Unidata's Integrated Data Viewer (IDV)
A tool for Geoscience Research and Education

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Joint AAP/ICTP Workshop – July 27, 2011

Overview

- What is Unidata?
- What is the IDV?
- IDV Features
- Who uses the IDV?
  - Examples
- Future development

What is Unidata?

- The Unidata Program Center, part of the UCAR Community Programs, sponsored primarily by the U.S. National Science Foundation (NSF)
- A diverse, worldwide community of over 160 institutions
- Mission: *To provide data, tools, and community leadership for enhanced Earth-system education and research.*

Unidata Efforts

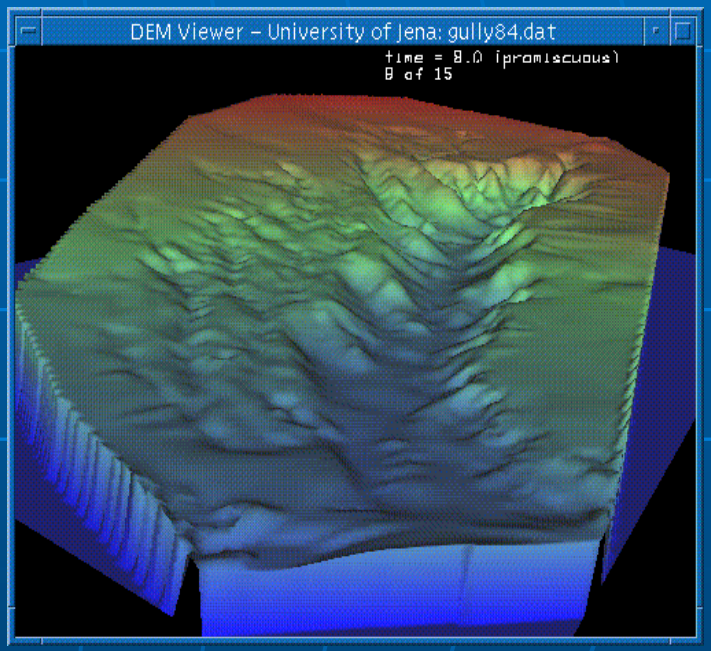
- Data access:
  - Local Data Manager (LDM)
  - Internet Data Distribution System (IDD)
  - Data Servers: ADDE, OPeNDAP, TDS, RAMADDA
- Data management: netCDF, Conventions, THREDDS, RAMADDA
- Visualization and analysis tools: IDV, GEMPAK, and McIDAS
- Technical support
- Build a community and advocate for it on data and related issues

What is the IDV?

- Visualization and analysis tool for geoscience data
- Freely available Java™ framework and application - multiplatform
- Integrated 2D/3D displays of a wide range of data
- Built on VisAD library

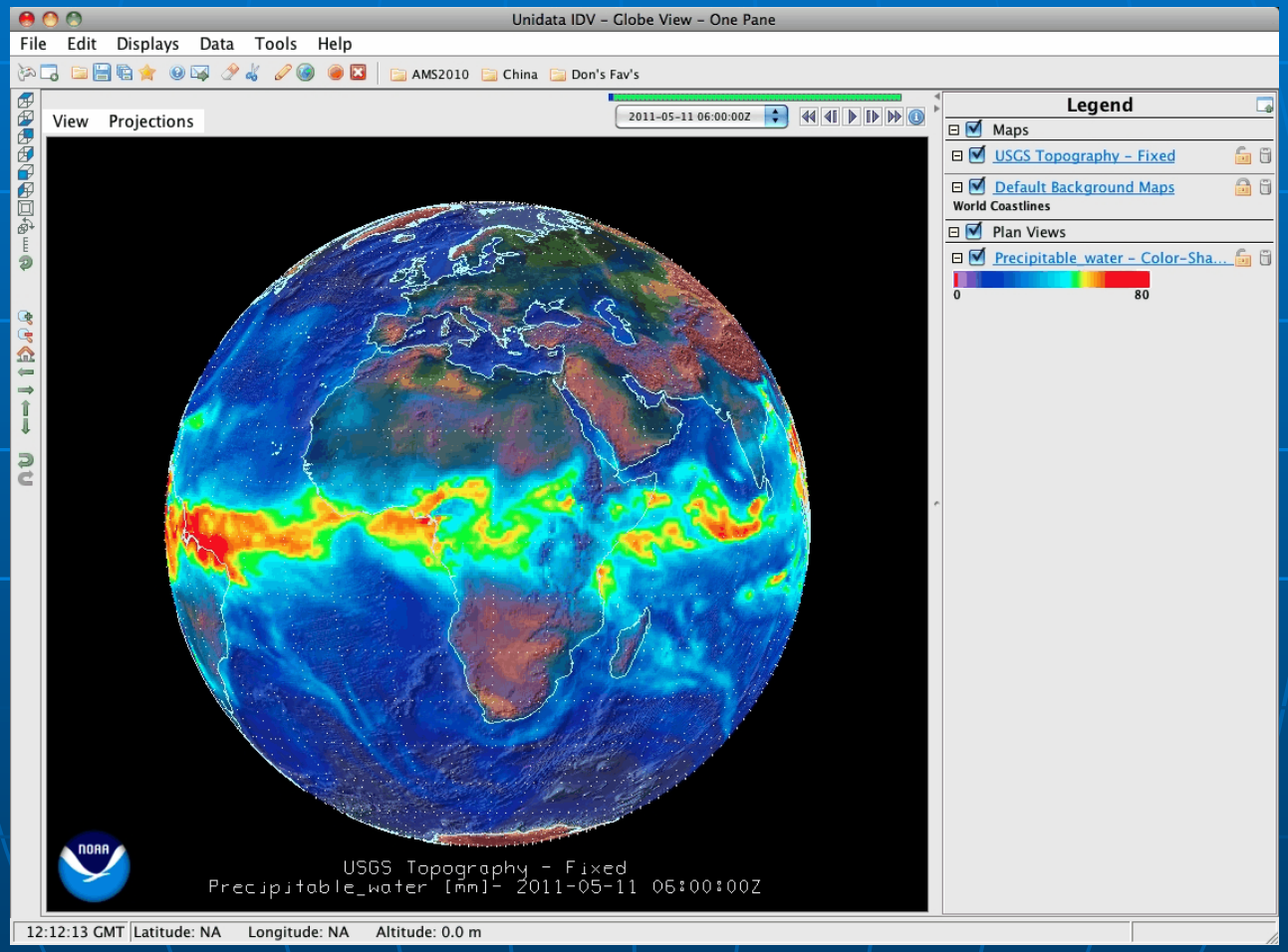
VisAD's Data Model

- Designed to support virtually any numerical data
- Metadata can be integrated into each data object
- Supports mathematical operations as well as evaluation and resampling of data
- Supports spatial and temporal co-location of data
- Supports data sharing among different users, different data sources and different scientific disciplines
- May be used independently of the VisAD display model



