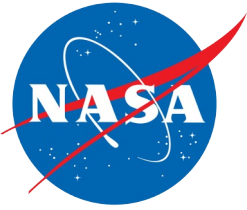


NASA Virtual Science Workshop on Lightning-Related Research Beyond the Troposphere



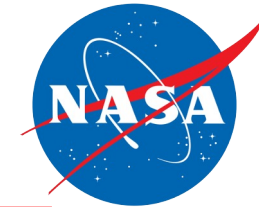
Day 1 (Monday, 2 May 2022)

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- Introductions - Workshop Planning Committee (5 minutes)
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Existing and Future Spaceborne Lightning-Mapping Capabilities



Timothy Lang¹

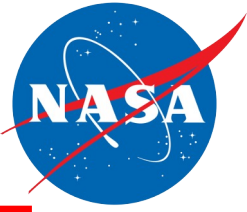
¹NASA MSFC, timothy.j.lang@nasa.gov

With Contributions From:

Sarah Bang, Phil Bitzer, Rich Blakeslee, Dennis Buechler,
Shing Fung, Patrick Gatlin, Burcu Kosar, Doug Mach, Torsten
Neubert, Michael Peterson, Mason Quick, Bill Rison

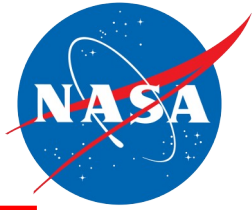


Purpose

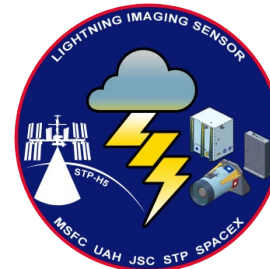
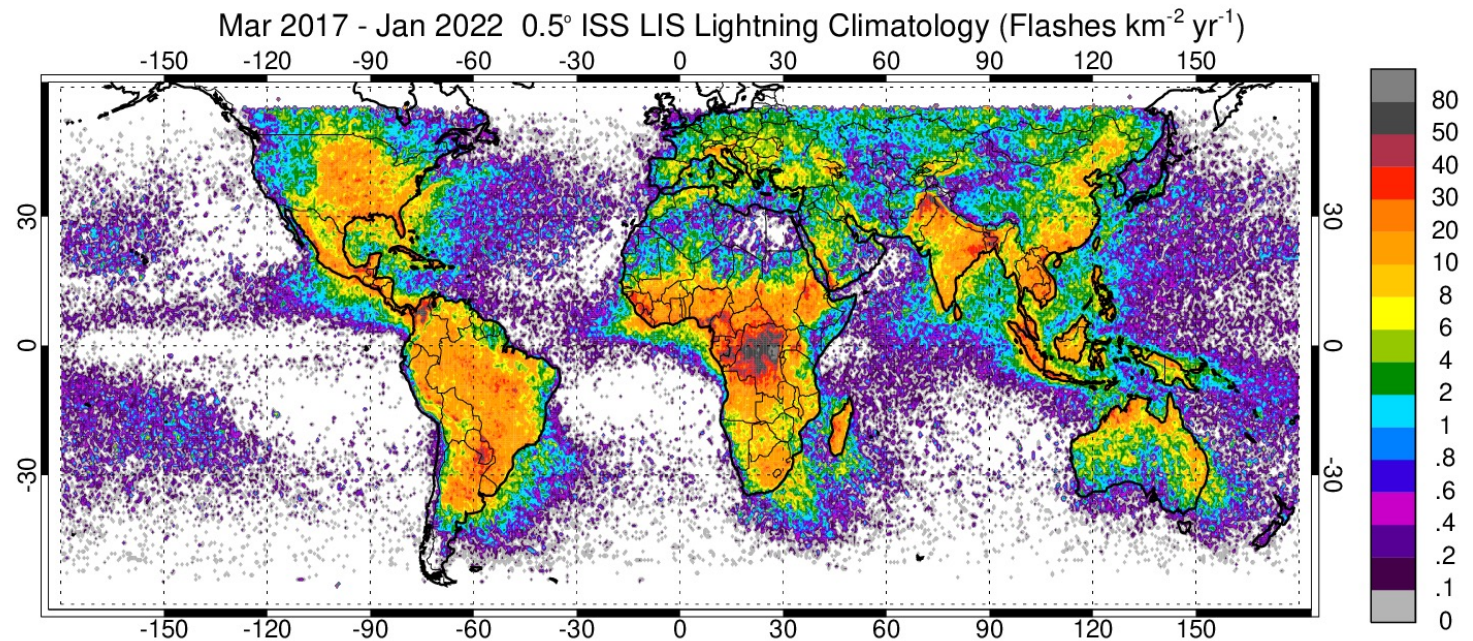


