Field Campaign Explorer: Simultaneous Data Exploration, Discovery, and Visualization

Amanda Weigel[1], Ajinkya Kulkarni[1], Manil Maskey[2], Helen Conover[1], Rahul Ramachandran[2]

ITSC, University of Alabama in Huntsville[1]

NASA MSFC[2]

American Geophysical Union Fall Meeting IN53E

San Francisco, CA, 16 December 2016

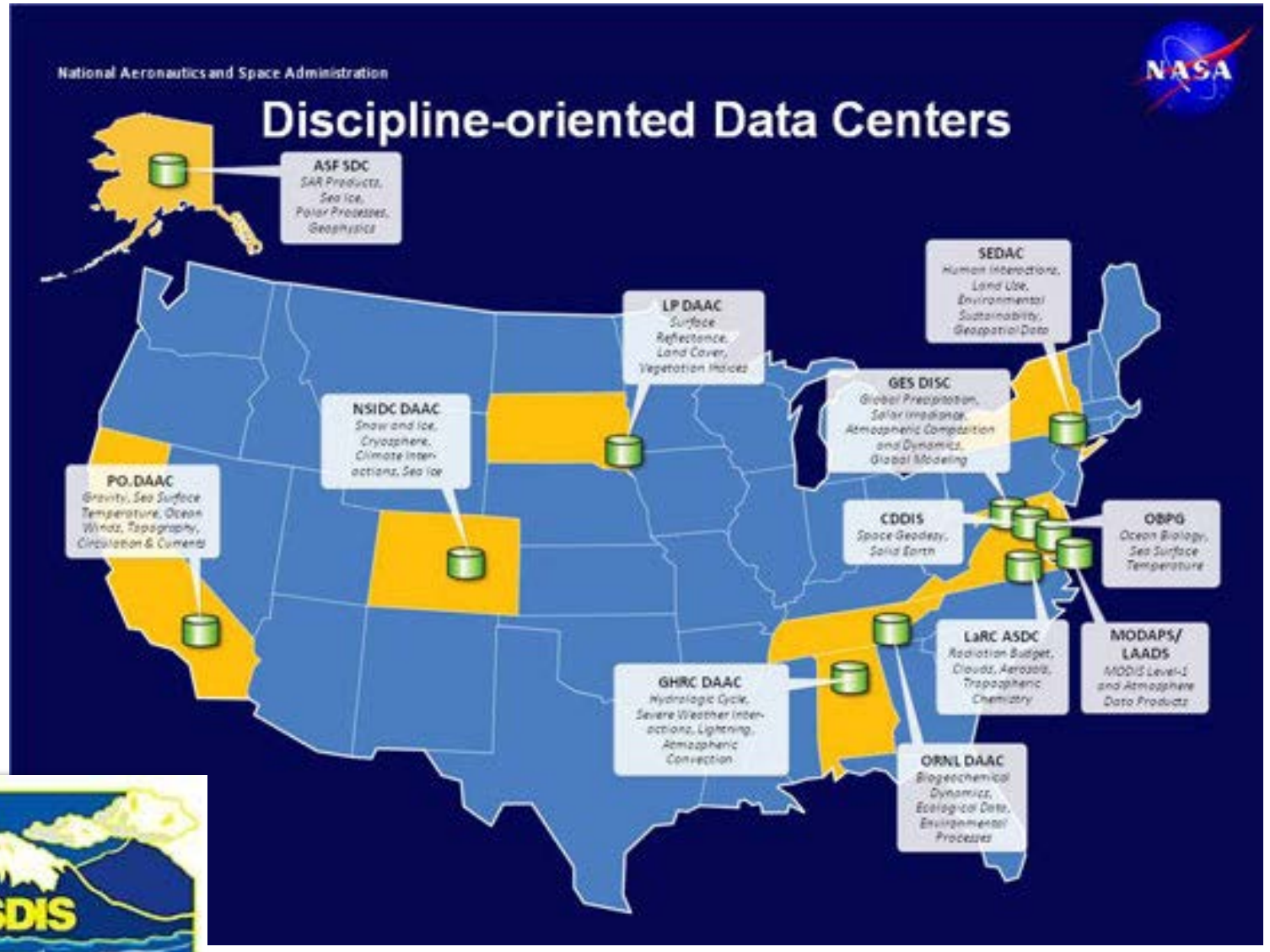
NASA

itsc
INFORMATION TECHNOLOGY AND SYSTEMS CENTER

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

About GHRC

- There are *12 NASA Earth Science Data Centers*. One of these data centers
- Each center serves one or more scientific Earth science disciplines
- Global Hydrology Resource Center (*GHRC*), is located at the National Space Science and Technology Center in Huntsville, AL.
- GHRC is a collaborative effort between UAH and NASA