Gully erosion/deposition from VisAD-based DEMViewer

IDV Examples



Globe Display of GFS .5 Degree Precipitable Water

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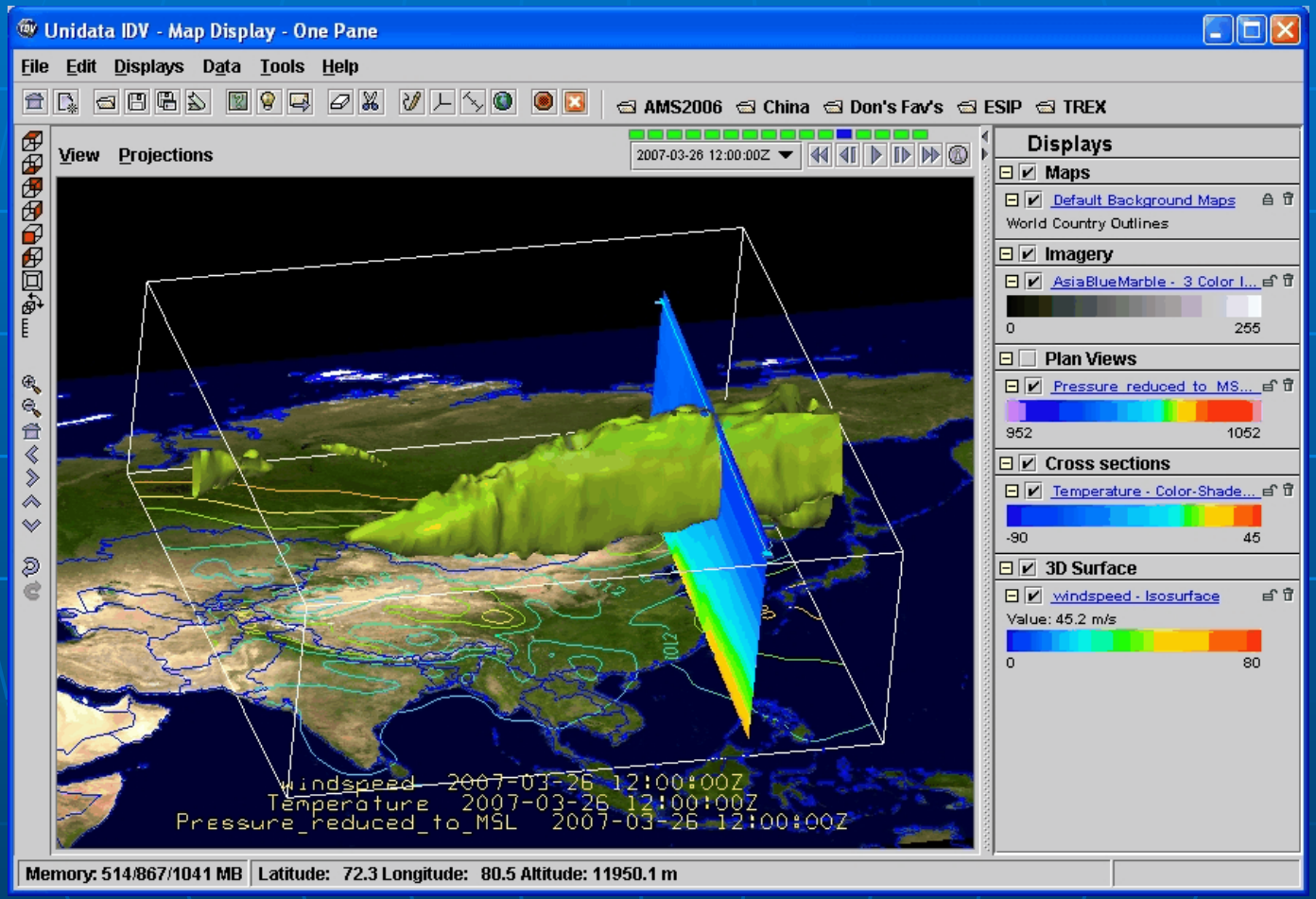
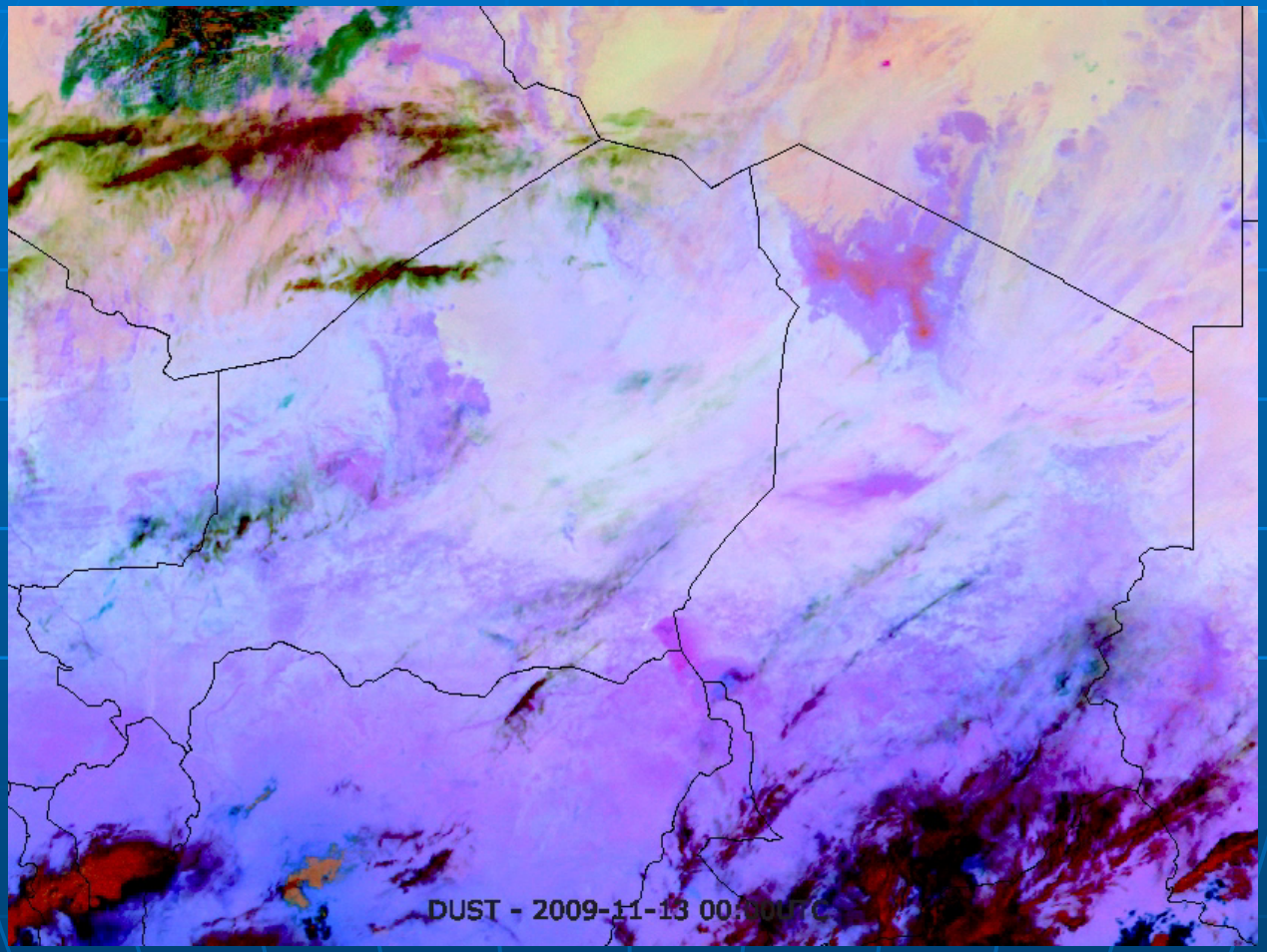
IDV Examples



