

The Integrated Data Viewer

An integrated, interactive and collaborative visualization and analysis tool for research and education



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Presentation Outline

- Challenges of research and education in the geosciences
- Integrated Data Viewer (IDV) features overview
 - Integrator
 - Interactive tool
 - Collaborative tool
- IDV examples
- The future of the IDV



UNIDATA

- Our Vision:

Geoscience at the speed of thought through accelerated data discovery, access, analysis, and visualization.

- Our Mission:

To transform the geosciences community, research, and education by providing innovative data services and tools



Integrated Visualization at the Speed of Thought

- A metaphor introduced by Paul Edwards in his book “A Vast Machine” (2010)
- In the geosciences, data gathering, analysis, and visualization collectively constitute “data friction”
- IDV is dedicated to minimizing data friction and maximizing the science in research, education, and weather service



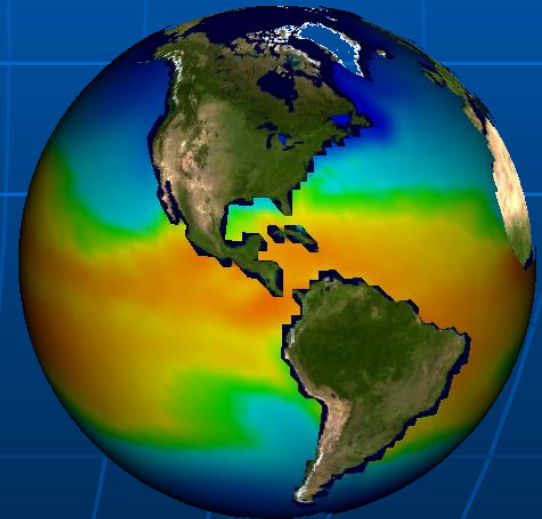
Challenges of Diverse Geoscience Data

- Complex 1D/2D/3D spatial datasets with time varying data
- Diverse data sources (model output, observation, statistics, databases, ...)
- Expanding data volumes
- Large collections of heterogeneous data
- Lack of conventions and standards
- Multidisciplinary integration



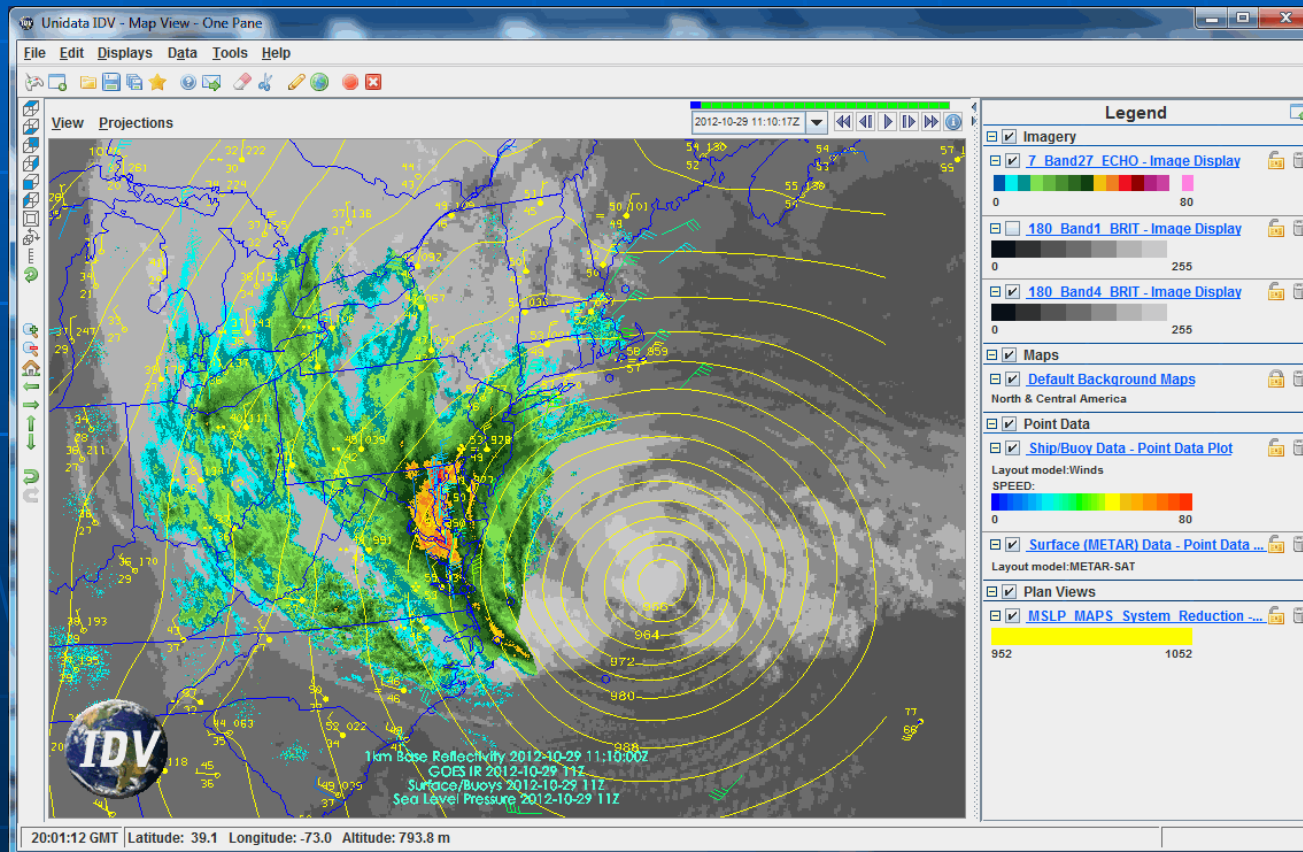
Integrated Data Viewer (IDV)

- 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



Data Spatial Projection

- A set of pre-defined map projections is included
- Data on different projections are automatically remapped
 - The projection of existing display can be remapped automatically
 - The same projection can be applied to different displays