About GHRC

NASA Earth Science Data Systems Vision

Make NASA's free and open Earth science data interactive, interoperable and accessible for research and societal benefit today and tomorrow.

Mission Statement

- To provide a comprehensive and active archive of both data and knowledge augmentation services with a focus on **hazardous weather, its governing dynamical and physical processes,** and **associated applications.**
- Within this broad mandate, GHRC will focus on **lightning, tropical cyclones and storm-induced hazards** through integrated collections of satellite, airborne, and in-situ data sets.

http://ghrc.nsstc.nasa.gov/

HS3 Field Campaign

Hurricane and Severe Storm Sentinel (HS3)

- **Objective** - To measure environmental and inner-core processes that lead to storm formation and intensification into major hurricanes
- **Temporal Extent** – 2012 to 2014

Data Users

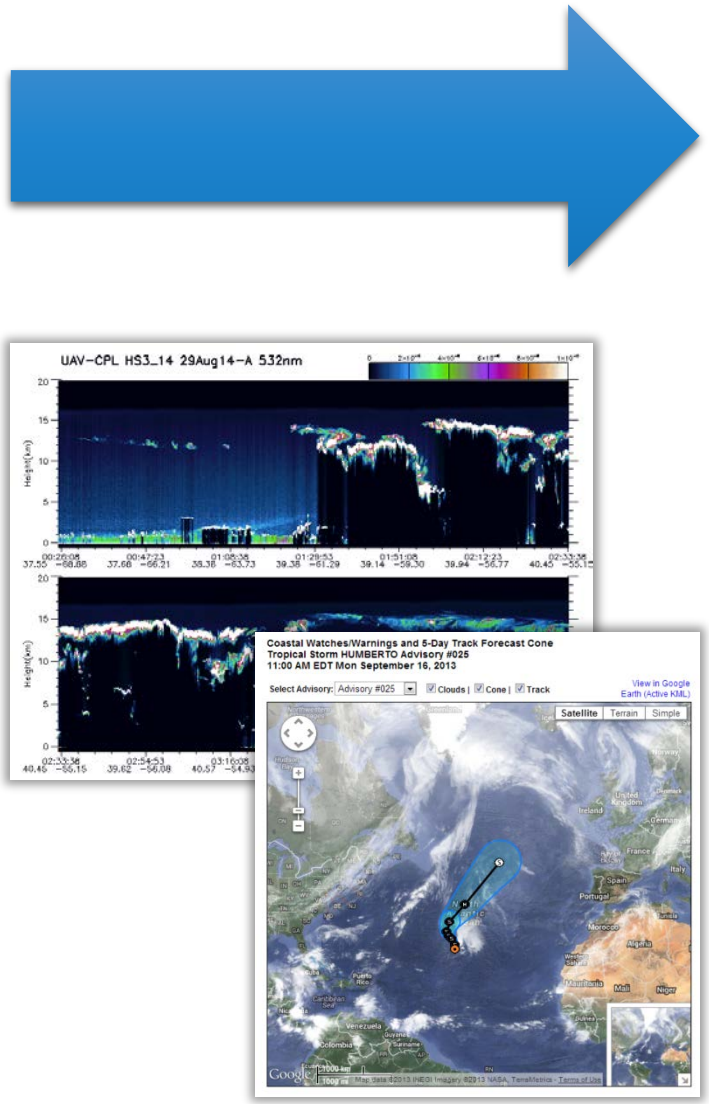
- HS3 science team
- NASA Hurricane Science Research Program (HSRP)
- Operational users at the NOAA National Hurricane Center
- Larger scientific community