GFS Windspeed Isosurface and Temperature Cross Section

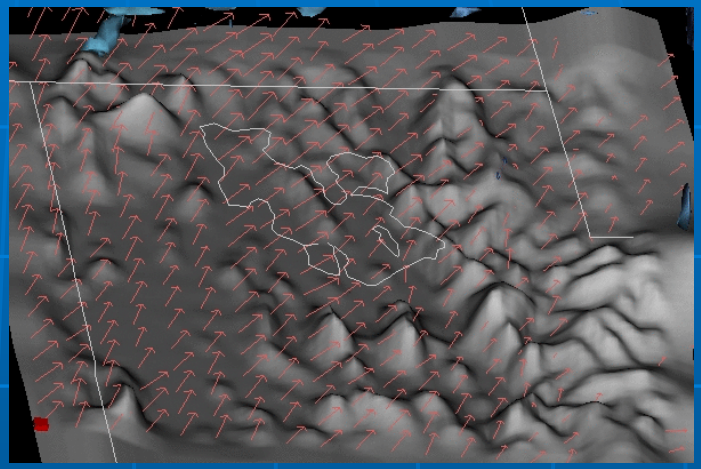
IDV Examples



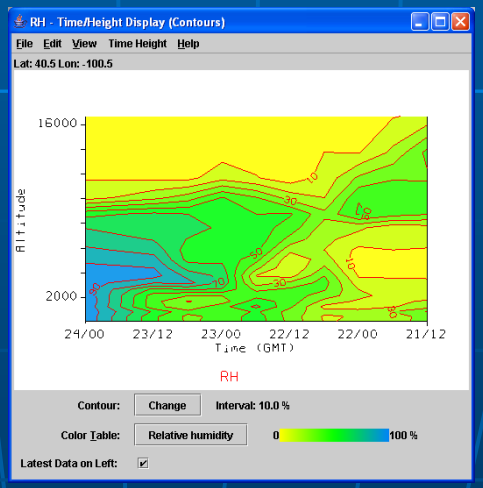
Meteosat satellite imagery of dust storm over Africa – November 2009 – Courtesy of Hans Peter Roesli - EUMETSAT

IDV Features

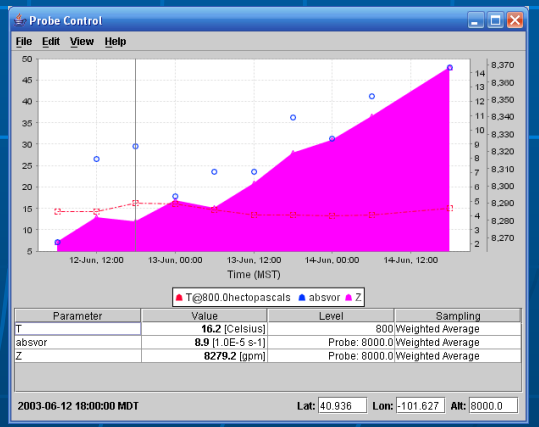
- Versatile data interaction
  - 3D views of 3D data
  - Probes to interrogate data – time series, vertical profiles, etc.



Model simulation of wind, isentropic potential vorticity and low level moisture flow over the Great Salt Lake basin



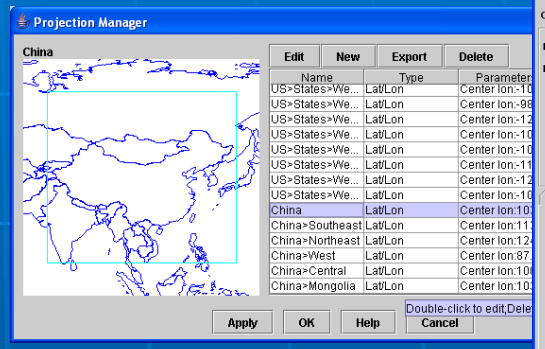
Time Height Cross section



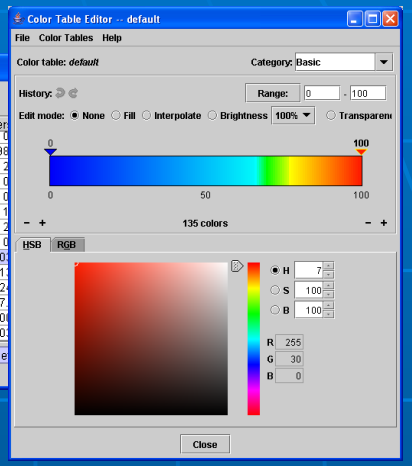
Time Series Data Probe

IDV Features

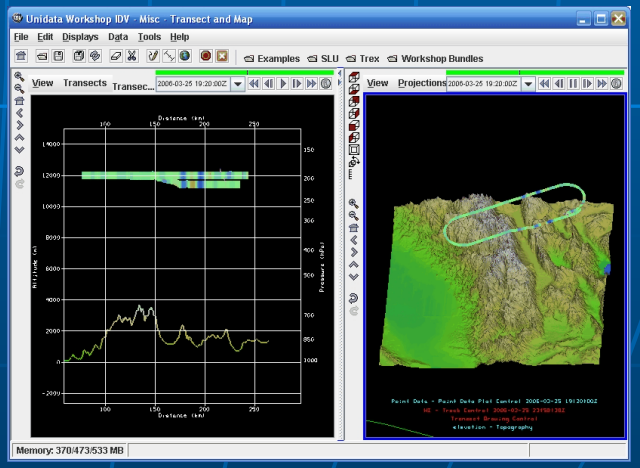
- Resource creation – Color tables, projections, station models
- Highly Configurable
  - Multiple UIs & displays – 3D Map, 2D Map, Globe, Transect
  - Plug-ins
    - New Features
    - Language Support



