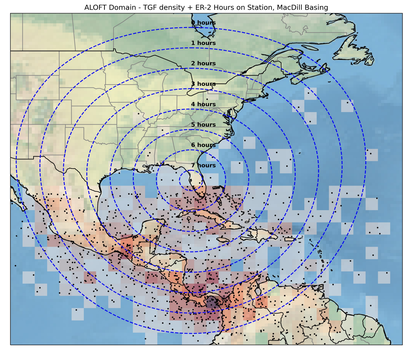
The ALOFT Campaign

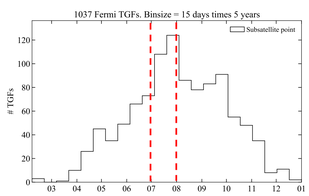
ALOFT = Airborne Lighting Observatory for FEGS and TGFs
FEGS = Fly's Eye GLM Simulator
TGF = Terrestrial Gamma-ray Flash

50-h ER-2 airborne field campaign in July 2023 out of Florida base

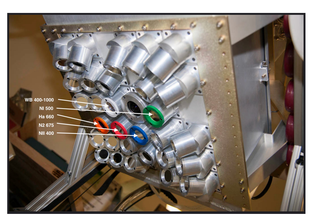
Science Goals

1. Observe TGFs in one of the most TGF-intense regions on the planet.
2. Observe gamma-ray glows in thunderstorms and their relation to TGFs.
3. Perform ISS LIS and GLM validation using improved suborbital instrumentation (including upgraded FEGS).
4. Evaluate new design concepts for next-generation spaceborne lightning mappers.
5. If relevant instrumentation is available, make measurements useful to advance convection science from a suborbital platform.





ALOFT Spatial & Temporal Domains



FEGS Upgrades for ALOFT

1. Update electronic gains to improve overall performance (including nighttime functionality)
2. Improve filter on wideband photometer to mitigate saturation
3. Improve radiometric precision by mitigating stray light with black paint on metal surfaces
4. Replace the 400-nm channel with 337-nm UV
5. Replace 660-nm channel with 868.3-nm NIR
6. Replace 675-nm channel with wideband SWIR (1-2 μm)