

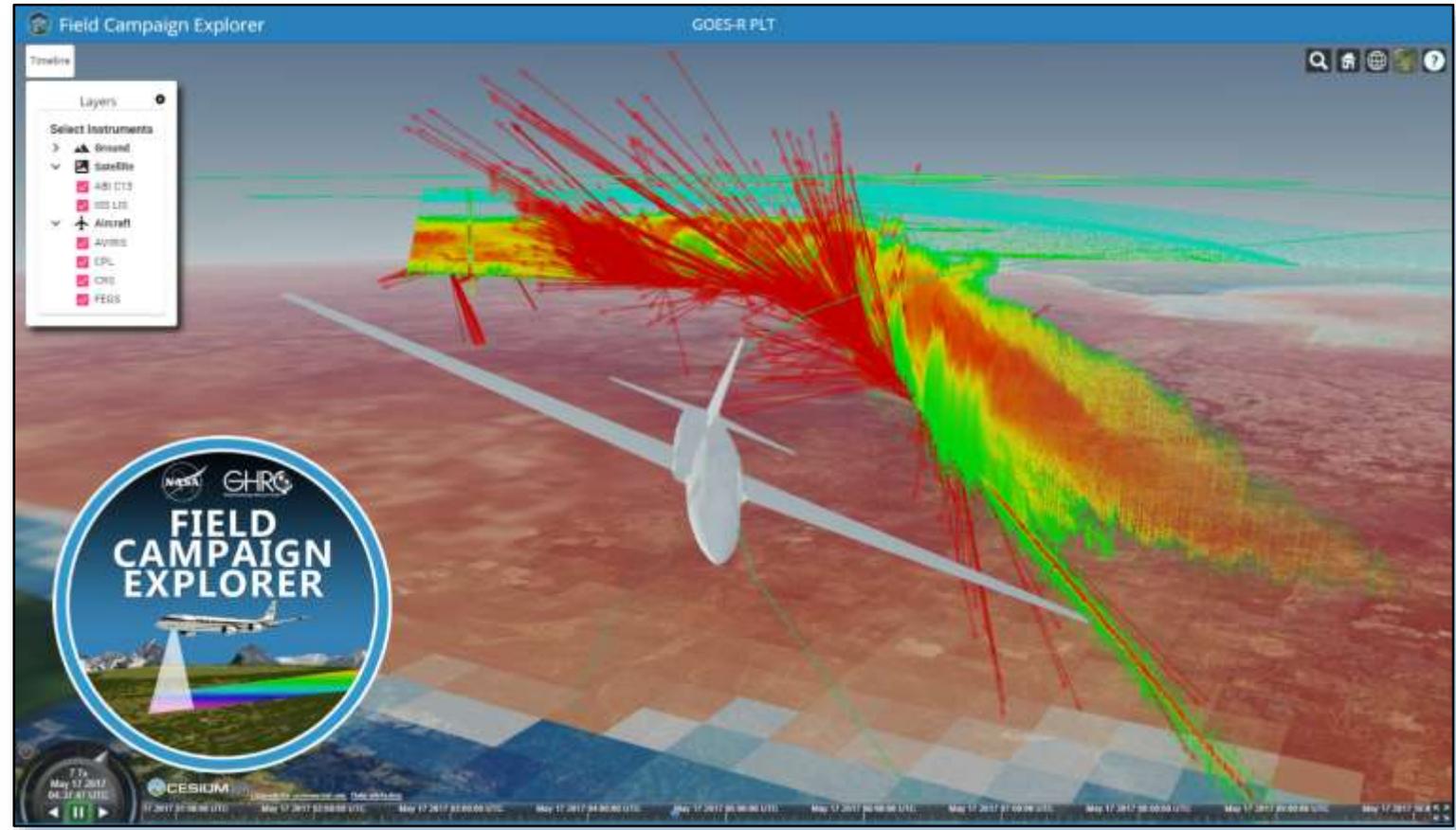
Field Campaign Explorer (FCX) Updates & Future Plans

Ajinkya Kulkarni

System Engineering, Architecture & Development



- Team
- Introduction
- Goals
- FY 20 Updates
- Current Use Case
- Demo
- Past & Current Architecture
- Future Plans