Platform	Instrument
Global Hawk UAV	High-resolution Interferometer Sounder (S-HIS)
Global Hawk UAV	Airborne Vertical Atmospheric Profiling System (AVAPS)
Global Hawk UAV	Cloud Physics Lidar (CPL)
Global Hawk UAV	High-Altitude Imaging Wind and Rain Airborne Profiler (HIWRAP)
Global Hawk UAV	Hurricane Imaging Radiometer (HIRAD) multi-frequency interferometric radiometer
Global Hawk UAV	High altitude MMIC sounding Radiometer (HAMSR)

Motivation

User Needs

- Importance of event-based research
- Heterogeneous data
  - Data Format
  - Dimension
  - Processing methods
  - Visualization methods
- Identify data around a specific feature or event
- Requires several instrument measurements of the feature/event
- Less manual and time consuming process



Flight reports

- Information rich contents
- Quality of the data
- Additional multimedia
- Important for data search and discovery

Field campaign data

- “Golden cases”
- Event-based data (GHRC goal)
  - Tropical Cyclone Precipitation Feature (TCPF)
  - HS3 subset of World Wide Lightning Location Network (WWLLN)

FCX Overview

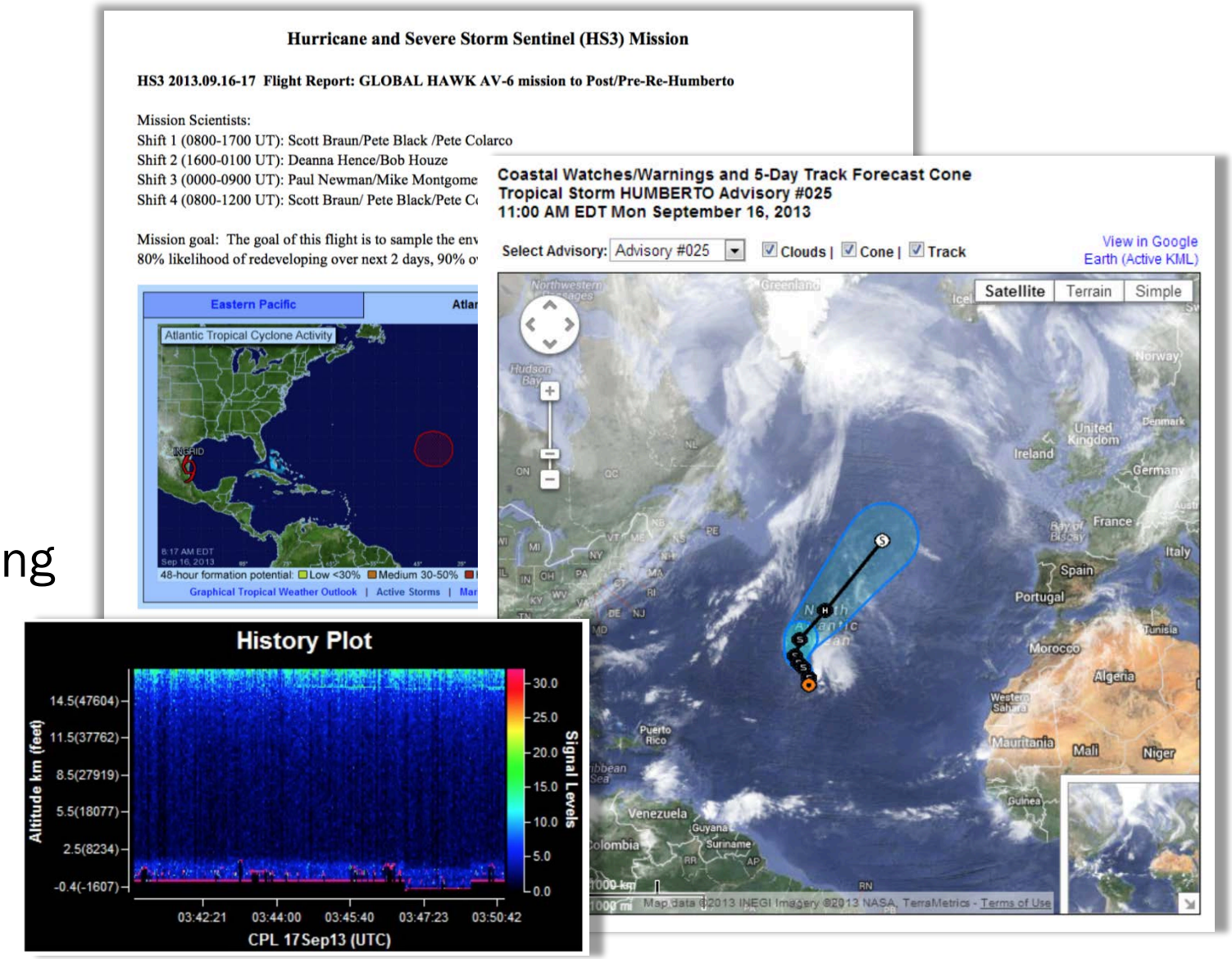
Field Campaign Explorer System (FCX)

