

National Aeronautics and
Space Administration

NASA Hydrosphere

Field Campaigns & Assets

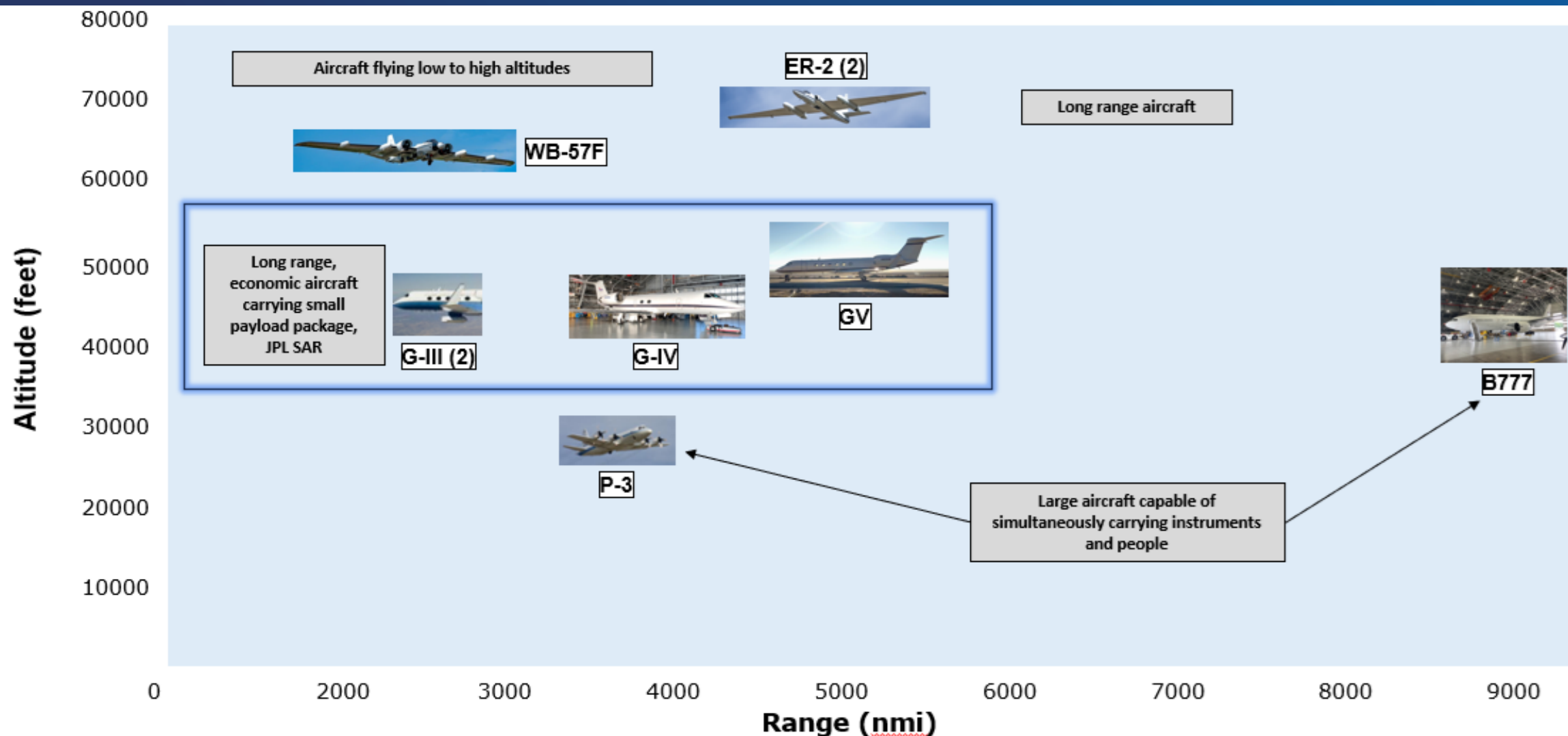
Precipitation Science

Will McCarty and Justin Stachnik
NASA Hydrosphere

A large, circular graphic on the right side of the slide. It features a central image of Earth from space, surrounded by concentric rings. The rings contain various images: a satellite, a desert landscape, a forest, a river, and a network of nodes. A white NASA aircraft is flying in the lower right. The text "NASA Earth" is written in large white letters across the center of the graphic.