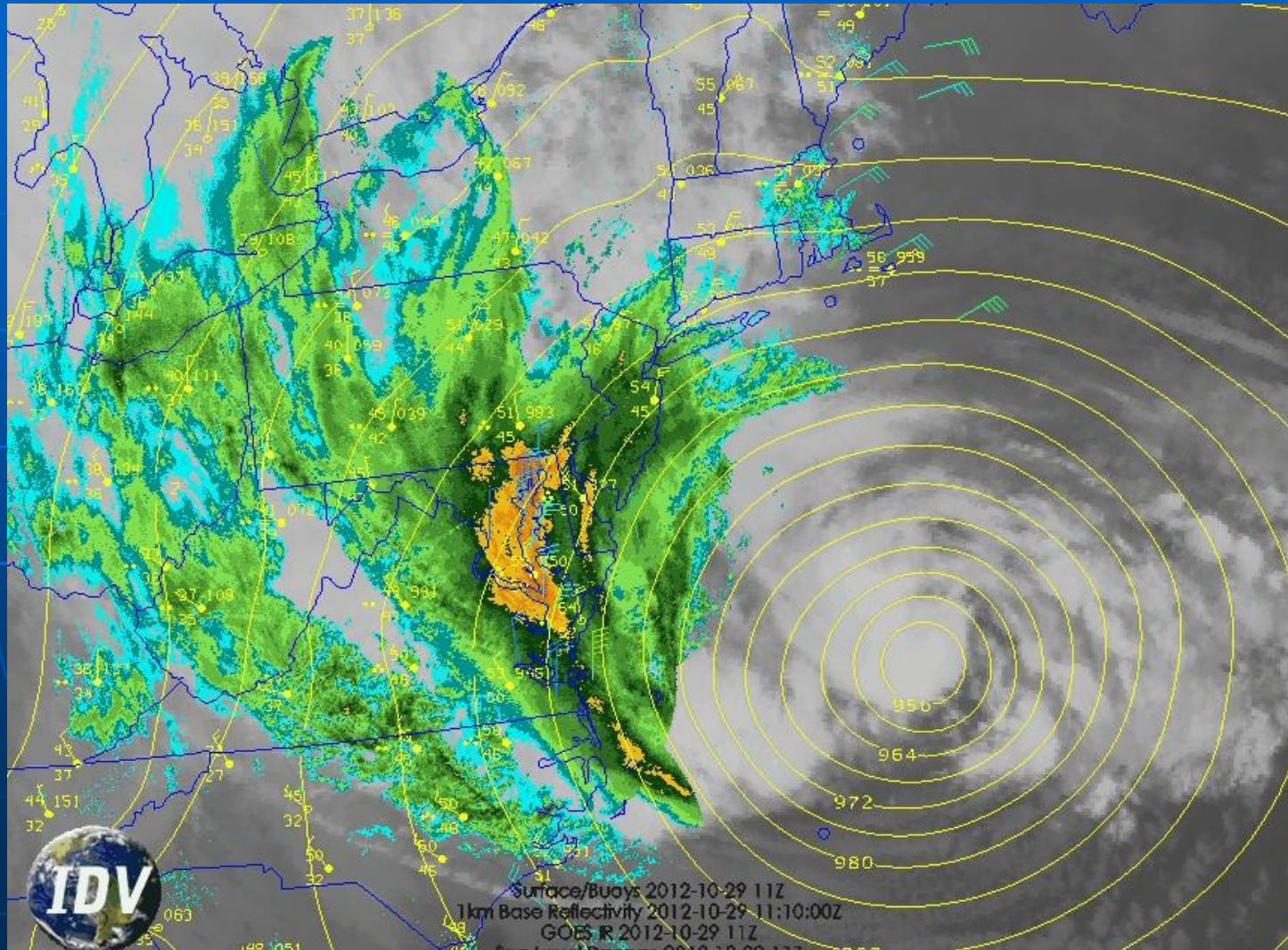


Time Matching

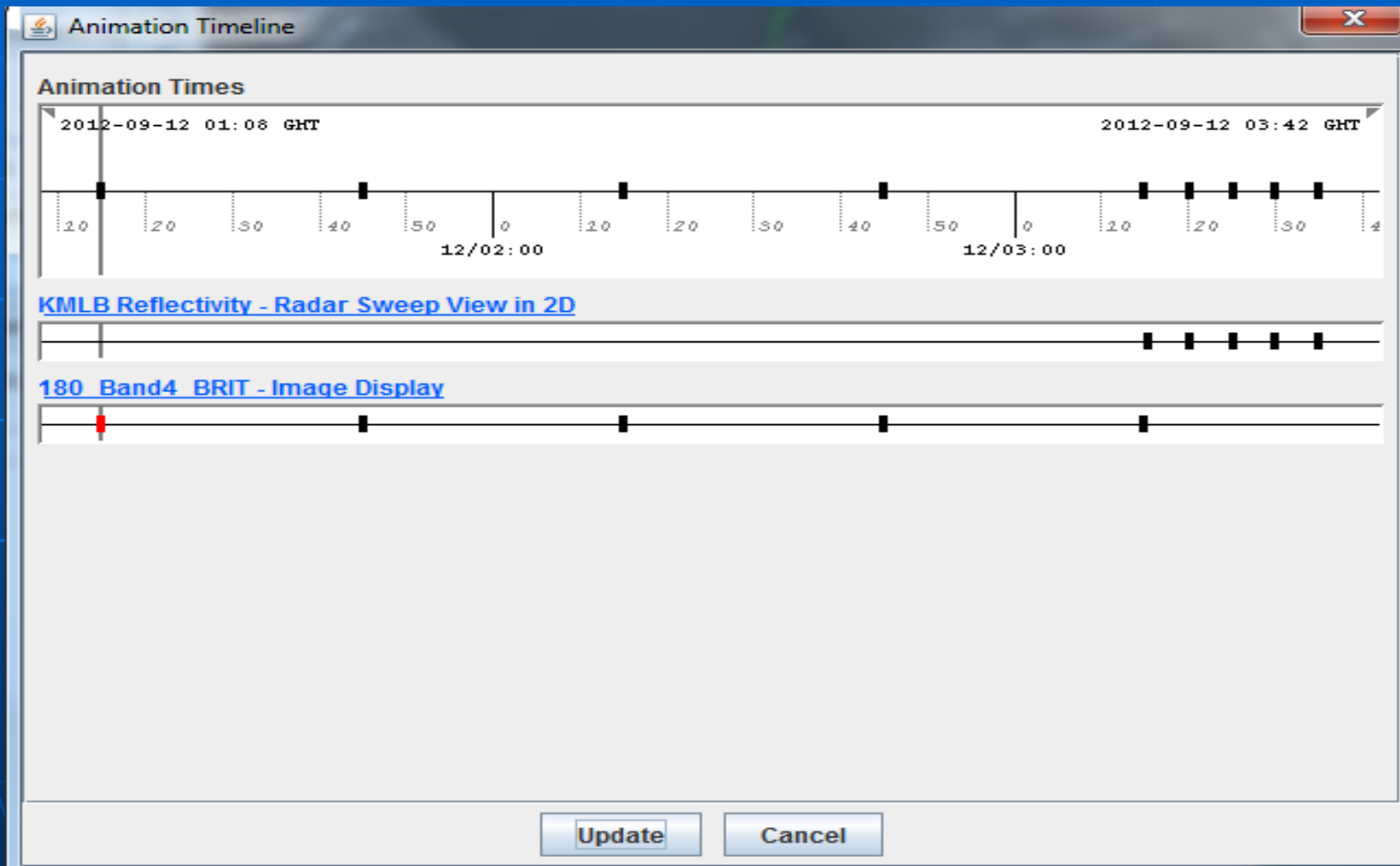
- The IDV can match display times. This is done by first setting a **time driver** based on a display or a predefined animation time set, and then setting a display to **Use Time Driver Times**. A display can be set as the time driver or to use time driver times.