- HS3 field campaign data
- Created to reduce the effort in discovering field campaign data to study atmospheric events
- Caters to event-based research
  - Target “Golden Cases” - multiple instruments available to study a physical processes
- Seamless movement between data visualization, discovery and acquisition
- Leverages critical unstructured resources
  - Flight and mission reports
  - Geospatial and temporal tags

FCX Data and Targeted Users

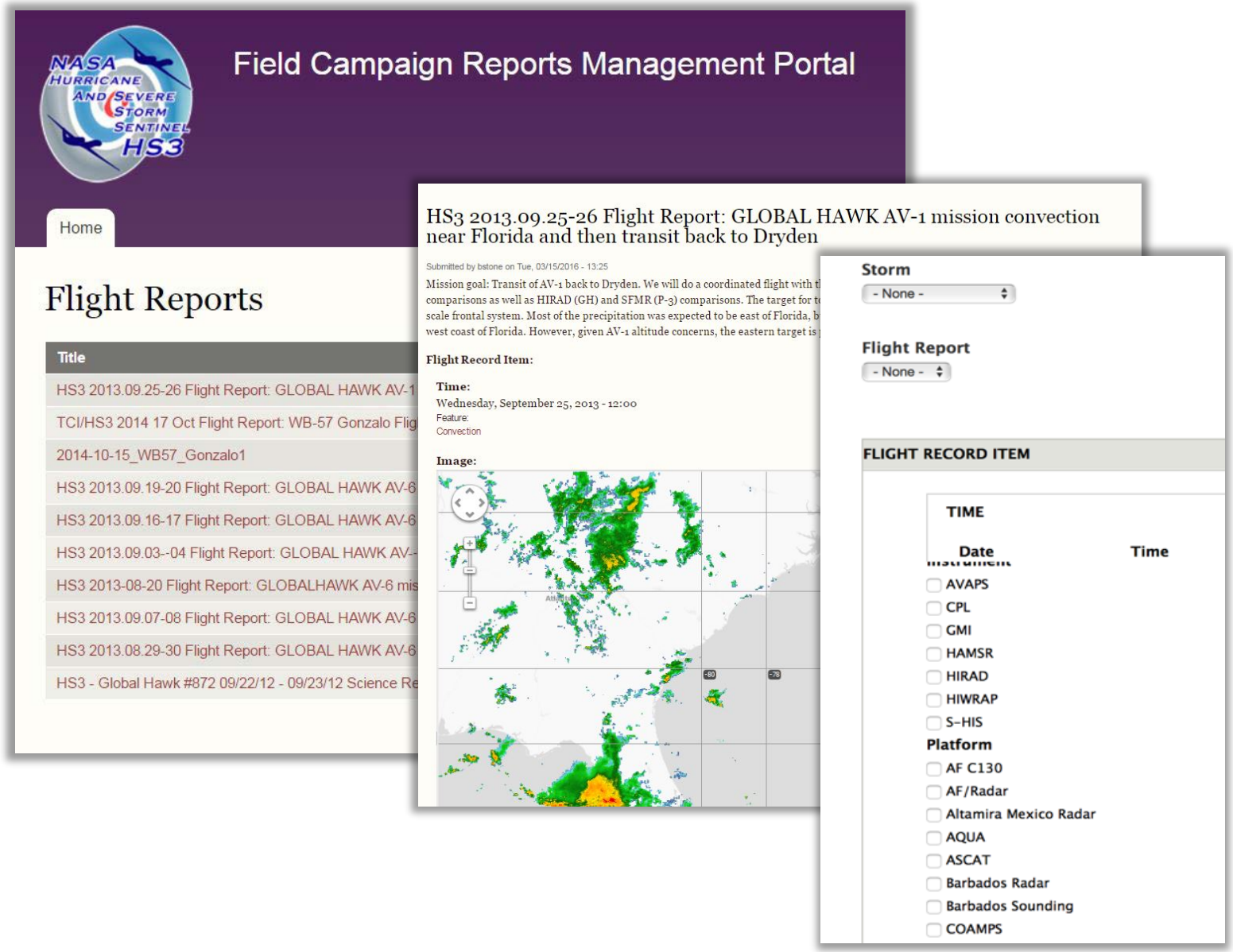
Current Data

- Science data – netCDF/CF
  - High-Amplitude Wind and Rain Airborne Profiler (HIWRAP)
  - Hurricane Imaging Radiometer (HIRAD) multi-frequency interferometric radiometer
  - High altitude MMIC sounding radiometer (HAMSR)
- Browse images
- Flight reports
- Flight tracks