- The purpose of this talk is to remind workshop participants as to what NASA and related agency spaceborne and suborbital assets exist, or (hopefully) will exist, for measuring lightning
- These capabilities could help form a basis for any interdisciplinary study of lightning-related effects beyond the Earth's troposphere
- This is not a comprehensive review of all lightning-measuring capabilities, nor does it review all types of observations that might be needed by such interdisciplinary studies

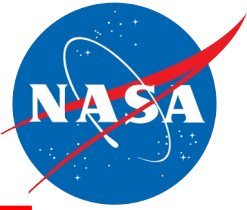
International Space Station Lightning Imaging Sensor



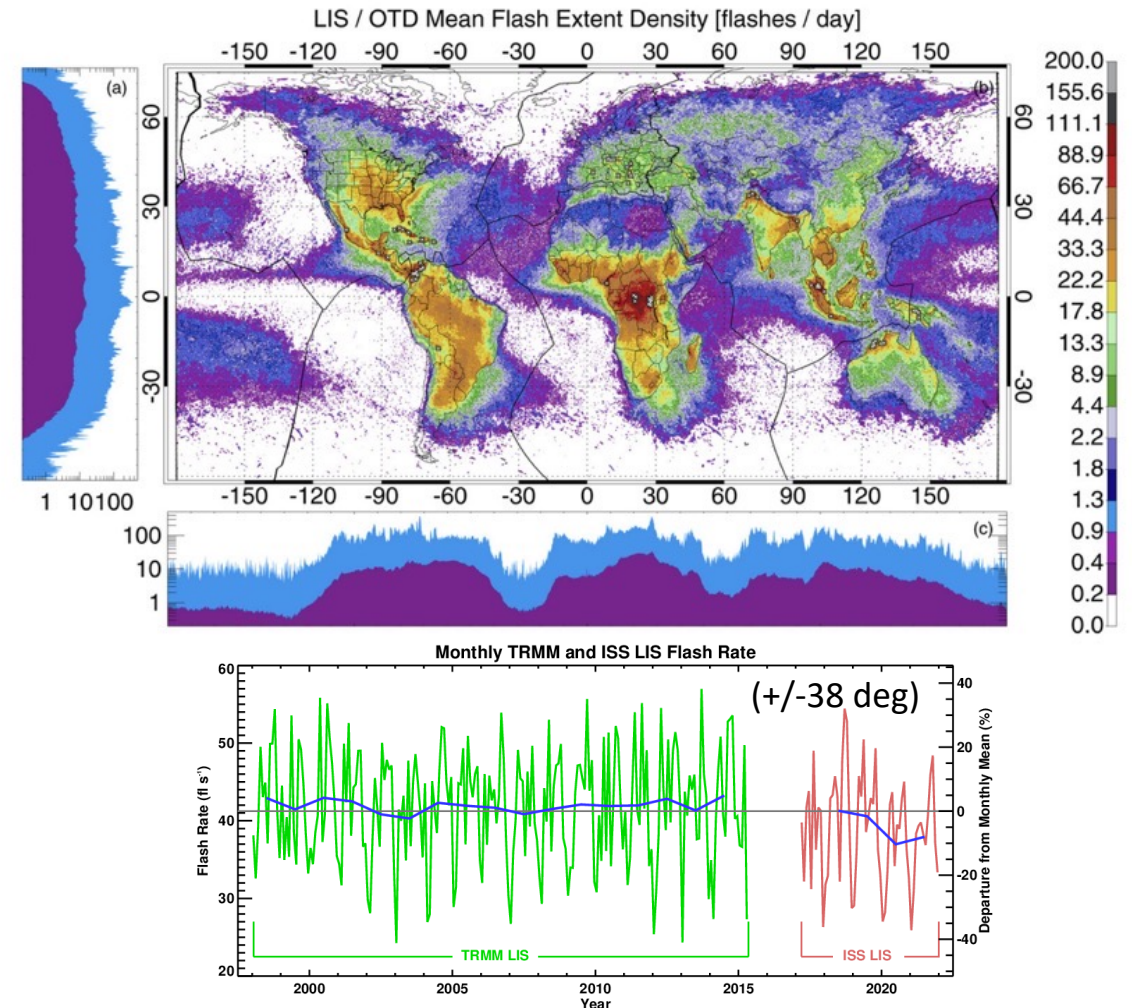
- Modified flight spare for TRMM LIS on ISS February 2017-Present
- Optically based transient detector at 777.4 nm
- ISS LIS expands the TRMM LIS record of global lightning via LEO to +/-55 deg
- Mission extended thru 2023
- Data available from the NASA Global Hydrometeorology Resource Center (GHRC)