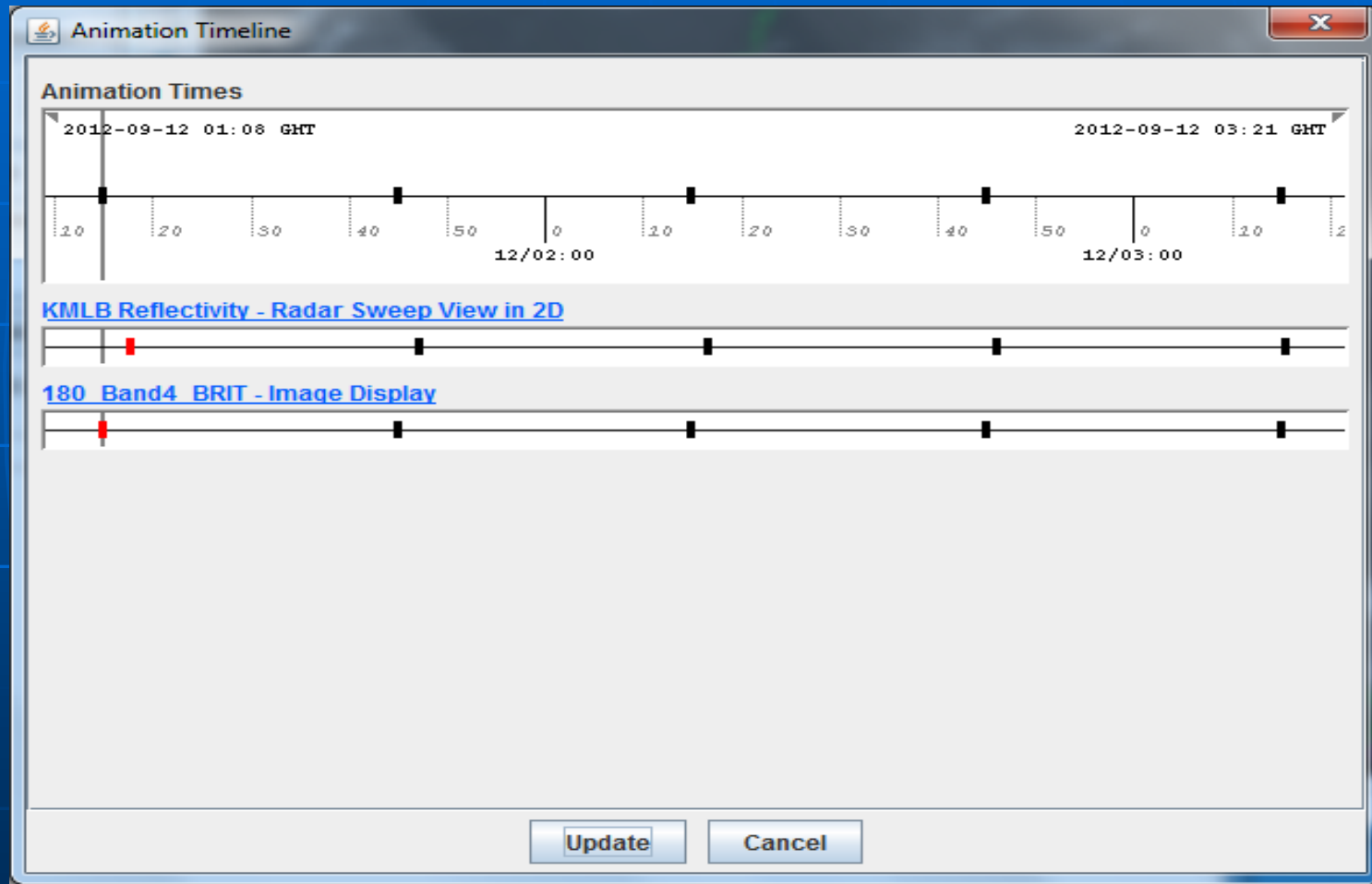
Time Matching



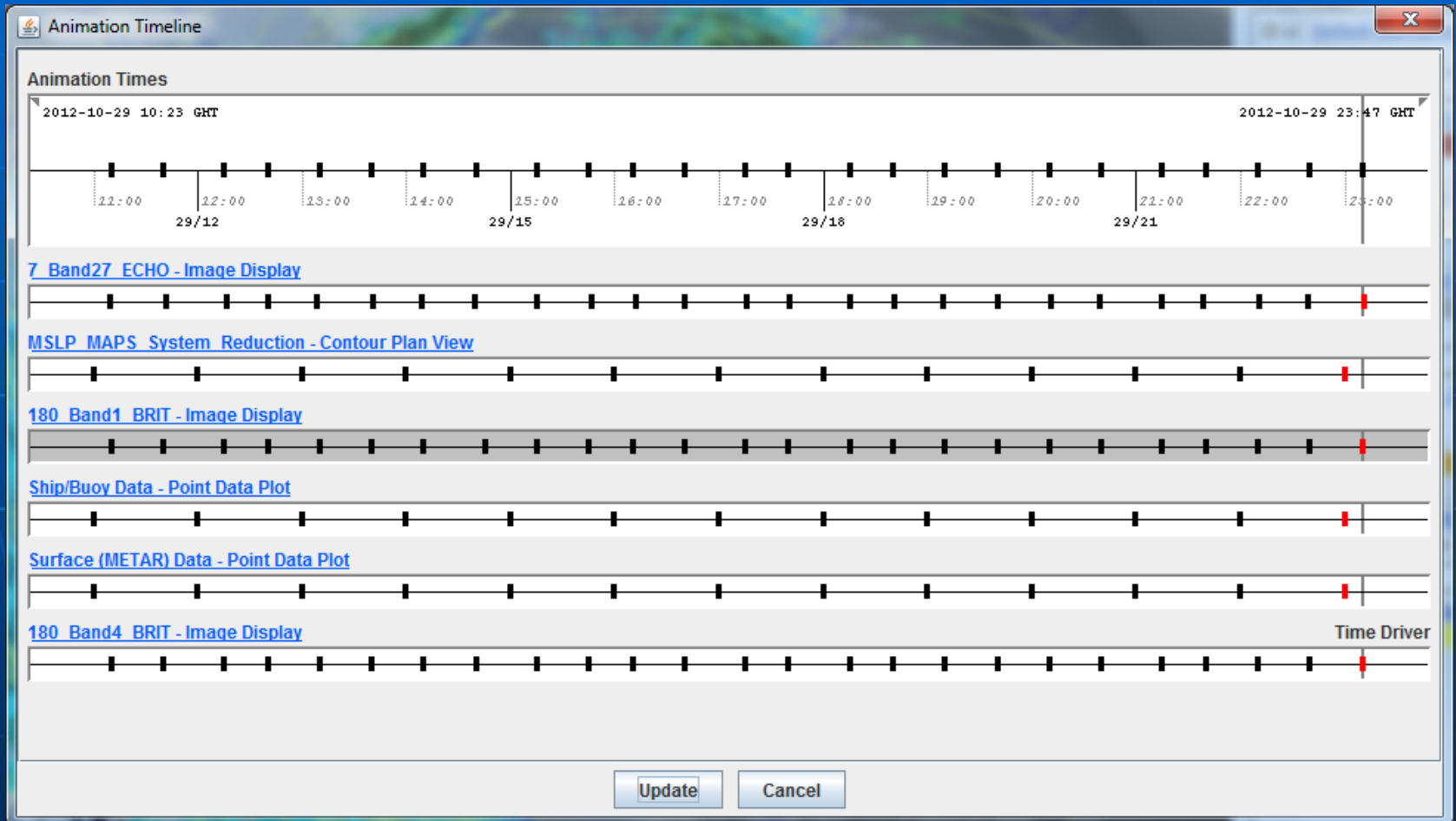
Without Time Matching



With Time Matching



Time Matching

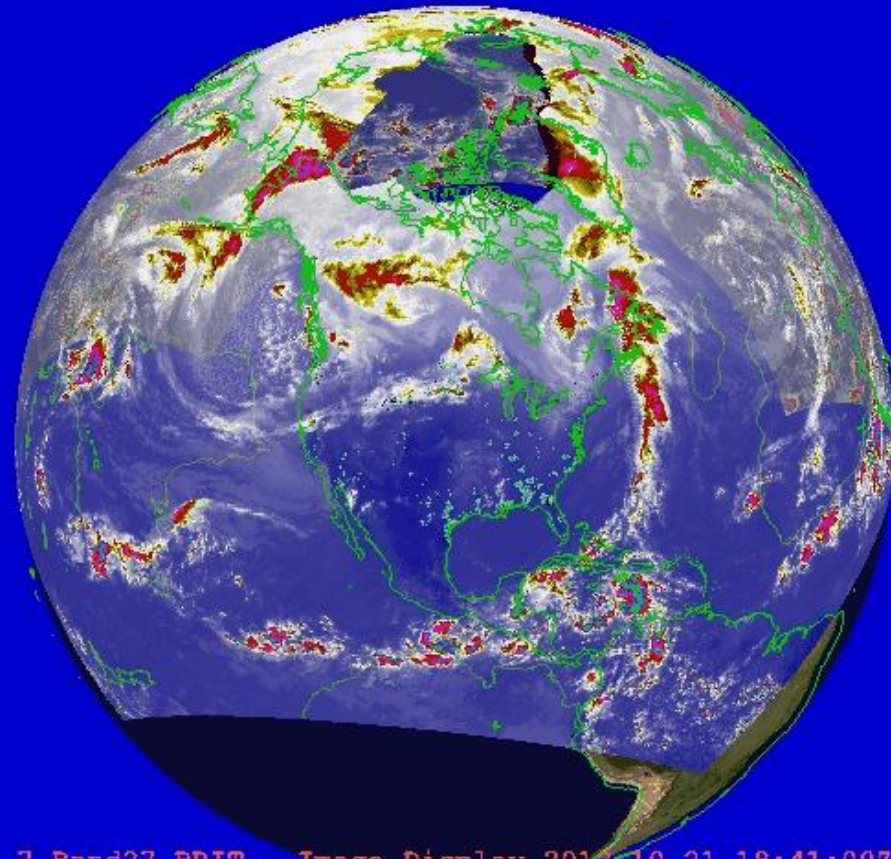


IDV - an interactive visualization and analysis tool

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



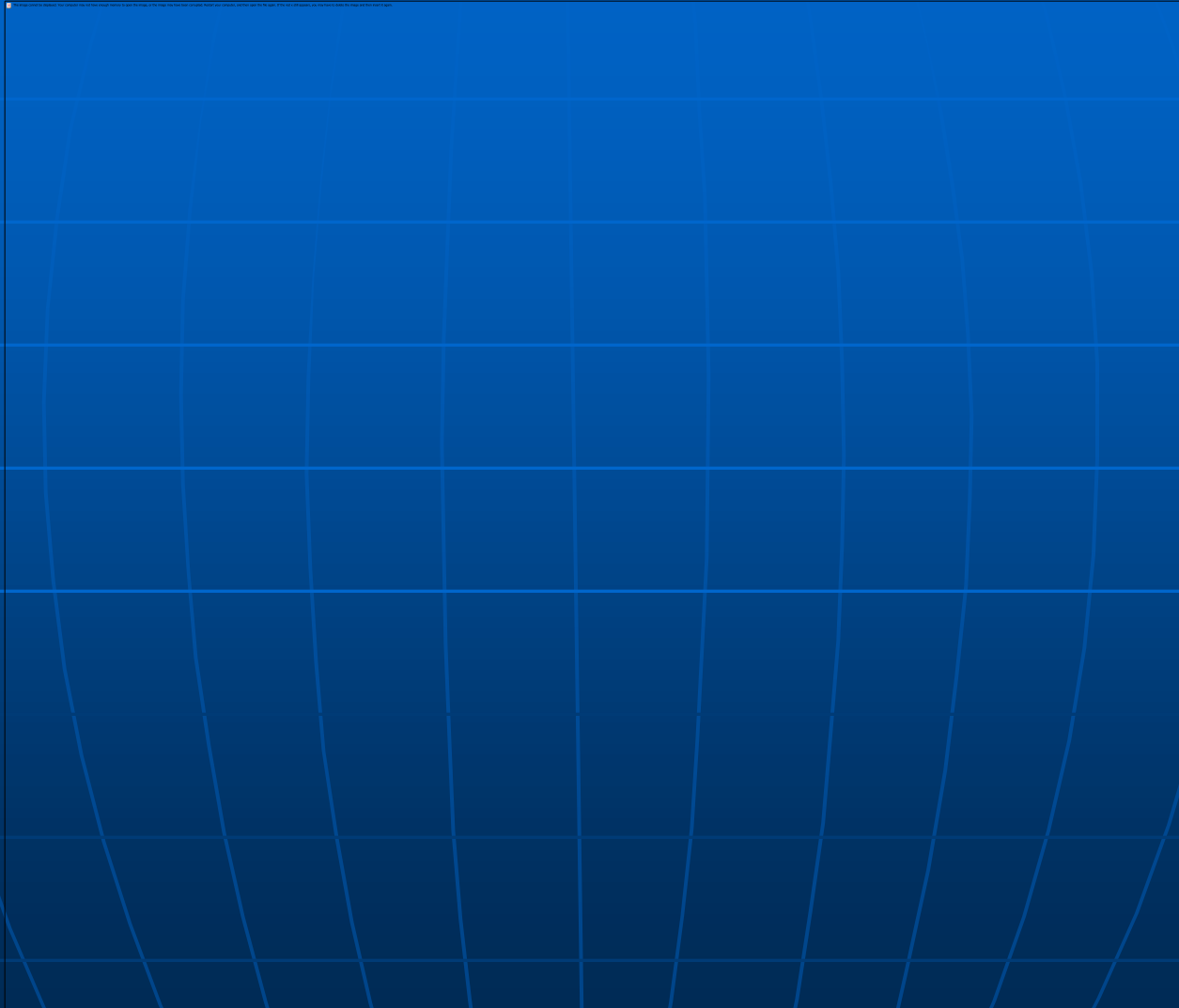
IDV Example: 3D Globe View of Sandy



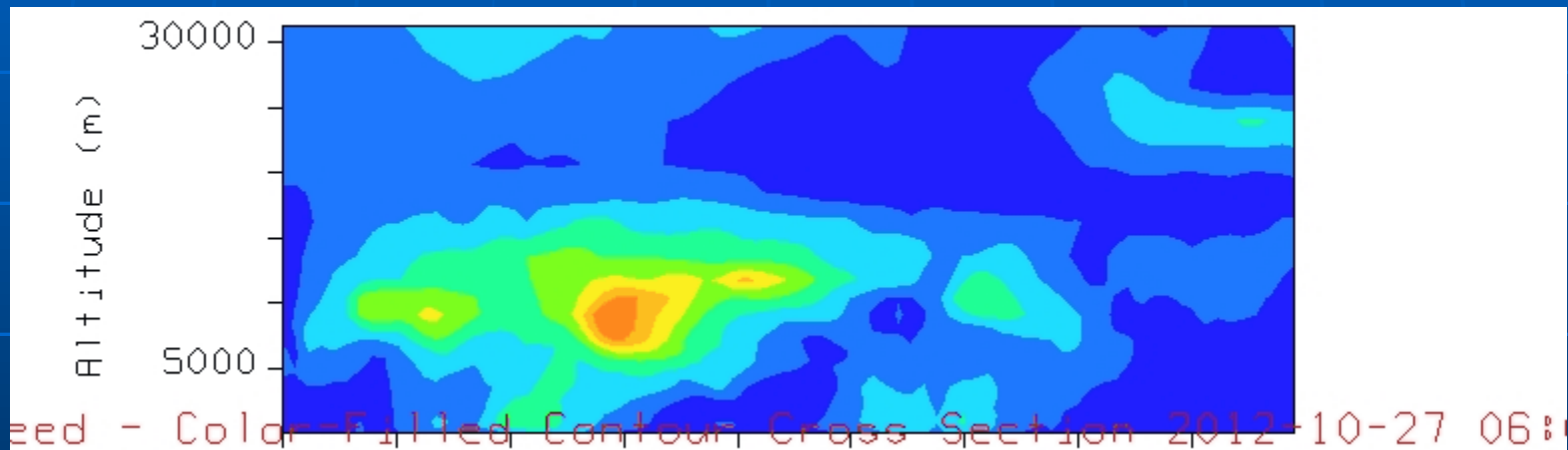
7_Band27_BRIT - Image Display 2012-10-21 18:41:00Z
10_Band4_BRIT - Image Display 2012-10-21 18:00:00Z
Blue Marble - Static - WMS Control



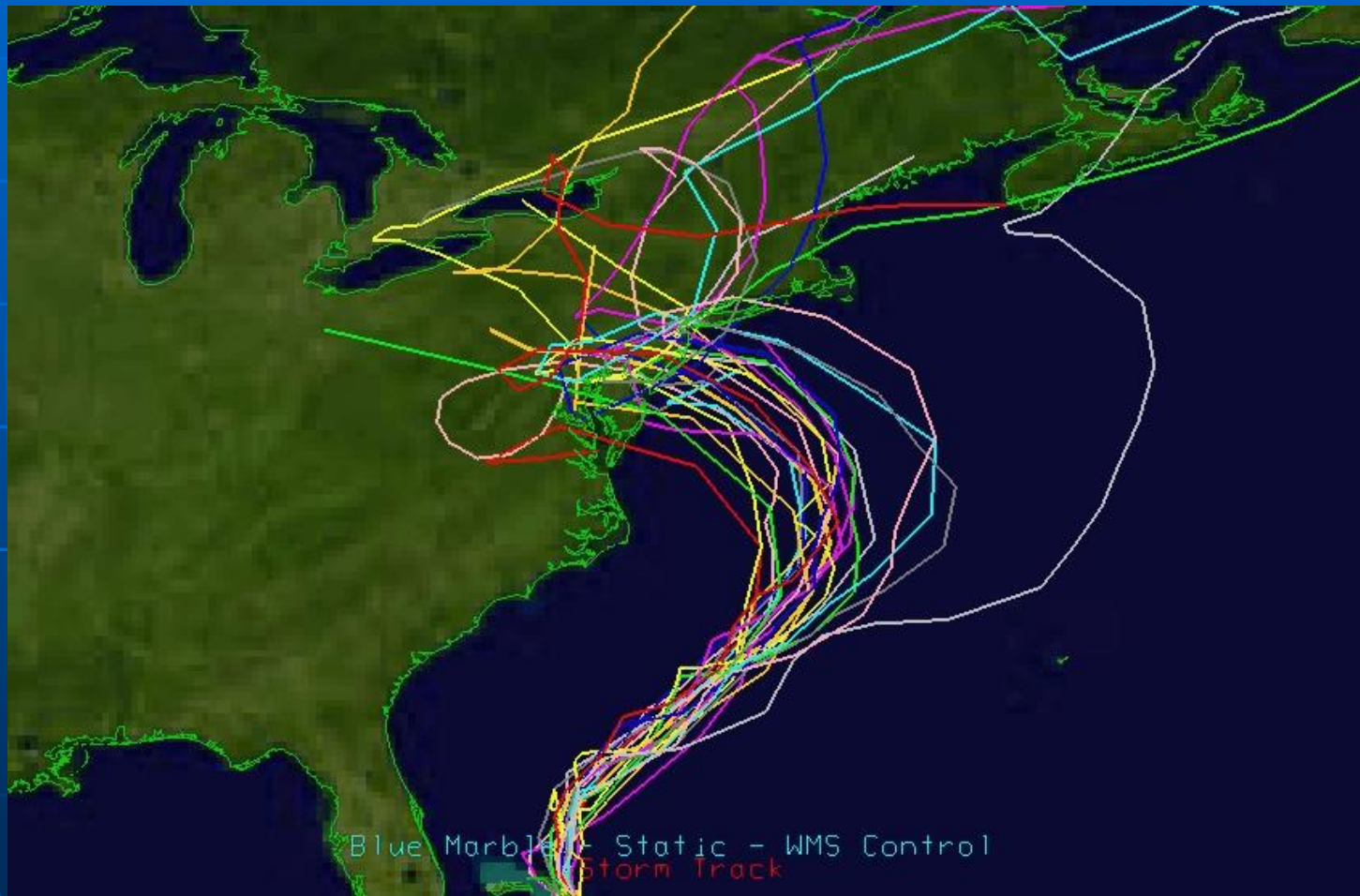
IDV Example: 3D Globe View of Sandy



IDV Example: Crosssection View of Sandy

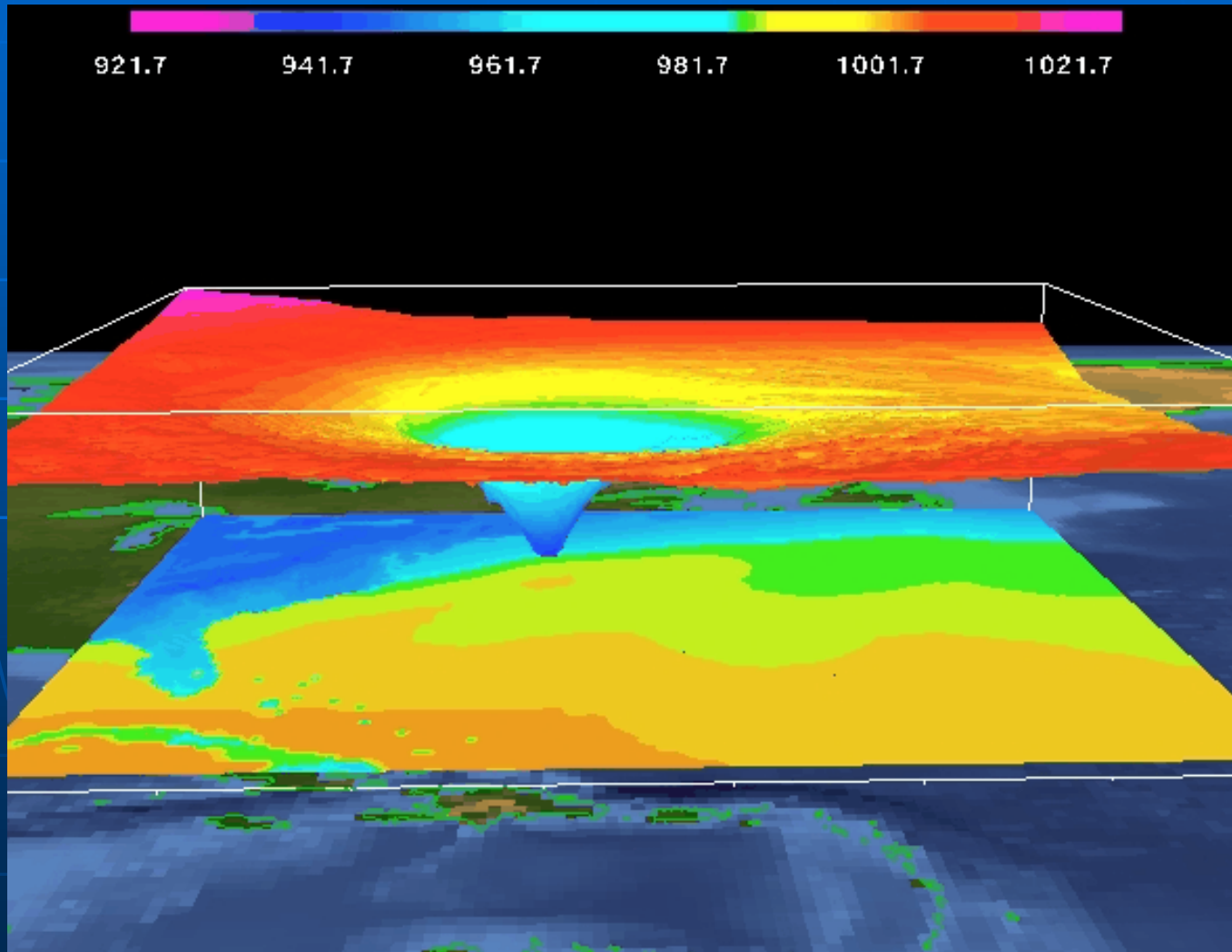


IDV Example: Sandy storm tracks

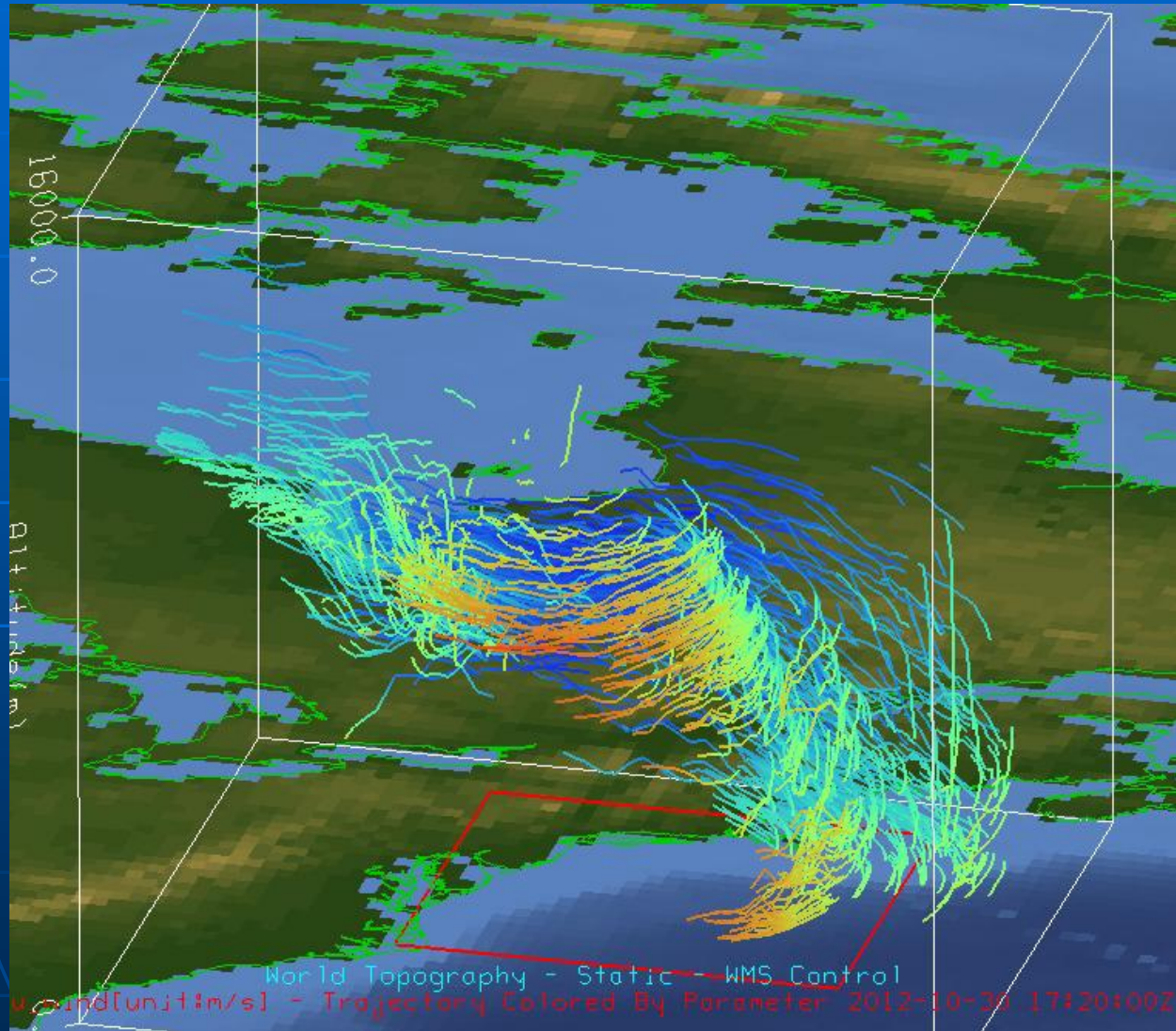


IDV Example: 3D Display

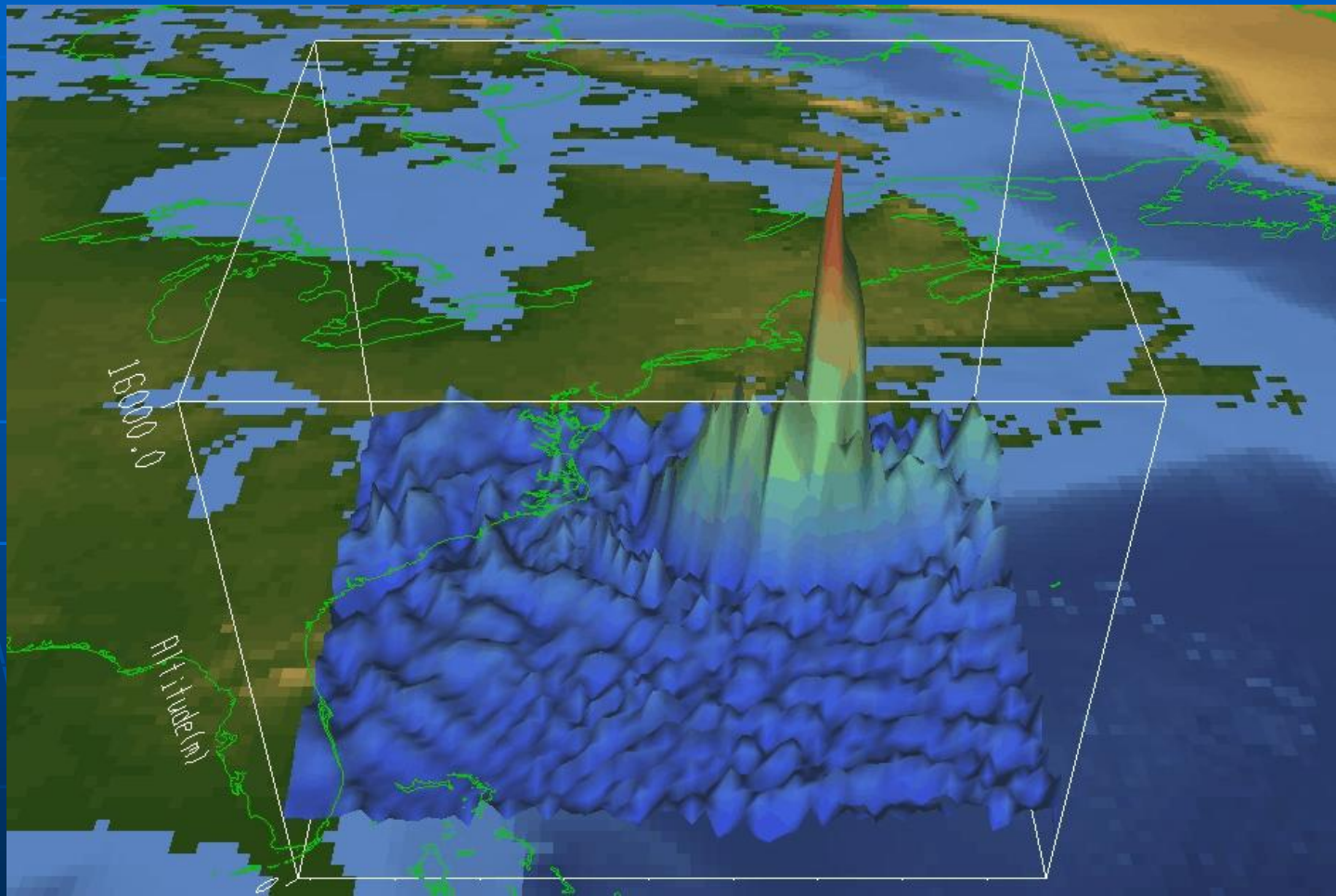
- 3D views of Sandy WRF output: PMSL and temperature



IDV Example: 3D Display

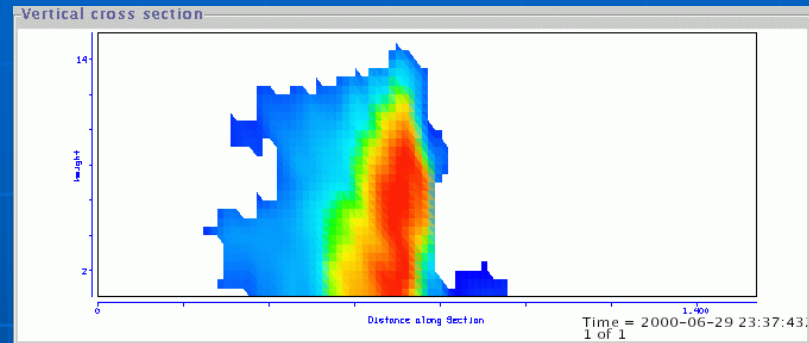


IDV Example: 3D Display

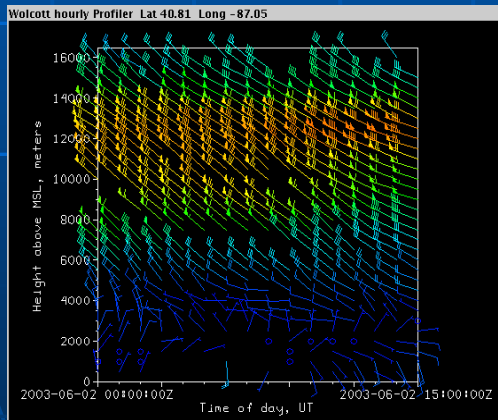


IDV Feature: Data Interaction

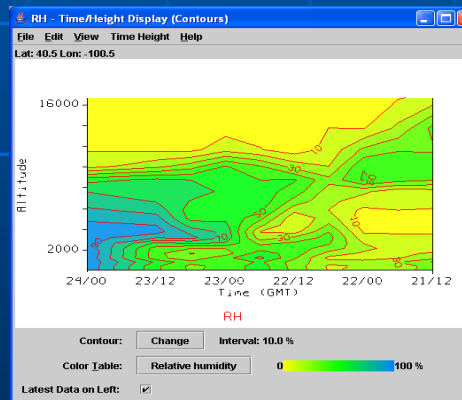
- Versatile data interaction
 - Probes to interrogate data – time series, vertical profiles, etc.



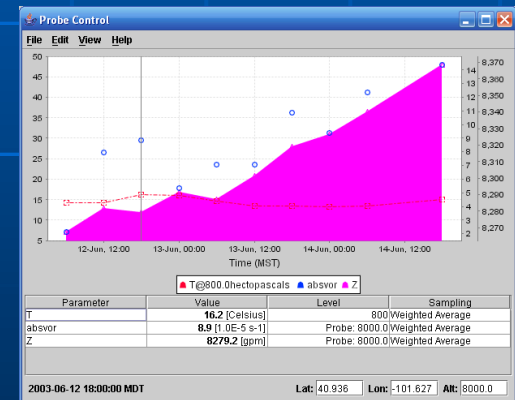
S-POL Radar Cross section



NOAA Profiler Network station (time height)



Time Height Cross section



Time Series Data Probe



IDV Feature: 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

The screenshot displays the IDV software interface. The 'Formula Editor' window shows the formula $(NIR-R)/(NIR+R)$ for the 'Normalized Difference Vegetation Index' (NDVI). The 'Jython Libraries' window shows a list of libraries including 'data/default.py', 'resources/default.py', and 'DefaultIdv/default.py'. A script window shows a Python function `def dBz2R(dBz):` that calculates rainfall rate from dBZ reflectivity. The script includes comments about the Marshall-Palmer constants and the resulting units in in/hr. The script code is as follows:

```
# function dBz2R to calculate rainfall rate from dBZ reflectivity
def dBz2R(dBz):
    # a Z to R relation, where a and b are
    # Marshall-Palmer constants. Results in in/hr.
    a = 200.
    b = 1.6
    c = 10.**(dBz/10.)
    d = c/a
    r = d**(1.0/b)
    r = 0.039*r
    return r
```

Below the script window, a globe icon labeled 'Unidata IDV' is shown. Two yellow folder icons are connected to the globe: one labeled 'IDV Scripting' with a double-headed arrow, and another labeled 'Images, Movies, KML/KMZ' with a single-headed arrow pointing from the globe to the folder.

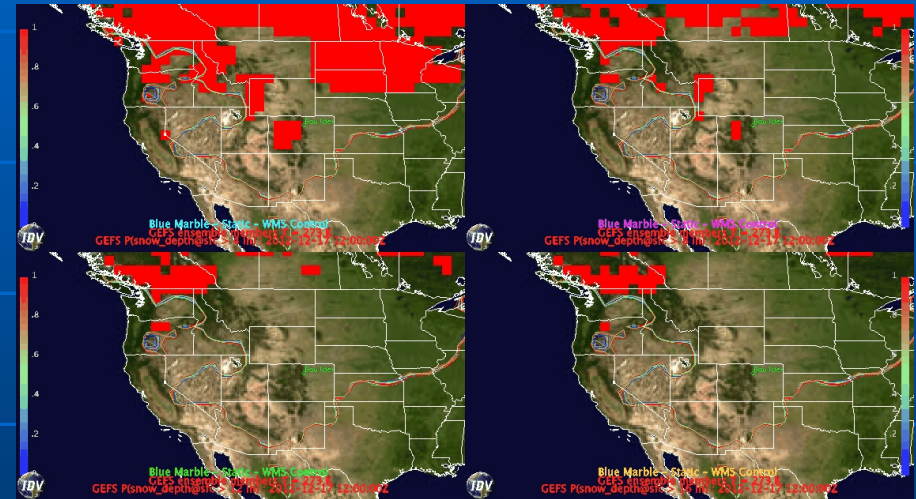
IDV: a collaborative visualization and analysis tool

- 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 Feature: Bundling

- State of the application (loaded data sources and data depictions) can be saved in XML “bundles”
- Bundles can be loaded at startup or imported on-the-fly
- Bundles can be distributed around the Internet (on web servers or e-mail attachments)



GFS ensemble 4 panels Bundle by Sean Arms

RAMADDA

- Content management system for geoscience data
 - Allows users to create, organize, and share content
- Web based API
- Tagging and Search
- Plugin facility provides easy way to add functionality
- Originally developed at Unidata, now an open-source project



IDV and RAMADDA

The screenshot displays the IDV software interface. At the top, there is a menu bar with 'File', 'Edit', 'Displays', 'Data', 'Tools', and 'Help'. Below the menu bar is a toolbar with various icons. The main interface is divided into several sections:

- Left Panel:** A tree view showing a hierarchy of categories: General (Files, URLs, Catalogs, Directory), Sat & Radar (Images, Radar), Observations (Point, RAOB, Profiler), and Fronts.
- Top Right:** A 'Catalogs' dropdown menu showing the URL 'http://www.unidata.ucar.edu/georesources/idvcatalog.xml' and a 'Select File...' button.
- Center:** A 'Data Source Type' dropdown menu set to 'I'm Feeling Lucky'. Below it is a tree view of the catalog structure:
 - Unidata's RAMADDA Server
 - Case Studies
 - Data
 - IDV Community Resources
 - Bundles
 - Bills IDV Bundles
 - Climate
 - Dave Dempsey's Bundles
 - Don's Bundles
 - 3D Atmospheric Rivers
 - SST Anomaly as Topography (with a thumbnail of Earth)
 - Boulder Weather with Time Matching (with a thumbnail of weather data)

- Bottom Right:** A checkbox labeled 'Show Thumbnail Images' which is checked.
- Bottom Center:** A blue text prompt: 'Please select a dataset from the catalog'. Below it is an 'Add Source' button and two circular icons.
- Bottom Left:** A status bar showing the time '06:54:03 GMT'.

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



What's Up Next for IDV?

- Performance: memory and CPU
- Support for "Big Data"
- Improving the GUI and making it more user friendly
- Integrate the new RAMADDA collection services into the choosers
- Server side functions development and thinner client design



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