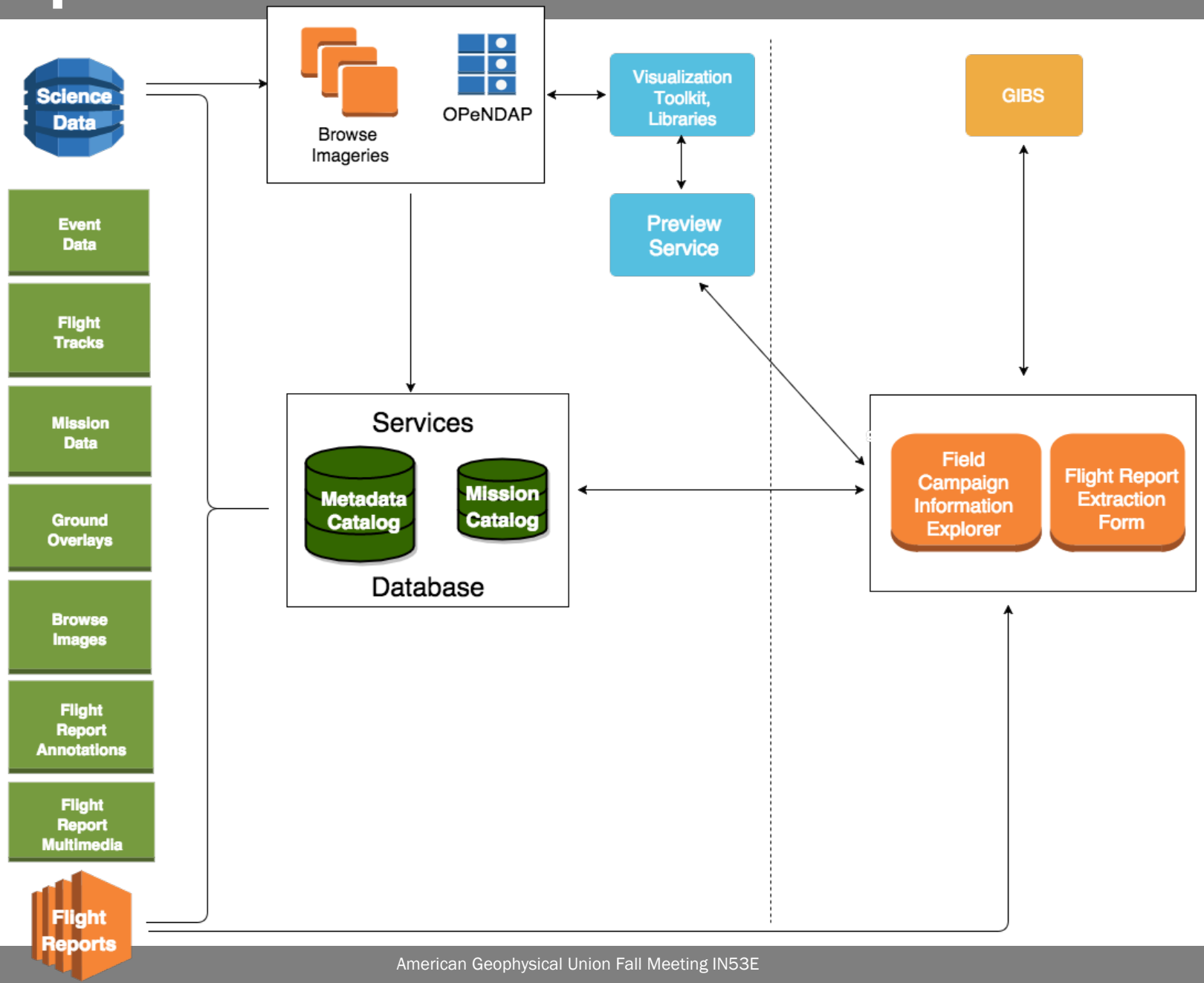


FCX Unstructured Resources

- Manual information extraction from HS3 flight and mission reports
- Content was ingested into a database
- Information queried through spatial and temporal tags

