The Integrated Data Viewer

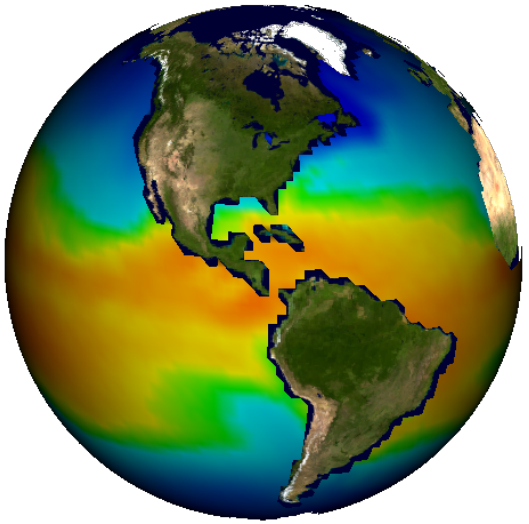
A 3D visualization and analysis tool for atmospheric and oceanic research and education

Unidata/UCAR

Boulder, CO

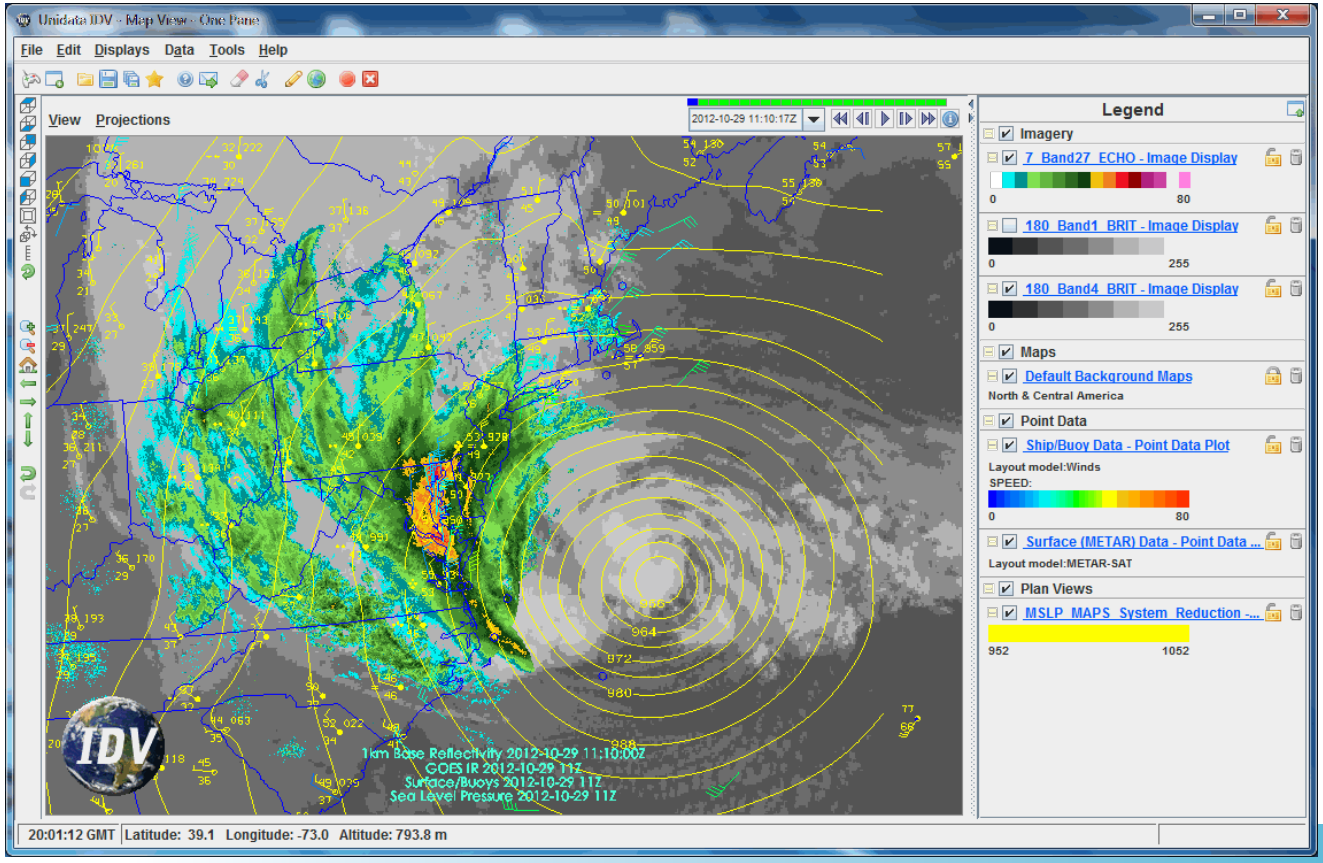
Integrated Data Viewer (IDV)

- Unidata's visualization and analysis tool for atmospheric data
- Java™ framework and application
- Integrated 2D/3D displays of a wide range of data
- Built on VisAD library



IDV is an Integrator

- Integration of data from disparate data sources



IDV Integrates Diverse Data Sources

- Data Types:
  - Gridded data
  - Satellite imagery
  - Radar data
  - Point observations
  - Balloon soundings
  - NOAA Profiler Network winds
  - ACTF tropical storm
  - GIS data
  - Quick Time movies
  - Web Cams
- Supported Formats:
  - netCDF/HDF
  - GrADS
  - GRIB
  - ADDE
  - Vis5D
  - KML (Google Earth)
- Access Methods:
  - Local files
  - HTTP and FTP
  - ADDE and TDS servers
  - RAMADDA

ADDE = Abstract Data Distribution Environment
TDS (THREDDS) = Thematic Realtime Environmental Distributed Data Services

Challenges of Integration

- Challenges of supporting and integrating many different data sources:
  - Different data formats
  - Different time frequencies
  - Different spatial projections and coverage
- Solutions provided by the IDV:
  - Data model (CDM and ADDE)
  - Auto projection converting
  - Time matching
  - Adaptive Resolution (AR) and Match Display Region (MDR)

Time Matching

- The IDV can match display times. This is done by first setting a **time driver** based on a display or a predefined animation time set, and then setting a display to **Use Time Driver Times**. A display can be set as the time driver or to use time driver times.

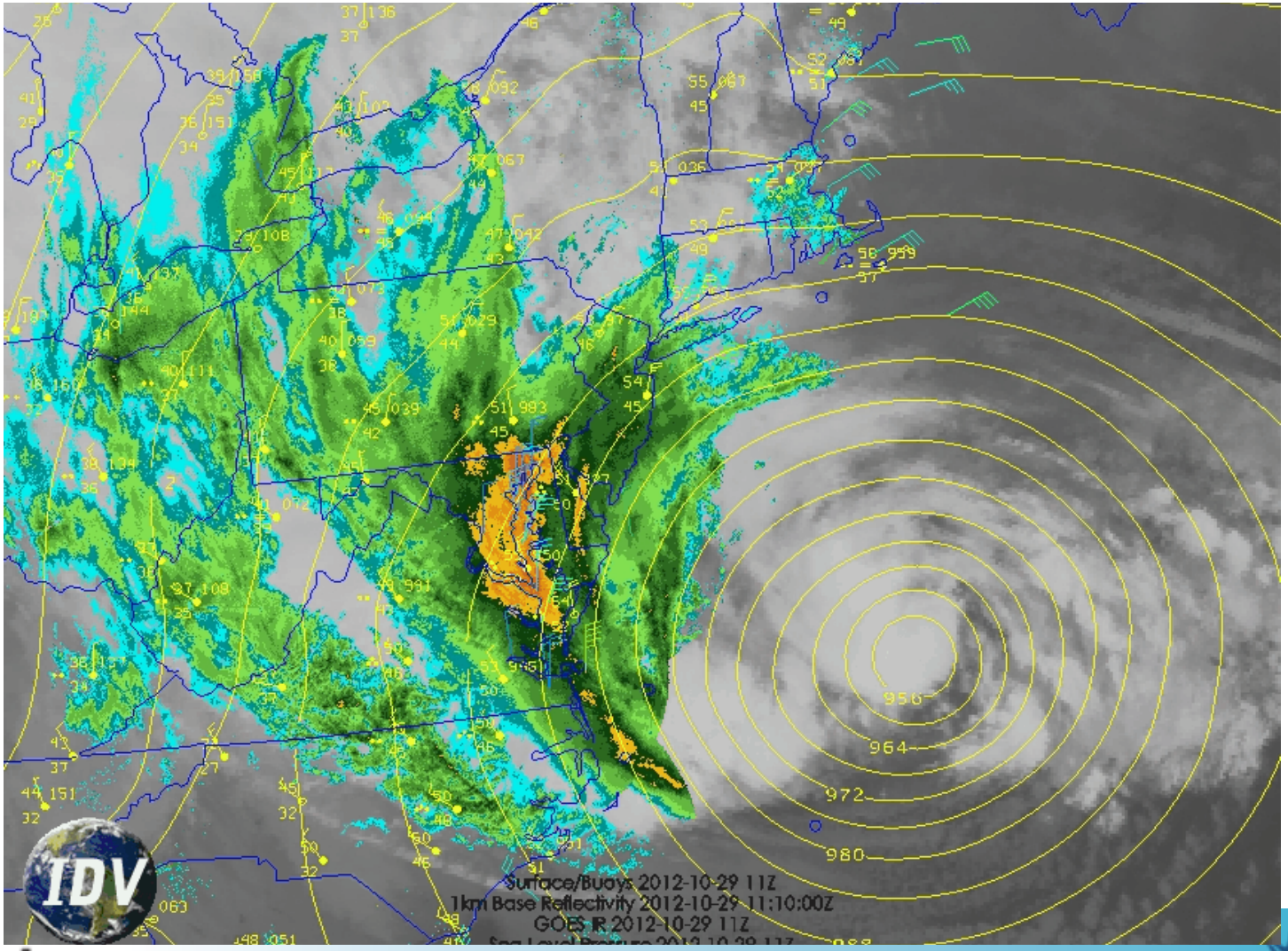
Adaptive Resolution and Match Display Region (AR/MDR)

- Adaptive Resolution (AR) dynamically adjusts the data sampling of the imagery dataset based on the resolution of the display view window.

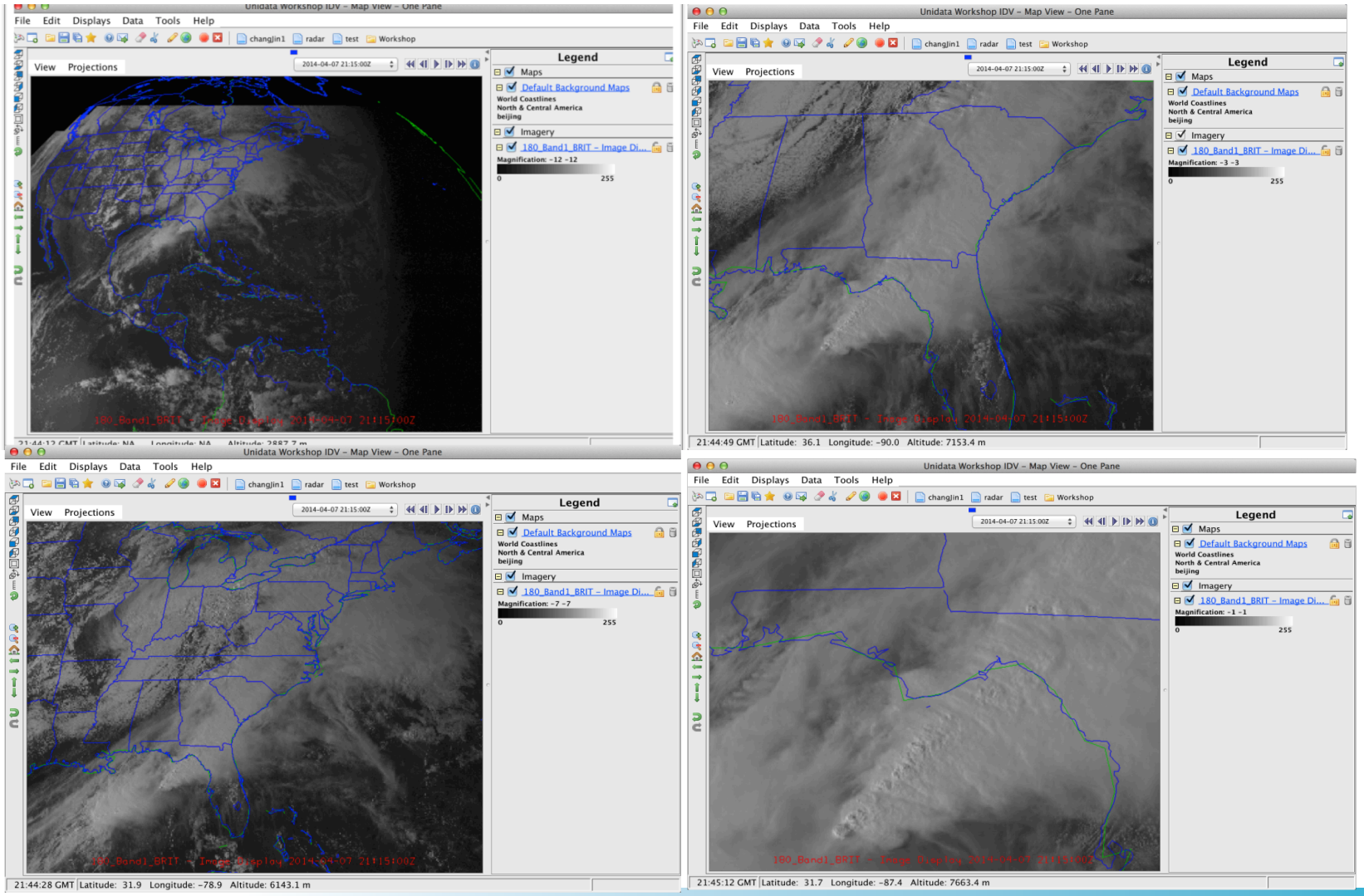
- Match Display Region (MDR) automatically spatially subsets the display area in the map view window.

- Designing a **display region** on a view window, the IDV can use this design region to request the data from local files or remote data servers, or existing bundles and create display.

Time Matching



Adaptive Resolution and Match Display region

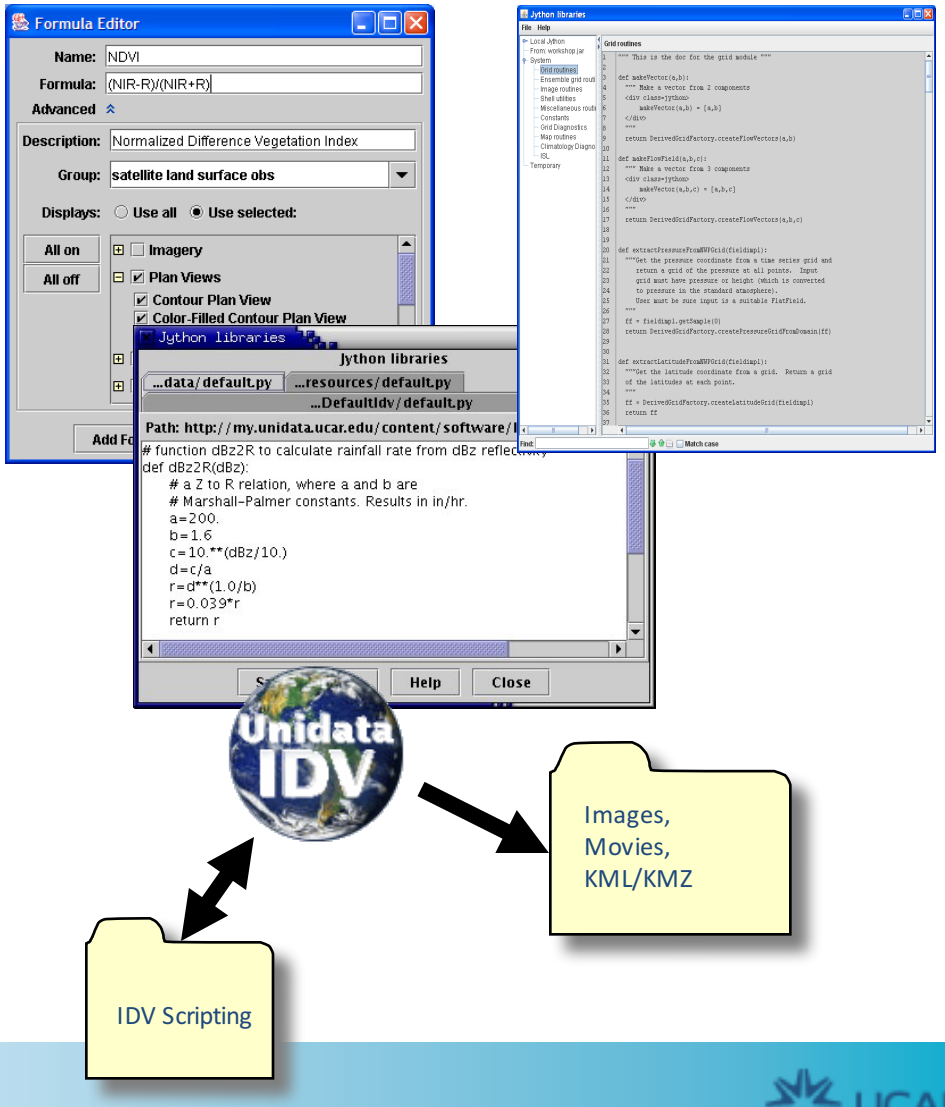


IDV - an interactive visualization and analysis tool

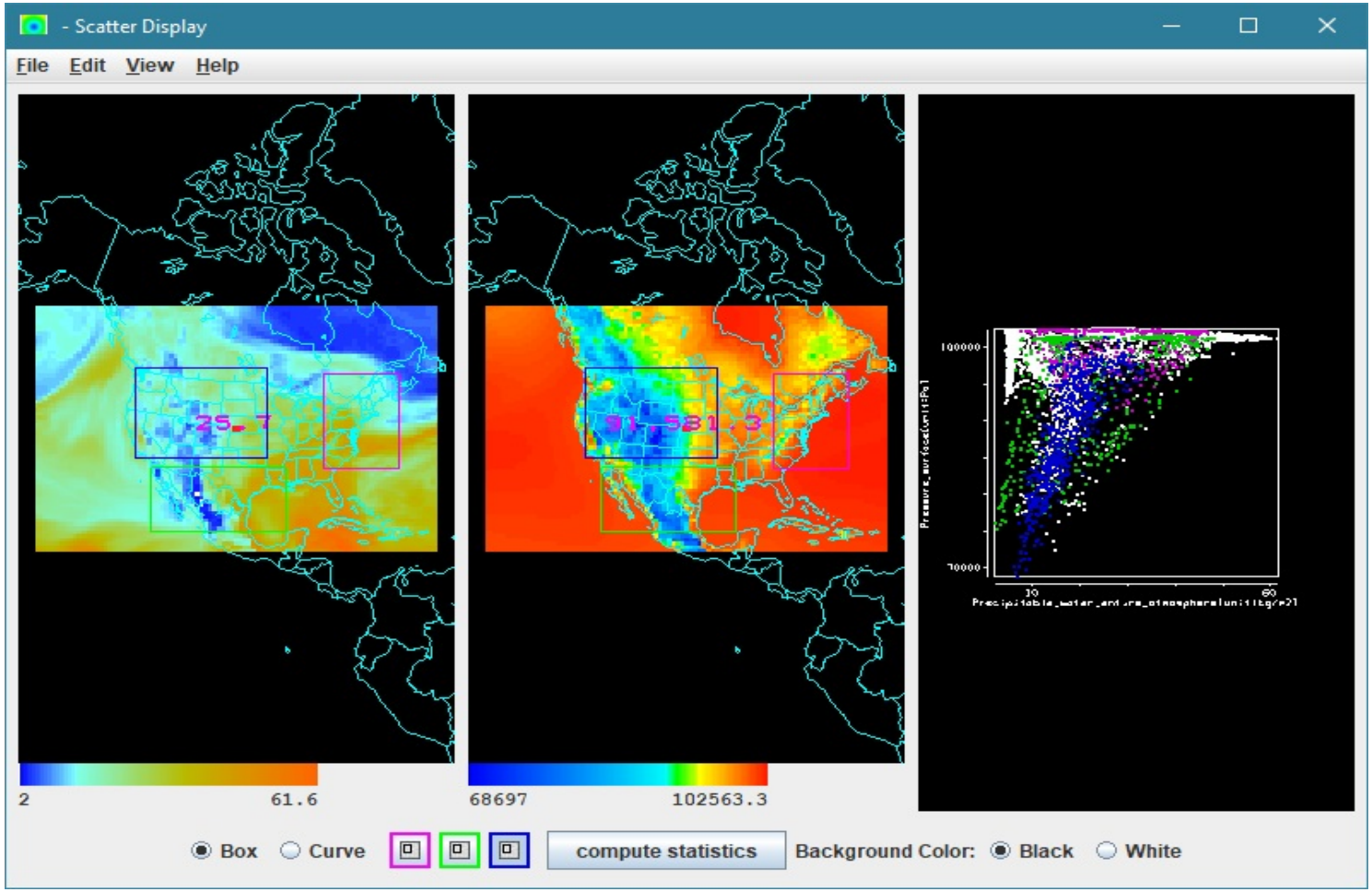
- General purpose 2D/3D displays
- Exploration of data details
- Quantitative analysis

Data Analysis

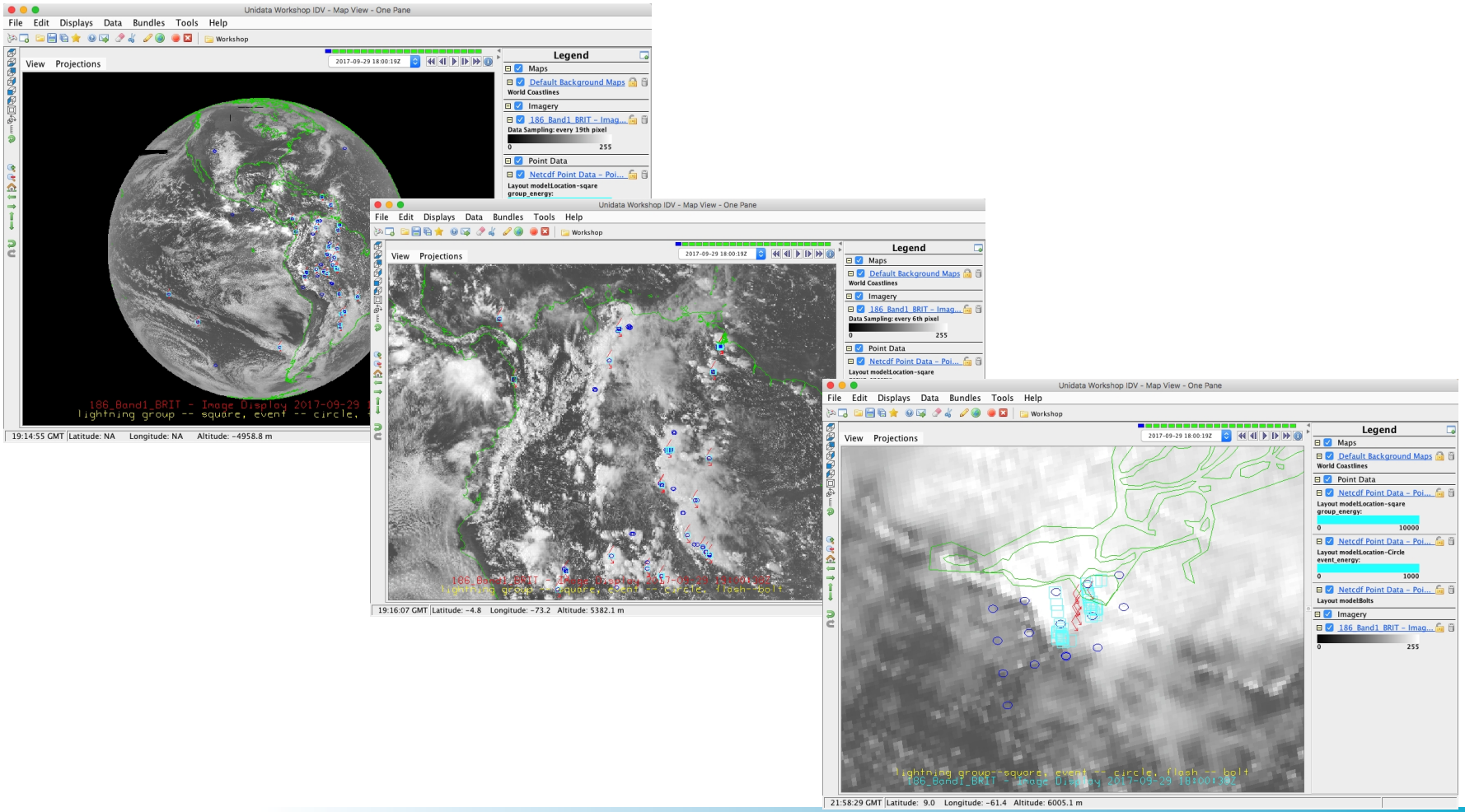
- Formulas and computation using Jython
- Interactive and script based generation of:
  - Images - JPEG, GIF, PNG, PDF, PS
  - Movies - Quick Time, animated GIF
  - Google Earth KML/KMZ



Scatter Analysis



GLM Lightning Display



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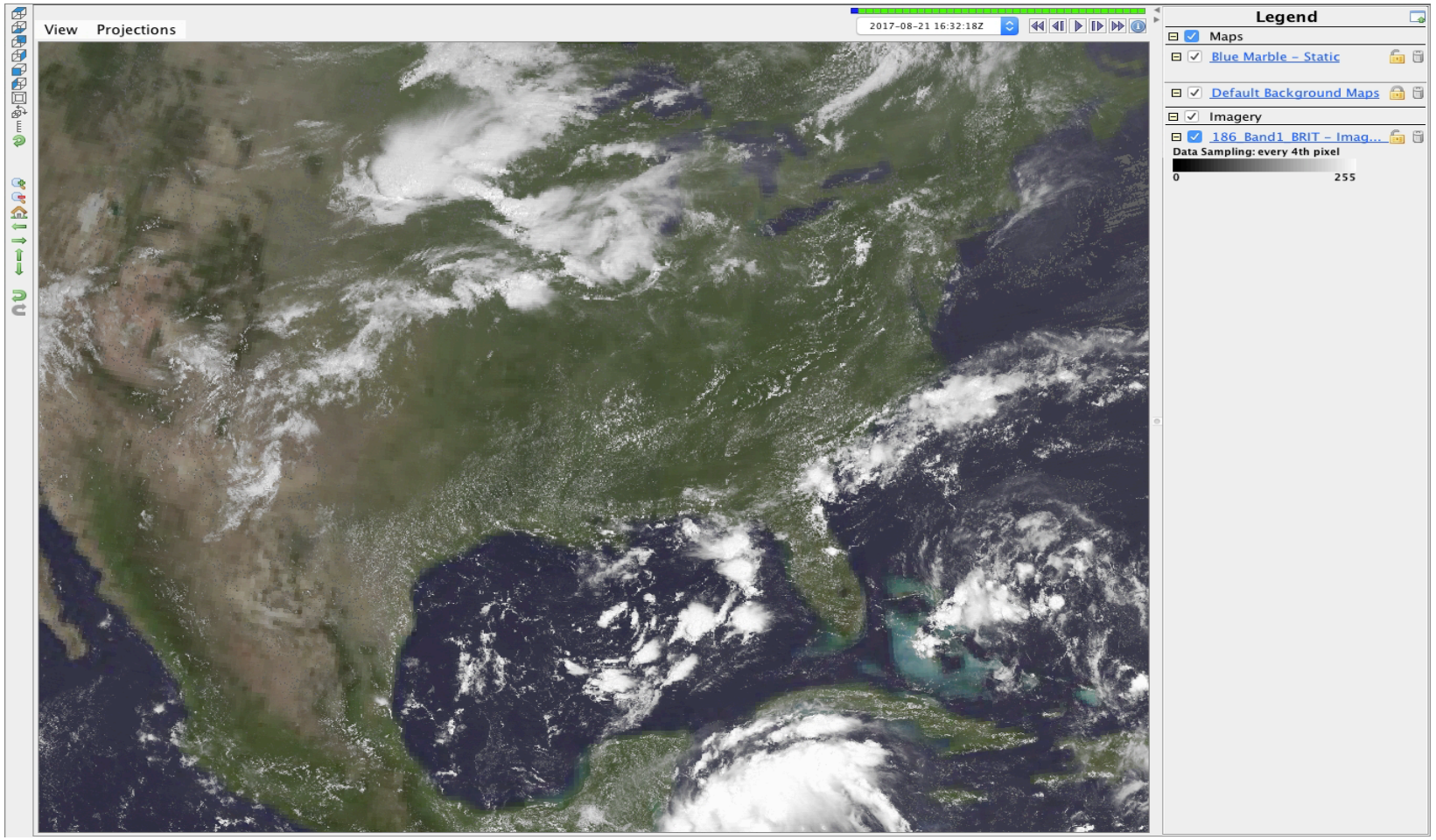
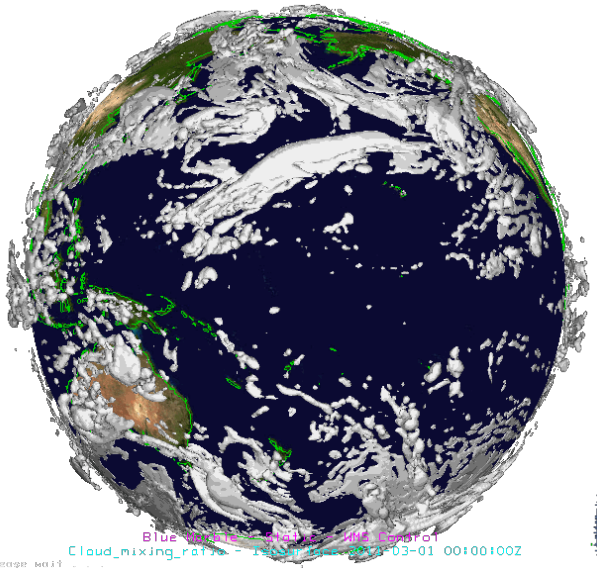
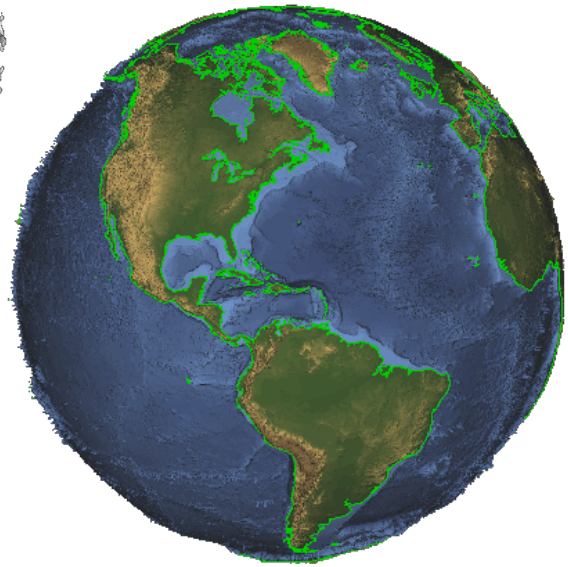
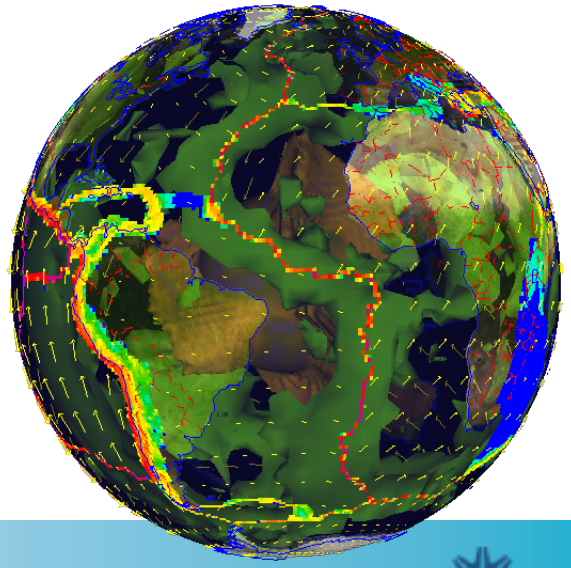
2017 Eclipse



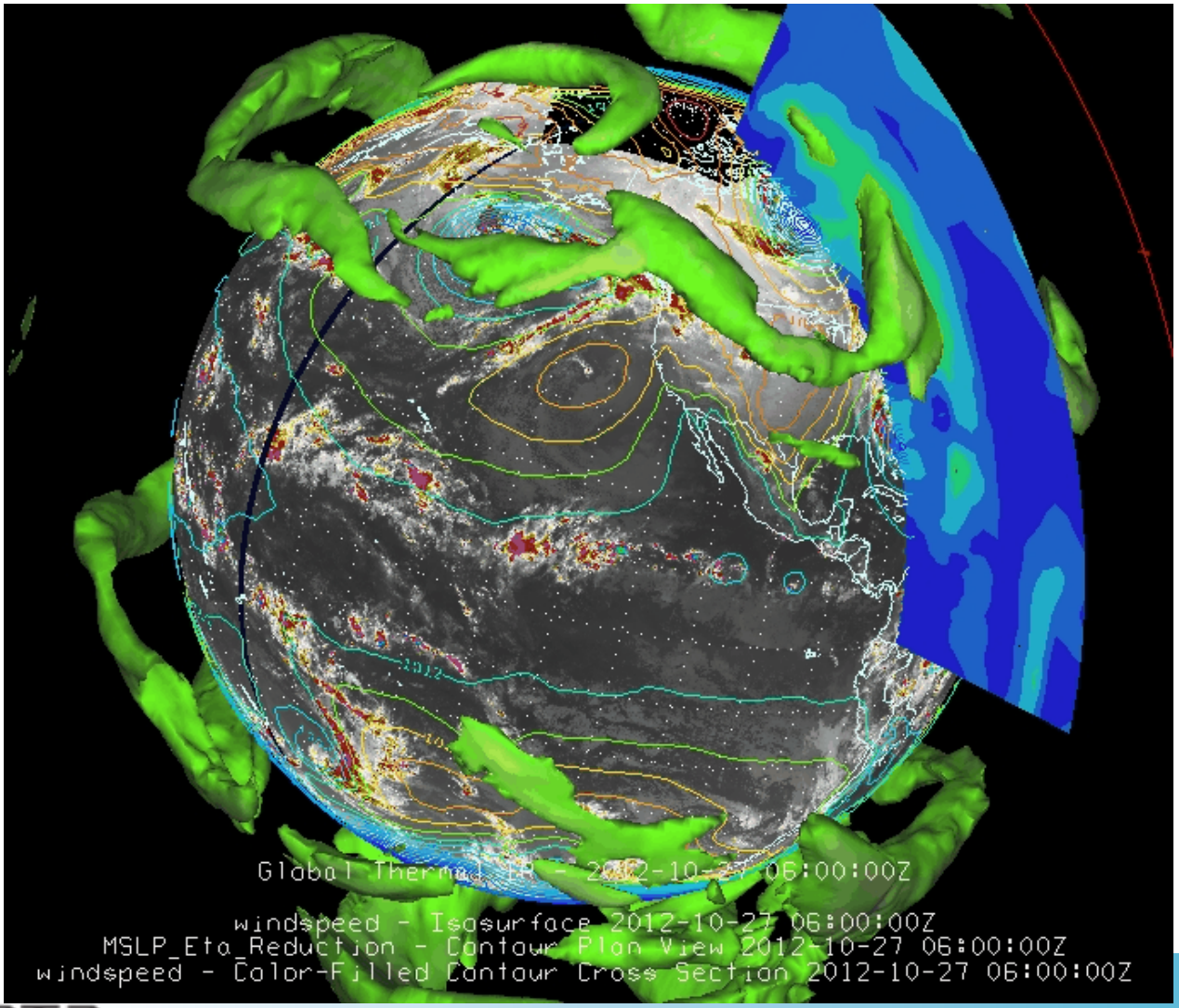
IDV Example: 3D Globe View



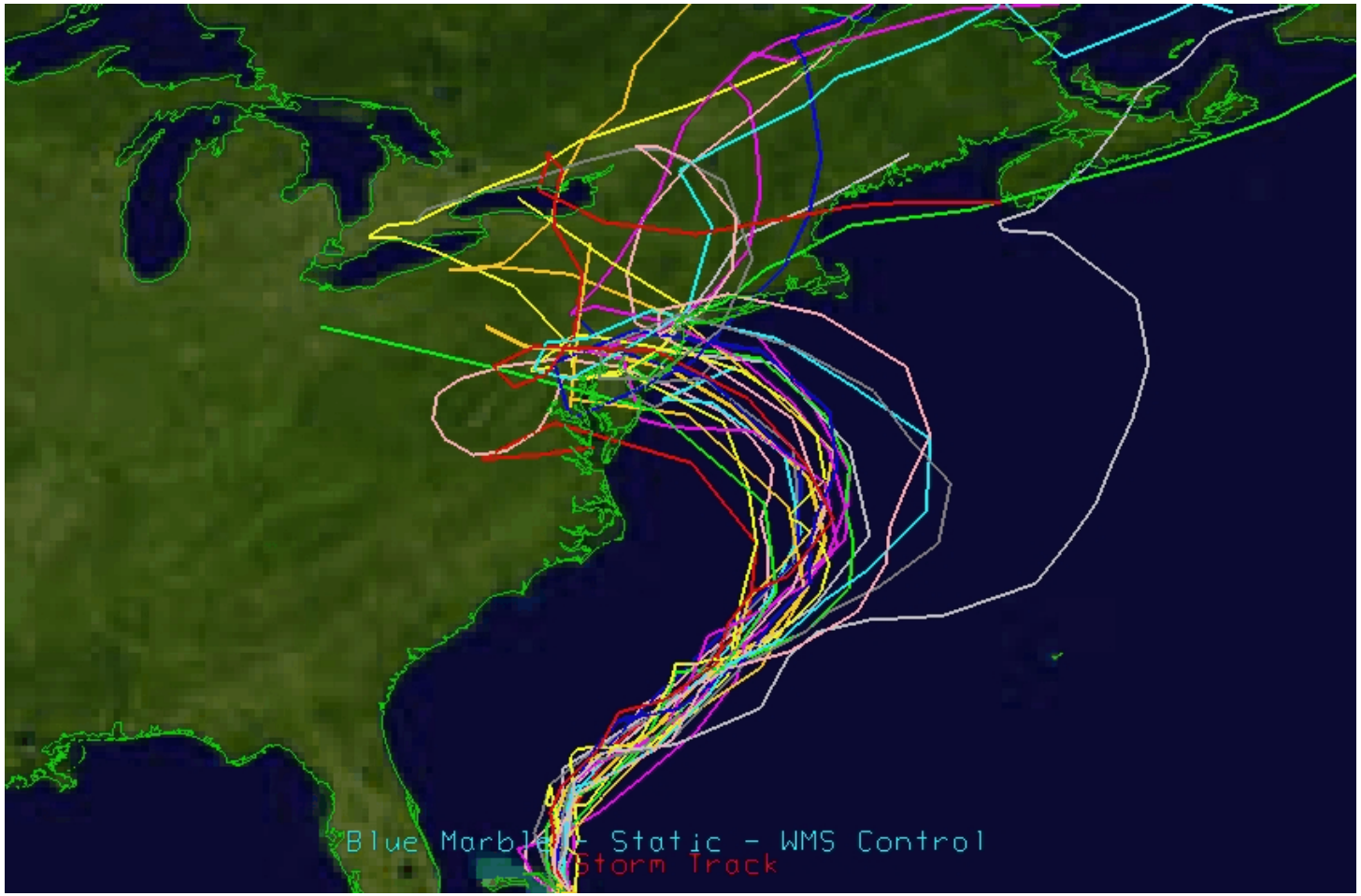




IDV Example: 3D Globe View of Sandy

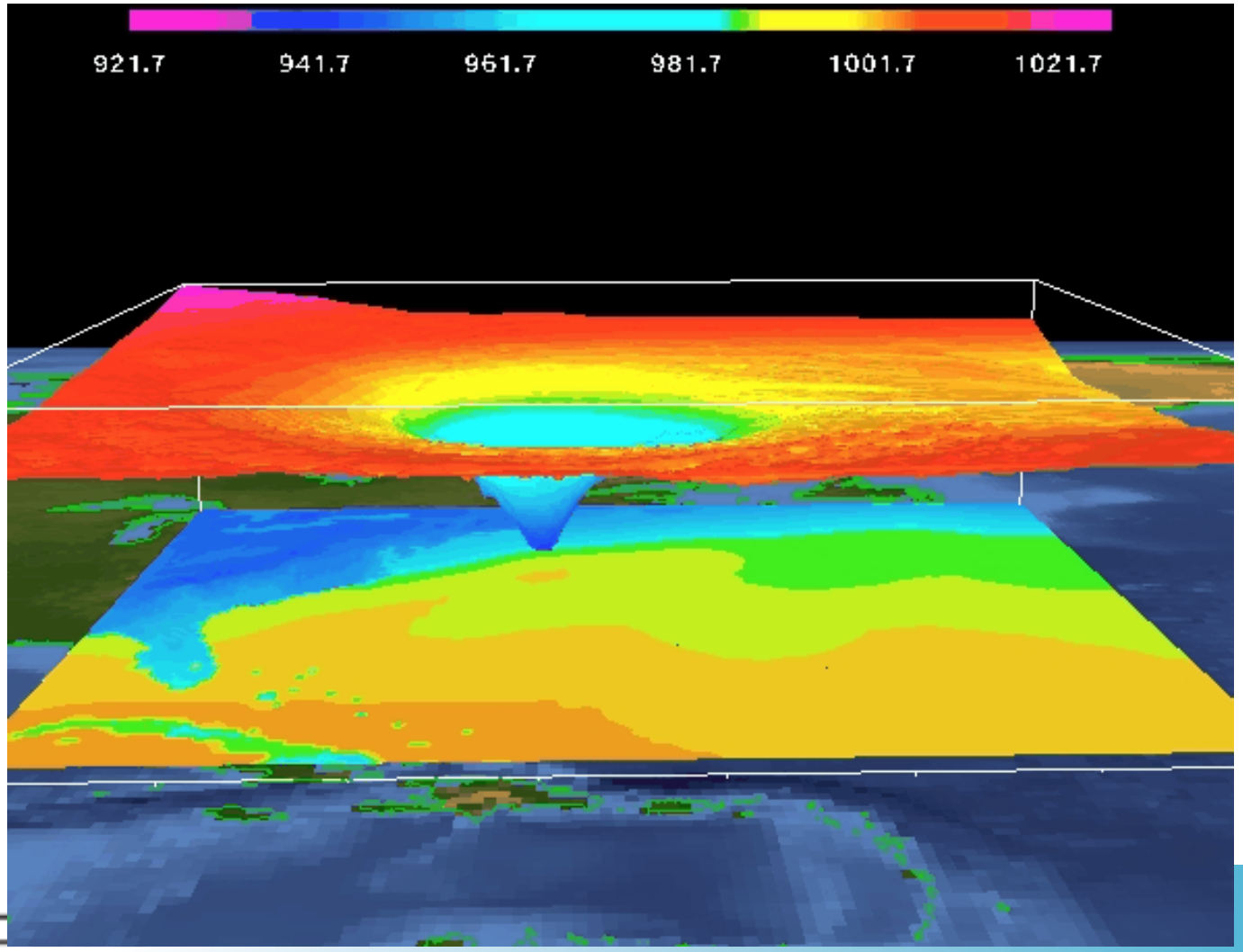


IDV Example: Sandy storm tracks

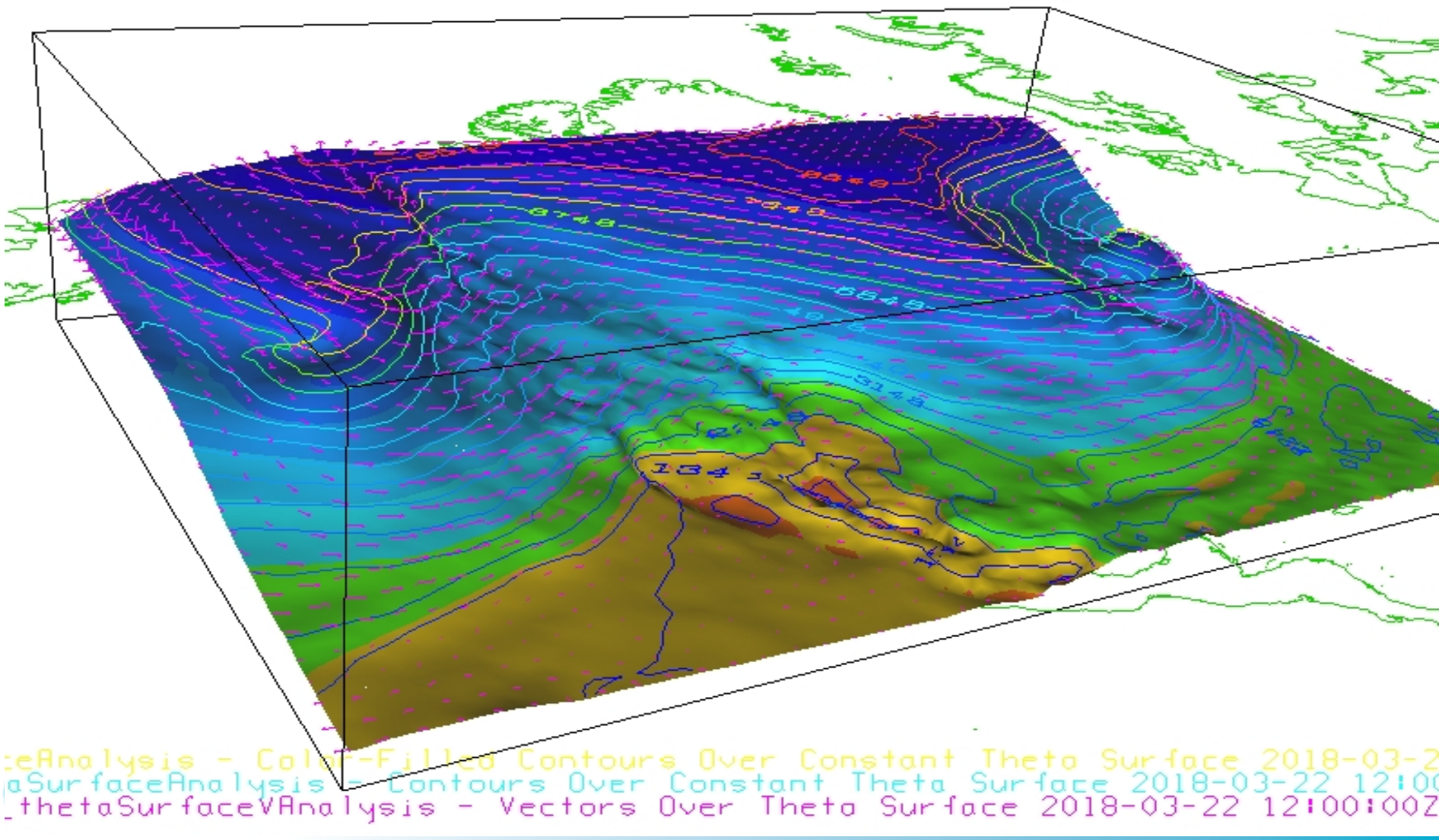


IDV Example: 3D Display

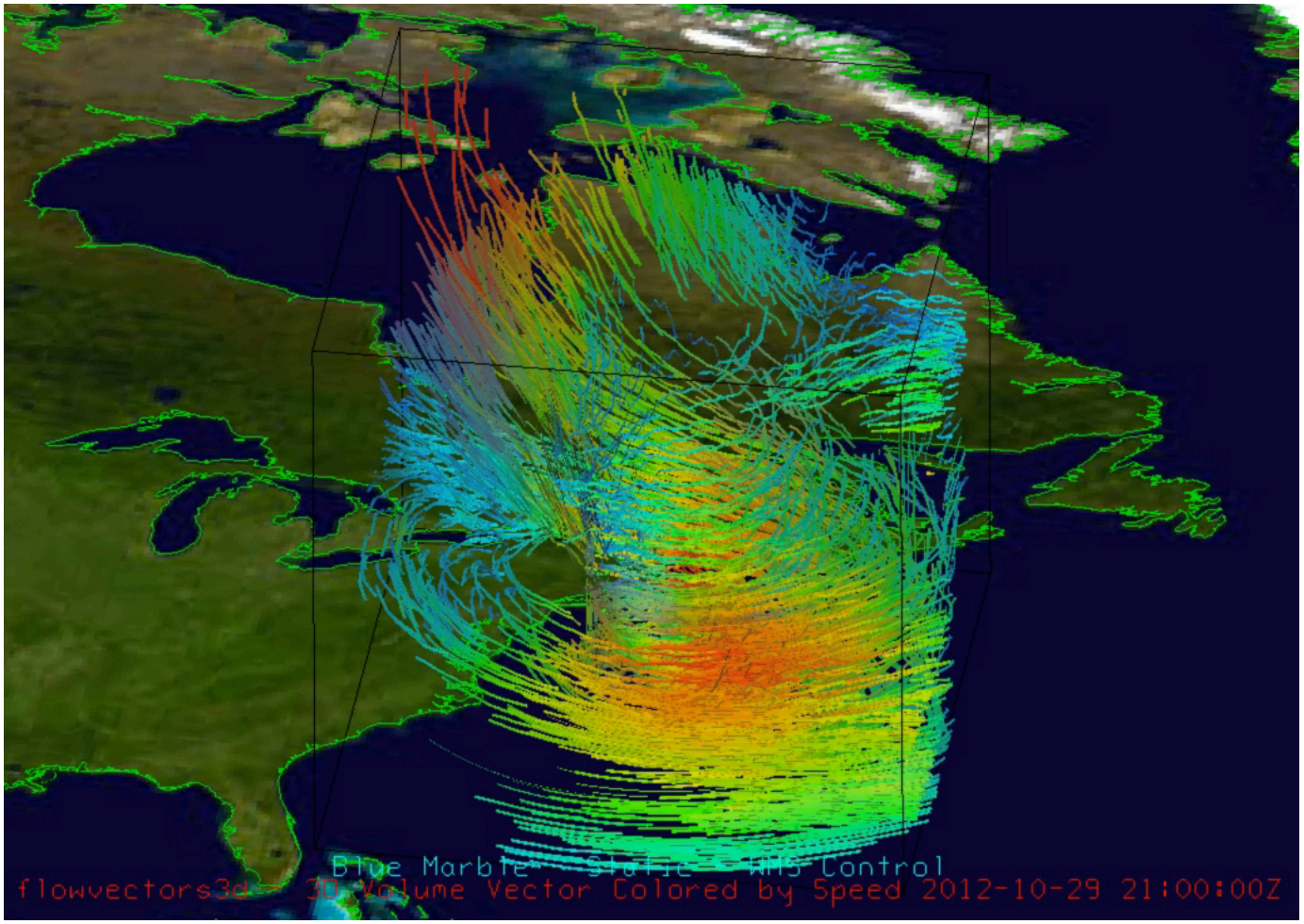
- 3D views of Sandy WRF output: PMSL and temperature



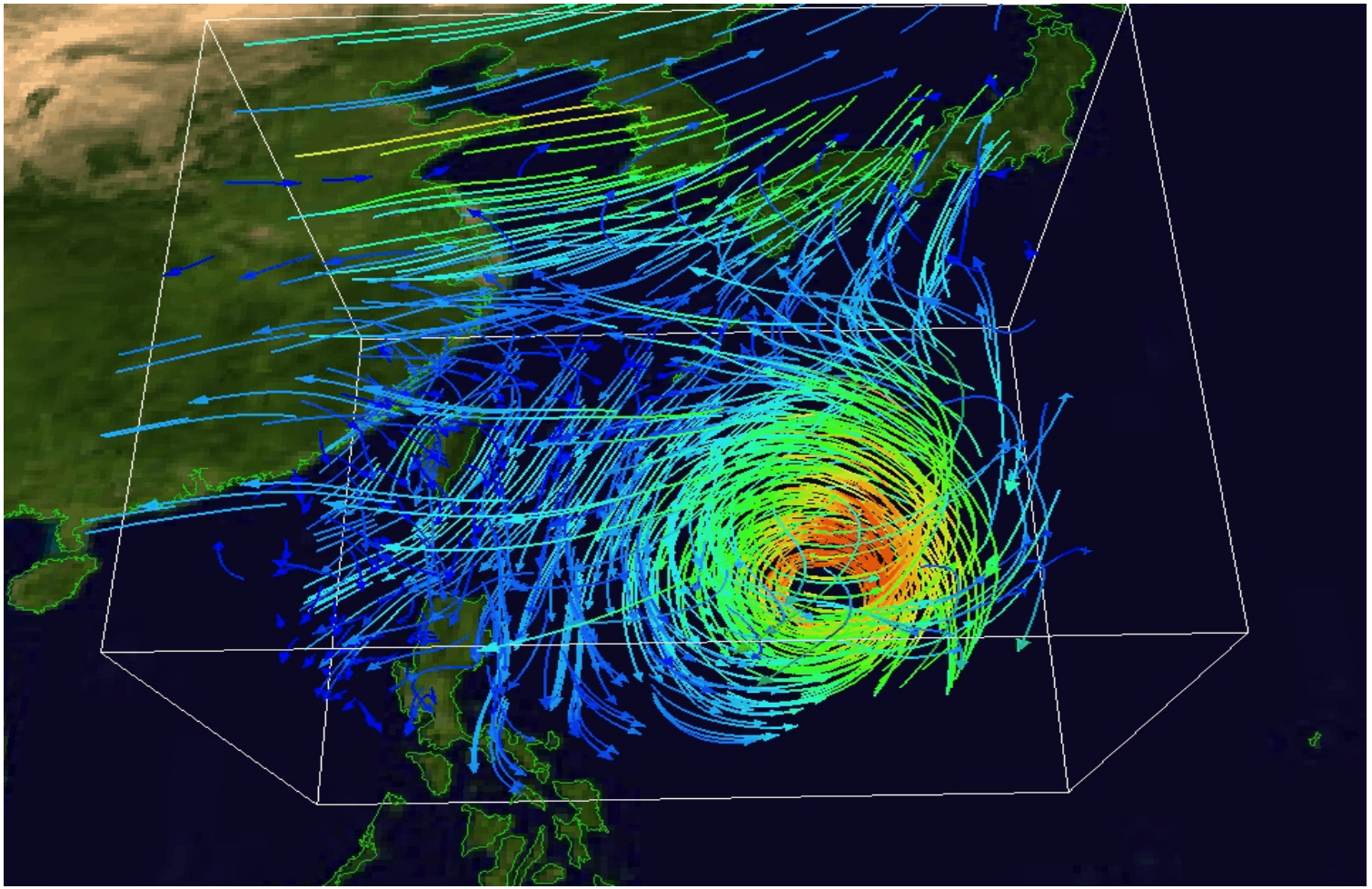
3D Isentropic Analysis



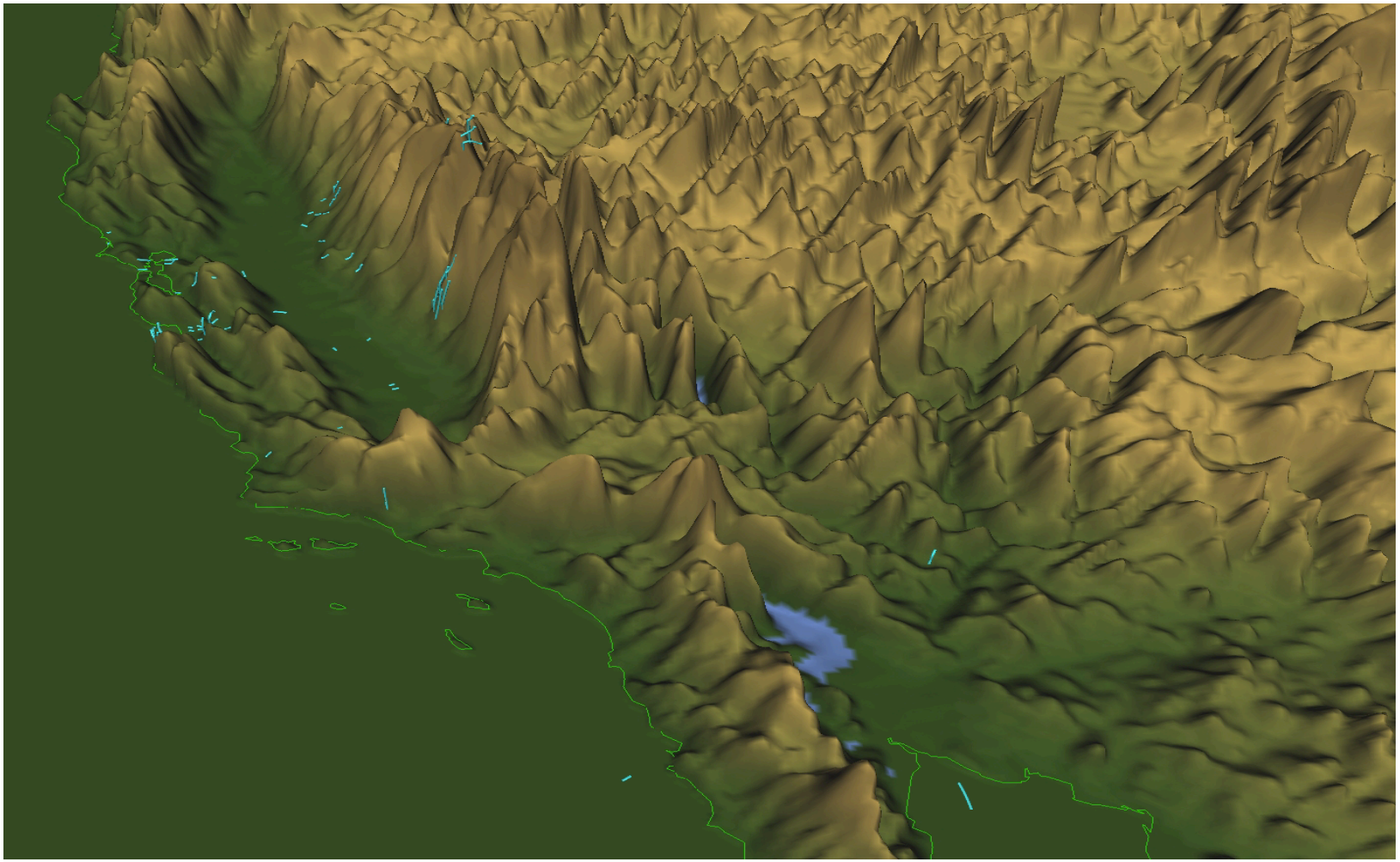
IDV Example: 3D Volume Trajectory of Hurricane Sandy



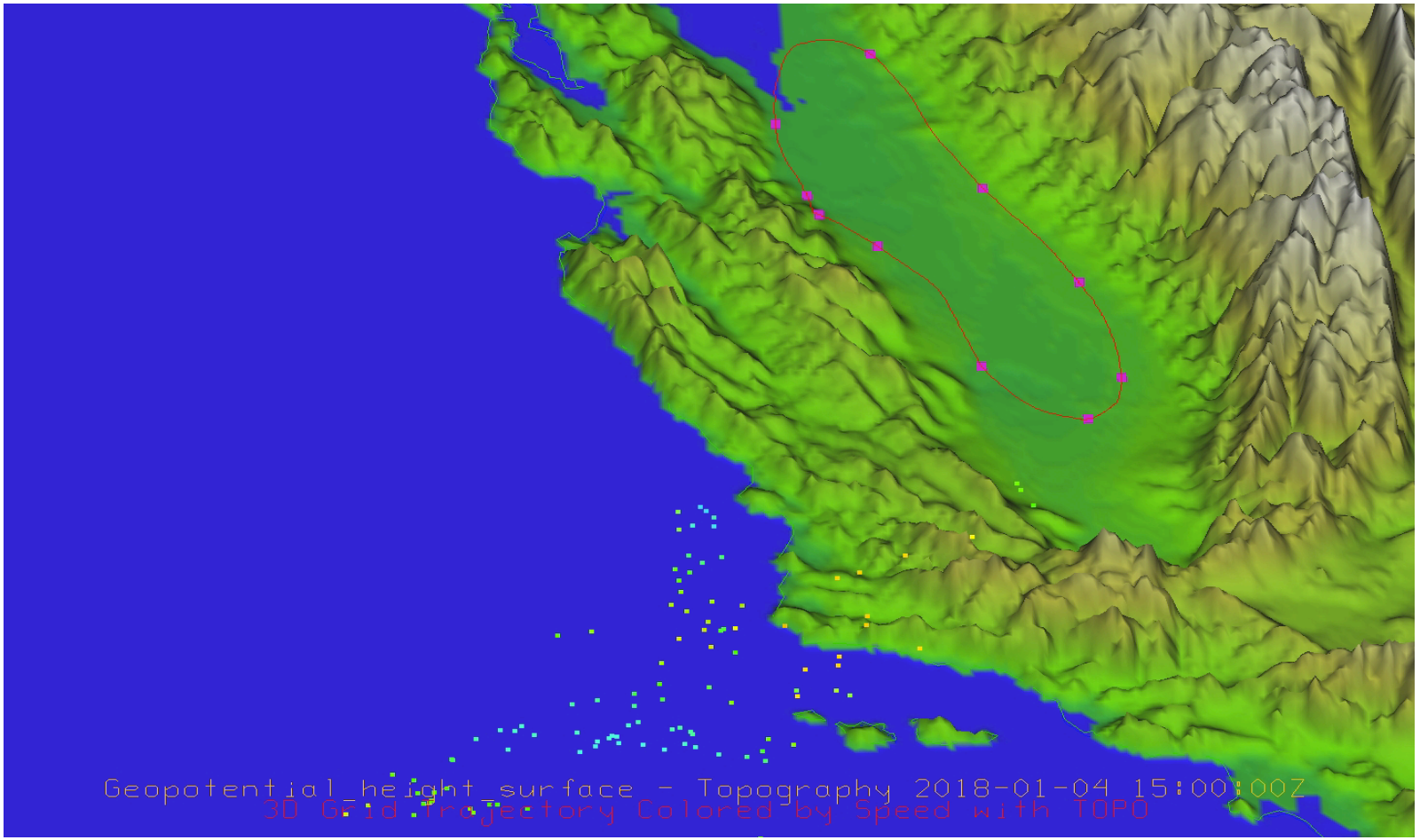
3D Streamline of Hurricane Florence



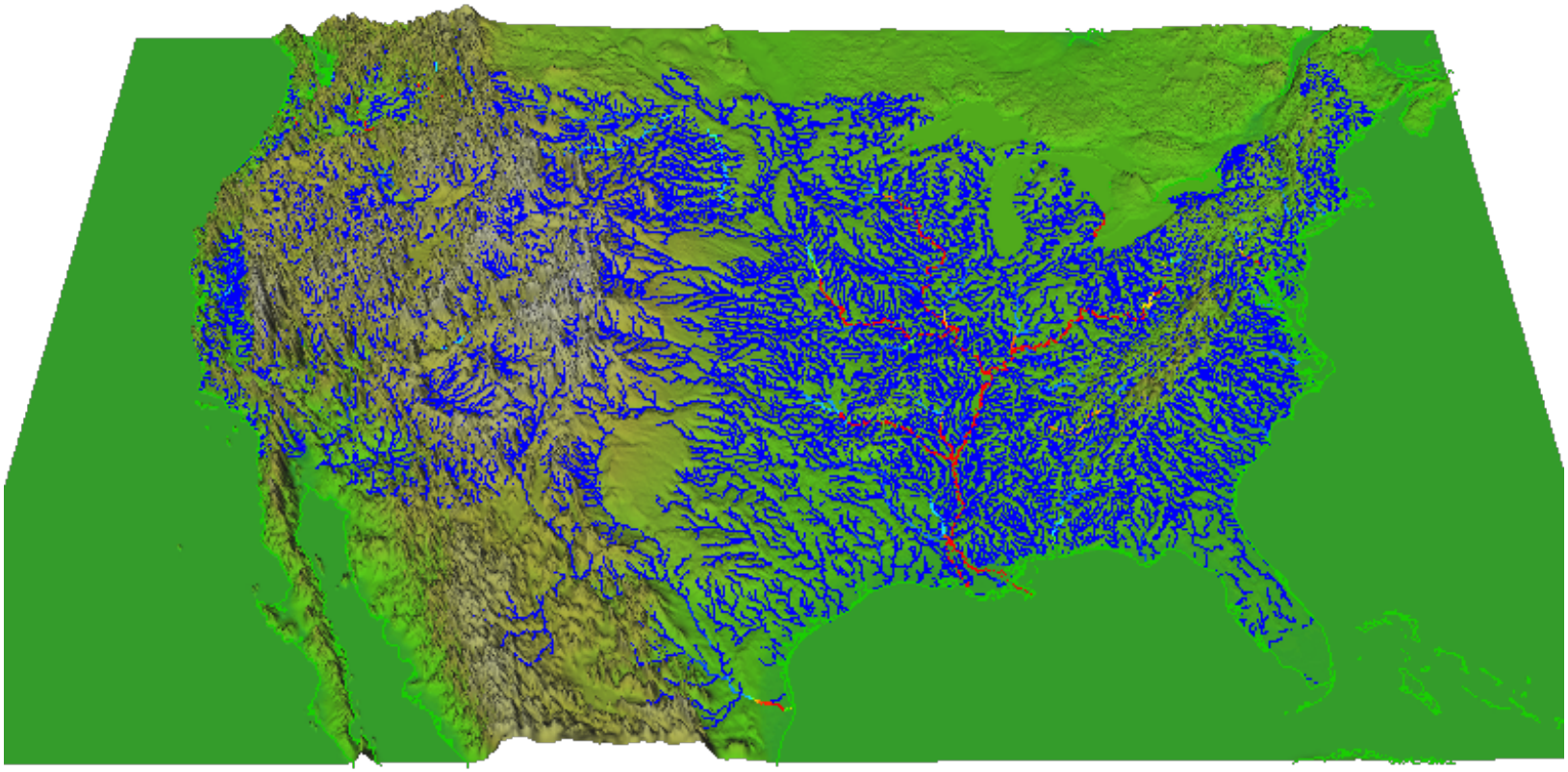
Trajectory with Topography



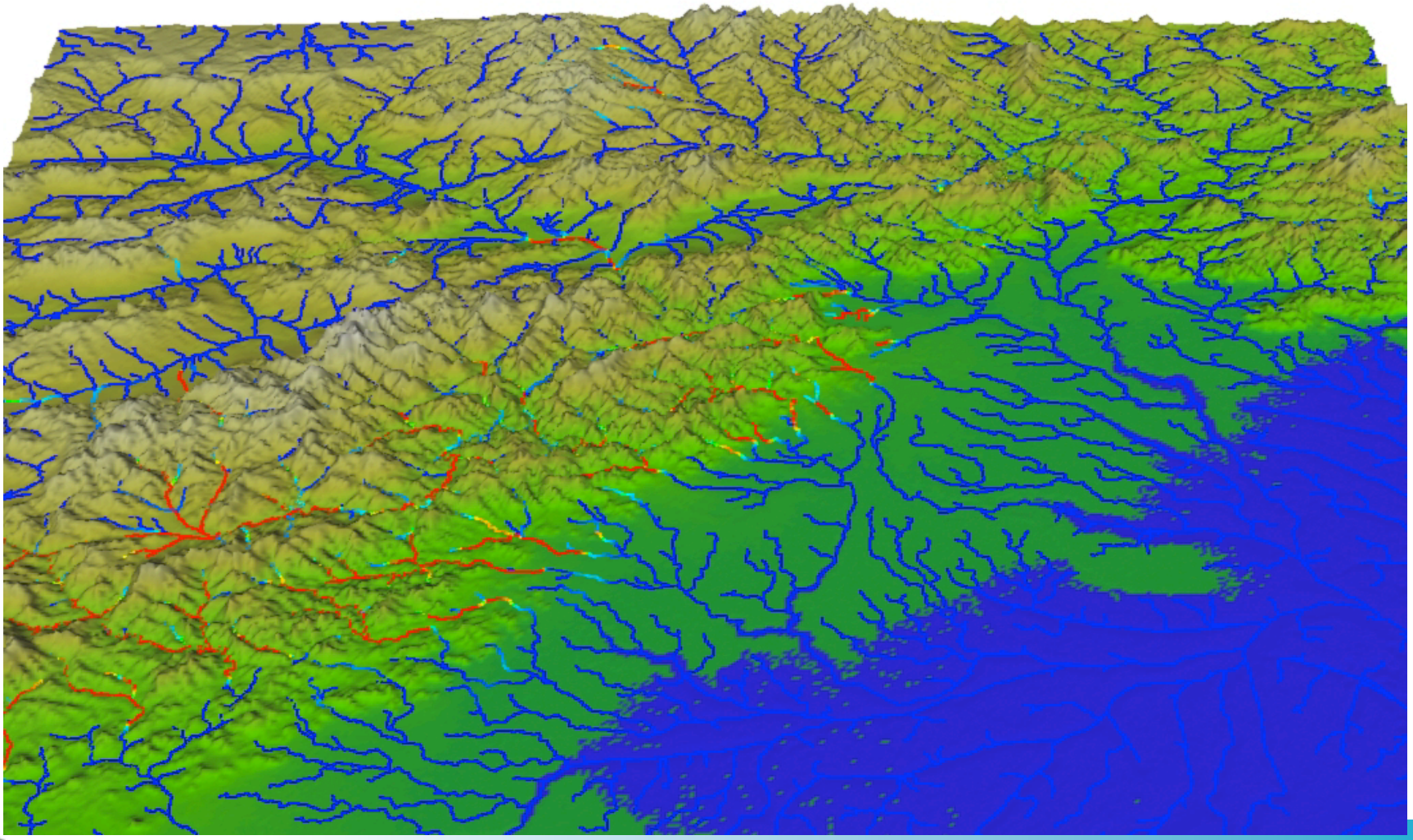
Backward Trajectory Display

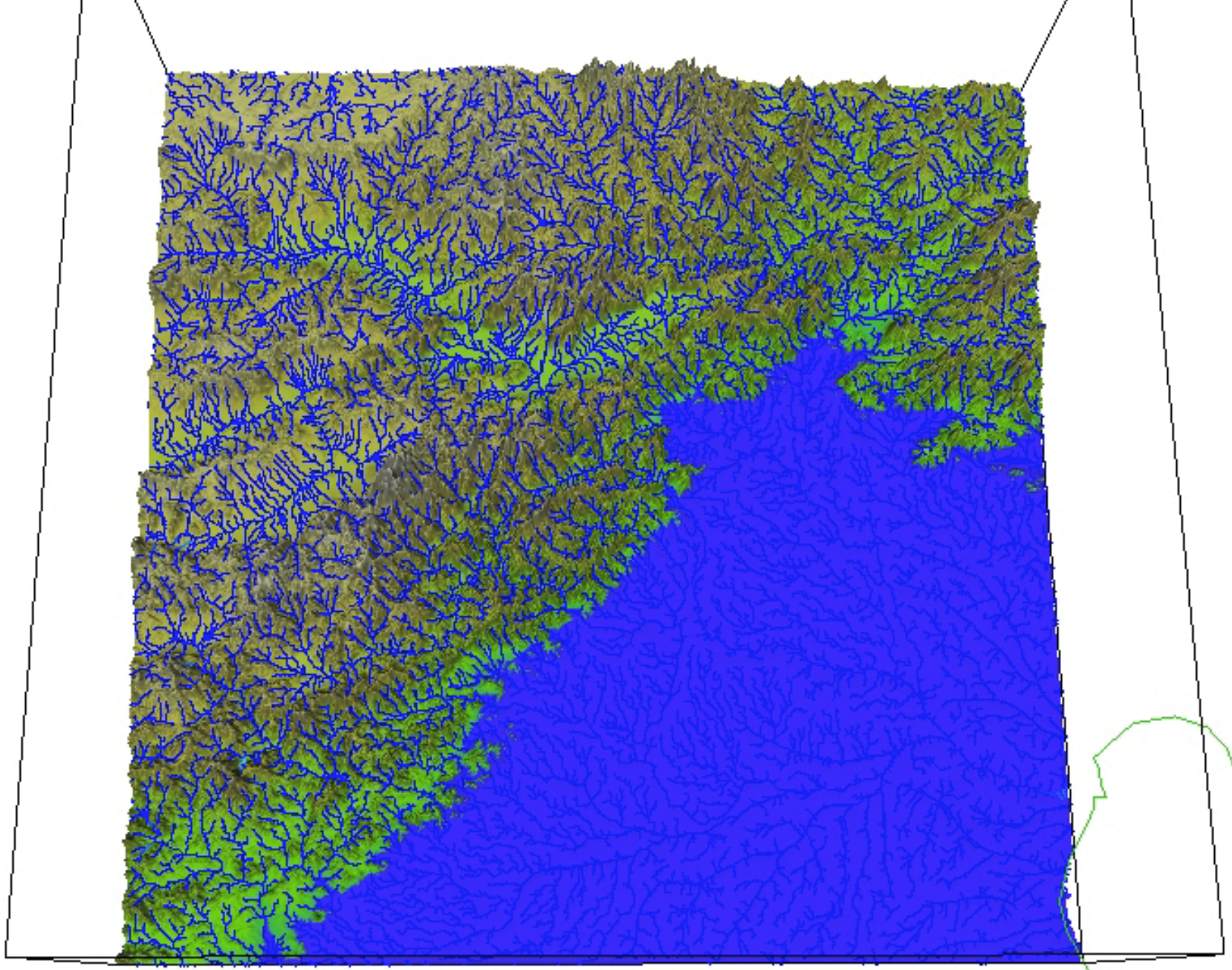


Stream Flow over Topography

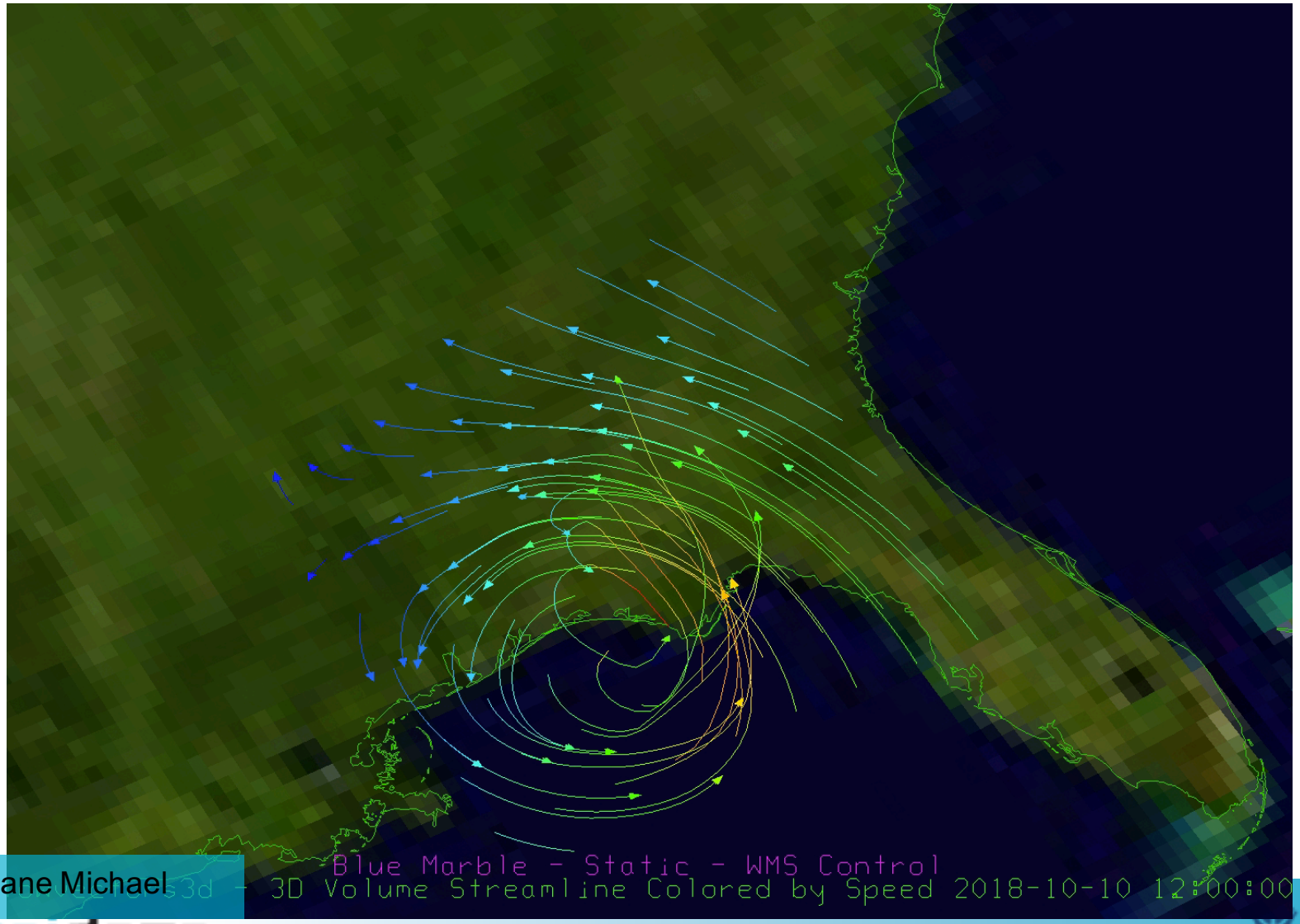


WRF Hydro Stream flow with TOPO

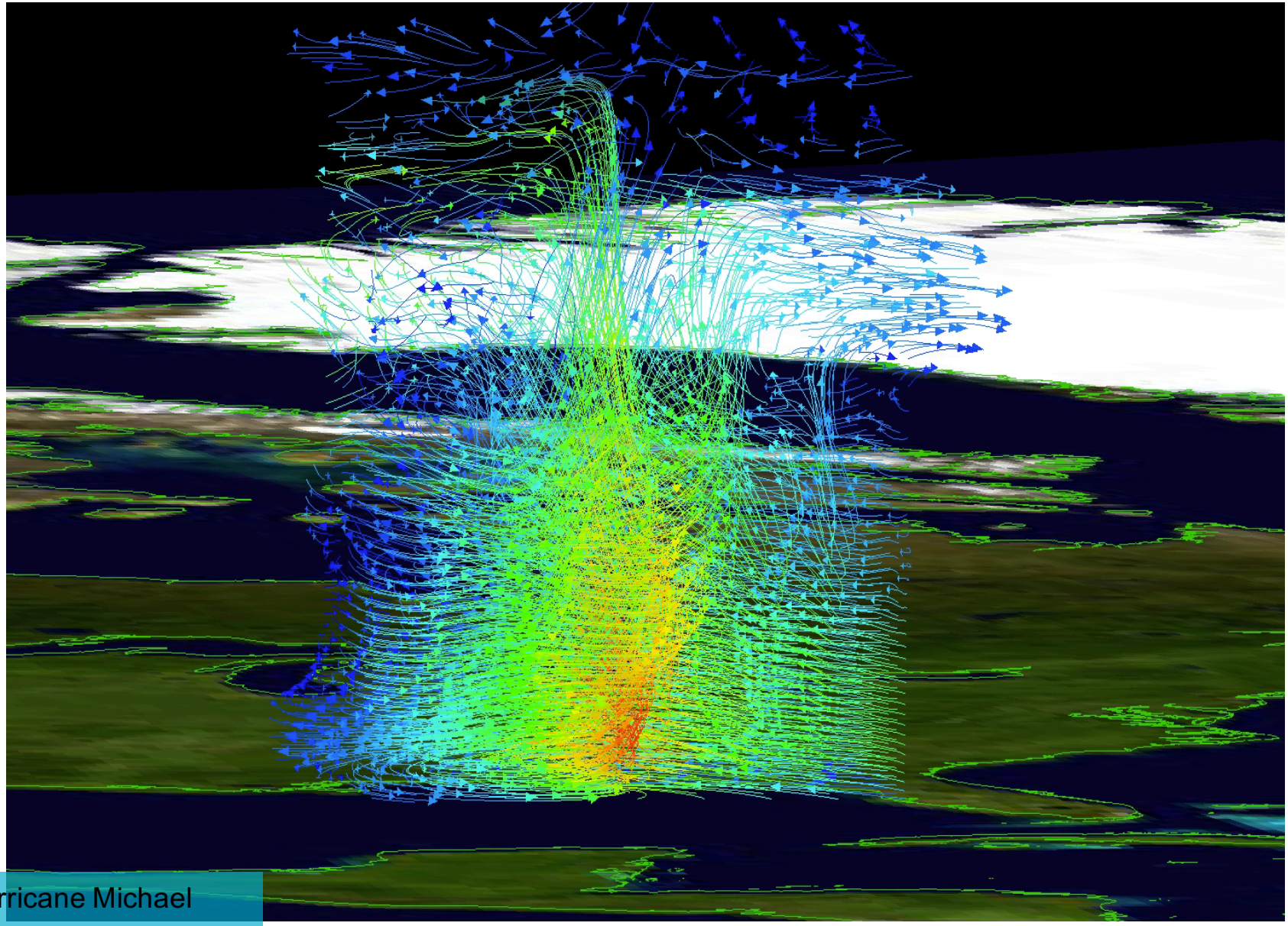



streamflow - Point Cloud 2012-07-21 12:00:00Z
TOPOGRAPHY - Topography

3D streamline initiated from XY plane

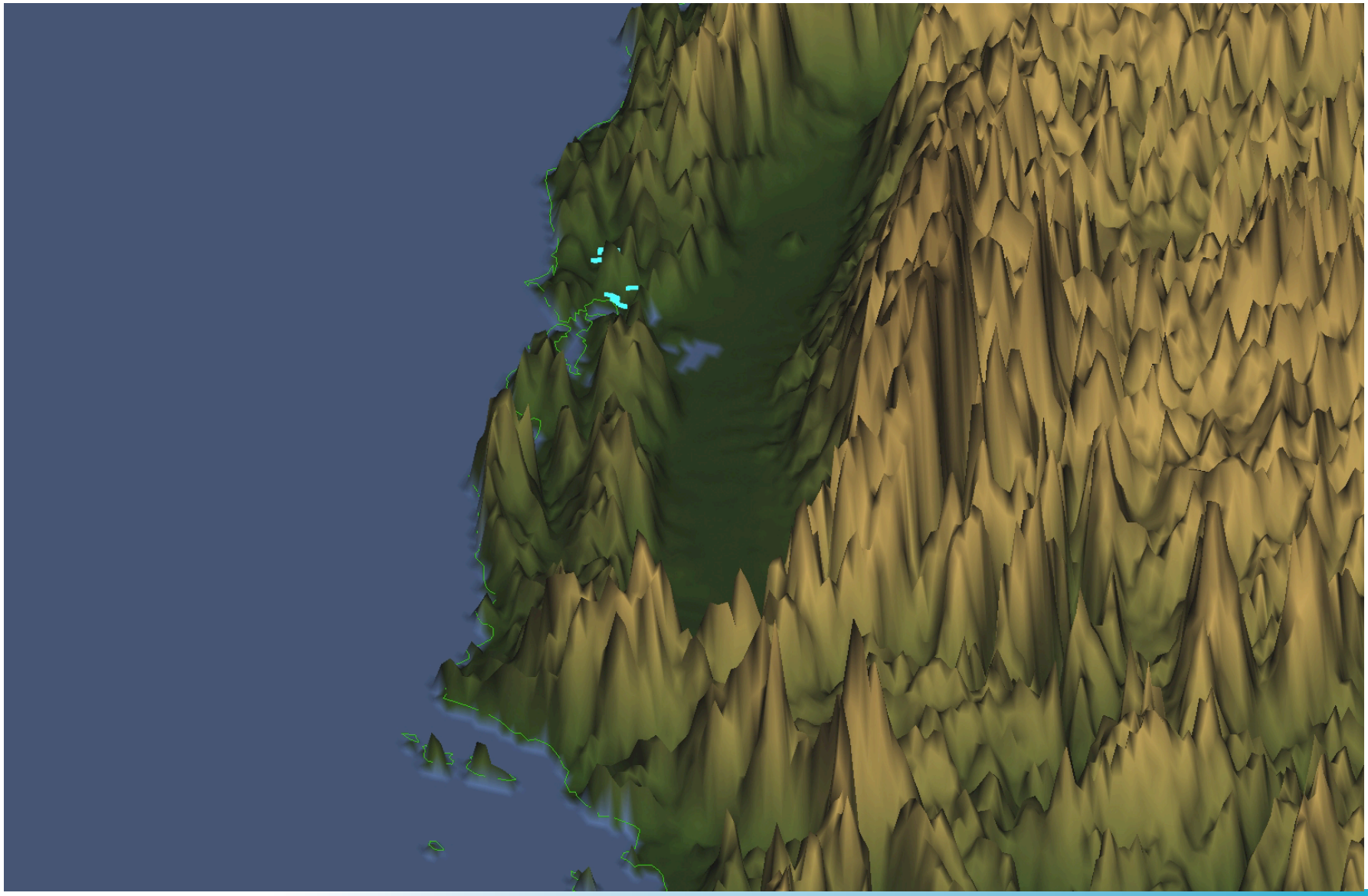


Hurricane Michael

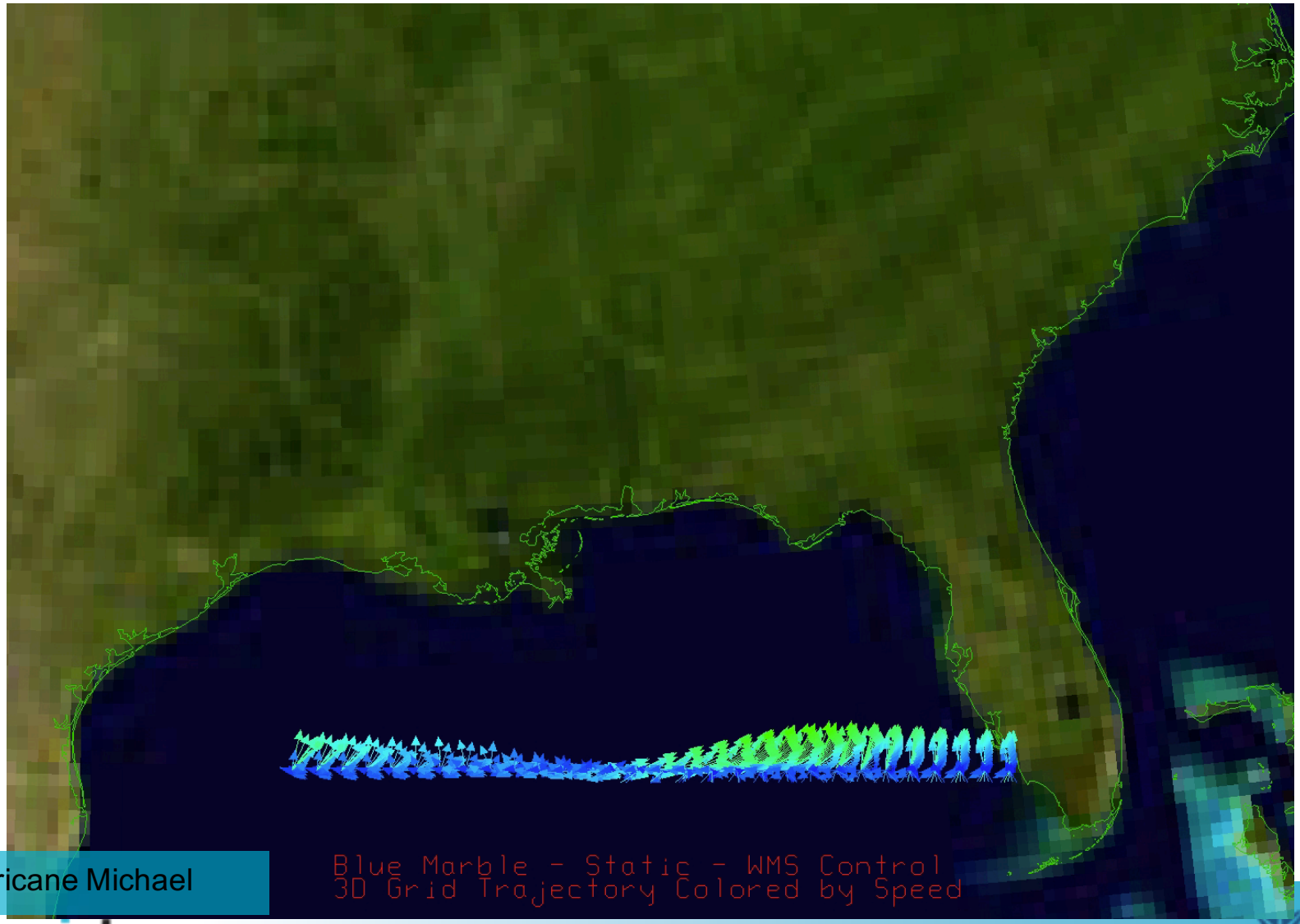


Hurricane Michael

a new parcel is initialized at each time step.

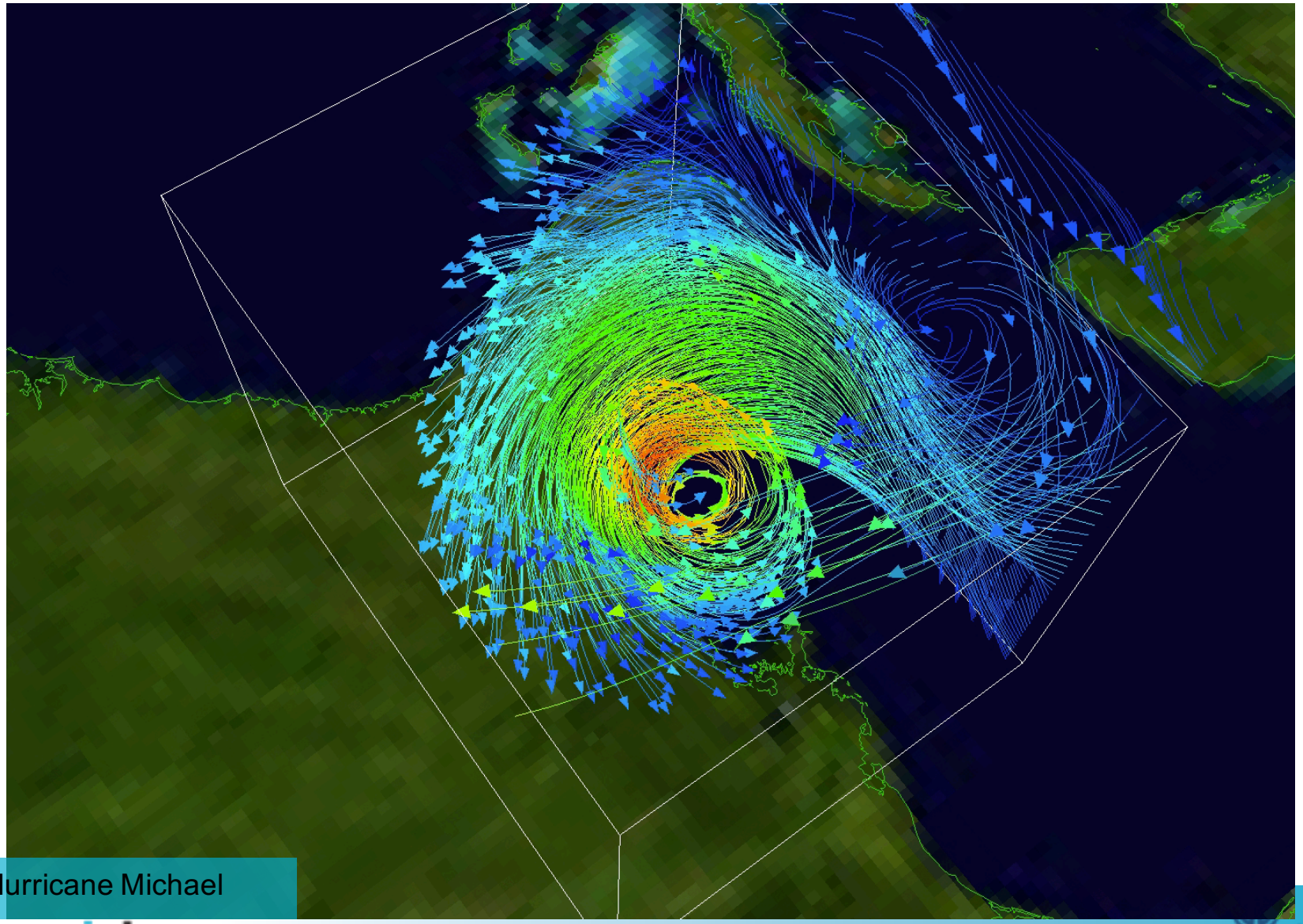


3D trajectory initiated from XZ or YZ plane



Hurricane Michael

3D Streamline initiated from XZ or YZ plane

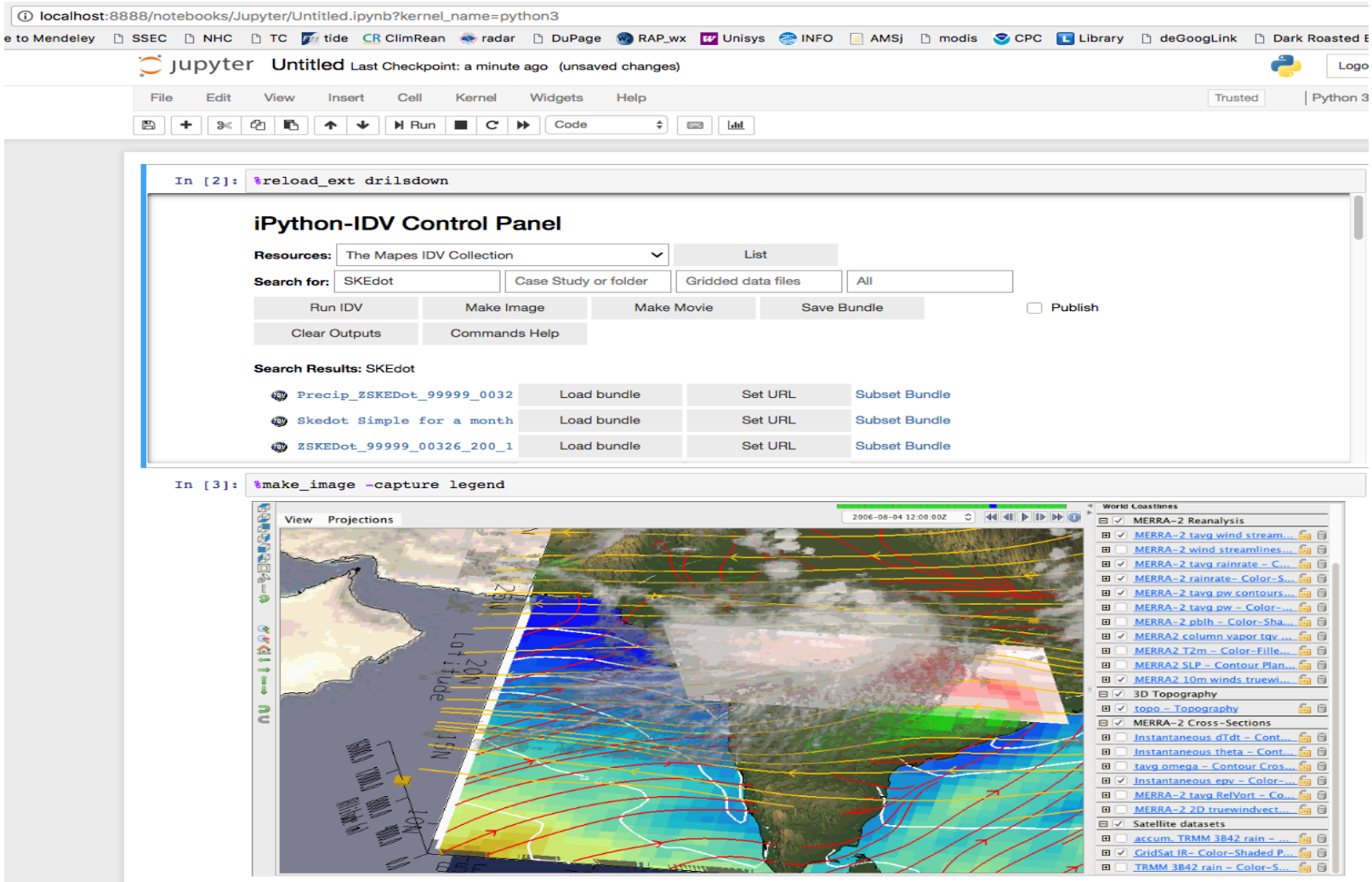


Hurricane Michael

Classroom machine

- module load idv
- runIDV

DRILSDOWN: IDV in Jupyter



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DRILSDOWN: extending & linking these already powerful systems

- Jupyter←→IDV comms (from Python shell):
  - Control Panel
  - .from_zidv() method for *xarray* package
    - get zipped-up IDV-fetched data hyperslabs into Python
  - .to_idv() method " " "
    - send xarray dataset into IDV for co-visualization w/ others
- Add functionality within the IDV
  - Mapes IDV collection plugin (functions, datasources, …)
- Add functionality within RAMADDA (and its server)
  - nbviewer, Case Study digital object, more services….
  - easier code-driven automatic publish
  - (trying to) make notebooks *active on server* (JupyterHub)

IDV: a collaborative visualization and analysis tool

- XML configuration and bundling allows collaboration with others

- Direct access to RAMADDA server, allows both downloading and publishing

- Use THREDDS catalogs of data holdings for discovery and usage metadata

- Client-server data access from remote systems

IDV and RAMADDA

- The IDV can generate images and bundles that can be published to RAMADDA, and RAMADDA can also run the IDV to post images on the web

- The IDV and RAMADDA enable users at partnering institutions to contribute and easily share data holdings and products

- The IDV and RAMADDA empower the community with the ability to create and deploy innovative data services in a collaborative, social network style

IDV Benefits

- In Classroom/Research:
  - More sophisticated presentation of concepts with real data
  - Better prepares students entering the geoscience career field
- In Operation:
  - Easy data accessibility
  - High level of interaction with data
  - High efficient image rendering
  - Platform independence allows for real-time collaboration

Summary

- IDV, when combined with other Unidata technologies, provides efficient data access, effective data usage, and reduces data friction
- IDV enables analysis, integration, and visualization of heterogeneous geoscience data
- IDV enables real-time collaboration

For more information

- IDV Homepage:
  - http://www.unidata.ucar.edu/software/idv
- Download IDV package:
  - http://www.unidata.ucar.edu/downloads/idv/index.jsp
- IDV Support
  - Support-idv@unidata.ucar.edu

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