NASA Earth

NASA Funded Aircraft Mapping your Requirements



Bridging to the First 777 Airborne Campaign



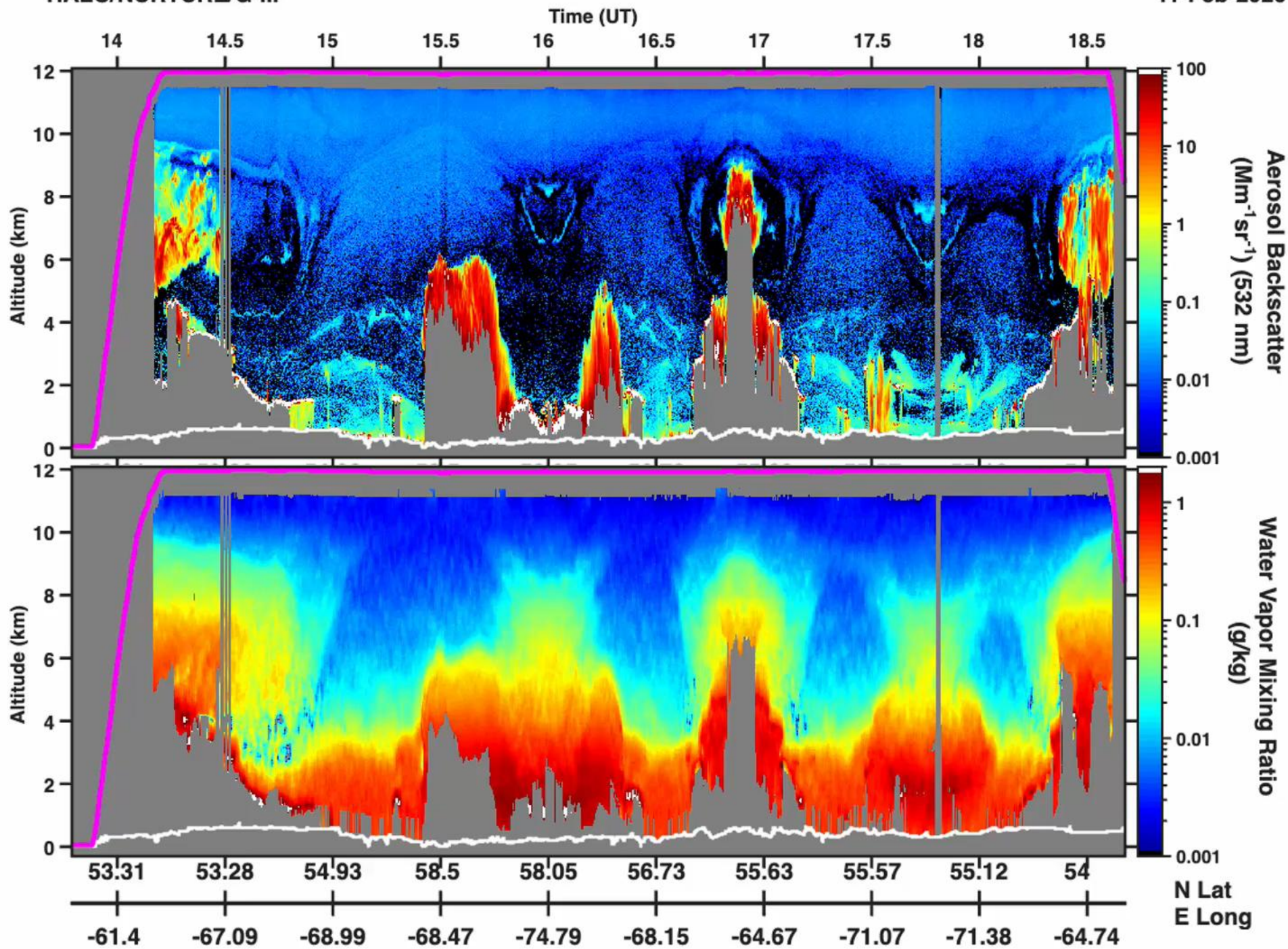
North American Upstream Feature-Resolving and Tropopause Uncertainty Reconnaissance Experiment (NURTURE)

Phase One: NASA G-III, January 26 - February 20, 2026

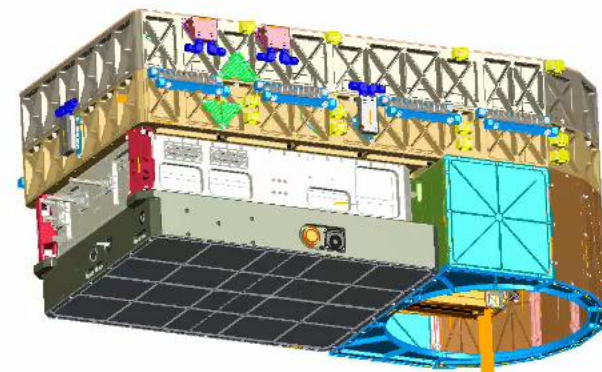
Phase Two: NASA 777, January 11 - February 21, 2027

To advance knowledge of processes that lead to extreme High-Impact Weather winter events:

- Tropopause polar vortices, dry air intrusions, turbulence, interactions with jet stream
- Upper tropospheric and lower stratospheric and diabatic heating influences on tropopause structure/dynamics and jet streams
- Boundary-layer processes between troposphere and surface that precondition high-impact weather events (cold air outbreaks, windstorms, hazardous seas, snow and ice storms, sea ice breakup, extreme precipitation)



Water Vapor DIAL/HSRL



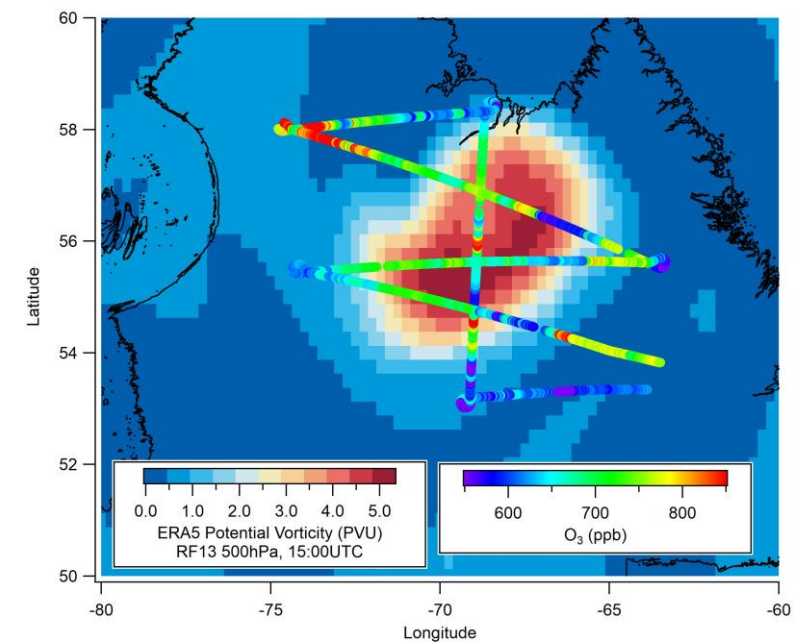
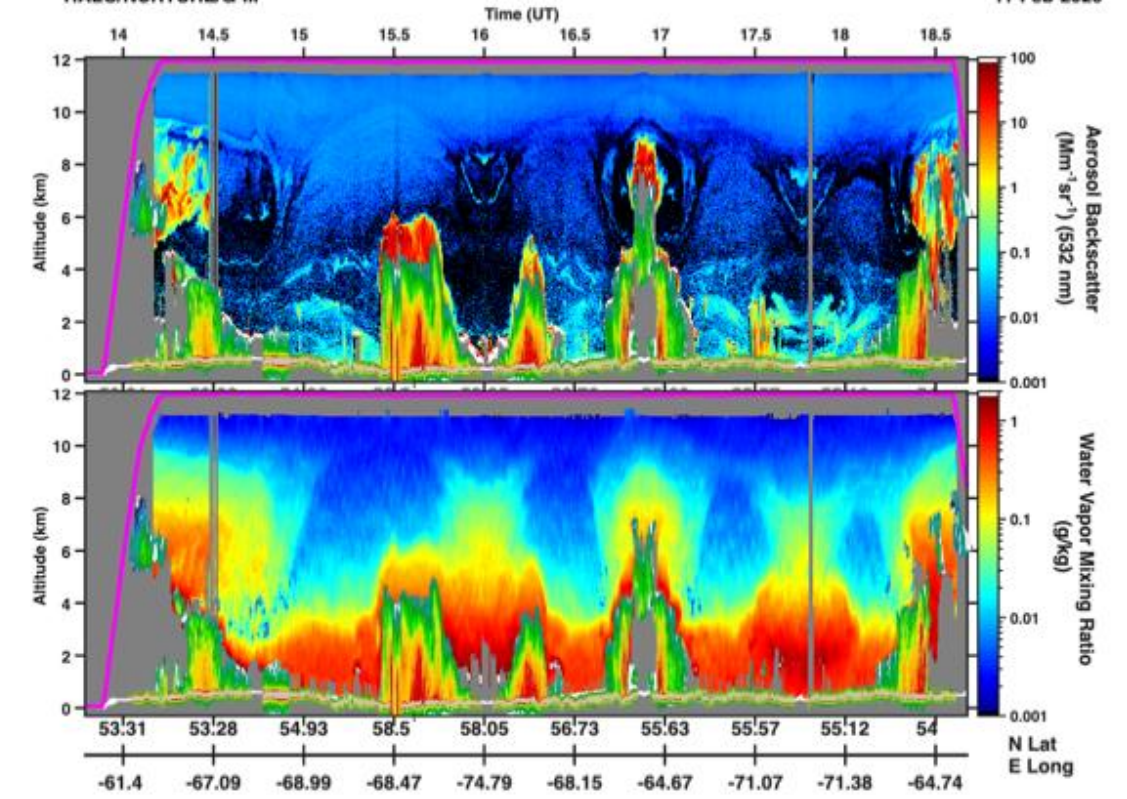
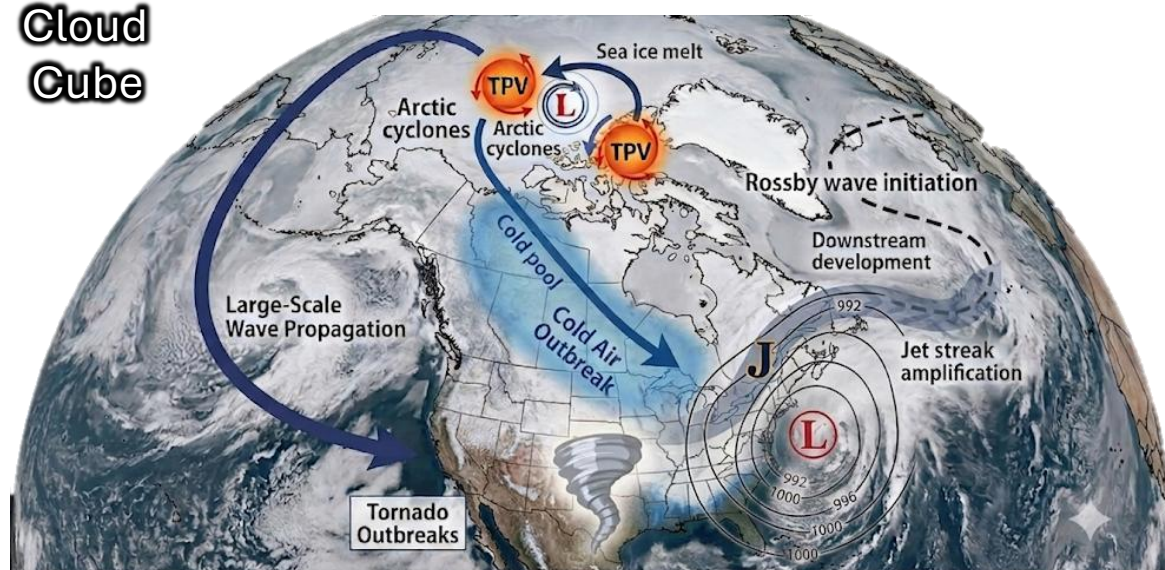
N₂O, O₃ In-Situ