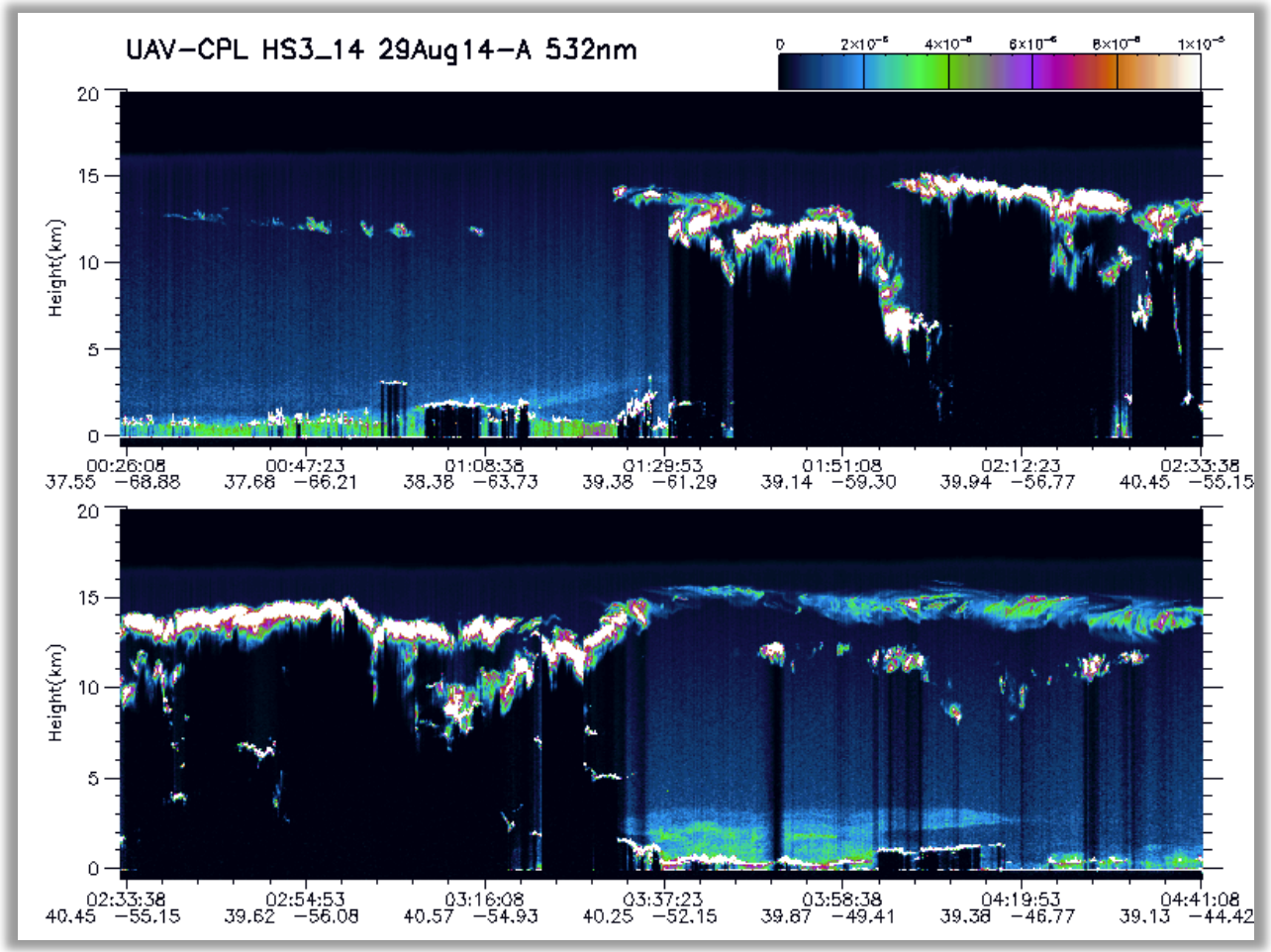


FCX Components



FCX Capabilities

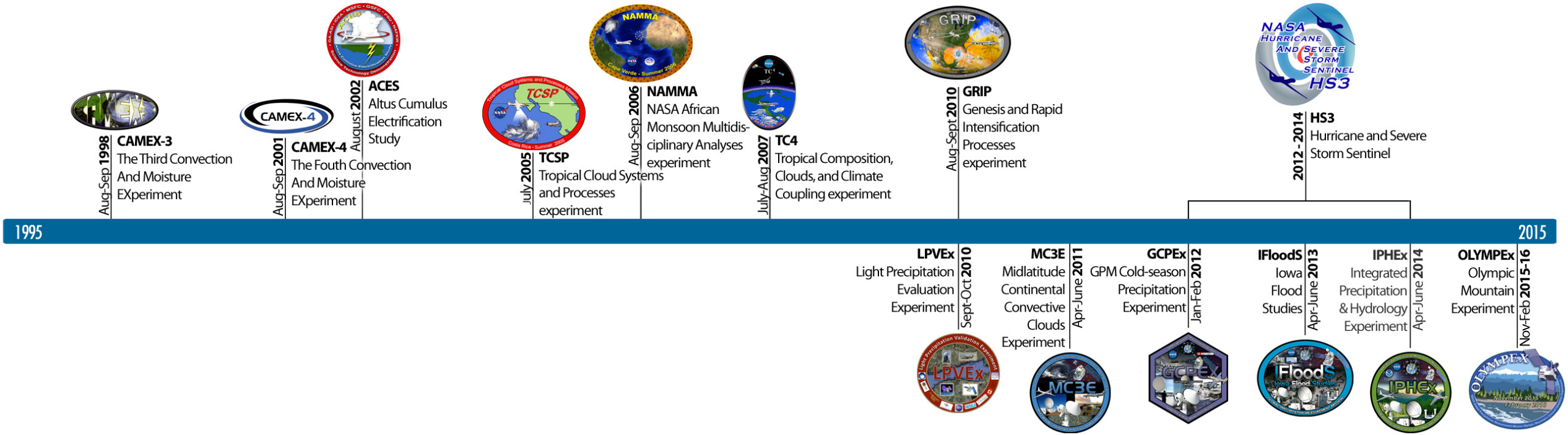
- Analyze historical hurricane trends and parameters
- Target data and information for a particular hurricane or period of interest
- Data exploration with an interactive map viewer
- Re-enact mission flights – fly along the Global Hawk UAV as it collects data
- On-the-fly data visualization and subsetting using OPeNDAP
  - Reduces size of data acquired
- Data download