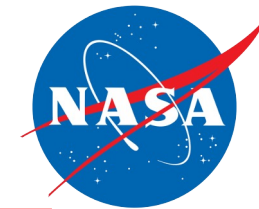
Long-Term Global Record of Lightning from Space



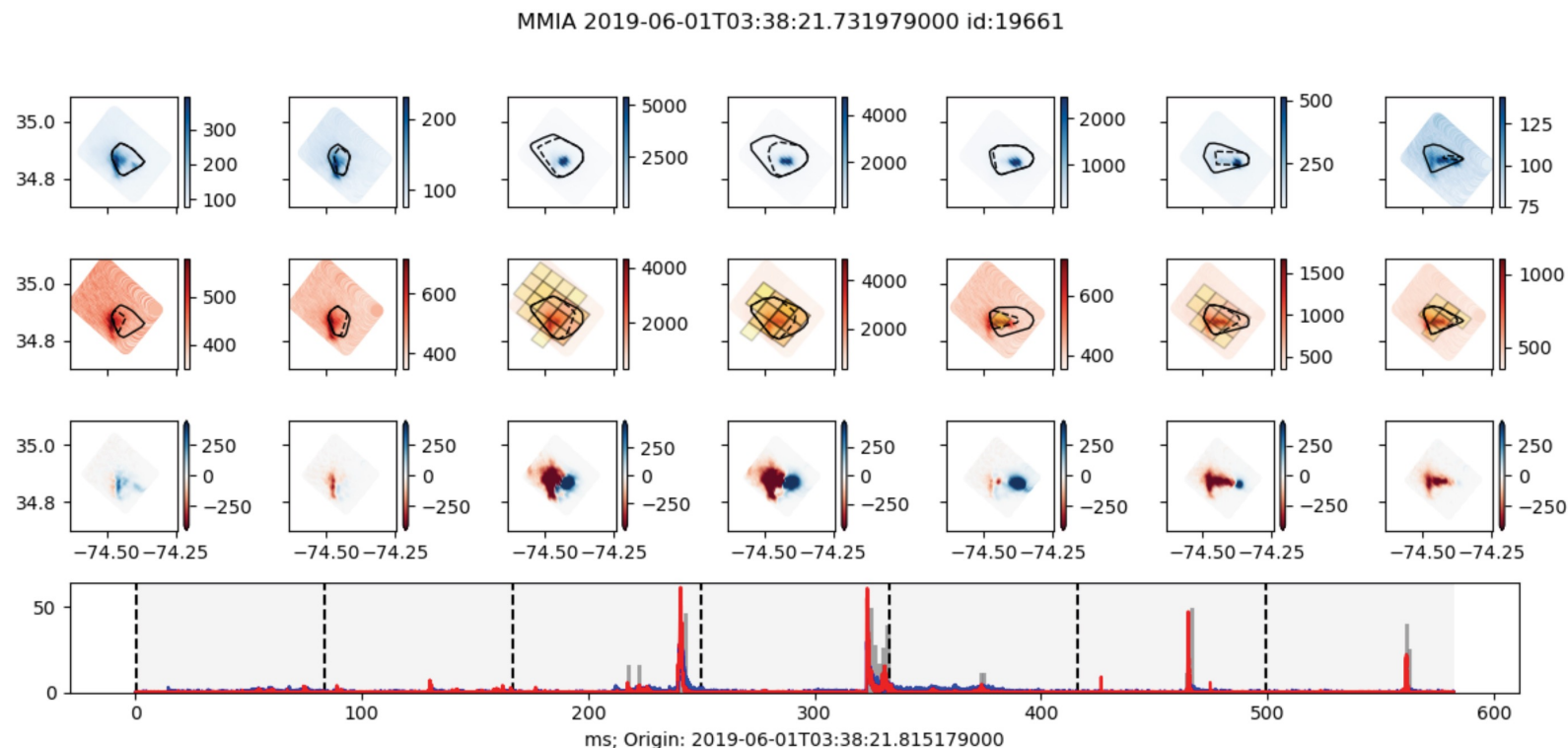
- Optical Transient Detector (OTD; 1995-2000) – 70-deg inclination
- TRMM LIS (1997-2015) – 35-deg inclination
- ISS LIS (2017-Present) - 57-deg inclination
- Working toward harmonization and reprocessing of full 25+ year dataset for this WMO Essential Climate Variable