Radio Occultation

HALO

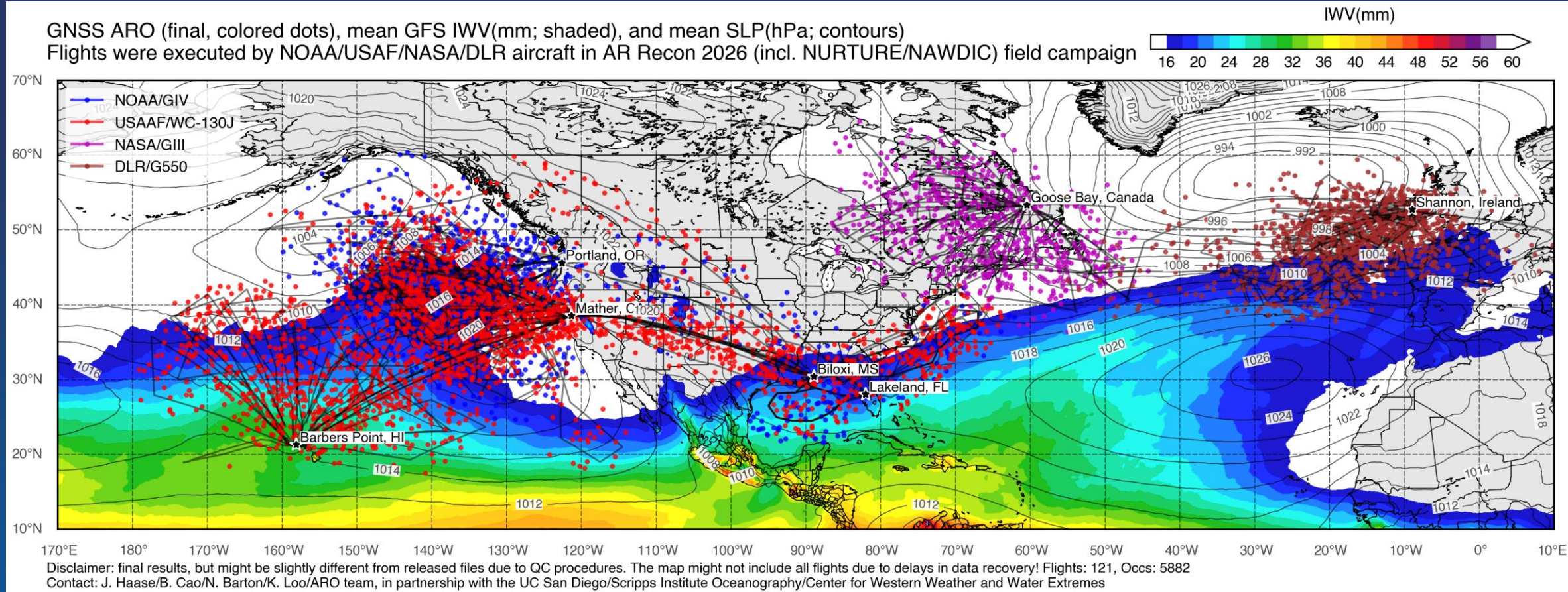
Dropsondes

Cloud
Cube



NURTURE 2026

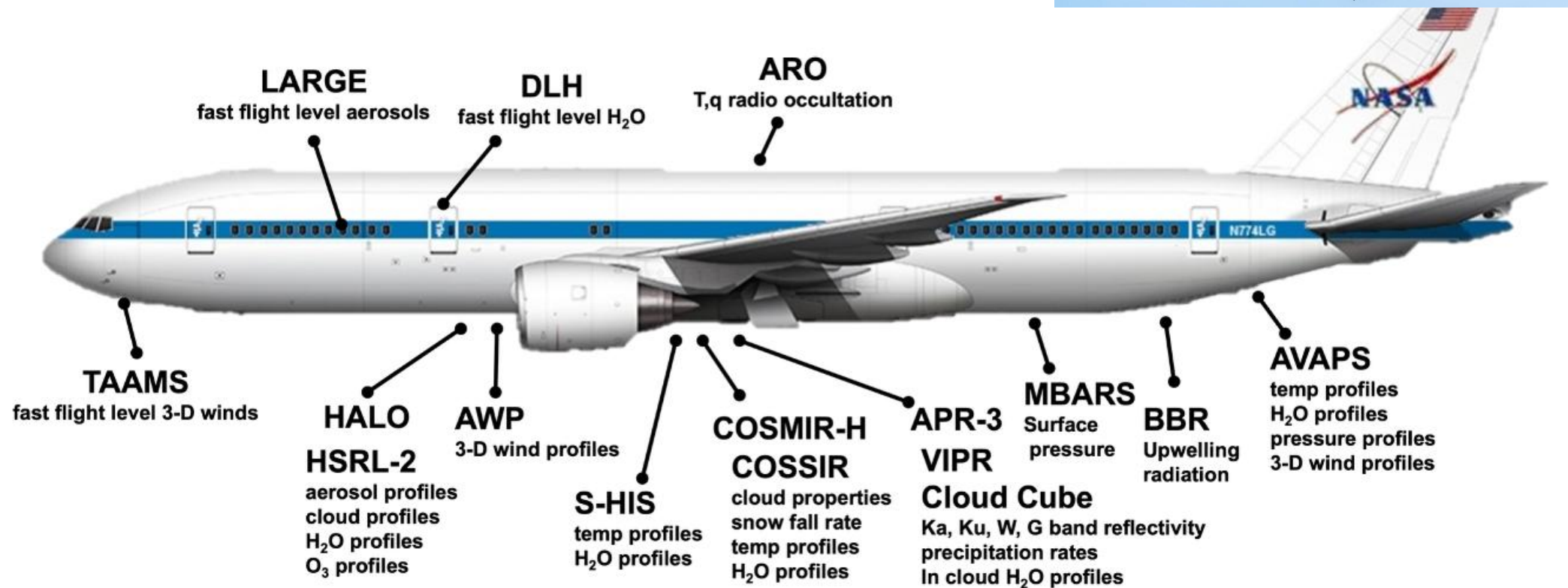
A Piece in a Hemispheric Campaign



NURTURE 26 was part of the Global Atmospheric River Reconnaissance Program (GARRP), which coordinated field efforts from NOAA (AR-Recon), Europe (NAWDIC), and NASA for hemispheric-wide observational coverage