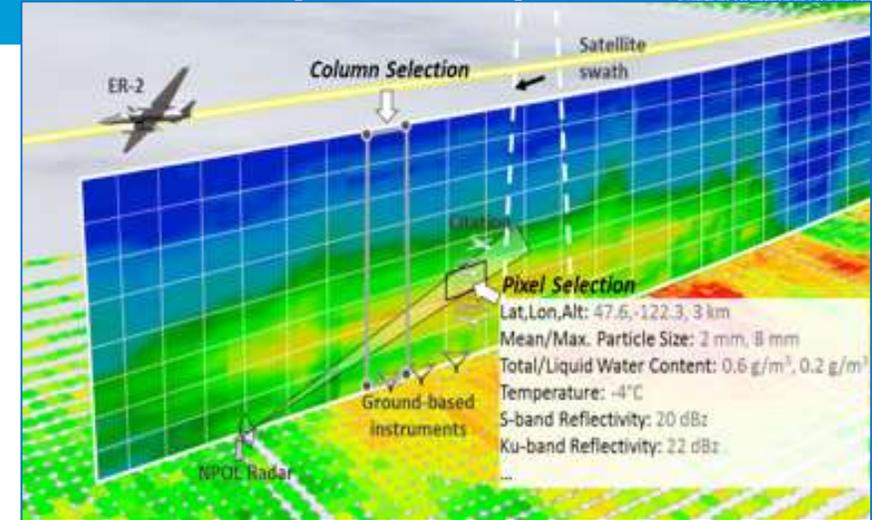


- Current
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 - Yuling Wu
- Past
 - Brian Ellingson
 - Bibek Dahal
 - Slesa Adhikari
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- Science Support
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- Original Idea
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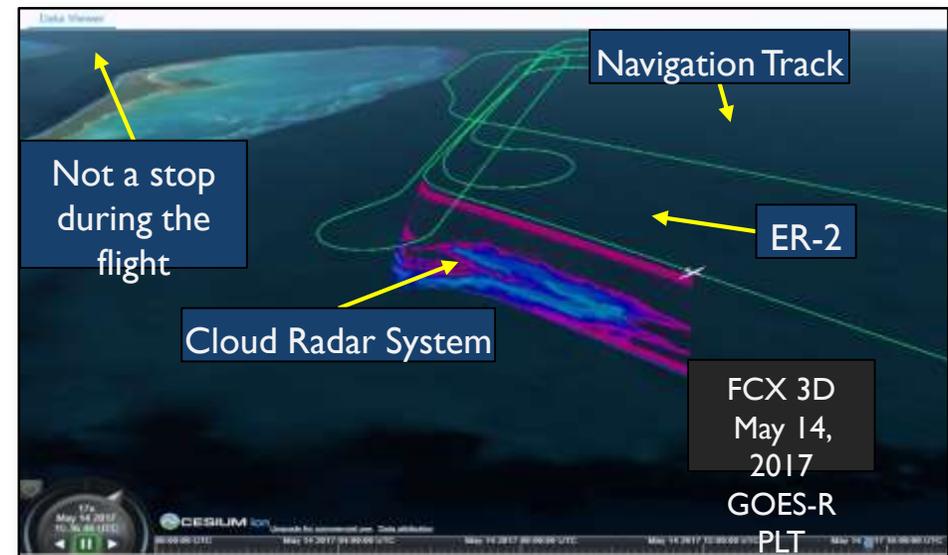
What is the Field Campaign Explorer (FCX)?

FCX is a 3D data exploration tool to provide visualization and analytic capabilities for diverse coincident datasets, with a focus **on airborne field campaigns**

- Addresses challenges inherent with using field campaign data
 - Variety of variable fields, dimensions, measurement types (e.g., ground, airborne, and satellite) and data formats
- Originally built for the Hurricane and Severe Storm Sentinel (HS3) field campaign

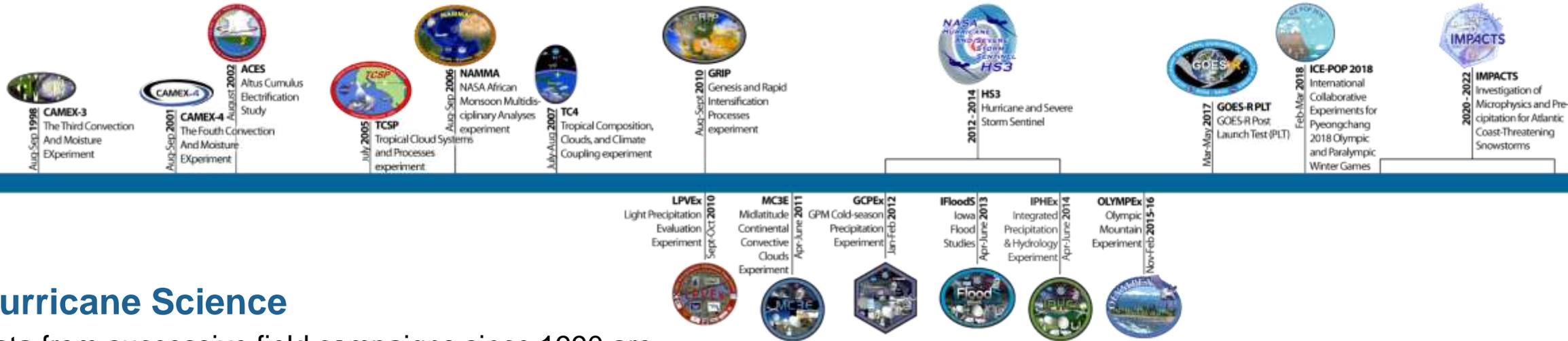


Original FCX concept to visualize and interrogate diverse, fused field campaign datasets



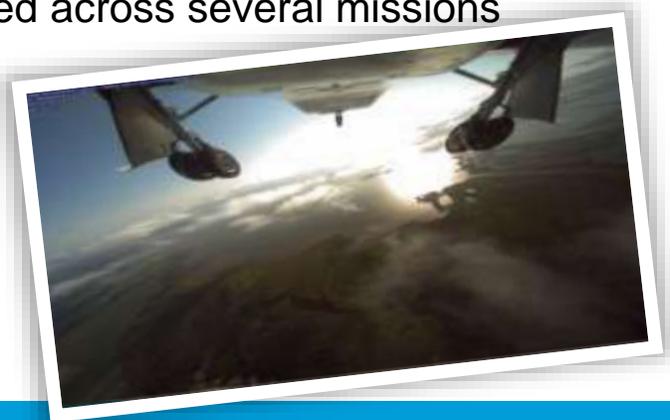
Current FCX Implementation

GHRC's Field Campaign Data Holdings



Hurricane Science

Data from successive field campaigns since 1990 are tied together through common procedures, consistent metadata, and discovery and archival systems making it easy to access data from instruments that have been employed across several missions



Global Precipitation Measurement Mission (GPM) Ground Validation (GV)

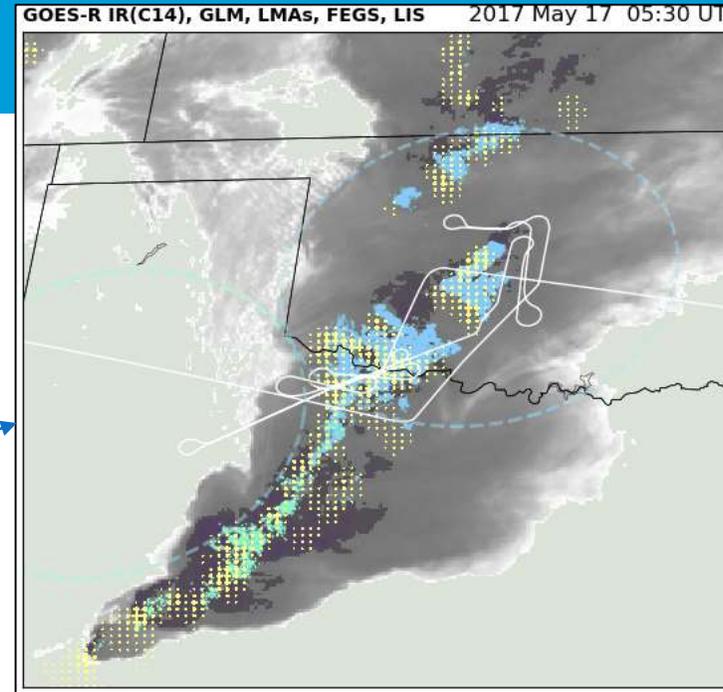
Ground and airborne precipitation datasets supporting physical validation of satellite-based precipitation retrieval algorithms

FCX Goals

I. Answer Science Questions tied to Field Campaign's Objectives and Observed Events

• Examples

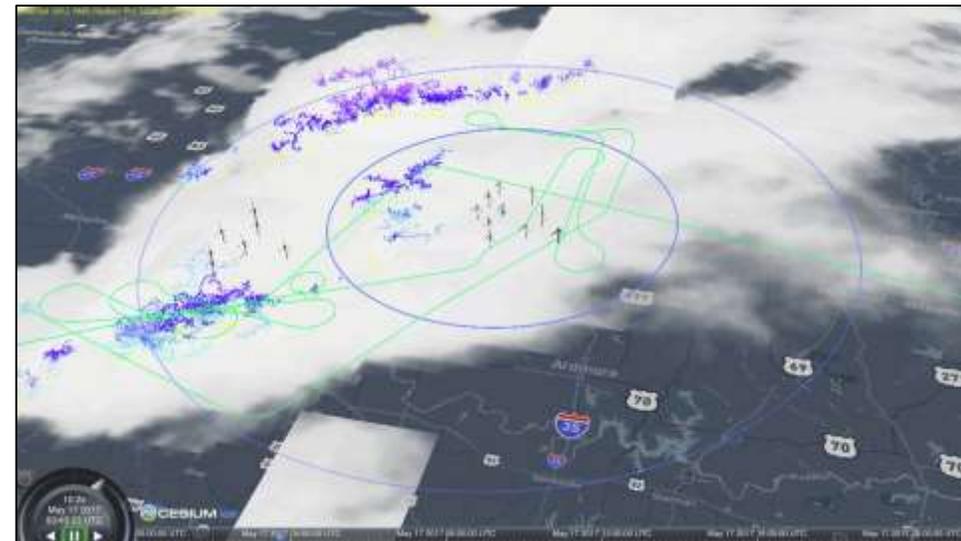
- Geostationary Lightning Mapper (**GLM**) Validation
 - Visualizing the cross-instrument validation of GLM lightning detection under different conditions of day/night/inland/highland/coast/overwater. For instance, the seemingly superb nighttime lightning detection efficiency of the GLM on May 17, 2017 can be largely validated by FEGS measurement from aircraft and ISS-LIS observation from satellite, and LMA from ground networks.
- Visualization of 2D/3D Lightning field in the storms
 - View 3D storm structure from the CRS aboard the ER-2 crisscrossing the storms and lightning fields that are detected by the ground LMA networks and the GLM and LIS onboard satellites, as well as lightning instruments on the aircraft.



2D non-interactive animation of lightning observed from various coinciding measurements (manually developed in Python - took several days)

goal

Same 3D interactive animation/exploration from FCX (running in the cloud, can be done within minutes)



2. Provide 3D interactive data visualization, interrogation, subsetting and downloading functionality for Field Campaign datasets

3. Reduce time to do "Science in Cloud"

- Migrated to NASA NGAP Cloud Environment
 - Includes 4 environment: Sandbox, SIT, UAT, OPS
 - Use of automated Bamboo CD/CI system
- Worked towards Open Sourcing FCX Code (in final stages)
- Made GOES-R PLT Field Campaign data publicly available in FCX
 - Developed new visualizations for datasets used in GOES-R PLT
- Refreshed FCX UI to the new technology stack as well as developed new UI Widgets
- Shifted the development to a new team
 - Onboarding and training for new members

Current Use Case: GOES-R PLT

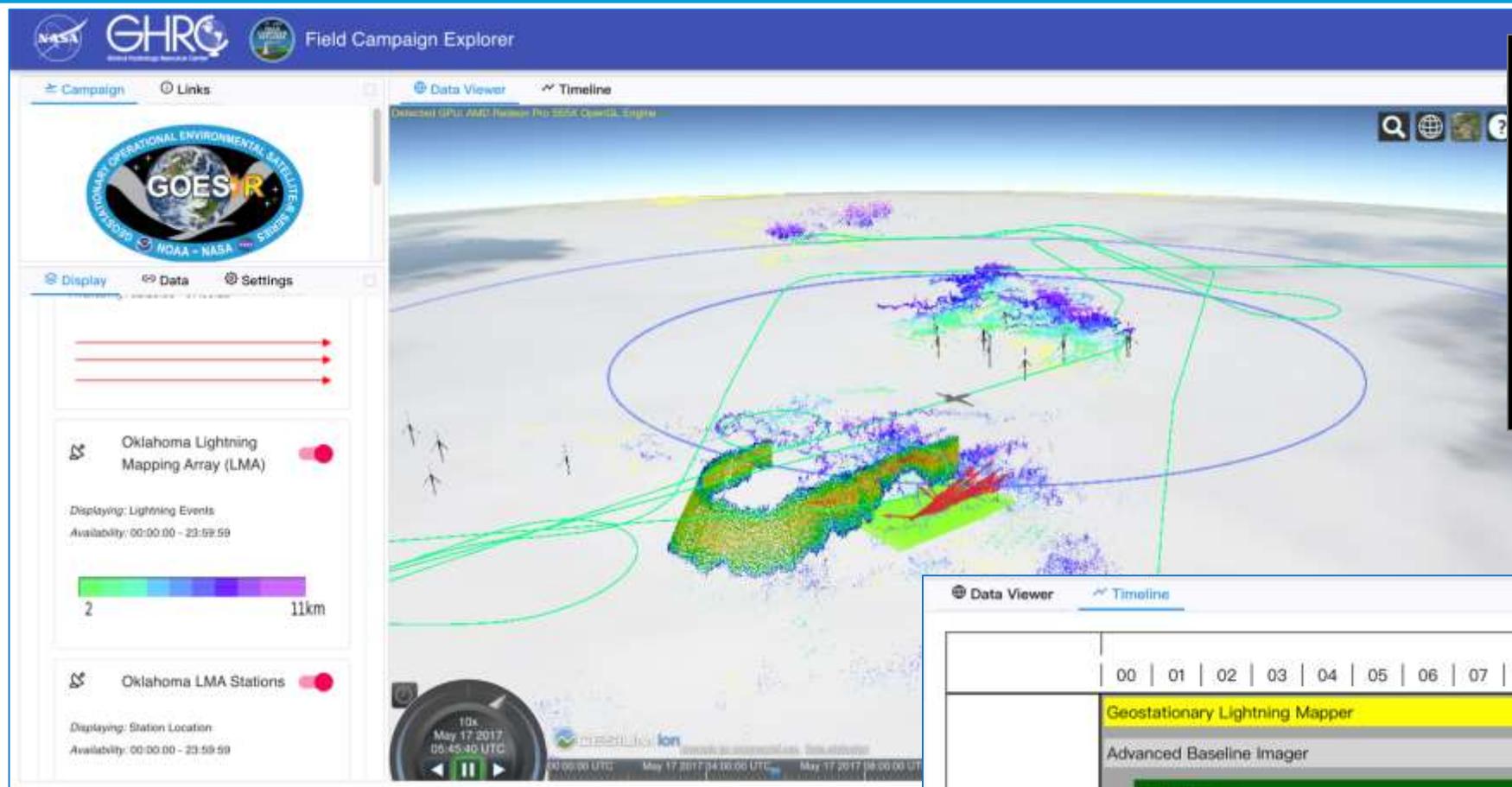
GOES-R Post Launch Test – Post-launch product validation of the Advanced Baseline Imager (ABI) and Geostationary Lightning Mapper (GLM) (Continental U.S., March – May 2017)

- Use Case: validation of the GLM instrument over Oklahoma on 17 May 2017; variety of observations from aircraft, ground-based lightning mapping array, and ISS Lightning Imaging Sensor

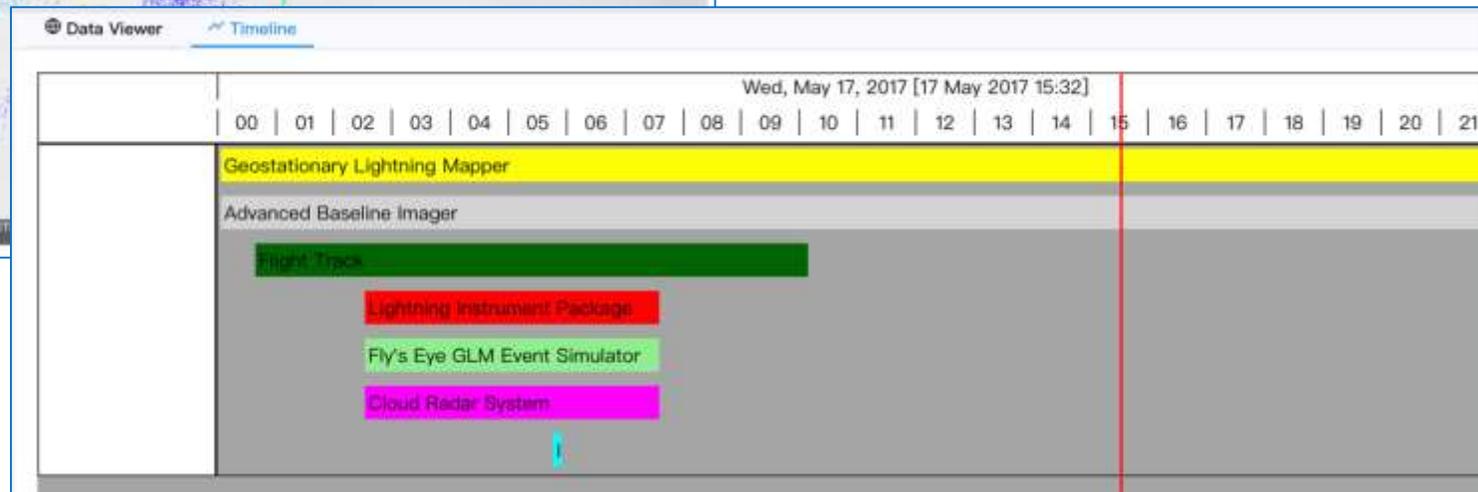
GOES-R Post Launch Airborne Science Cal/Val Field Campaign (March 21 to May 17, 2017)



The FCX Demonstration



- Demonstration will show capabilities being prepared for the public release
- Will use the GOES-R Post Launch Test field campaign (variety of datasets)

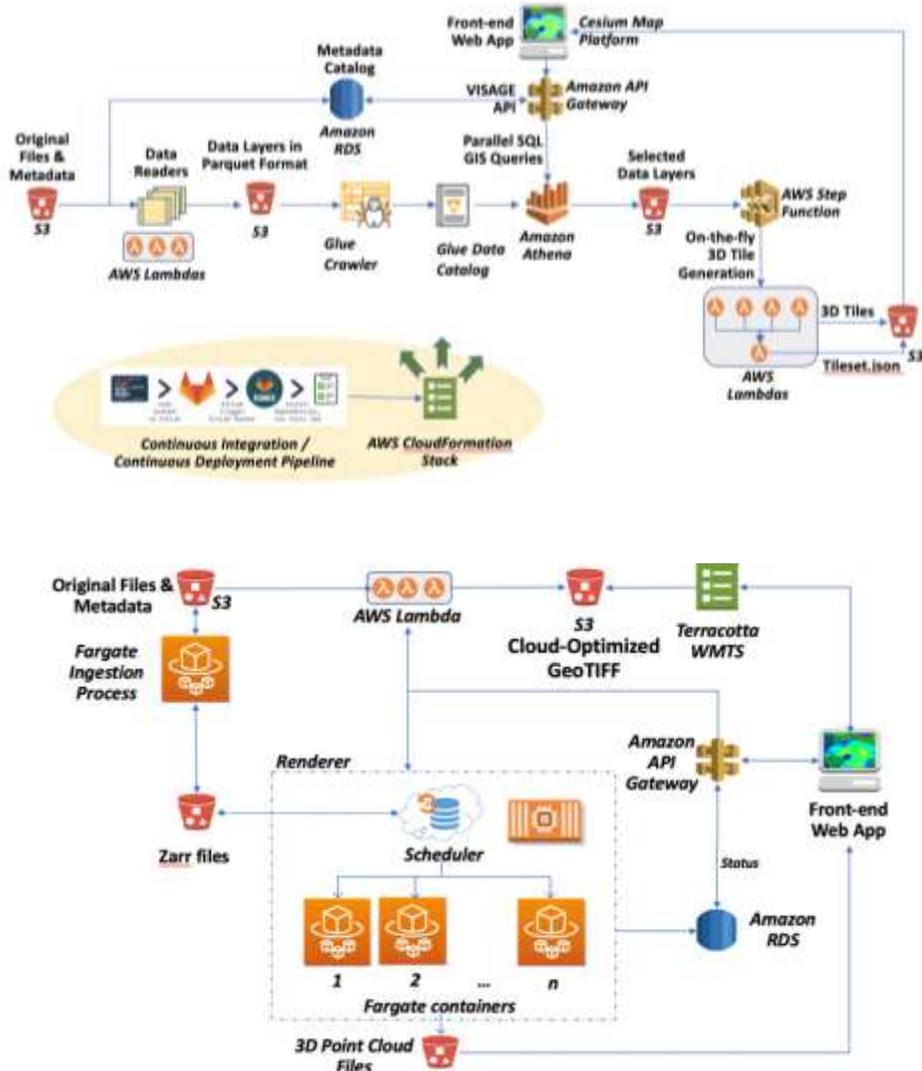


Live: <https://ghrc.earthdata.nasa.gov/fcx/index.html>

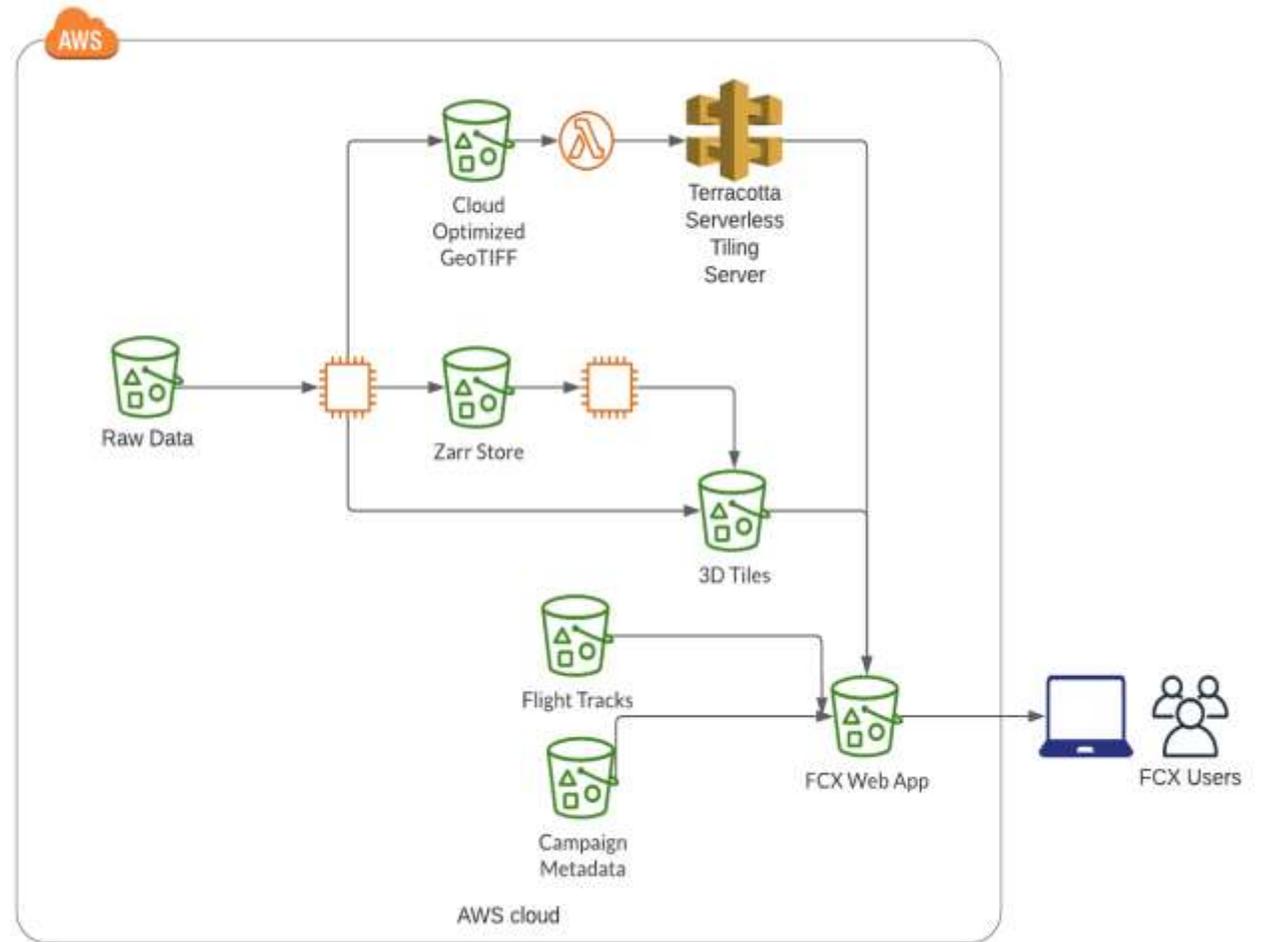
Video: <https://youtu.be/OActEAOPI6o>

FCX Architecture(s)

Past

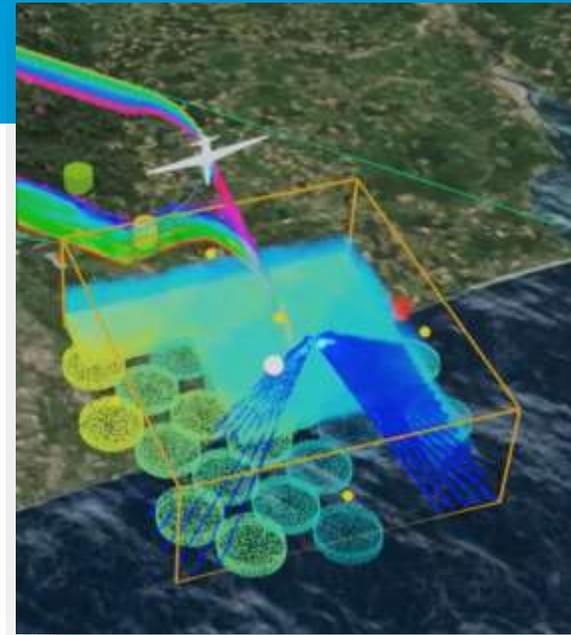


Current



FY21 Plan (1/3)

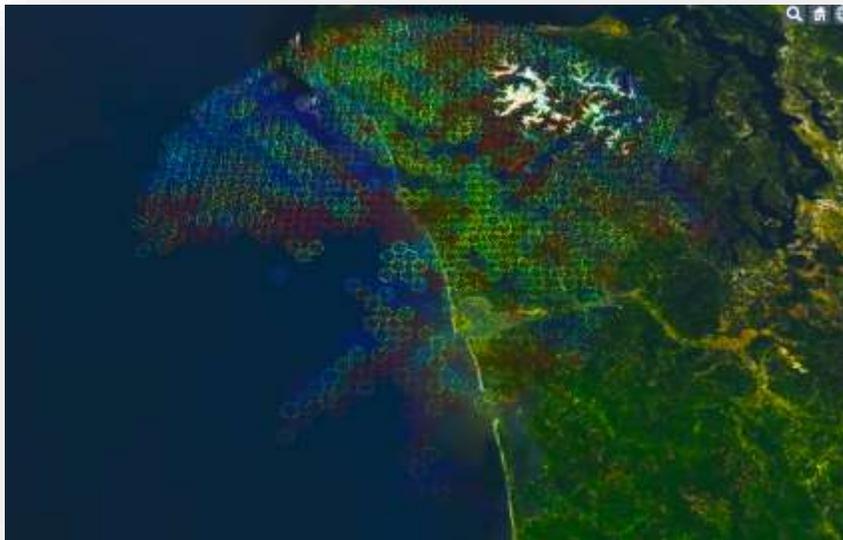
- We have developed standalone prototypes of 3D data analysis, plotting, and 3D data subsetting functionalities
- We would like to make these tools available in FCX to work with diverse datasets



3D subsetting

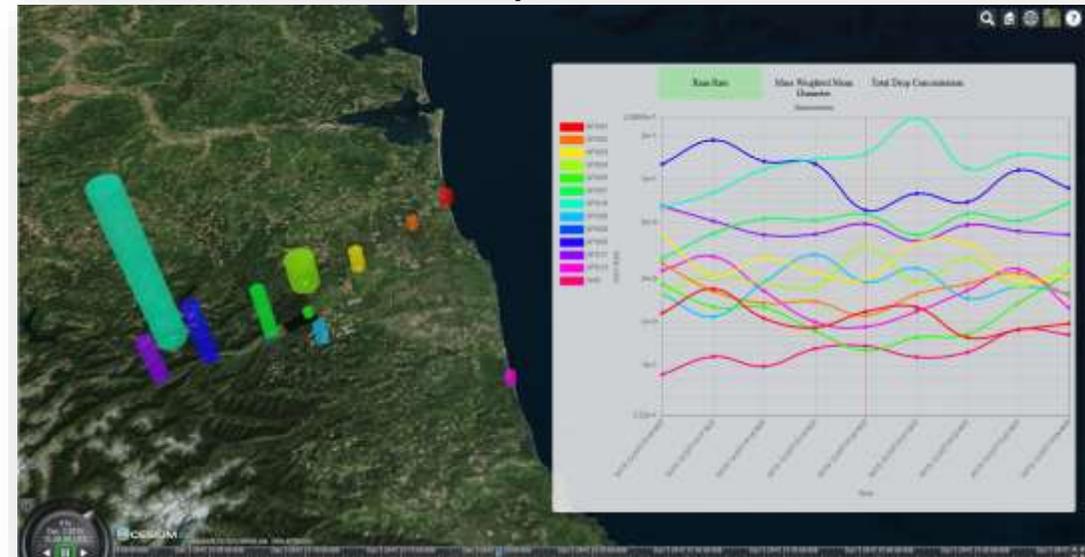


Comparison across different data fields

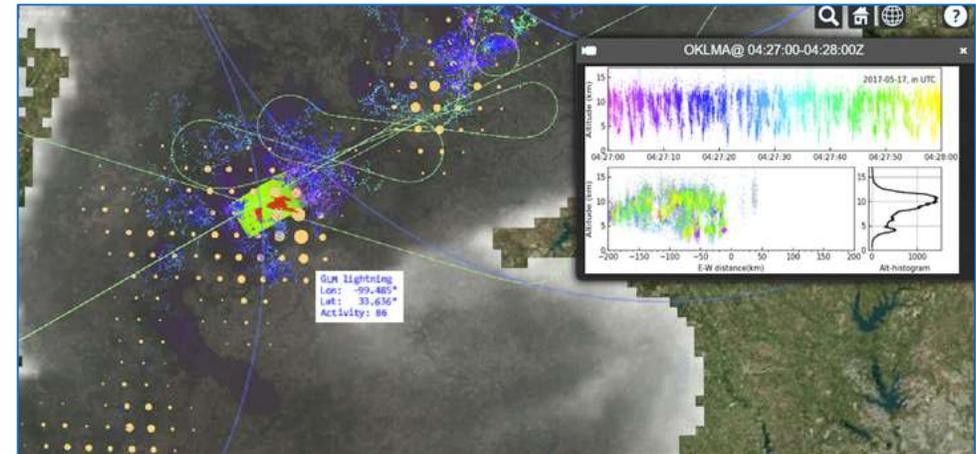


Dynamically generated map showing differences between ground radar reflectance and GPM radar reflectance

Data analysis



- Mouse interrogation
 - Work is in progress, but currently it not possible to implement this all different types of data visualizations (limitation of Cesium APIs)
- Improved data visualizations and inclusion of charts
 - Example: OKLMA 1-minute charts showing time sequence of the lightning vertical distribution and statistics
- Performance improvements
 - Currently needs a moderate-high graphics capability on a client machine
 - Despite the powerful GPU, Cesium's inbuilt rendering capabilities barely meets the need of FCX visualization and likely will fall short for future FCX projects visualizing multiple radar datasets in an event, such as those planned in IMPACTS
 - Need to migrate to using alternative renderer such as [Potree](#)



540 mb

97 mb

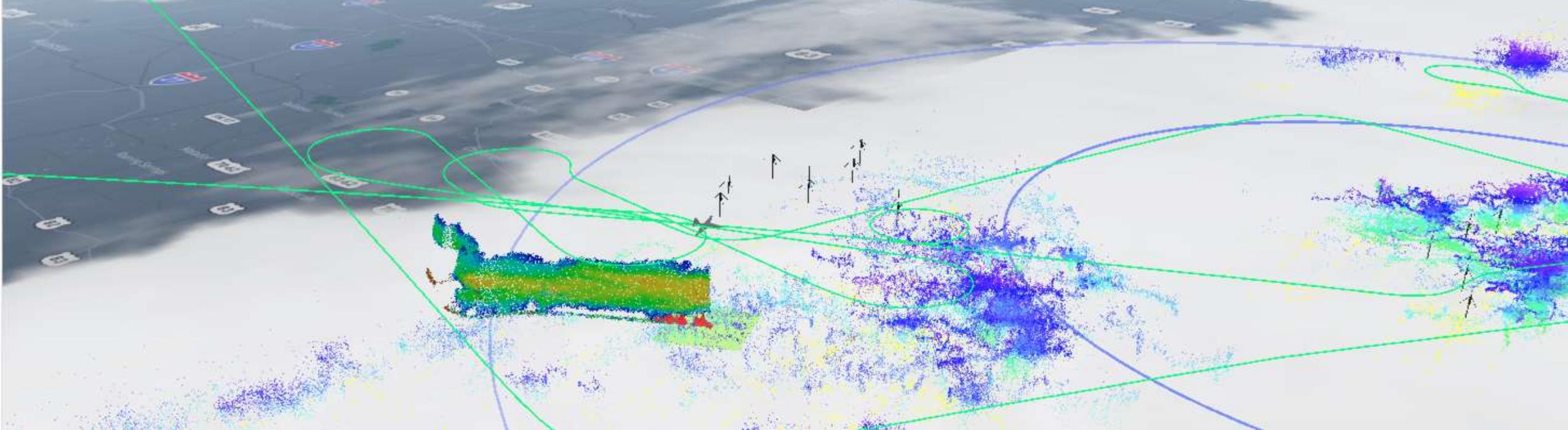
12 mb

Cesium "box" entities	Cesium 3D Tiles Point Cloud	Potree Point Cloud
Cesium entities use the most memory, as each entity is stored as a JavaScript object.	Cesium Point Clouds require far less memory than entities, but appearance degrades at higher zoom levels.	Potree Point Clouds are the most memory efficient, but Potree does not support variable transparency.
Memory Usage: 1205 MB	Memory Usage: 807 MB	Memory Usage: 722 MB
<p><u>Control</u> FCX Web application with no data loaded. Memory Usage: 710 MB</p>		

- Make IMPACTS (Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms) available in FCX
 - Develop visualizations for supporting winter storm measurements
- Explore potential collaborations with other DAACs such as:
 - ORNL on Airborne Data Visualizer <https://actamerica.ornl.gov/visualize/>
 - NSIDC on ICEBRIDGE: <https://nsidc.org/data/icebridge>
- Explore integration with the Harmony project (<https://ntrs.nasa.gov/citations/20190033889>)
 - It is a trans-EOSDIS framework to implement data transformation services in the Earthdata Cloud, was inaugurated with several prototypes. These prototypes have the ability to execute both off-the-shelf transformation tools (e.g., GDAL) and DAAC-provided code (e.g., PO.DAAC's Level 2 Subsetter).



- Short Term Plan
 - Make additional field campaigns available in FCX such as IMPACTS
 - Improve & develop new visualizations
 - Develop cloud-native 3D data subsetting & download functionality
- Long Term Plan
 - Make progress towards making FCX an enterprise tool
 - Single instance, cross-DAAC, pluggable modular data ingest/visualization pipeline
 - Develop 3D data analysis and plotting functionality
 - Performance improvements – new techniques for data visualization on web
 - Enable open-science, community driven development
 - Develop ability to answer/explore new science questions
 - Explorer potential collaboration with ORNL, NSIDC, and Harmony



THANK YOU!

QUESTIONS?