Projection Manager



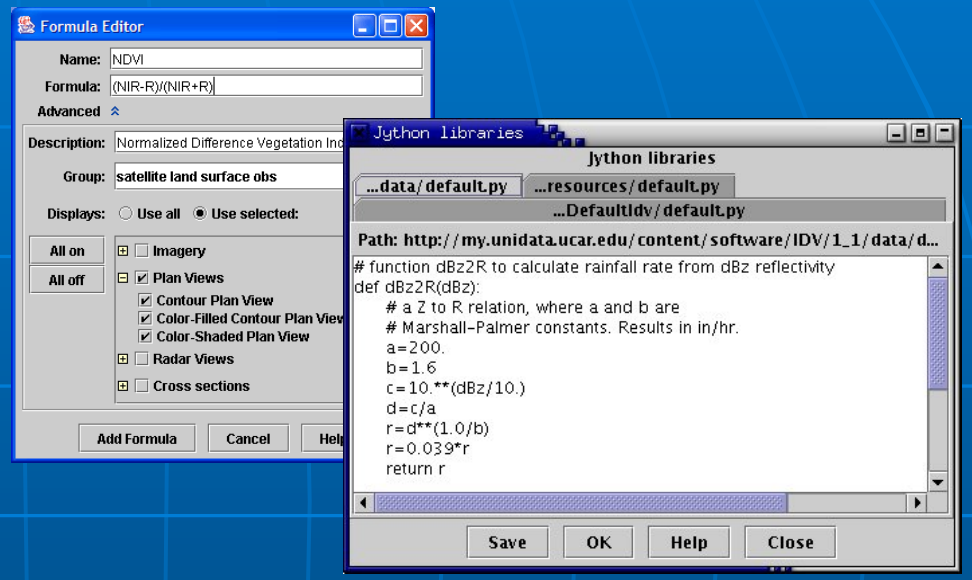
Color Table Editor

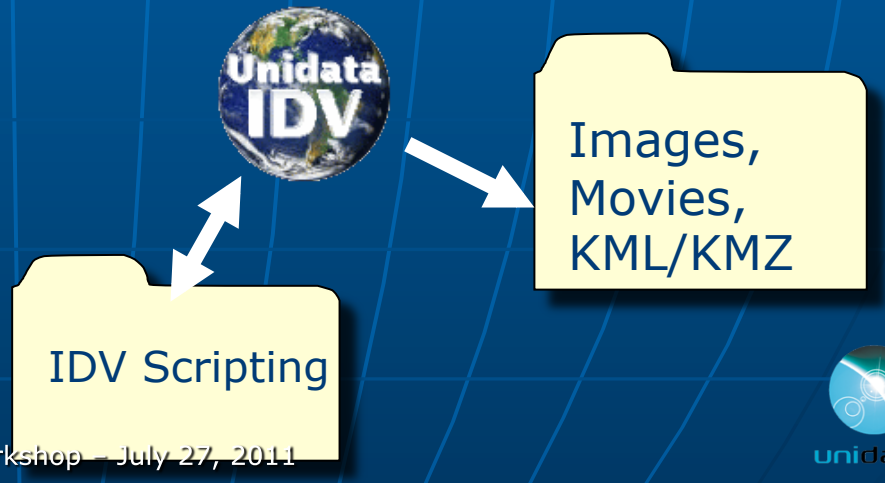


Transect Display and Map of Airplane Tracks

IDV Features

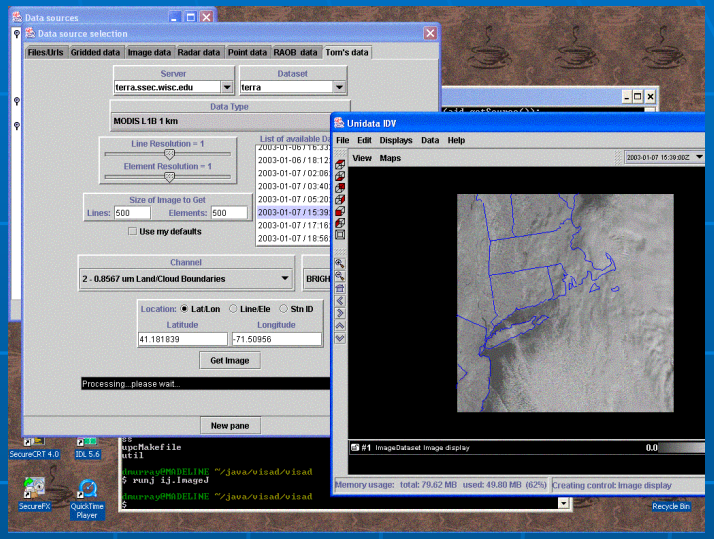
- Formulas and computation using Jython
- Interactive and script based generation of:
  - Images - JPEG, GIF, PNG, PDF, PS)
  - Movies - Quick Time, animated GIF
  - Google Earth KML/ KMZ

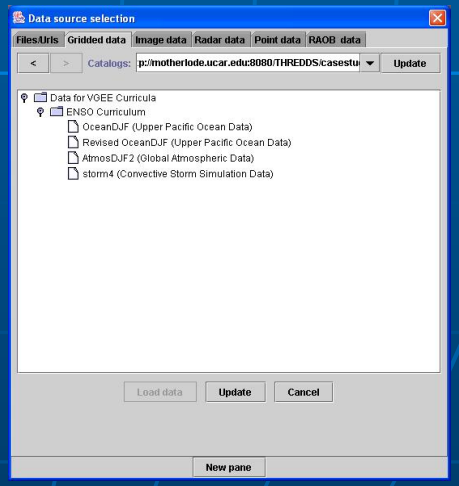




IDV Features

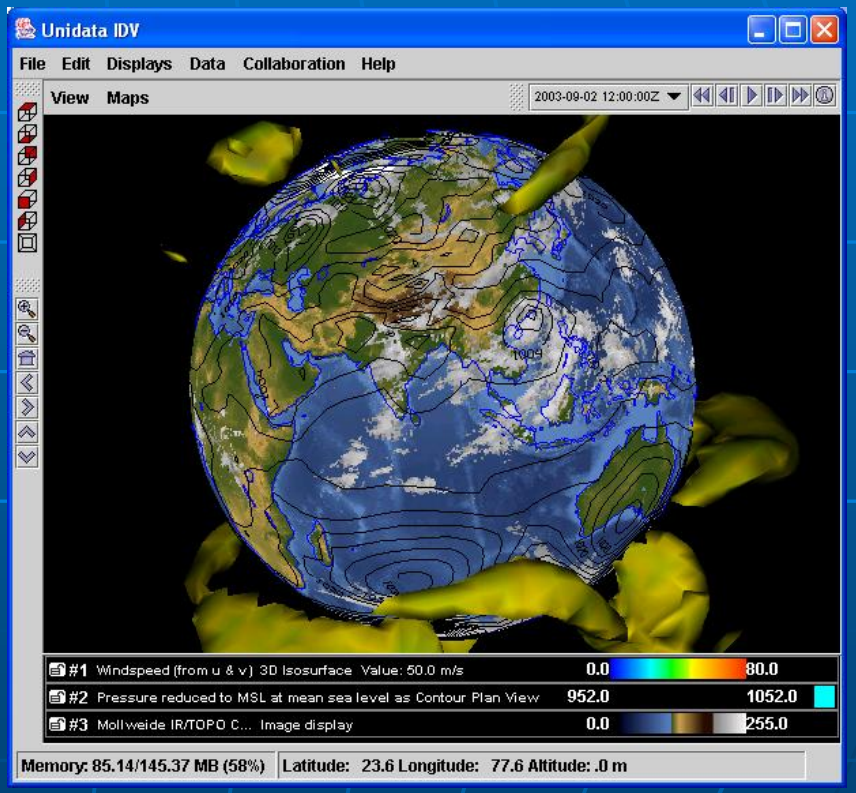
- Access data from OPeNDAP, ADDE or WMS servers, as well as local files, HTTP and FTP
- Allows subsetting of large datasets
- Can use THREDDS catalogs of data holdings for discovery and usage metadata





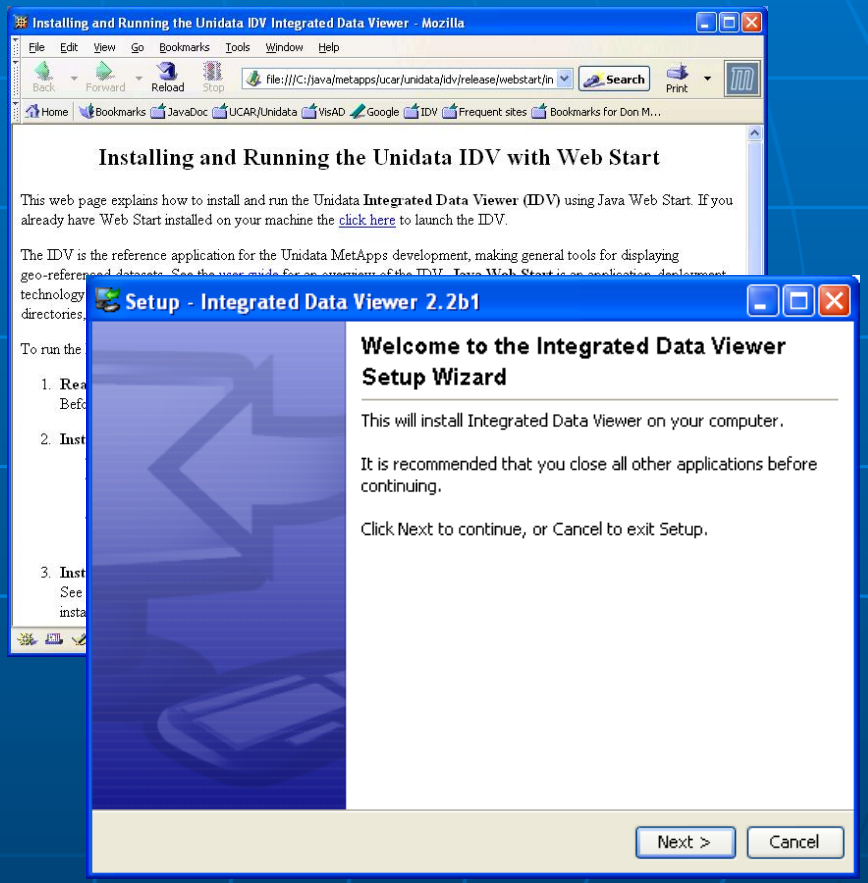
IDV Features

- State of the application can be saved in **bundles**
- Bundles can be loaded at startup or imported on-the-fly
- Displays can be annotated and saved in the bundle as explanations
- Bundles can be distributed around the Internet (e.g. on web servers)
- Data Bundles allow saving data in the bundle



Additional Features

- Easy to install
- Out of the box data access
- Comprehensive user support
  - Integrated documentation
  - Training workshops
  - support-idv@unidata.ucar.edu



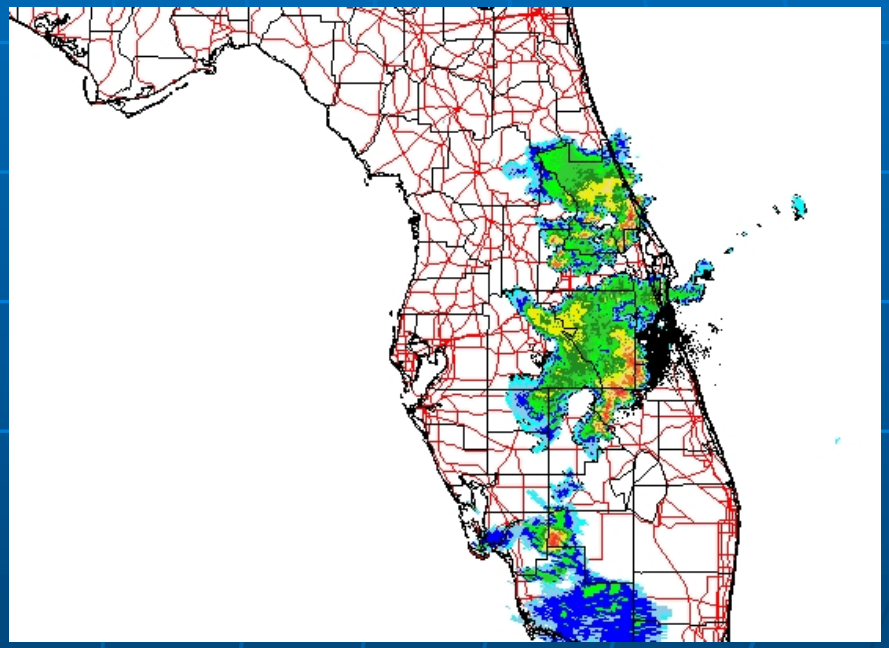
Supported Data Sources

- Gridded data – netCDF, GRIB, GrADS, GEMPAK, Vis5D
- Satellite imagery – McIDAS AREA, GINI
- Radar data - NEXRAD, CINRAD, DORADE
- Point observations
- Balloon soundings
- Aircraft track
- Fronts
- HTML
- GIS data - WMS, DEM, Shapefile
- Quick Time movies
- Web Cams

GIS Data Supported in the IDV

Shapefiles

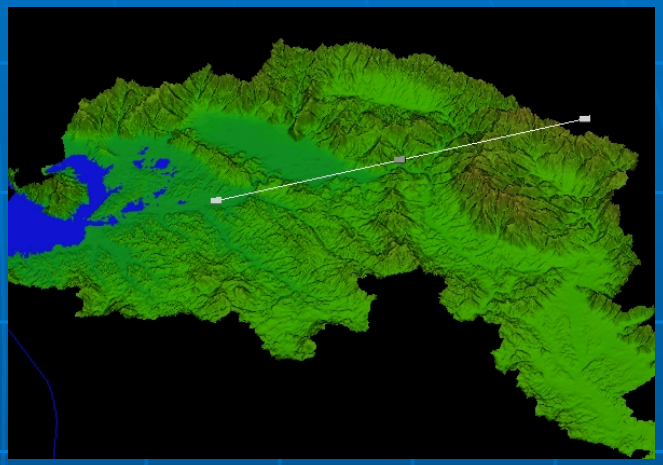
- Used for map files (i.e. geopolitical, social boundaries)
- IDV only plots polygons at present
- Work underway to support attribute data (e.g. place names)

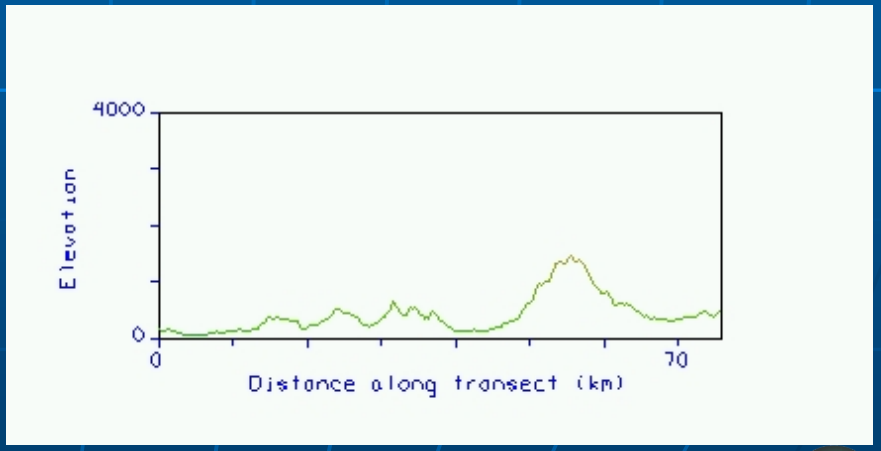


GIS Data Supported in the IDV

ArcInfo ASCIIGRID

- Digital Elevation Model (DEM) can be displayed as topography or data transects
- Gridded data (e.g. annual precipitation) can be compared with other non-ASCIIGRID data

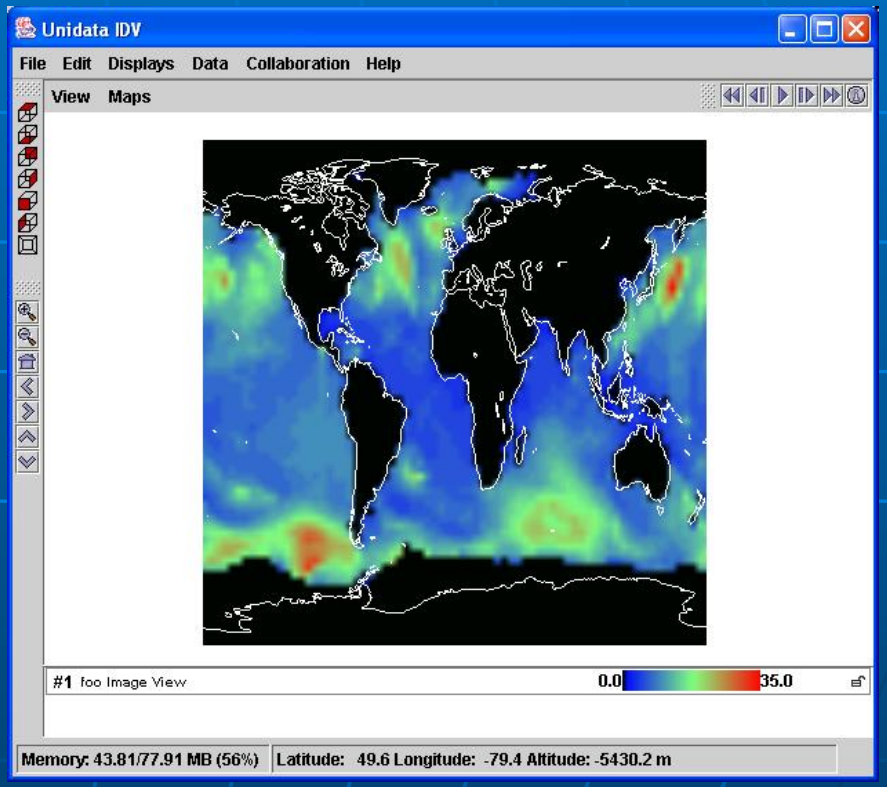




GIS Data Supported in the IDV

GeoTIFF

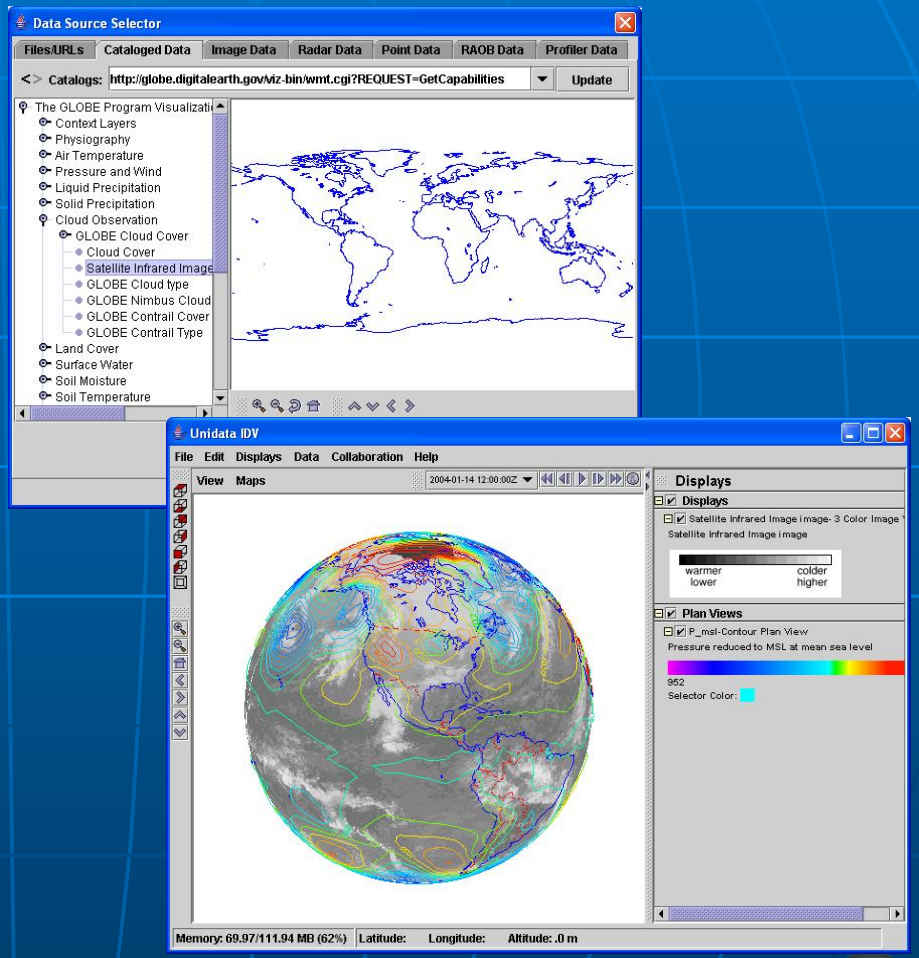
- The metadata tags in a GeoTIFF specify the geolocation parameters
- Useful for incorporating satellite and photographic imagery into complex displays of geoscience data.
- Only a couple of projections supported now, more being added.



GIS Data Supported in the IDV

Open Standards

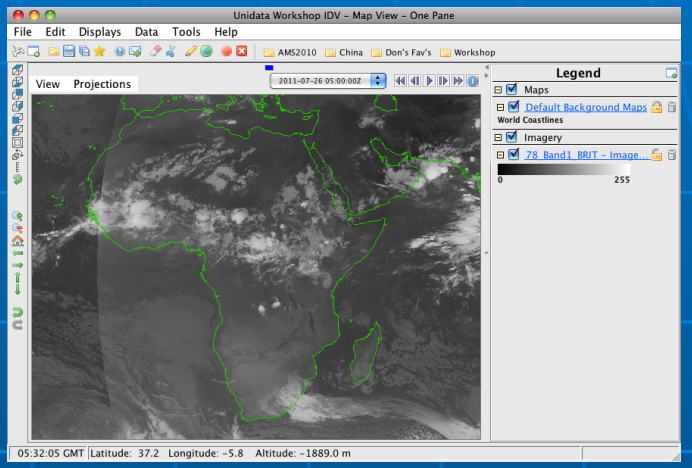
- OpenGIS standards
  - Web Map Server (WMS)
    - Processing on server
    - Produces GIF, IDV adds navigation info
  - Web Coverage Service (WCS)
    - Provides coverages
    - Prototyping with THREDDS project

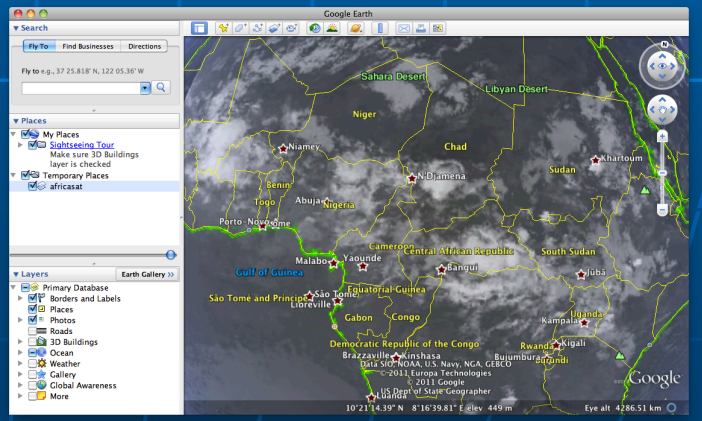


GIS Data Supported in the IDV

Google Earth (KML/KMZ)

- Export displays to KML/KMZ
  - Images need to be in rectilinear projection
- Import some KML features
  - Image overlays
  - Points



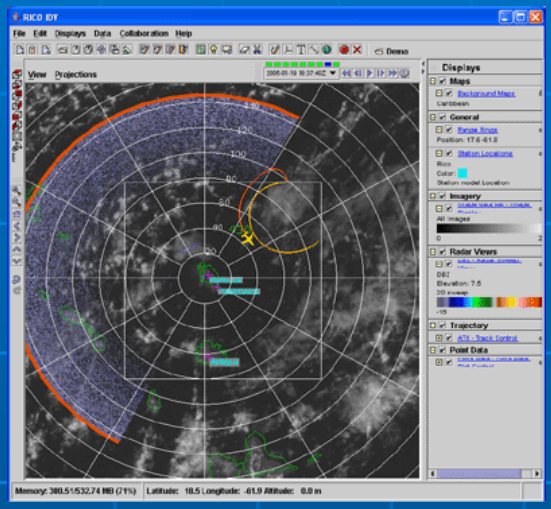


Who uses the IDV?

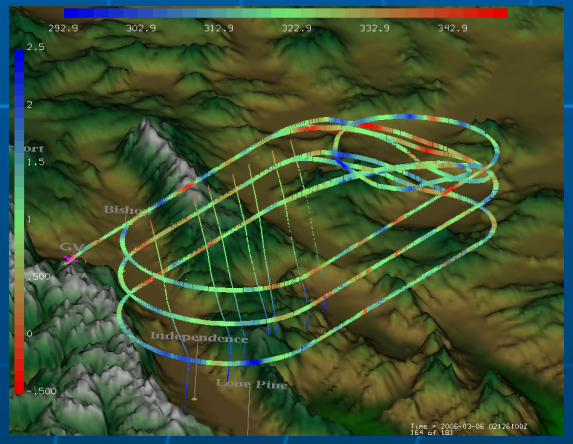
- Atmospheric science students and faculty at Unidata institutions
- Researchers
- Weather enthusiasts
- Oceanographers
- Geophysicists

User Examples: Field Projects

- Realtime aircraft tracks, radar, dropsondes, satellite and model data in operations center.
- Project specific customization
  - Specialized maps, locations, color tables
- Post project analysis:
  - Access data on remote storage or download and use locally
  - Share remote datasets and views through bundles



RICO: C130 track, SPOL radar and satellite

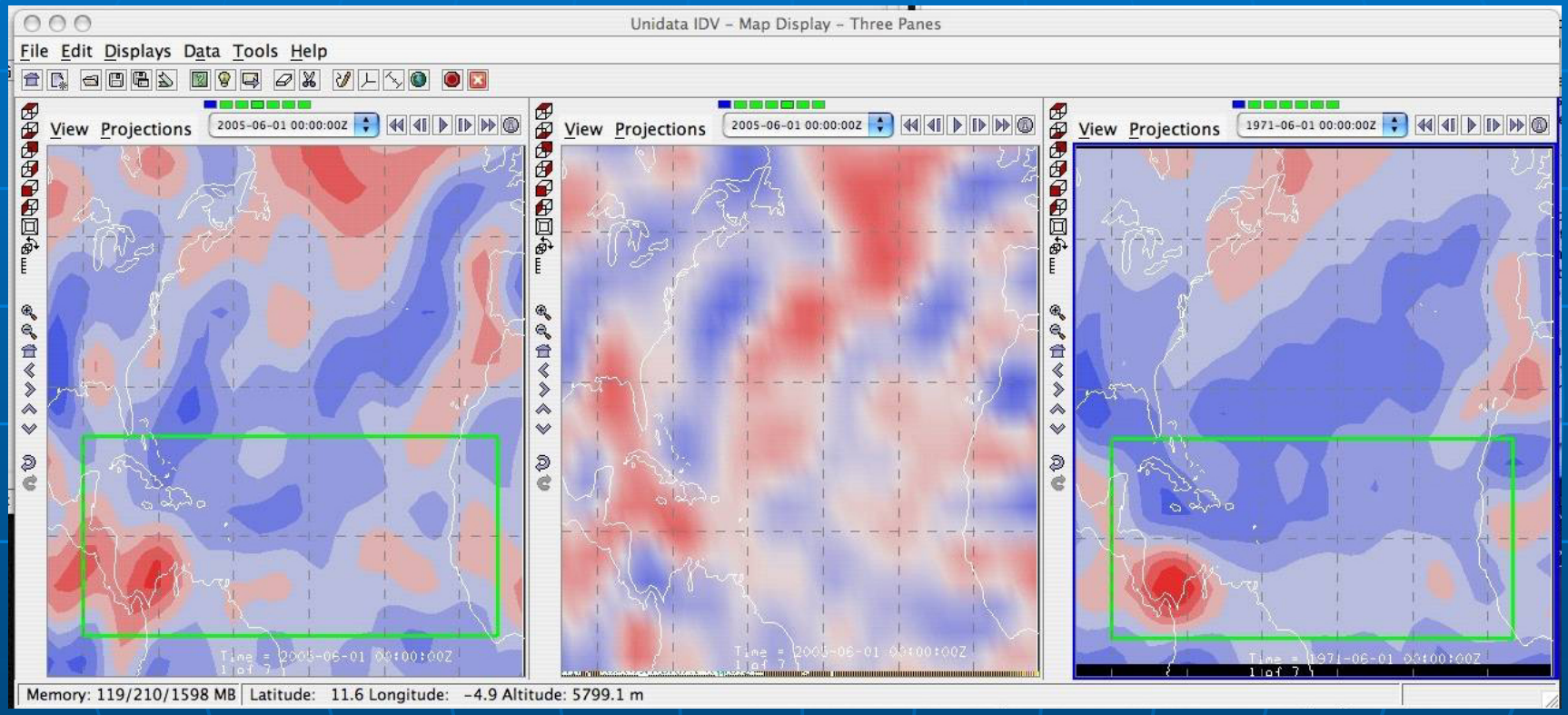


T-REX: G-V tracks and dropsondes

User Examples: Training Modules

- Project to develop IDV-based educational modules based on research topics.
- Modules:
  - What climatological factors were present in the 2005 Tropical Cyclone season to force the most active season on record?
  - Why was Hurricane Katrina so destructive?
  - How did Hurricane Wilma become the most intense hurricane in the Atlantic Basin?

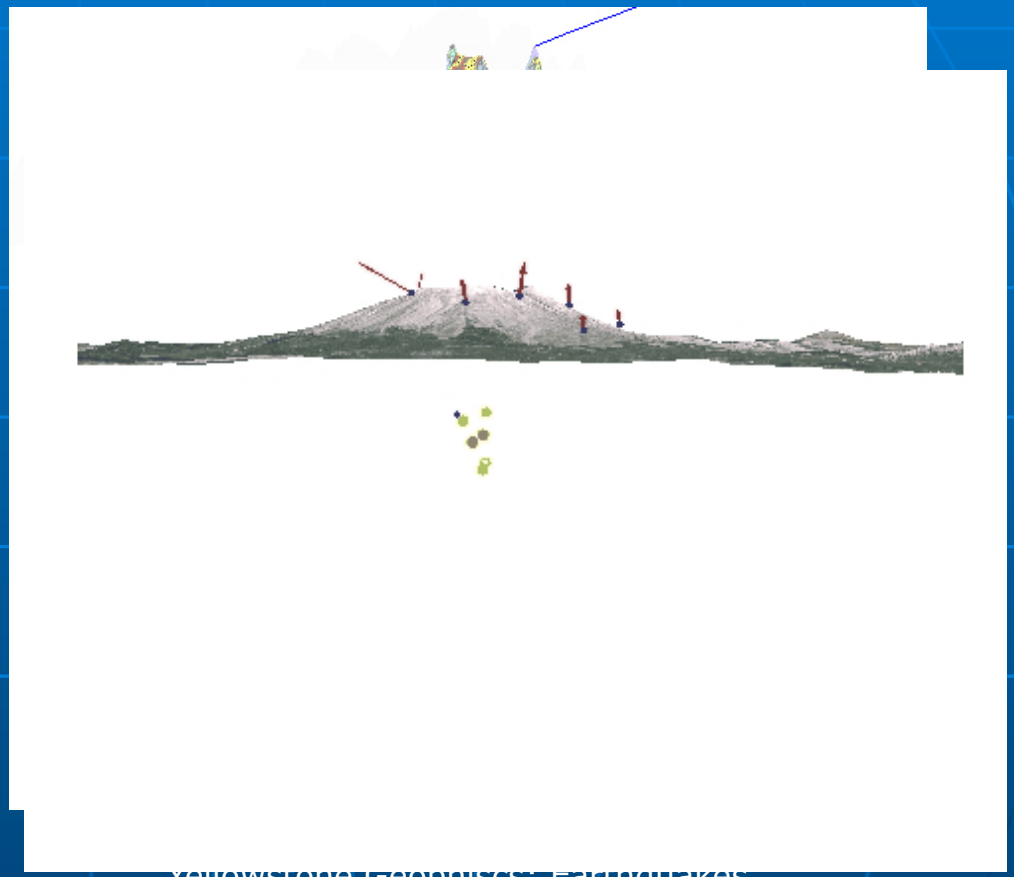
“IDV Perspective: Climatology of the 2005 Hurricane Season” presented at 2007 AMS Annual Meeting.



A comparison of Relative Vorticity in the Atlantic basin for the year 2005 (left panel) to climatology (1971-2001, and in right panel) and displays the difference of the two in the center panel.

User Examples: GEON-IDV

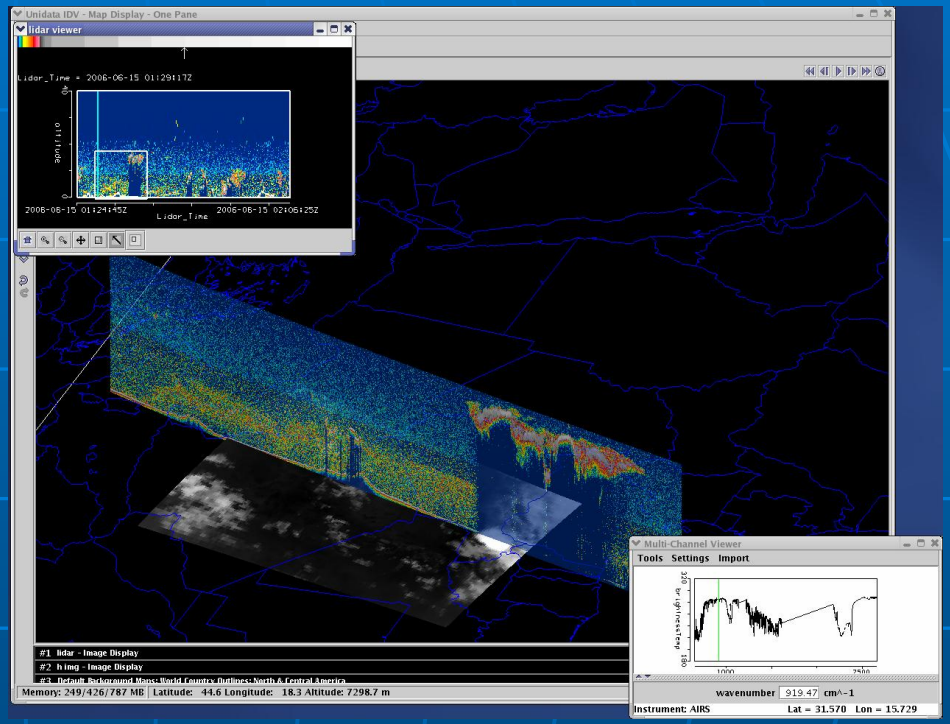
- GEON project is "Unidata for the solid earth sciences"
- The GEON-IDV is an extension of the Unidata IDV
  - Supports 2 and 3D displays of subsurface phenomena
  - Uses plug-in facility to customize the user interface and add features
  - Additional features include GPS velocity vectors, earthquake focal mechanisms, ray path traces.



Yellowstone Geophiscs: Earthquakes and tomography by Univ. Utah; Mt. St. Helens siesmic activity 2004 topography from USGS; geology map image provided by Robert L. Christiansentens (UNAVCO)

User Examples - McIDAS-V

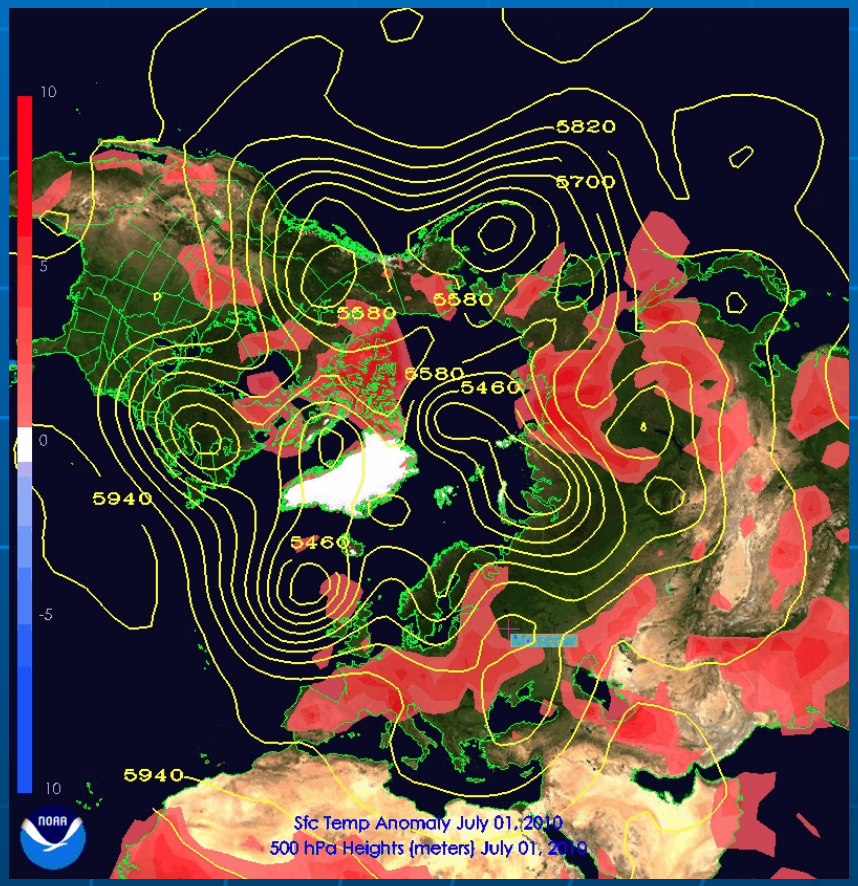
- Next generation of McIDAS is based on VisAD and IDV
- Provides visualization and analysis tools for multi-spectral and hyper-spectral data.
- HYDRA like capabilities (BAMS, Rink, et al, Feb 2007)



Hyperspectral slicing using AIRS, MODIS and Calypso data in McIDAS-V (courtesy Tom Rink, SSEC)

User Examples - CIRES/NOAA

- Used to create visualizations for climate attribution studies (e.g. 2010 Russian heat wave)
- Continual animations for Climate-Weather Lab
- Adding new features (Hovmöller plot, climate diagnostics)



Summary

- Unidata's IDV is a freely available, powerful analysis and visualization tool which can facilitate geoscientific research and education by:
  - Integrating diverse, distributed datasets
  - Allowing customized user experiences
  - Enabling collaborations
- Unidata would like to expand the use of the IDV worldwide
- Unidata is looking to work with other developers to enhance and expand the IDV capabilities

For more information

- IDV Homepage:
  - http://www.unidata.ucar.edu/software/idv
- VisAD
  - http://www.ssec.wisc.edu/~billh/visad.html
- McIDAS-V
  - http://www.ssec.wisc.edu/mcidas/software/v/