NURTURE 2027

The Maiden Voyage of the NASA 777



Acronym	Instrument	Observables
HALO *	High Altitude Lidar Observatory	Profiles of H2O, aerosol, cloud; surface winds, PBLH
HSRL-2	High Spectral Resolution Lidar 2	Profiles of ozone, aerosol, cloud, ocean; surface winds, PBLH
APR-3 *	Airborne Third Generation Precipitation Radar	Ku-, Ka-*, and W-Band* Profiles of radar reflectivity and vertical velocity
CloudCube *	Compact Millimeter-Wave Cloud Radar	G-Band Profiling Cloud Radar
AWP	Aerosol Wind Profiler	Profiles of wind direction and speed
VIPR	Vapor In-cloud Profiling Radar (VIPR)	High-vertical-resolution in-cloud water vapor soundings
MBARS	Microwave Barometric Radar and Sounder	Profiles of radar reflectivity; surface pressure
CoSSIR	Sub-mm Wavelength Radiometer	Profiles of ice cloud, H2O; snowfall
COSMIR	Conical Scanning Millimeter-wave Imaging Radiometer	Profiles of H2O, T
S-HIS	Scanning High-resolution Interferometer Sounder	Profiles of H2O, T, composition
AVAPS *	Advanced Vertical Atmospheric Profiling System (Dropsondes)	Profiles of H2O, T, P, wind speed, wind direction
DLH	Diode Layer Hygrometer	Open path measure of water vapor at aircraft
TAMMS	Turbulent Air Motion Measurement System	Aircraft level winds (20-100 Hz)
NSRC	Aircraft Data System	Aircraft navigational, meteorological

* 2026 G-III Payload

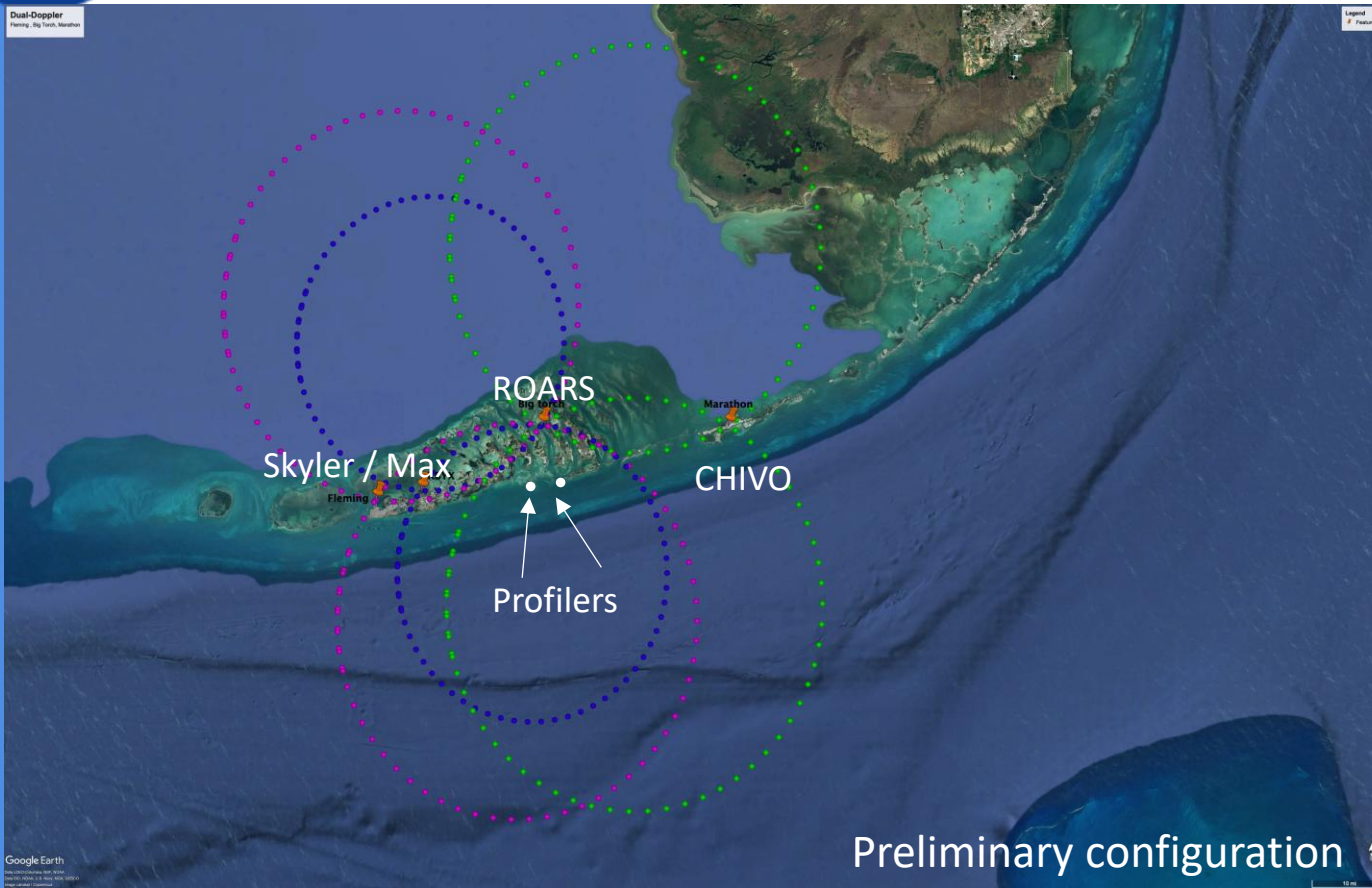


PIE-SLICE Key West

Post-Launch INCUS Experiment (PIE) Sub-orbital Investigation of Convective Evolution (SLICE)



INVESTIGATION OF CONVECTIVE UPDRAFTS



Heterogeneous Radar Network

- Scanning polarimetric dish radars (X and C-band)
 - CSU CHIVO, (UAH Max)
- Profilers
 - MRR pro, UAH 915 MHz
- Phased array radars (X-band)
 - SBU ROARS, (Skyler-II)

Time Frame

- Approx. 1 year for many of the anchor platforms (Fall 27- Fall 28)
- Summer 2028 IOP

Goals

Statistics of vertical motion, observations of anvil / updraft connections, reflectivity timelapse, and hydrometeor characteristics





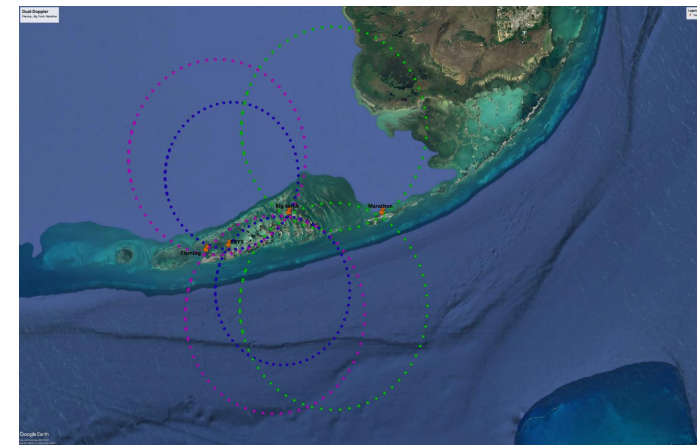
PIE-SLICE Key West

Post-Launch INCUS Experiment (PIE) Sub-orbital Investigation of Convective Evolution (SLICE)



Key West:

- Exploring synergies with other projects
 - PoSIR, PMM, ENLIGHTEN, EarthCARE
- **Looking for collaborations in Key West supporting:**
 - Atmospheric state (soundings, radiometers)
 - Additional vertically pointing radars and profilers
 - Aircraft with radars (particularly Ka-band!)
 - Ships / boats with small instrumentation (vertically pointing, phased array)



Globally:

- International Cal / Val partners
 - Univ. Reading, UK (Thorwald Stein), Nagoya Univ., Japan (Nobuhiro Takahashi), Kyungpook National Univ., South Korea (Gyuwon Lee)
- **Looking for partnerships with other global tropical or sub-tropical locations:**
 - TIME SLICE established a baseline strategy for observing convective evolution that can be translated elsewhere



Please reach out if you are interested in collaborating!
bdolan@colostate.edu, patrick.gatlin@nasa.gov, cschu@geos.tamu.edu



PolSIR Calibration/Validation (POLCA)

Co-Leads: Ian Adams (ian.s.adams@nasa.gov) and Rachael Kroodsma (rachael.a.kroodsma@nasa.gov), NASA GSFC

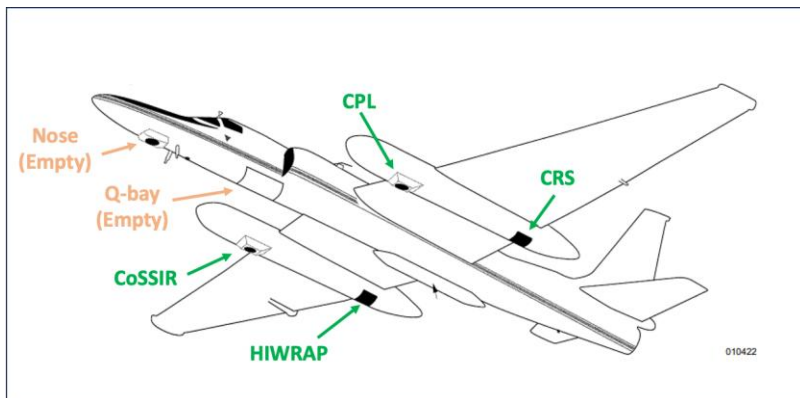
Objective: Validate PolSIR measurements and retrieval algorithms using a suite of airborne instruments onboard the high-altitude NASA ER-2 aircraft

Payload:

- CoSSIR (sub-mm radiometer)
- CPL (backscatter lidar)
- CRS (W-band radar)
- HIWRAP (Ka/Ku radar)

High-altitude ER-2 aircraft

- Flies at 65,000 ft (above ice clouds)
- 50-60 flight hours
- Deployment out of Florida/Georgia in late Summer 2028 following ENLIGHTEN



Proposed Flight Plans

- 1) PolSIR ground track underflight
 - Direct comparison with CoSSIR
 - Clear sky and cloudy scenes
- 2) Wide dynamic brightness temperature range
 - Cold deep convection
 - Anvil cirrus
 - Clear sky
- 3) Coordinate tracks with NWS radiosonde launches for 'truth'
 - Active sensors on the ER-2 will provide 'truth' cloud information
- 4) Potential for other cal/val contributions
 - ICI, INCUS, AWS

ENLIGHTEN (ALOFT Follow-On Campaign)

ExploriNg Lightning Initiation and Gamma-ray High-energy emission in Thunderstorm ENvironments

Science Objectives

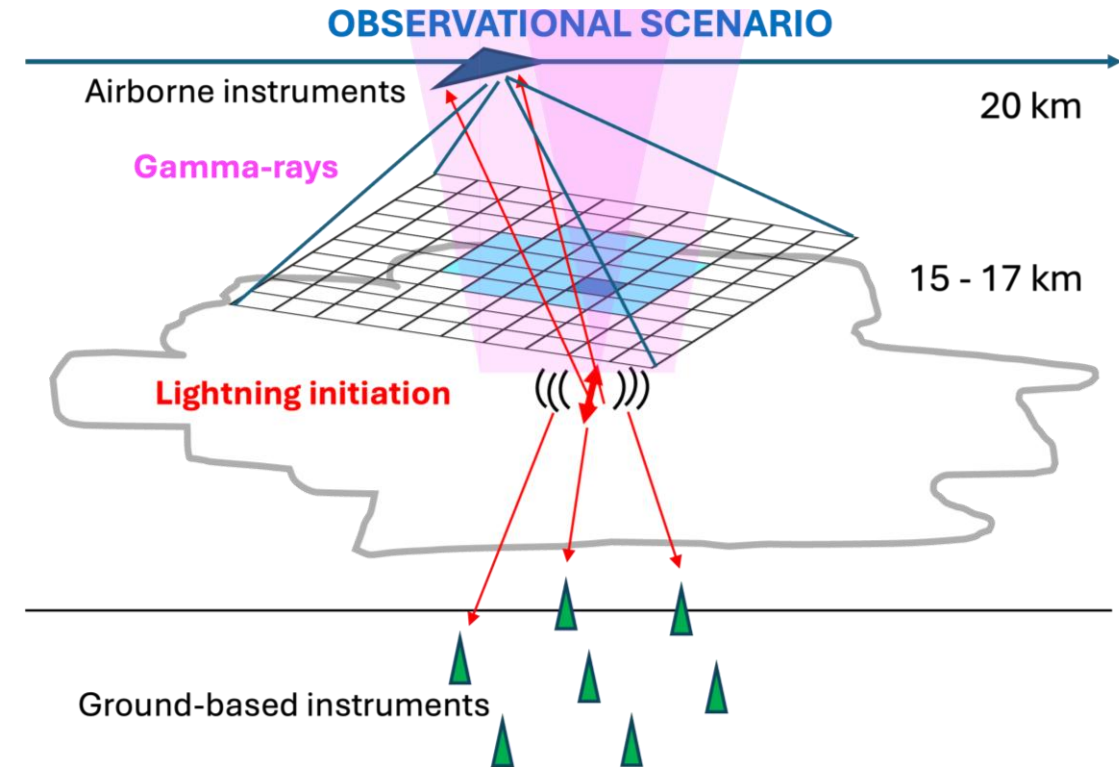
- Study the dynamical evolution in space and time of large-scale electric fields
- Understand spatial extent of gamma-ray flashes & glows
- Explore connection between particle acceleration and lightning initiation

Status/Plans

- Funded by ERC and on ER-2's calendar for **July 2028**
- ConOps modeled on ALOFT (incl. FL deployment)
- Core ALOFT lightning payload – optical + electric fields

New instruments

- Gamma-ray imaging via pinhole camera and collimated detectors (U of Bergen + NRL)
- Airborne UHF interferometer (Duke) – 3D lightning mapper
- Synergy with INCUS/PoISIR validation campaigns with microwave instruments added
- Potential participation by Sandia & Los Alamos NLs





NASA Earth

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Our Mission.

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