FCX Capabilities

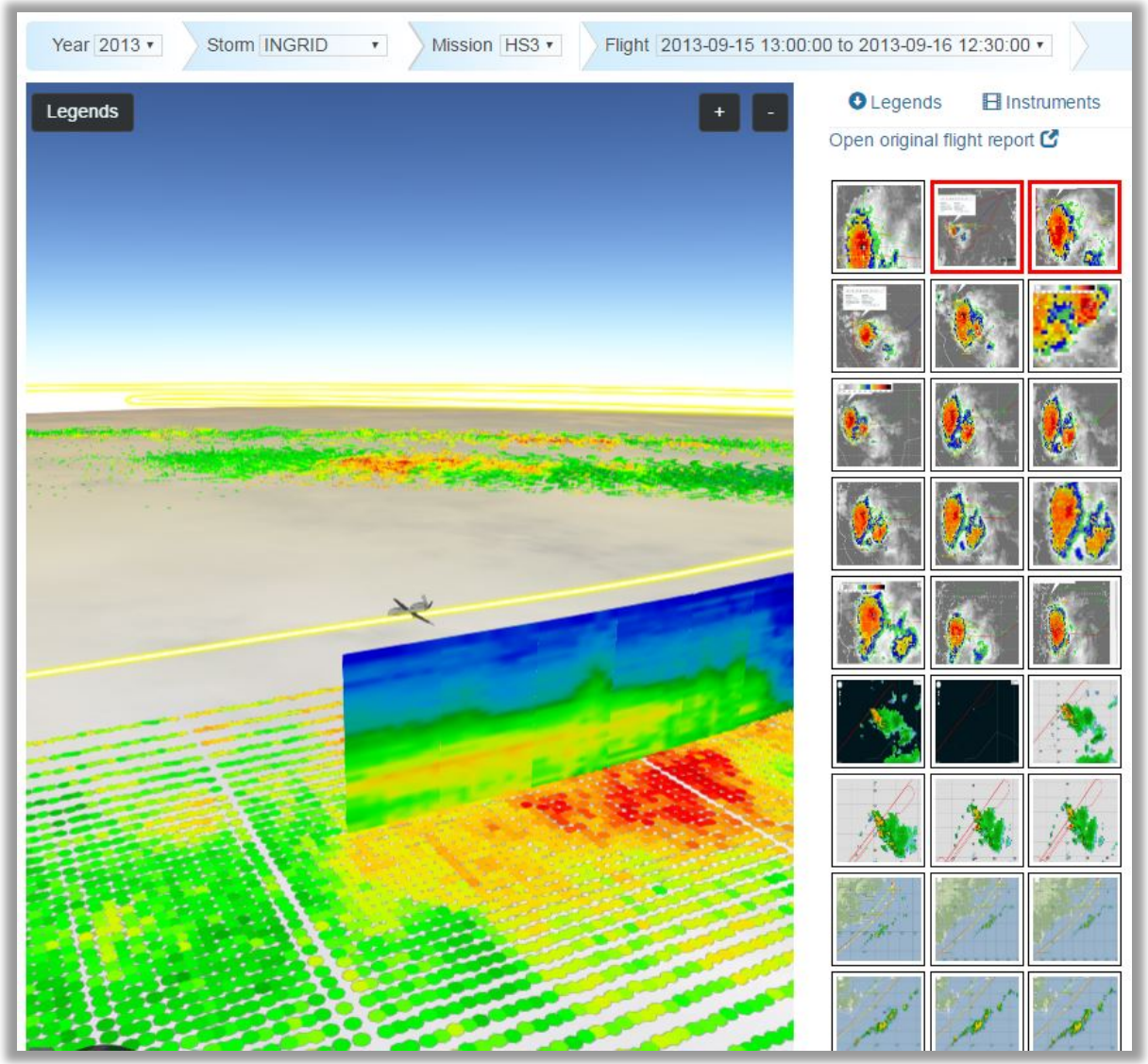
Future Plans

- Explore the tool at: https://ghrcdev.nsstc.nasa.gov/fc-explorer/
- FCX will become operational and available to the public in **2017**
- Work to transition other GHRC field campaign data collections into the system
- Enhance user experience by improving FCX usability



Conclusions

- FCX was designed using an adaptable infrastructure
- Leverages unstructured resources through geographic and temporal tagging
- Allows data of various formats and dimensions to be visualized and subsetted on the fly within an interactive map viewer
- Eases the labor intensive data discovery and visualization process for event-based research



Acknowledgements

GHRC

Manil Maskey
Ajinkya Kulkarni
Sherry Harrison
Marilyn Drewry
Mary Nair
Lamar Hawkins
Breanna Stone
Sandip Sahani
Helen Conover
Rahul Ramachandran

HS3 Science Team

Thank you

Questions?

American Geophysical Union Fall Meeting IN53E
San Francisco, CA, 16 December 2016

NASA

itsc
INFORMATION TECHNOLOGY AND SYSTEMS CENTER

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE