Using Unidata's Integrated Data Viewer (IDV) in Geoscience Research and Education

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Overview

- What is the IDV?
- Why use the IDV?
- Who uses the IDV?
  - Examples
- What's up next for the IDV?
- Where do I download the IDV?

What is the IDV?

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

IDV Examples
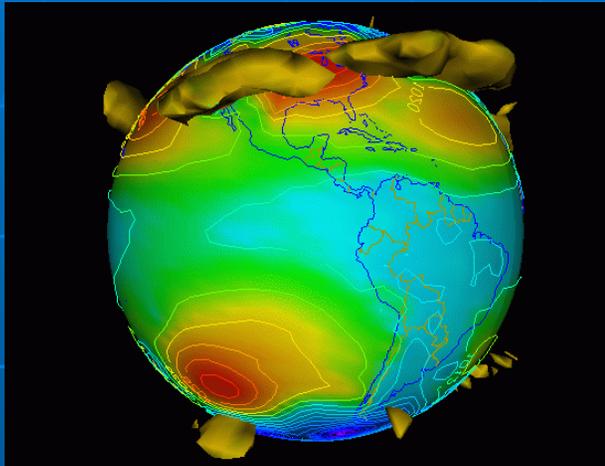
Sea-level Pressure and Upper-level Jet
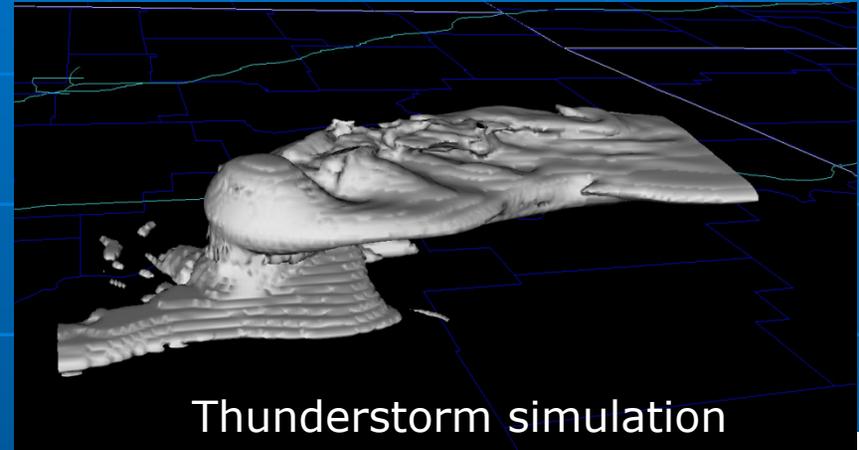
Thunderstorm simulation

Vertical cross section
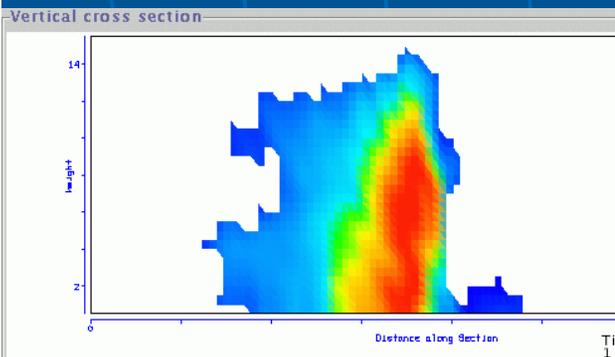
S-POL Radar Cross Section
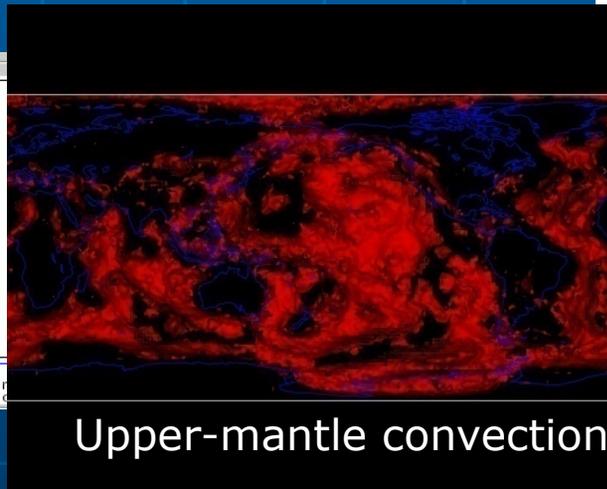
Upper-mantle convection
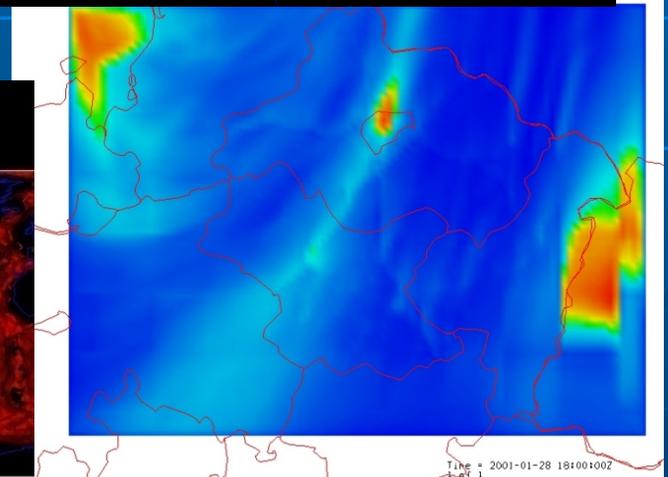
NO_2 concentration

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IDV
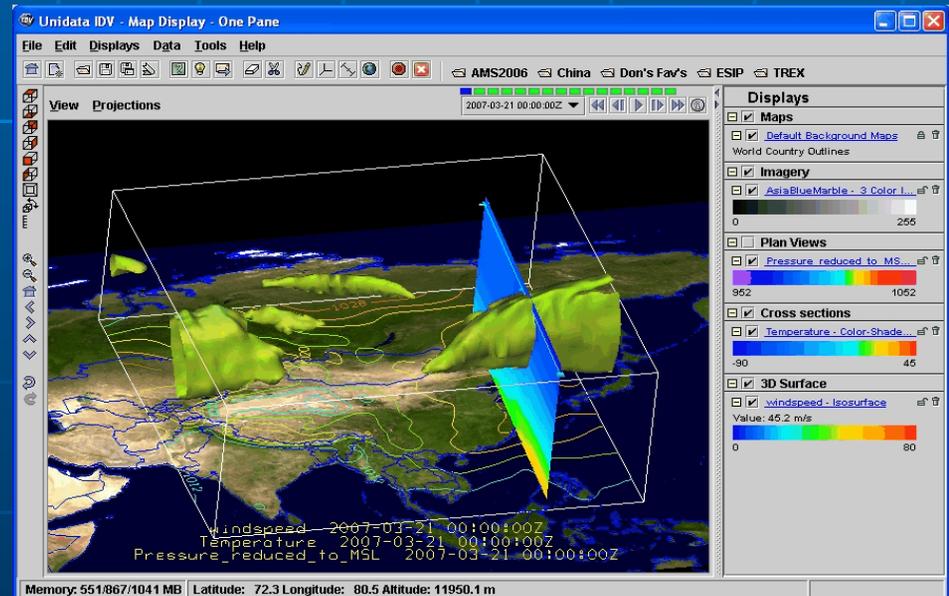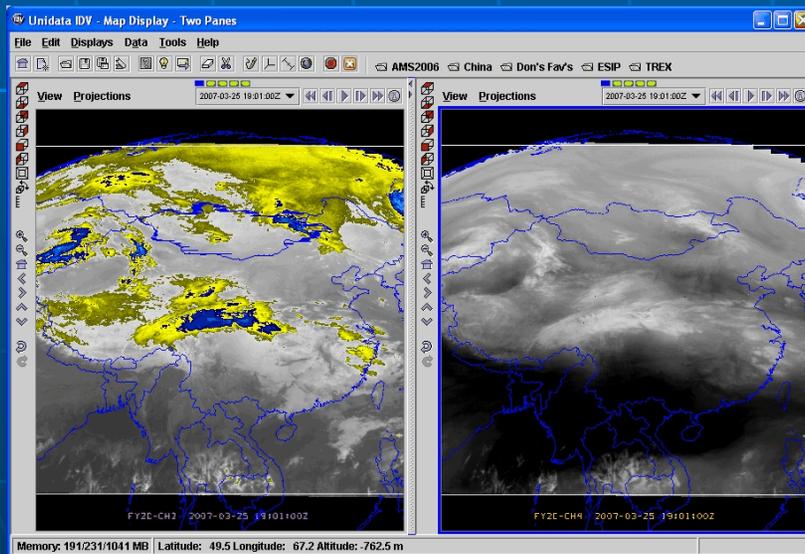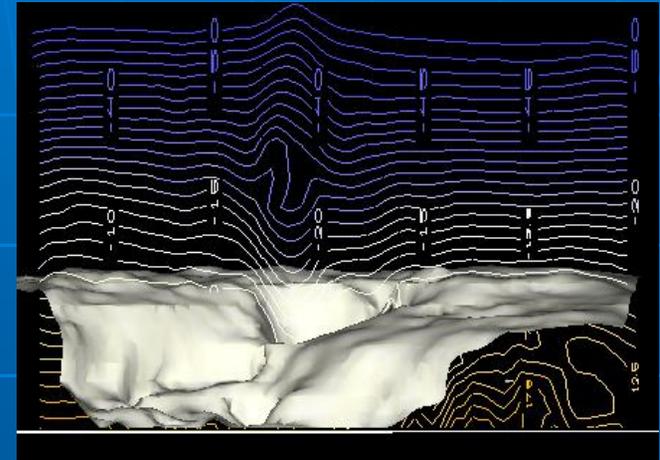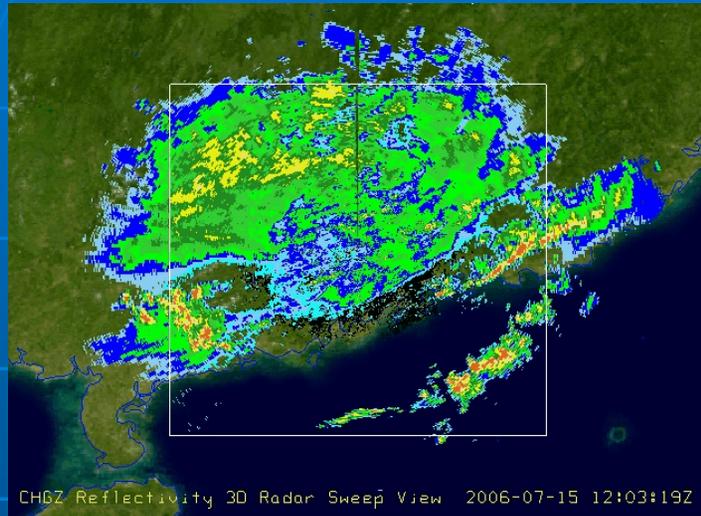
Examples

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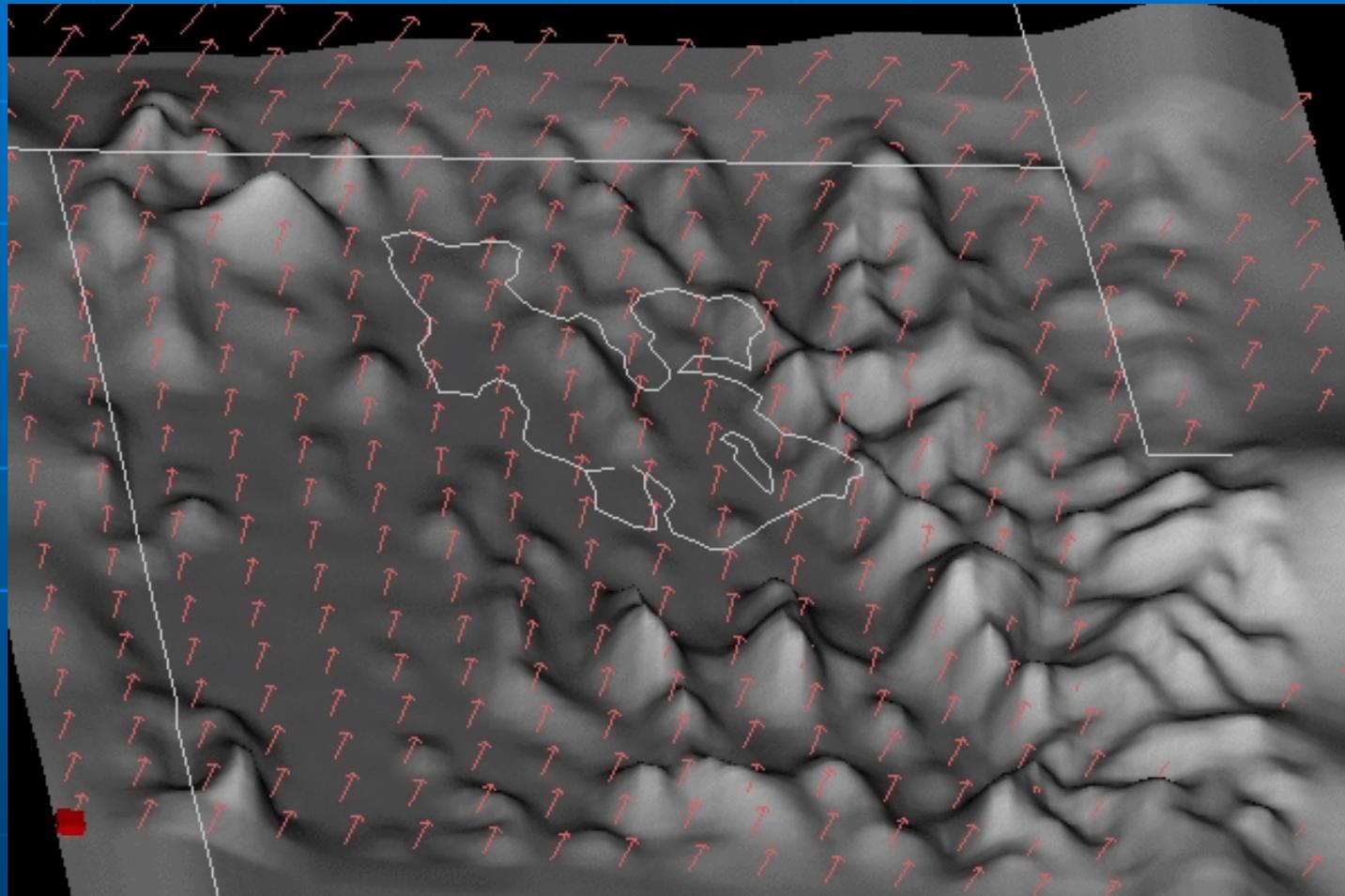
Model simulation of wind, isentropic potential vorticity and low level moisture flow over the Great Salt Lake basin

IDV Example

70_Band4_BRIT - Image Display 2006-07-22 21:00:00Z
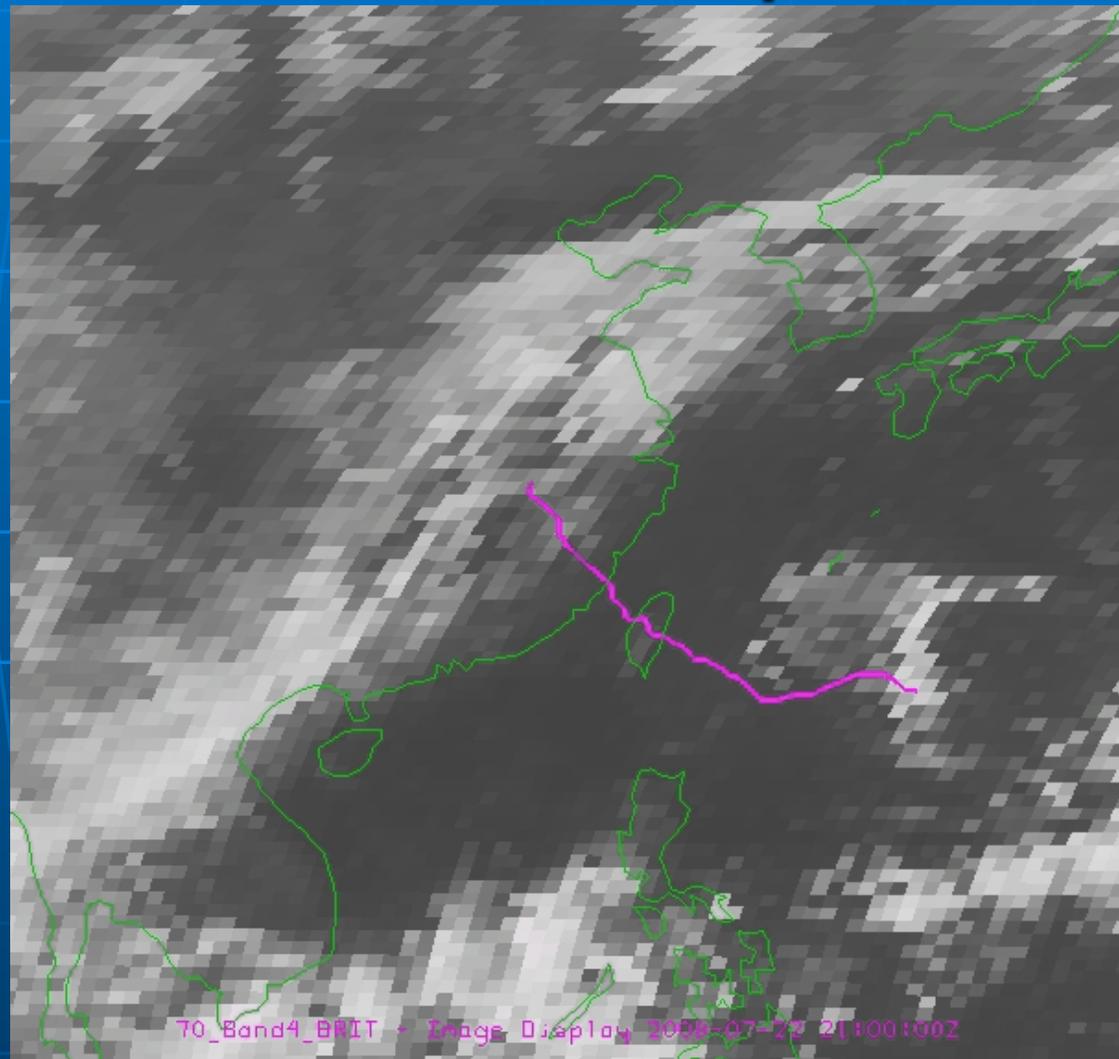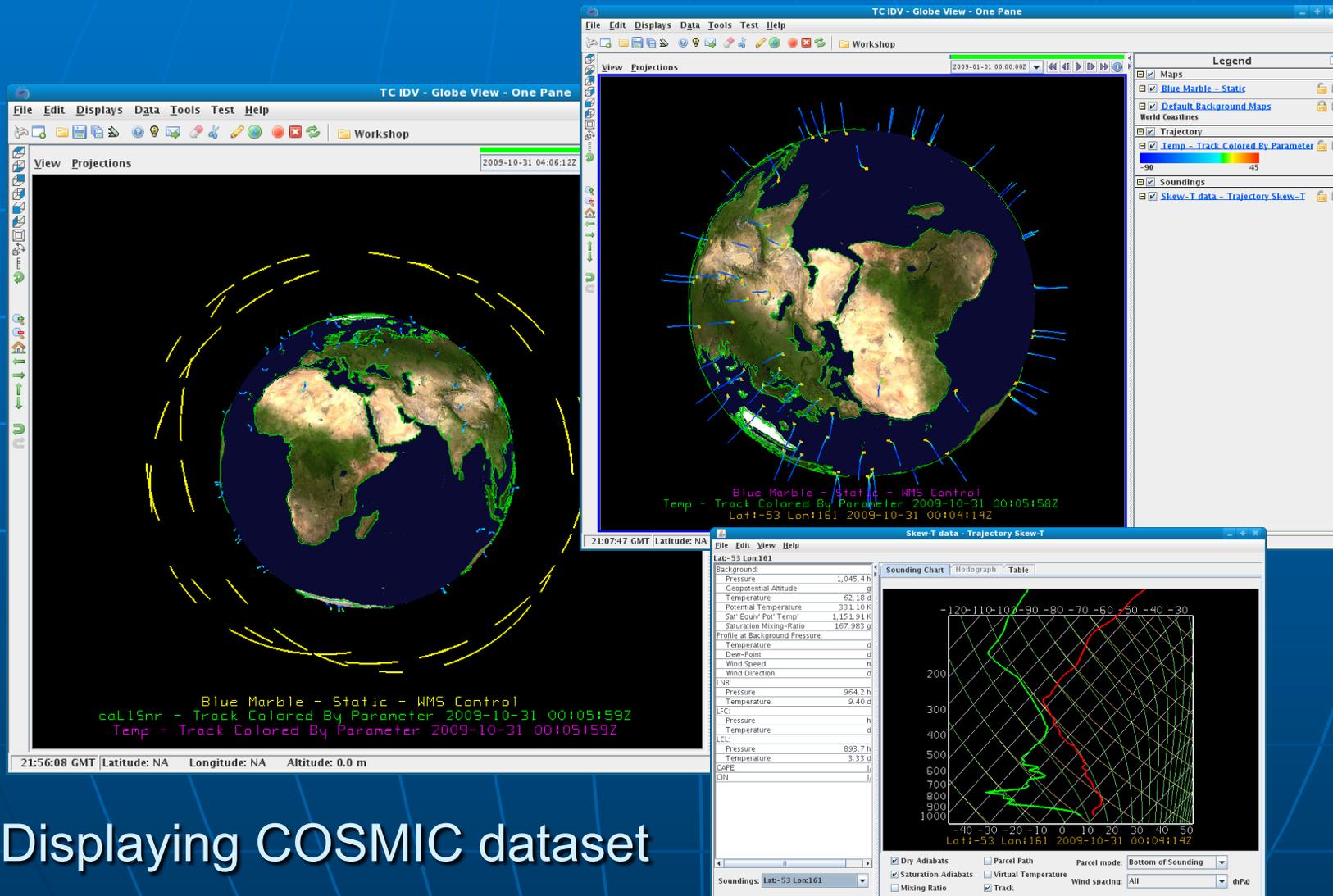
IDV Example

Displaying COSMIC dataset

IDV Example

Blue Marble - Static - WMS Control
collSnr - Track Colored By Parameter 2009-10-31 00:04:14Z
Temp - Track Colored By Parameter 2009-10-31 00:04:14Z
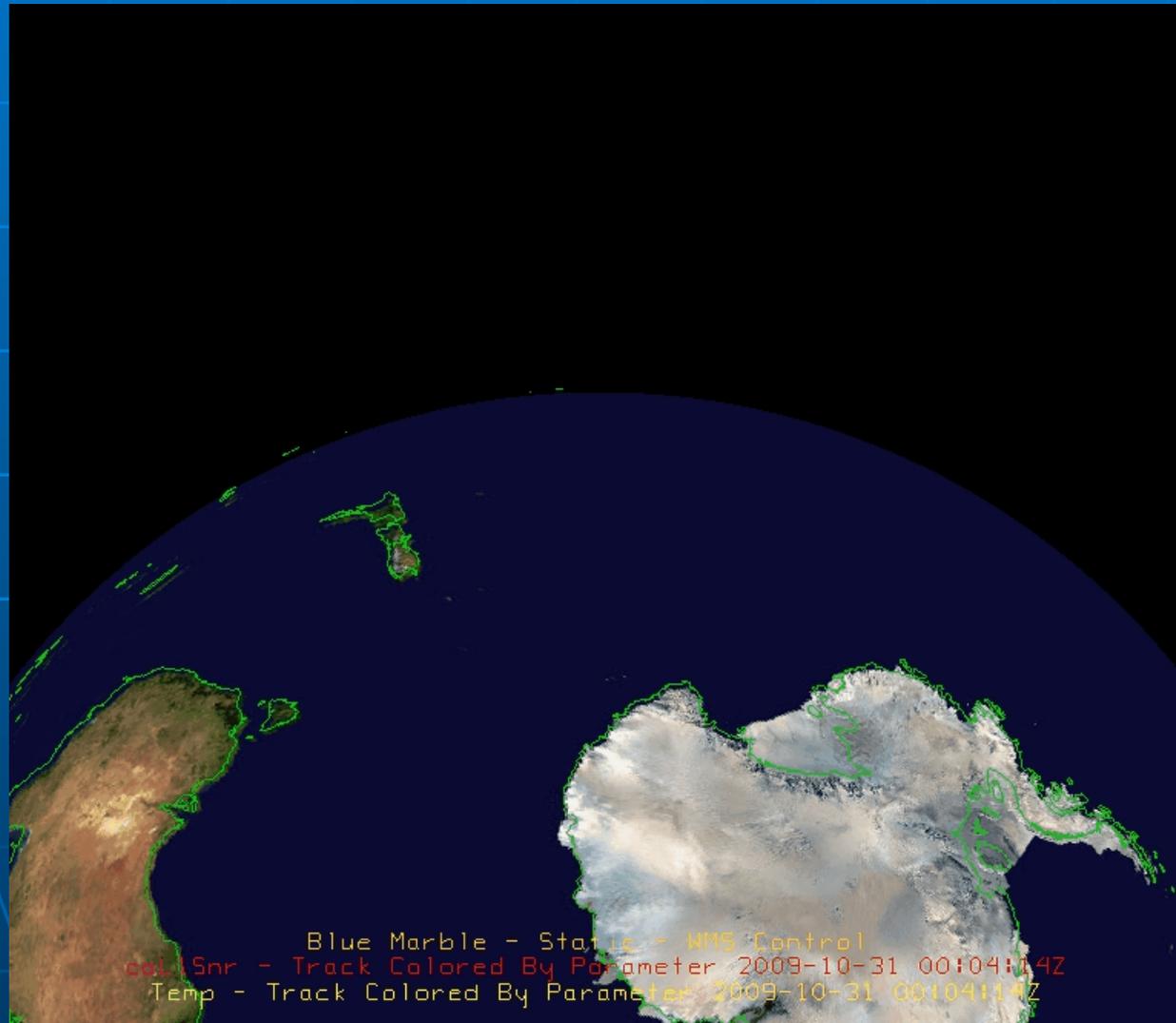
Unique IDV Features

- Interactive probes for dataset exploration
  - Parameter readouts
  - Vertical profiles
  - Time/Height displays
  - Lat/Lon/Alt position
- Movie capture and playback
- Incorporation of educational materials
- User defined formulas
- Extensible framework
- Extensive use of network resources
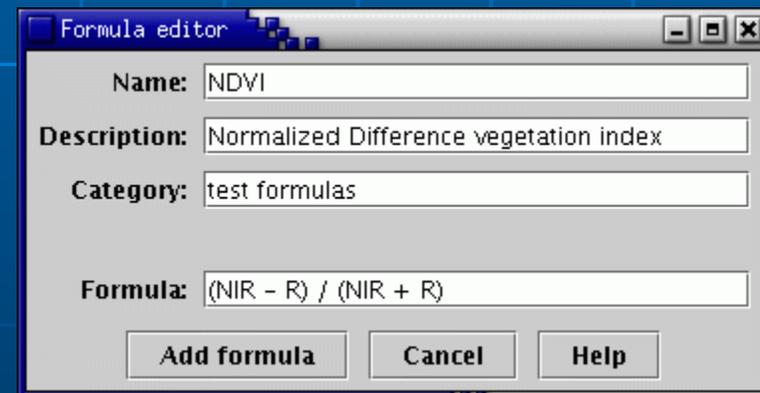
Web enabled features

- XML Configuration
- XML Persistence
- Integrated HTML Viewer
- Use of Java Web Start
- Real-time collaboration
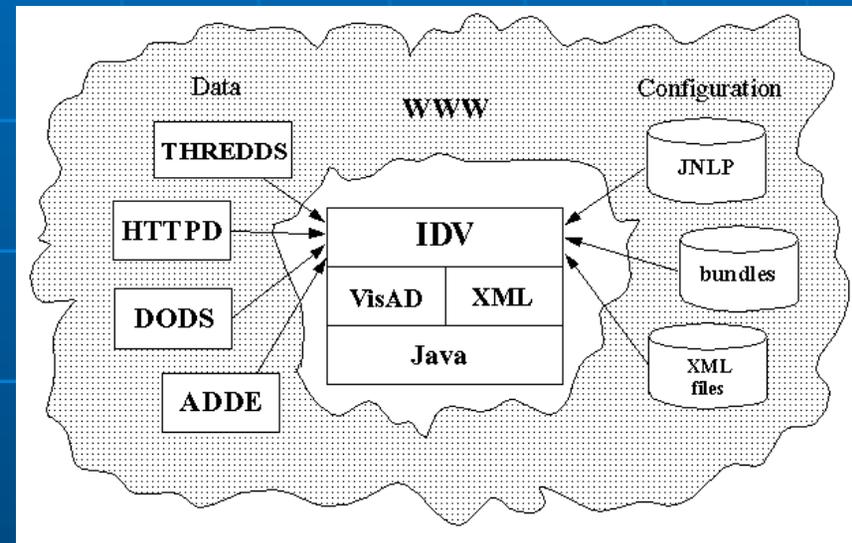
Client/Server Data Access

- Access data from DODS/ 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 indexed in digital libraries (e.g. DLESE) for discovery and usage metadata
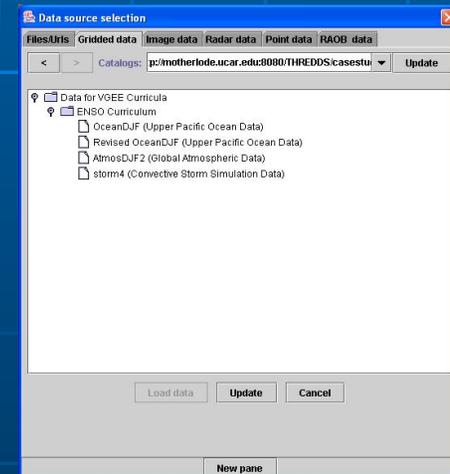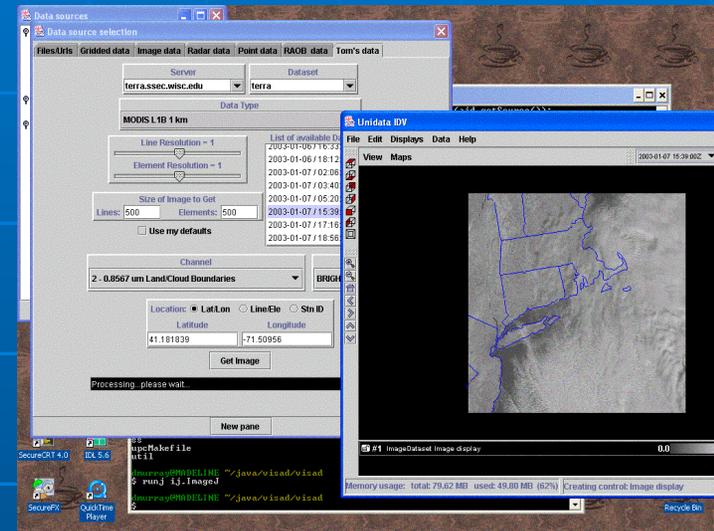
Web Enabled Features
XML Configuration

- IDV uses XML to configure the user experience
- Configuration files can be local or distributed across one or more web servers
- Offers flexibility to adapt the interface to different:
  - learners
  - tasks
  - data sets
  - content areas
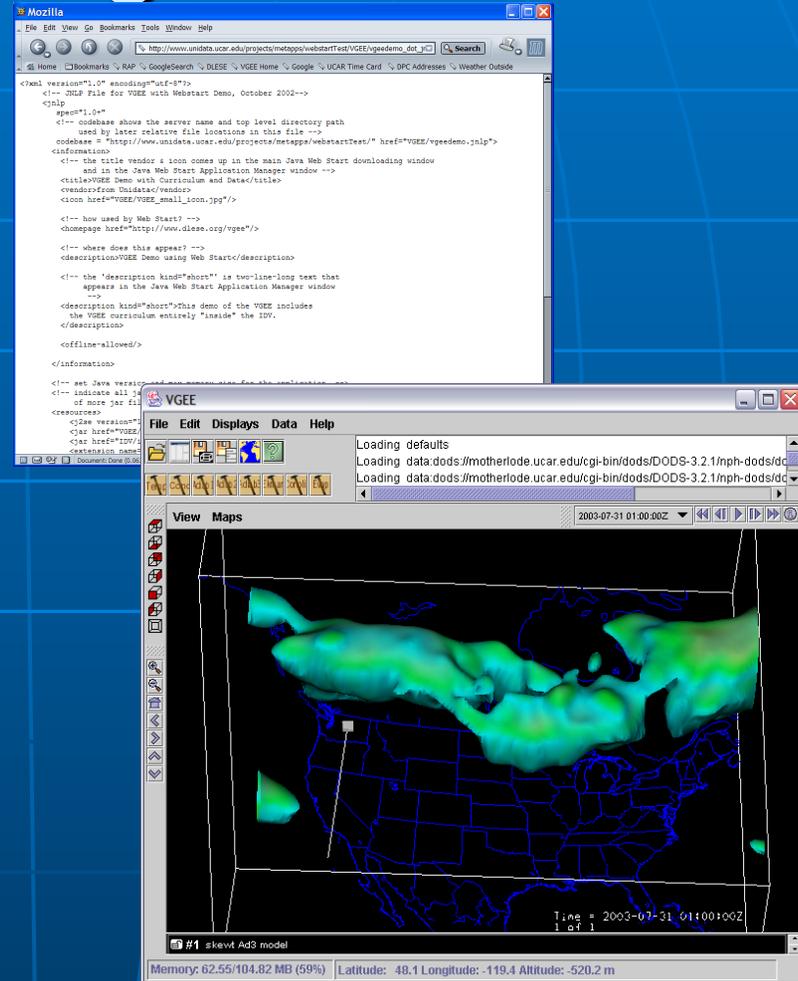
Web Enabled Features
XML Persistence

- 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
- Displays can be annotated and these can be saved in the bundle as explanations
- Bundles can be distributed around the Internet (on web servers or e-mail attachments)
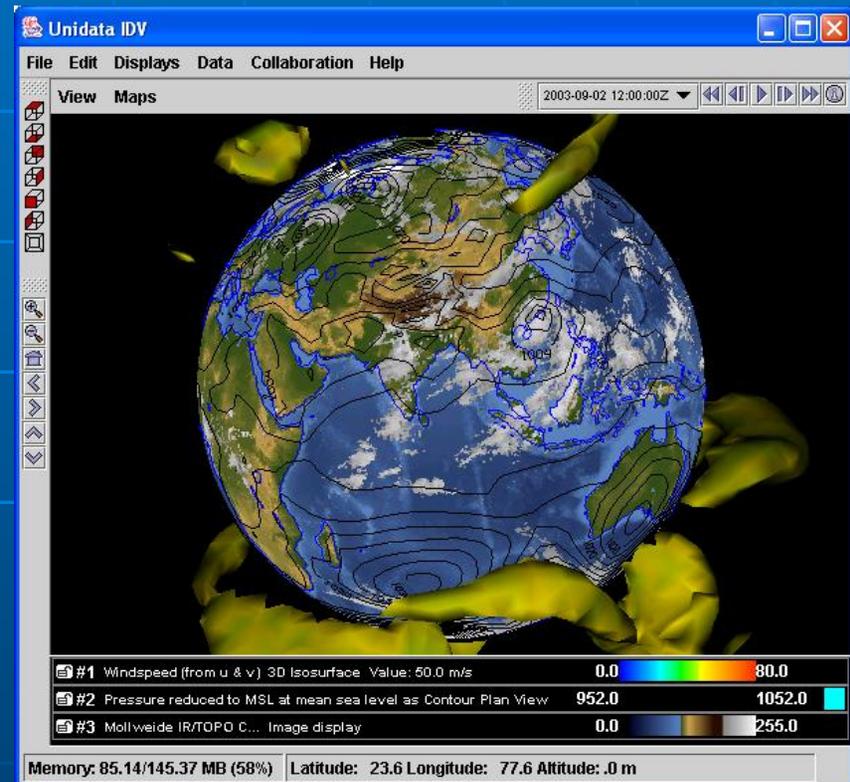
Who uses the IDV?

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

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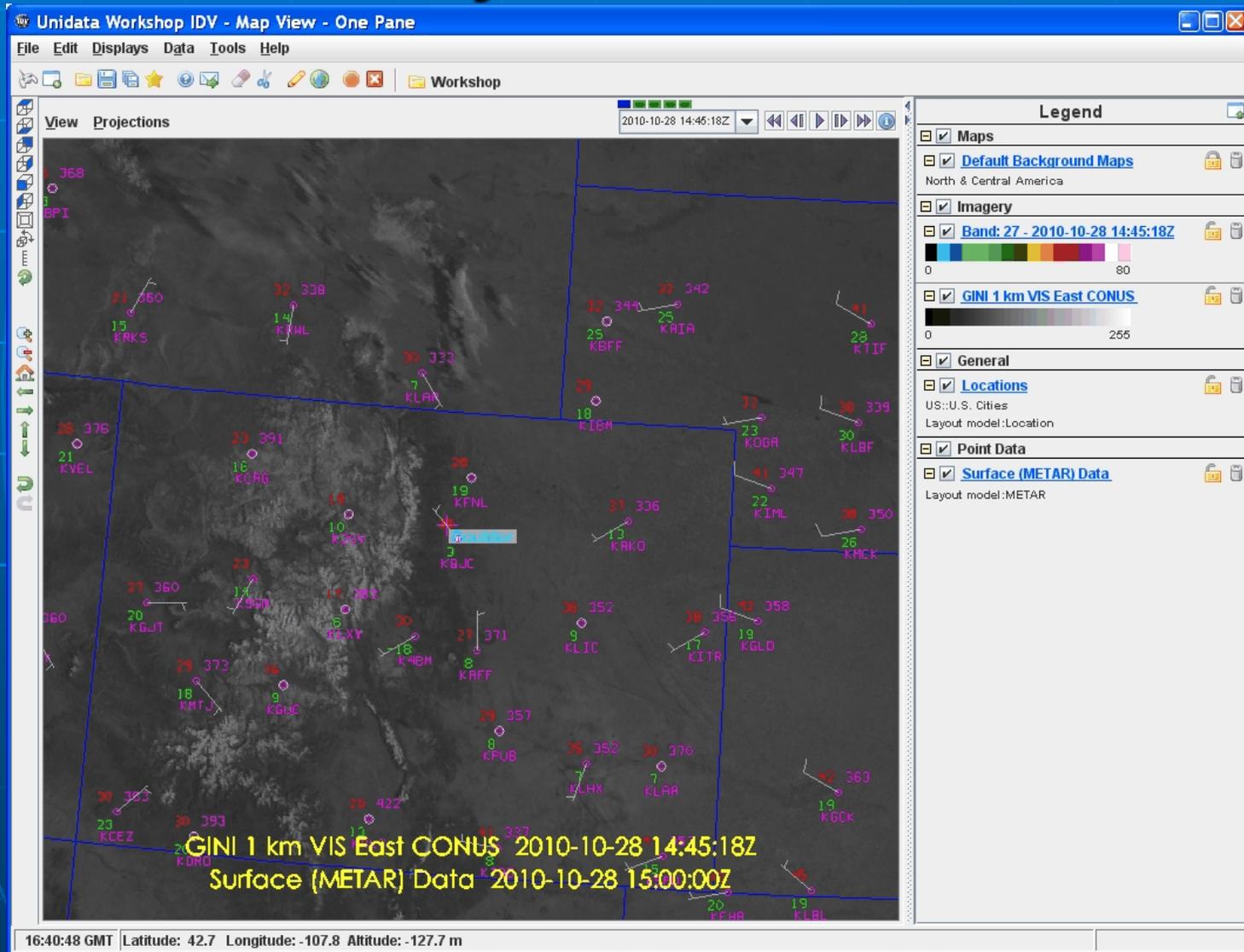
Today's Weather

Today's Weather
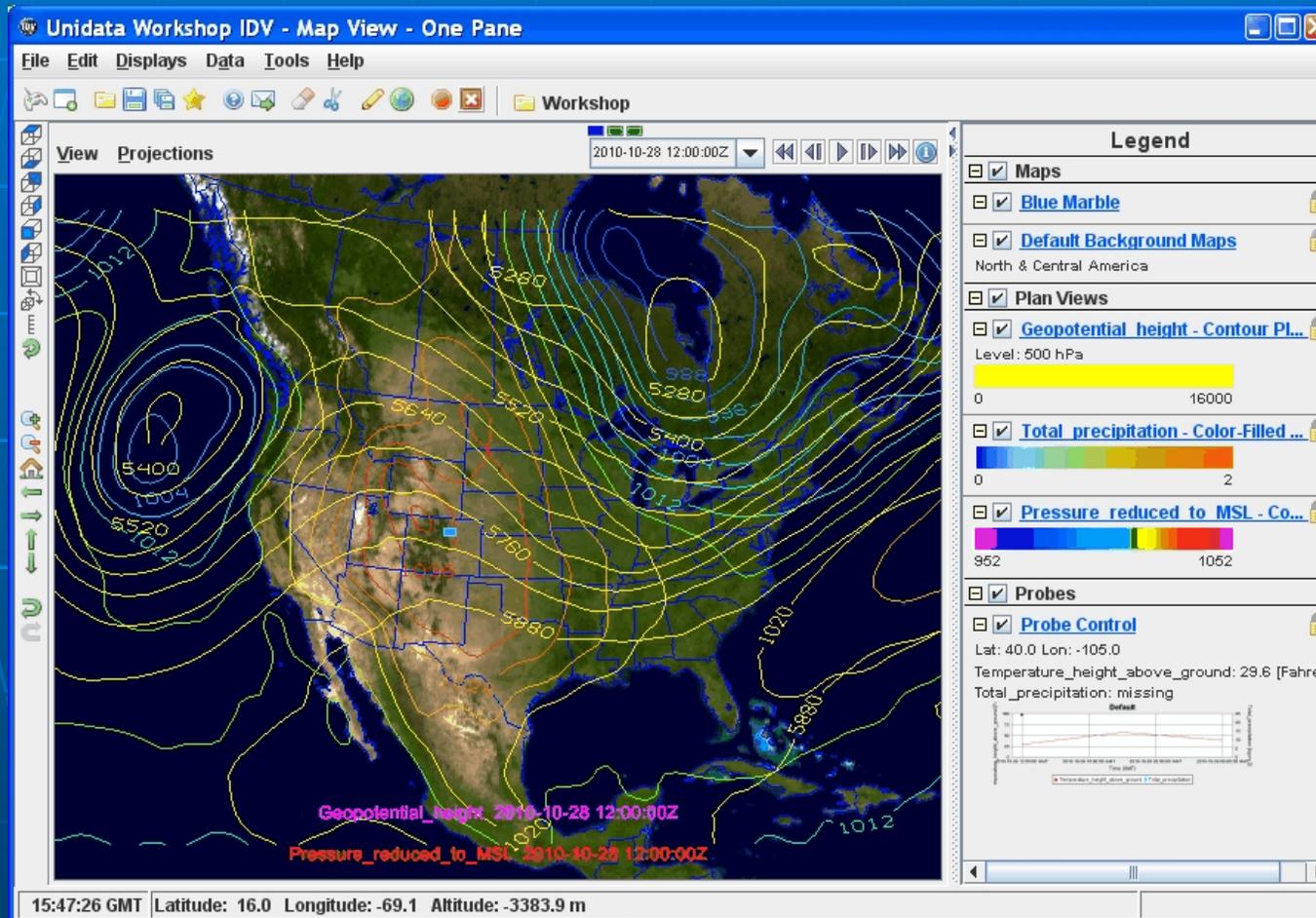
Why use the IDV?

- It's Free!
- Easy to install
  - Download from Web
  - Runs on most computers
- Easy data access
  - Remote servers (e.g., Unidata,NCDC) or local disk
- Versatile data interaction
  - 3D views of 3D data!
  - Probes to slice and dice
  - User defined formulas
- Bundles for quick access to data and displays
- Excellent user support
  - Integrated documentation
  - Unidata for qualified users
  - IDV community for others

IDV Benefits

- In Classroom:
  - More sophisticated presentation of concepts with real data
  - Better prepares students entering the atmospheric career field
- In Research:
  - Easy data accessibility
  - High level of interaction with data
  - Platform independence allows for real-time collaboration between researchers

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Supported Data Sources

Data Types:

- Gridded data
- Satellite imagery
- Radar data
- Point observations
- Balloon soundings
- NOAA Profiler Network winds
- GIS data
- Quick Time movies
- Web Cams

Supported Formats:

- netCDF
- GRIB
- ADDE
- Vis5D
- KML (Google Earth)

Access Methods:

- Local files
- HTTP
- ADDE and TDS servers

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

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Educational Modules

- Project to develop educational modules to showcase features of IDV.

- PIs: Brian J. Etherton, Shelley O. Holmberg (UNC-Charlotte), Jeff Weber (Unidata)

- Educational 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?

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"IDV Perspective: Climatology of the 2005 Hurricane Season" presented by Shelly at 2007 AMS Annual Meeting.
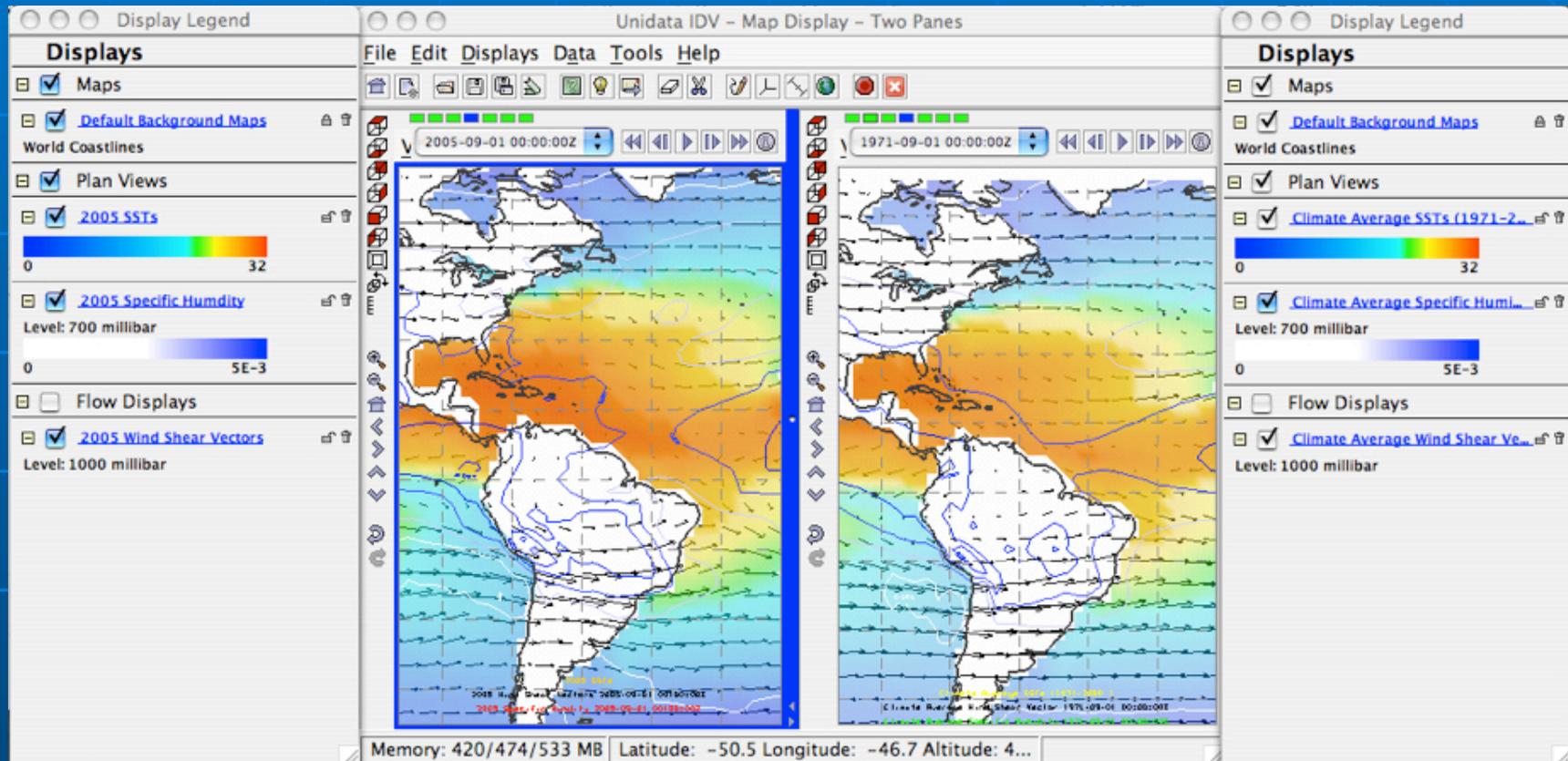
Comparison of 2005 season parameters to 30 year average. Data sources: SST (NCDC Extended Reconstructed Global SST); wind shear and specific humidity (NCEP/NCAR Reanalysis monthly mean pressure level data).

The Visual Geophysical Exploration Environment (VGEE)

- The VGEE is an integrated framework in which students use authentic data and tools to investigate a contemporary scientific issue

  It includes:
  - A learner-centered interface to the IDV
  - Concept models that support physical insight
  - A curriculum to guide inquiry
  - A catalog of data and services to use data
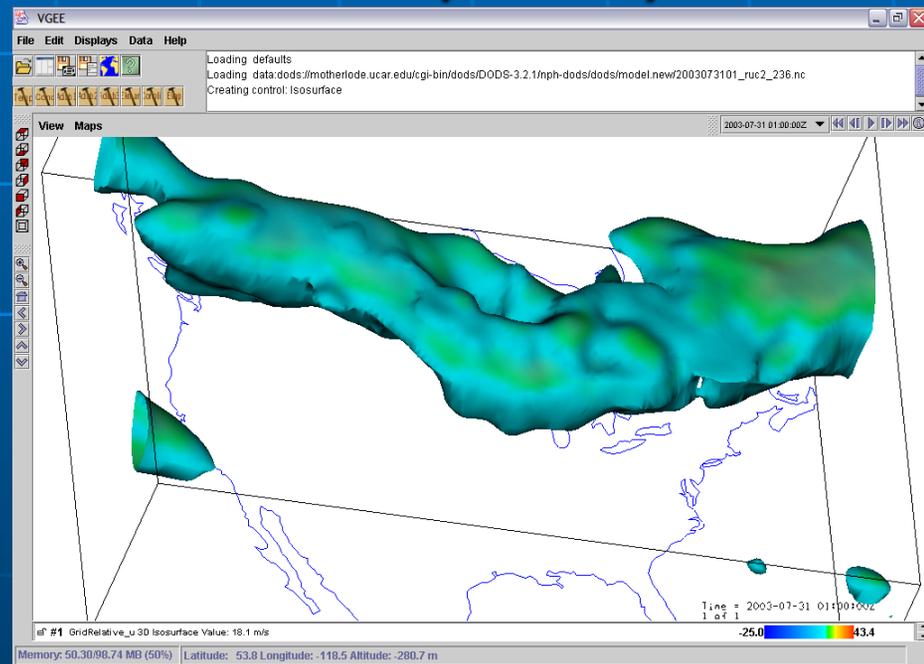
Probing Data in the VGEE
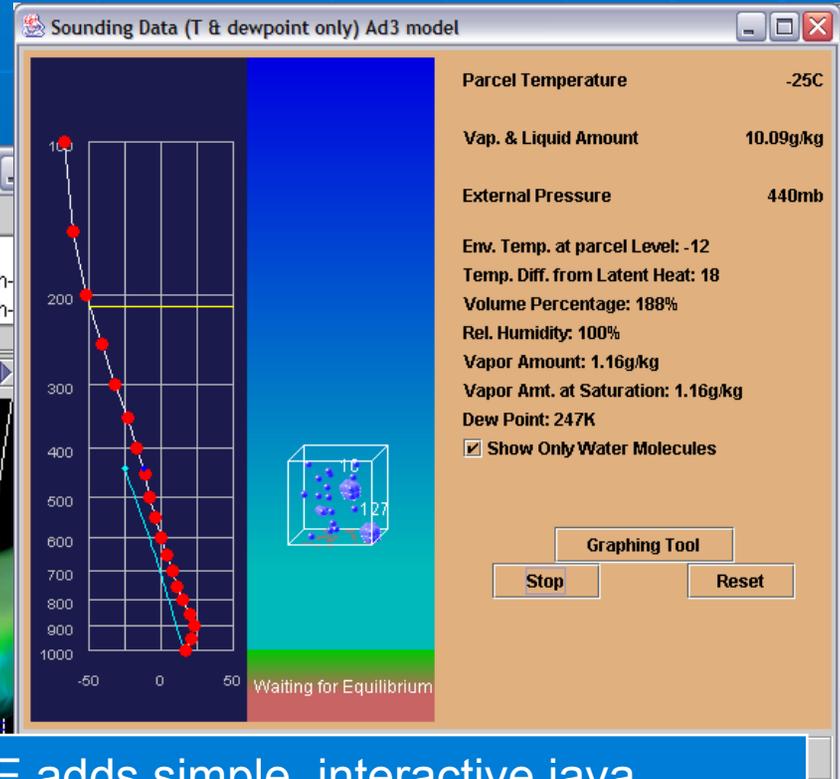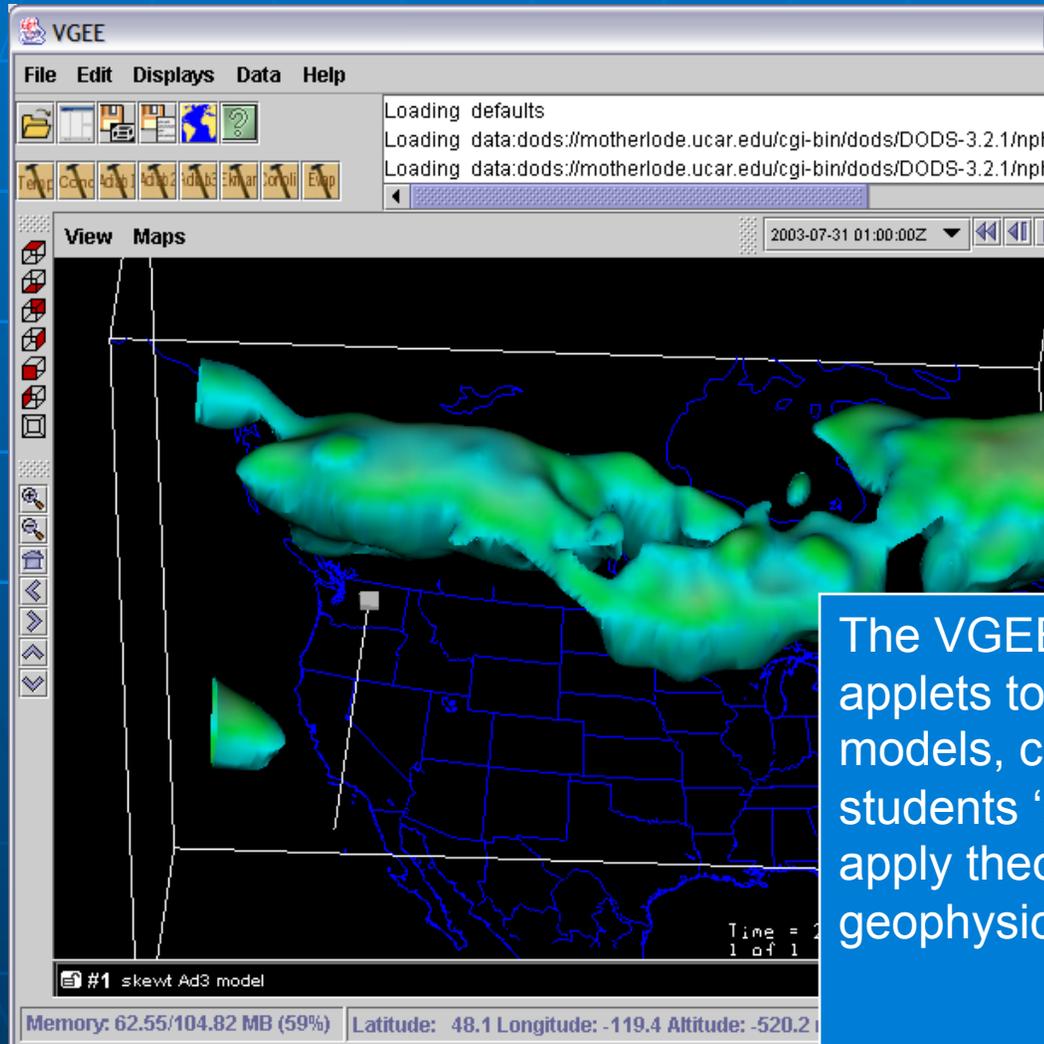
The VGEE adds simple, interactive java applets to the IDV. These applets, or concept models, can be used to probe data. This helps students 'see' basic physics in real data and apply theoretical understandings to real geophysical phenomena.

IDV in LEAD

- **LEAD Visualization Tool:**
  - WRF output from LEAD workflow simulations
  - Initial and boundary conditions for workflow
  - Compare results to observations
- **LEAD-To-LEARN modules:**
  - Bundles associated with on-line modules
  - Support inquiry based learning

Lake Effect Snow Module

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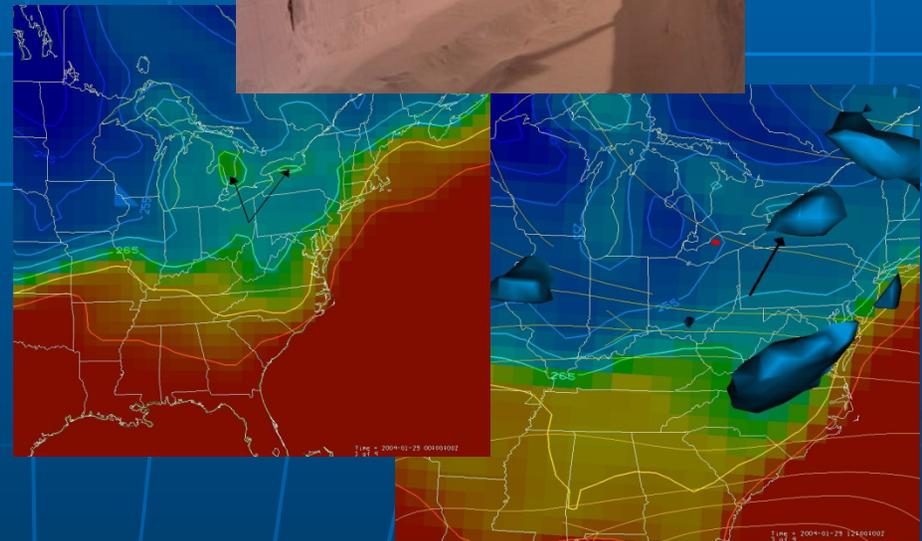
IDV in Field Projects

- Used to plot realtime aircraft tracks, radar, dropsondes, satellite and model data in operations center.
- Project specific customization
  - Specialized maps, locations, color tables
  - Specialized code for new functionality
- Support for real-time streaming data and remote access to additional datasets
- Post project analysis:
  - Access data directly from NCAR Community Data Portal or download and use locally
  - Share remote datasets and views through bundles
- Visualization tool in the proposed Virtual Operations Center (VOC)
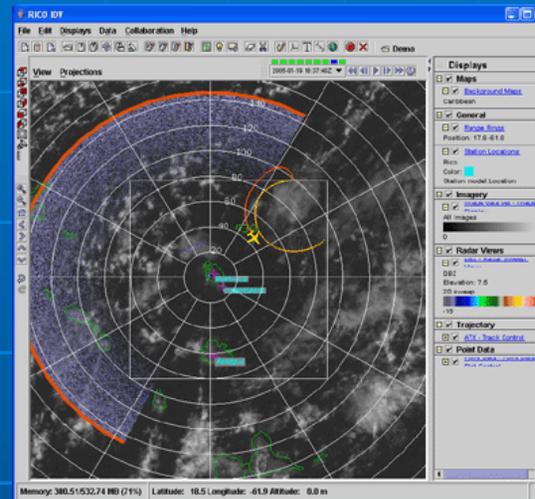
RICO: C130 track, SPOL radar and satellite

T-REX: G-V tracks and dropsondes
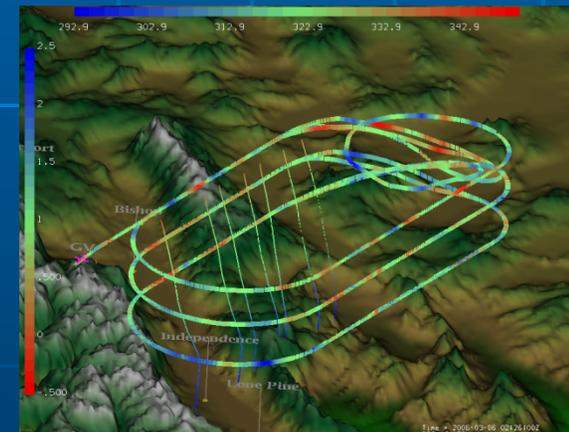
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Customized IDV: GEON-IDV

- GEON is building cyberinfrastructure to allow seamless data and tool interoperability for the geosciences.
- 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.
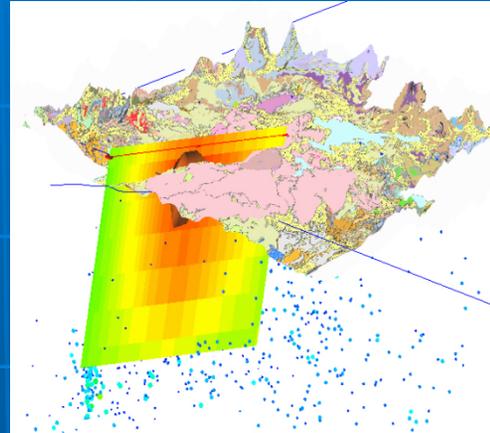
Yellowstone Geophiscs: Earthquakes and tomography by Univ. Utah; topography from USGS; geology map image provided by Robert L. Christiansentens (UNAVCO)

Mt. St. Helens siesmic activity 2004
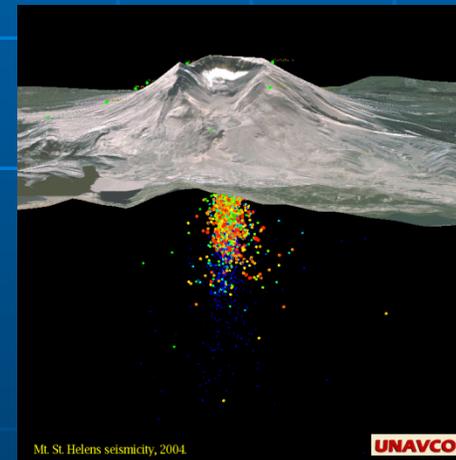
Mt. St. Helens seismicity, 2004.

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Customized IDV: TC-IDV

- TC-IDV is a customized version of IDV for typhoon tracking and analysis
- Being developed for Shanghai Typhoon Institute (STI)
- Access to database of storm tracks and forecasts
- Can be combined with satellite and model data
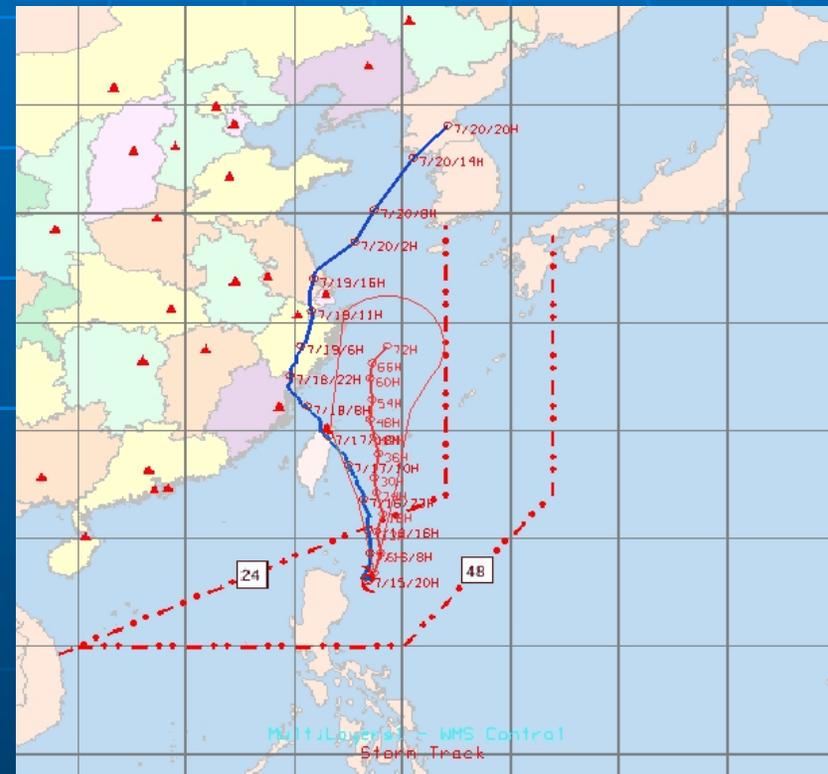
What's Up Next for IDV?

- Support for ensemble grids and diagnostics
- New time handling paradigm to allow data selection based on existing displayed data
- Integrate the new RAMADDA collection services into the choosers (e.g., radar server).
- New Displays – better charting capabilities, meteorograms

For more information

- **IDV Homepage:**
  - http://www.unidata.ucar.edu/software/idv

- **Download IDV package:**
  - http://www.unidata.ucar.edu/downloads/idv/index.jspI

- **DV Support**
  - Support-idv@unidata.ucar.edu

McIDAS-V

- Next generation of McIDAS will be based on VisAD and IDV
- Goal is to provide data visualization and manipulation tools for multi-spectral and hyper-spectral researchers and algorithm developers
- HYDRA like capabilities (BAMS, Rink, et al, Feb 2007)
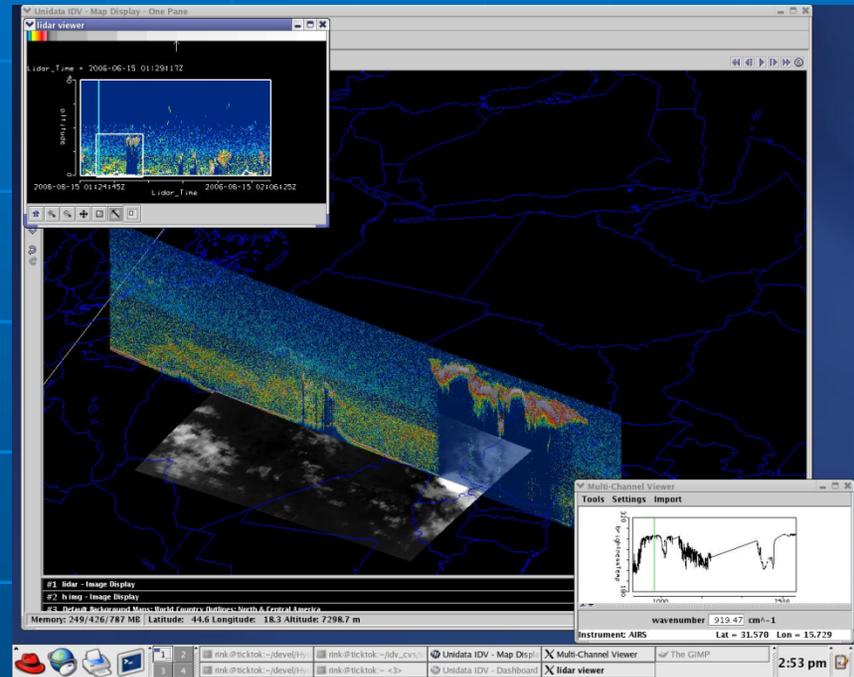
Hyperspectral slicing using AIRS, MODIS and Calypso data in McIDAS-V (courtesy Tom Rink, SSEC)

IDV Features

- Integrated displays of a variety of data types
- Support for a variety data access methods
- Multiple display types
- Interactive probes
- User defined formulas
- Bundling of user preferences
- Easy configuration
- Integrated documentation
- Plug-in facility for customization
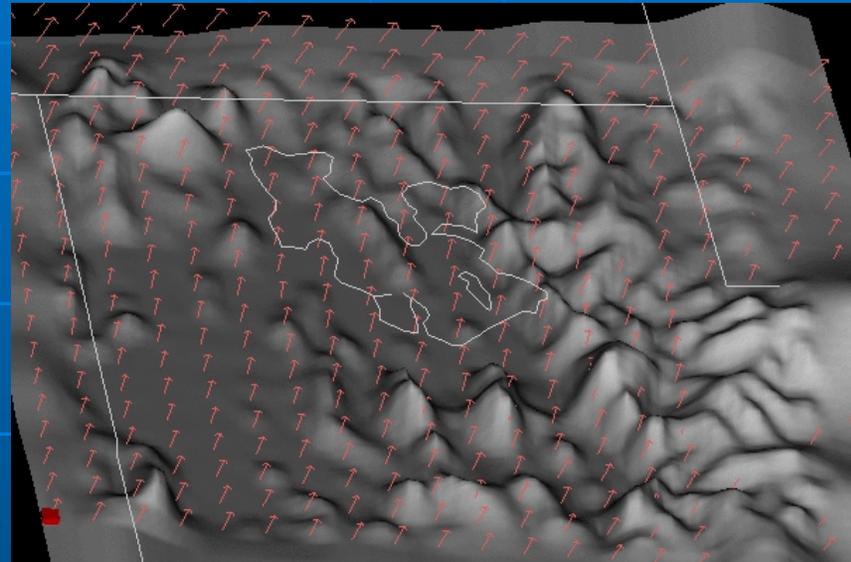
Model simulation of wind, isentropic potential vorticity and low level moisture flow over the Great Salt Lake basin

IDV Community of Users

- Universities
  - Education
  - Research (LEAD, GEON)
- UCAR (CGD, SCD, RAP, EOL, COMET)
- Government (NTSB, NCDC, NWS, NGDC, USGS, EPA)
- Military (NUWC, Air Force/ABL)
- Private Industry
- International (Gov of Macau, Norwegian Met Institute)

IDV for Post Field Analysis

- Access data directly from NCAR Community Data Portal or download and use locally
- Share remote datasets and views through bundles