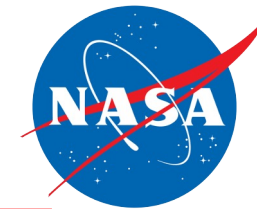
Atmosphere-Space Interactions Monitor



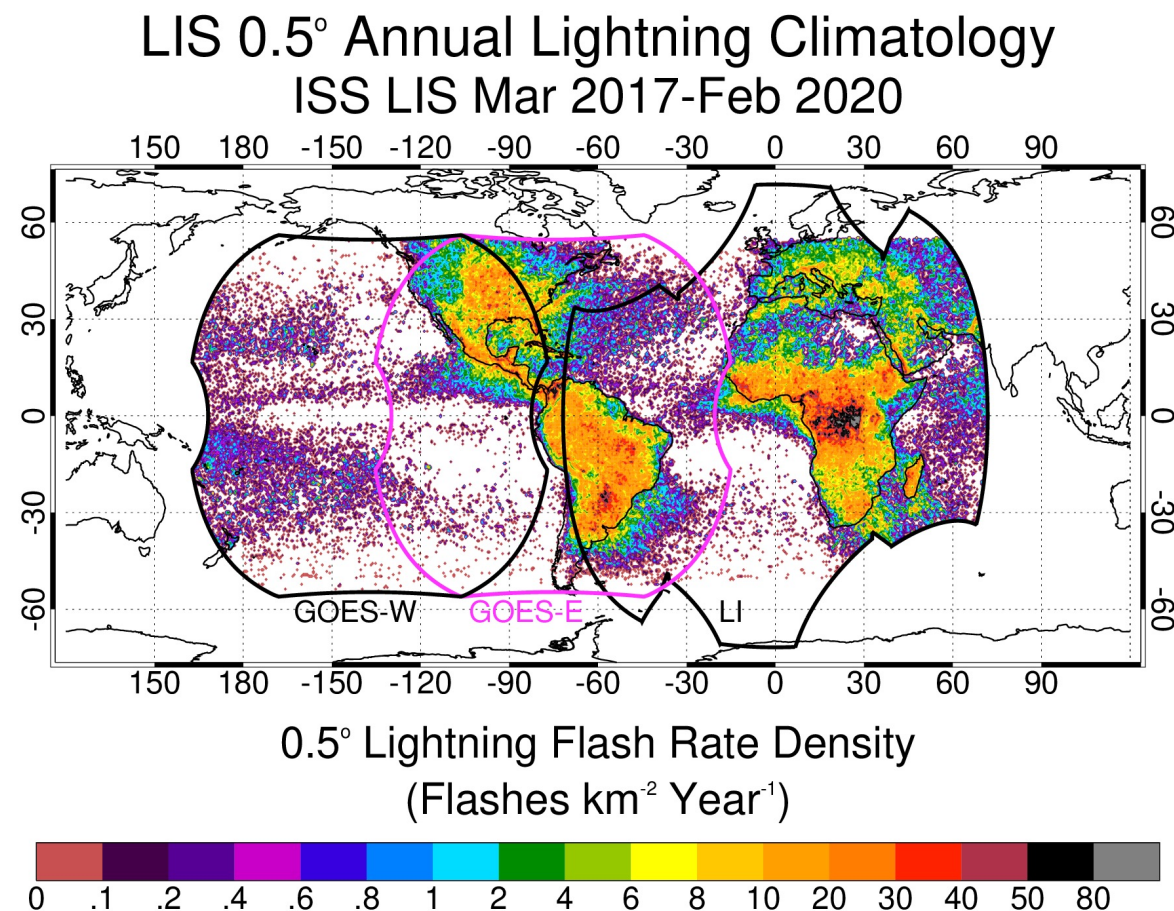
- Combination of imagers/photometers (MMIA) and high-energy particle detectors (MXGS) on ISS 2018-Present
- Observes lightning at both 337 and 777 nm
- Recent relocation will have more limb-focused view



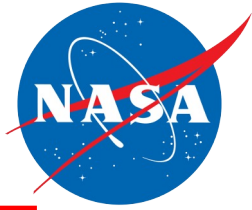
Geostationary Lightning Detectors



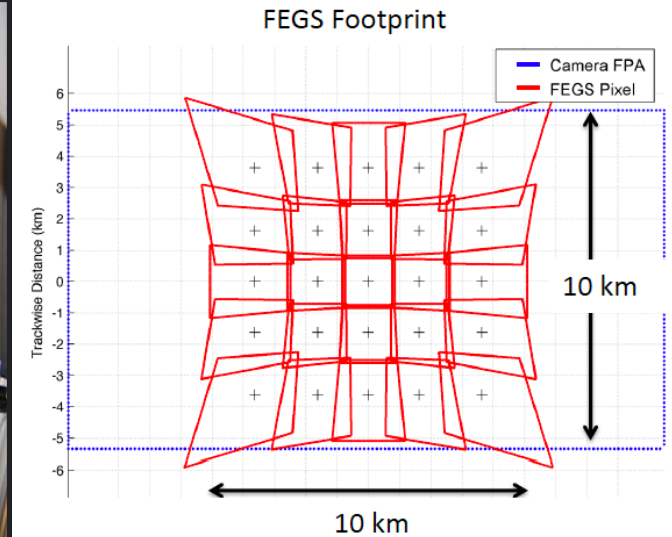
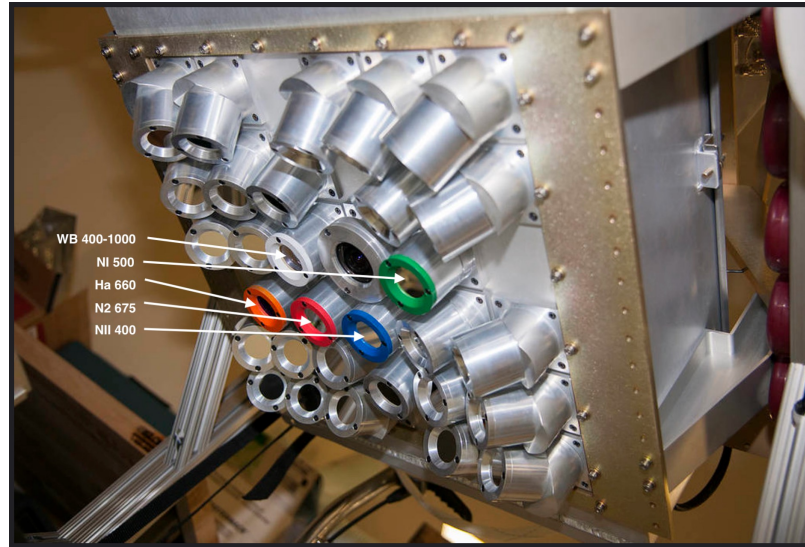
- Geostationary Lightning Mapper (GLM) on GOES-East & GOES-West (16/17); GOES-18 just launched
- Lightning Imager (LI) on forthcoming Meteosat Third Generation
- Chinese geostationary Lightning Mapping Imager (LMI)
- GOES-R follow-on – GeoXO



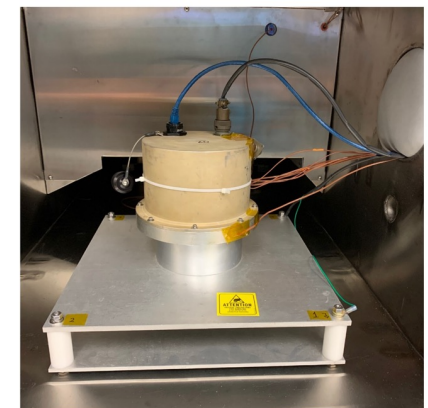
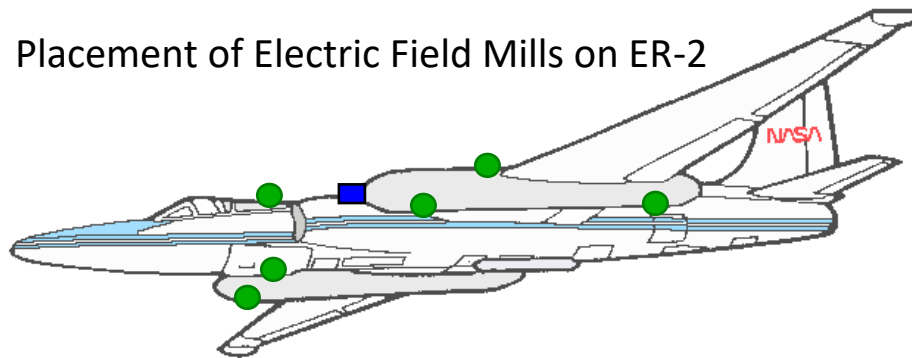
NASA Airborne Capabilities



- Fly's Eye GLM Simulator (FEGS) – Array of 777-nm and other photometers & cameras
- Lightning Instrument Package (LIP) – Array of electric field meters (plus conductivity probe)
- Planning to fly again together in ALOFT (July 2023, Florida)

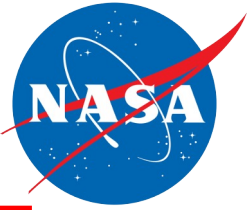


Placement of Electric Field Mills on ER-2

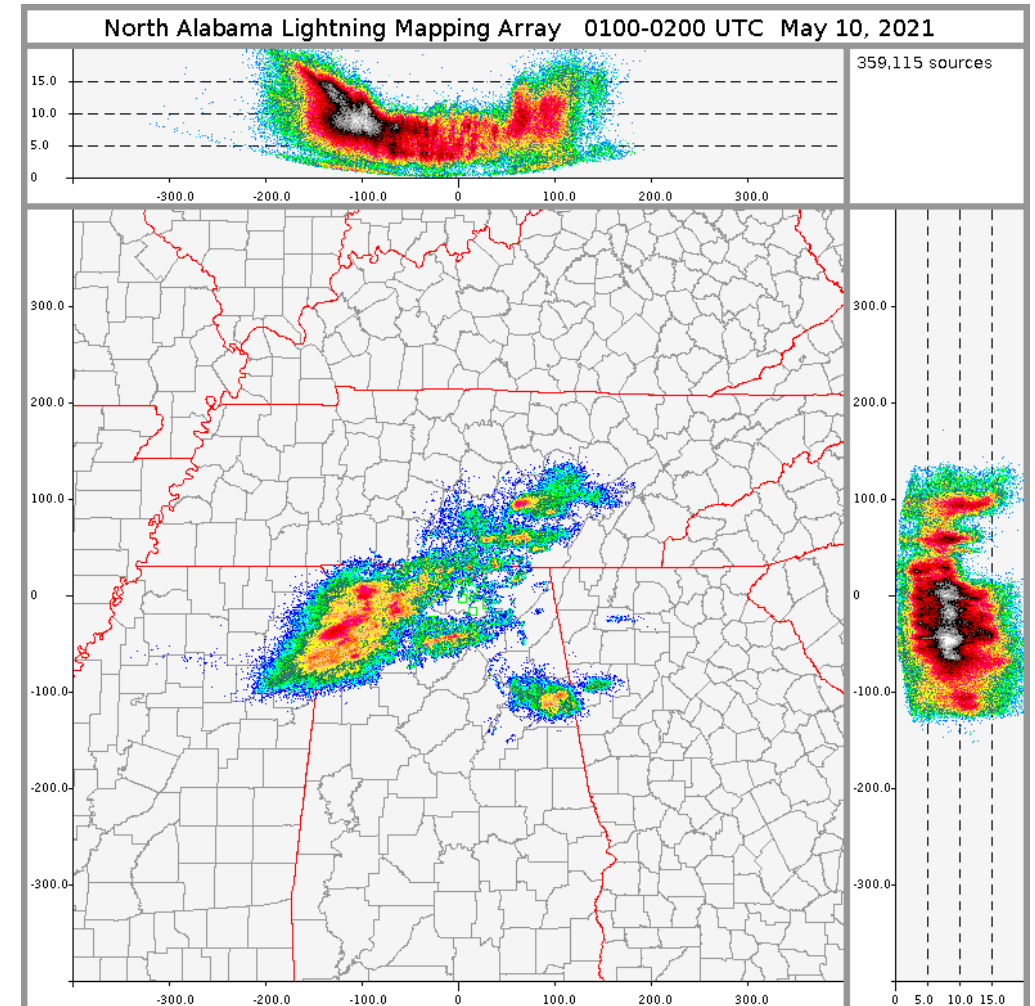


ABFM on Test Fixture

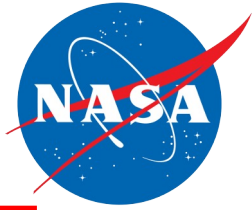
Ground-Based Lightning Mapping



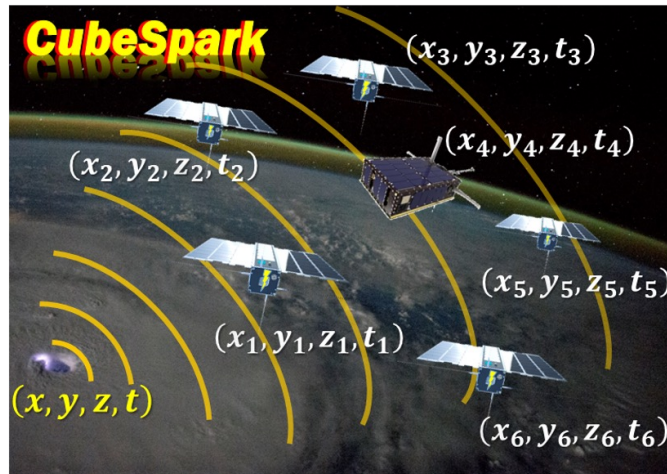
- NASA owns multiple 3D VHF Lightning Mapping Arrays (LMAs) – e.g., North Alabama, DC, WFF; Used primarily by NASA for LIS and GLM validation
- Permanent KSC ground network (field mills, LMA, etc.)
- NASA has supported field deployments of ground sensors as well
- NASA commercial ground network data purchases/ingests (e.g., Vaisala, EarthNetworks, WWLLN)



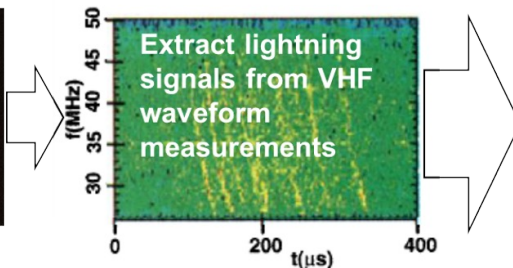
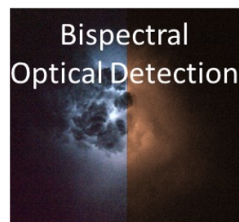
CubeSpark



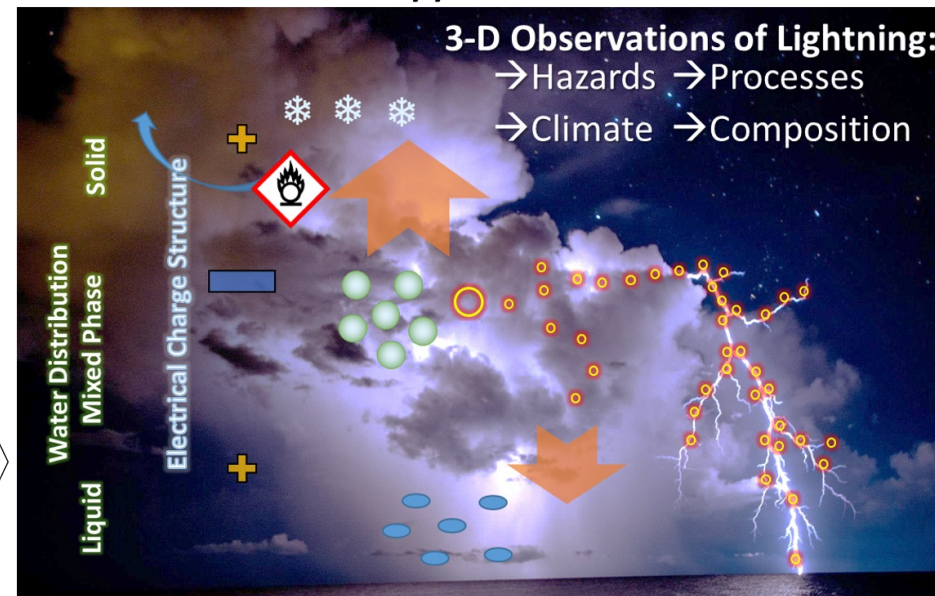
- CubeSpark is a mission concept being developed by NASA Marshall Space Flight Center and Los Alamos National Laboratory to improve the detection of optically dim flashes and retrieve 3D lightning structure from a LEO constellation of cubesats



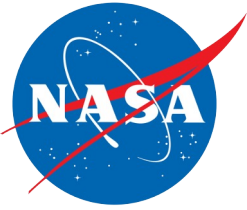
Measurement Concept



Enabled Science and Applications



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