UCAR Africa Initiative
Unidata Tools

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http://www.unidata.ucar.edu
Unidata - Principle Activities

- **Provide Tools** to visualize, analyze, organize, receive, & share data
- **Facilitate Data Access** to a broad spectrum of observations & forecasts (most in real time)
- **Support Faculty** who use Unidata systems at universities
- **Build a Community** where data, tools, & best practices in education/research are shared
Tools and Support Are Central

- Enhance and distribute software developed by others
  - Meteorological display and analysis tools from UW-Madison (McIDAS-X), National Weather Service/NCEP (GEMPAK), etc.
  - Remote access technologies: OPeNDAP (U of RI, NASA, and others), ADDE (UW-Madison)
- Develop software in-house
  - Widely used tools for managing scientific data (e.g., LDM, netCDF, UDUNITS, data decoders, etc.)
  - Java-based tools (IDV Framework built on top of VisAD) for 2D and 3D visualization and next-generation, collaborative data analyses
- Build systems from the software we support
  - Internet Data Distribution (IDD) system
  - THemetic Realtime Environmental Data Distributed Services (THREDDS)
- Support the use of software by offering training, consultation, bug fixes, and upgrades
NetCDF – Network Common Data Form

- Stable, multi-platform, multi-language data access since 1988
- Data model for multidimensional and structured scientific data
- Set of APIs (C, Java, Fortran, C++, Perl, Ruby, MATLAB, Objective C, Tcl/Tk, …) for data access
- Reference implementation for the APIs
- Over 100 software packages provide netCDF access
- In use in over 100 countries

NetCDF/HDF5 Merger
LDM/Internet Data Distribution System

- Local Data Manager (LDM) – one of largest distributed applications – put met departments on leading edge of Internet use
- Initiated in the mid-1990s in response to weather-data ingest challenges:
  - Solar occultation data loss
  - Terrestrial interference
  - Campus *beautification* committees
- Event-driven network of cooperating Unidata Local Data Manager (LDM) servers interconnected by TCP/IP Ethernet
- Built to realize a communications goal laid out in the earliest Unidata planning documents (Cooper, 1985)
  - Active use of local-area and national network infrastructure
  - Allow for multi-way sharing of data including locally-held datasets
- Evolved in lock-step with national and international networking capabilities
- Profoundly changed how universities acquire and use (real-time) data
- Lowered costs *and* increased reliability of data delivery
Internet Data Distribution System Concept

Sharing data from multiple sources using cooperating LDMs
Integrated Data Viewer

- A Java based software framework for analyzing and visualizing geoscience data

- Provides the ability to display and work with:
  - satellite imagery
  - gridded model output
  - Surface, upper-air, wind profiler, lightning, etc. observations
  - radar data
  - and much more …

- Can create a variety of displays:
  - 2-D horizontal contours and color-filled contours
  - 3-D iso-surfaces
  - vertical cross sections
  - interactive data probing
  - and much more…

http://www.unidata.ucar.edu/software/idv
IDV Displays

Sea-level Pressure and Upper-level Jet

S-POL Radar Thunderstorm Cross-section

Upper-mantle convection

NO₂ concentration
Real-time Data Flows

In the Beginning...  

“a dizzying volume of information – on the order of 100 MB/day, aggregate” (Davis and Rew, 1990)

Now

LDM-6 Internet2 bandwidth use

21-33 TB/week
More Data and New Data Sources
- NEXRAD Dual Polarization data (27x)
- GOES-R (201?) / NPOESS (201?)
  - Both GOES-R and NPOES will have data rates 30-60 times the current
- METOP (Europe polar orbiter(s))
- Raw data rate: 3 terabytes per day
- Global, coupled models at a grid spacing of 1-5 km, integrated for multi-decades
- NCAR Global WRF model for use in Weather and Climate research
- NEXRAD Level II expansion by 27x
- TIGGE
- SCOOP
- AMPS
- New initiatives…

The Impending Data Deluge
THREDDS Data Server (TDS):
- a web-based server which provides metadata and data access
- provides several data access protocols including OPeNDAP and HTTP
- developed, distributed and supported by Unidata
- written in Java and easily implemented by the Tomcat server

Free and open access to the data is now available to users around the world using standard web browsers and RAMADDA/TDS-enabled applications:
- Integrated Data Viewer (IDV, Unidata)
- McIDAS-V (McV, UW/SSEC)
Thematic Real-time Environmental Distributed Data Services Data Server (TDS)

• Combines IDD “push” with several forms of “pull” and DL discovery

• About 25 data providers are partners in THREDDS

To make it possible to publish, locate, analyze, visualize, and integrate a variety of environmental data

People

Documents

Data

Discovery and Publication Services

Data Cataloging Services

THREDDS Middleware

Discovery and Publication Tools

Analysis and Visualization Tools

Catalog Generation Tools

Discovery and Publication Services

Data Cataloging Services

THREDDS Middleware

Discovery and Publication Tools

Analysis and Visualization Tools

Catalog Generation Tools
Repository for Archiving, Managing and Accessing Diverse Data - RAMADDA

- **RAMADDA:**
  - a new development effort in Unidata
  - a Java-base server that runs under Tomcat or can be run as a standalone application
  - provides a publishing platform and content management system for Earth system data
  - implements a front end to THREDDS Data Server functionality

- RAMADDA provides new opportunities for data access:
  - preview/browse functions
  - collections search facility
  - federated servers provide transparent access to geographically-distributed data holdings
Multiple data collections can be accessed through Unidata’s RAMADDA server

http://motherlode.ucar.edu/repository
IDD products are cataloged by RAMADDA & TDS to include basic metadata information.
A variety of data views are provided

http://motherlode.ucar.edu/repository/entry/show/Top/Projects/Antarctic+IDD
Browse is provided for model output, satellite imagery, observations, etc.

http://motherlode.ucar.edu/repository/entry/show/Top/Projects/Antarctic+IDD
A variety of data views are provided

http://motherlode.ucar.edu/repository(entry/show/Top/Projects/Antarctic+IDD)
IDV accesses project data using RAMADDA, TDS and McIDAS ADDE services

http://www.unidata.ucar.edu/software/idv
IDV analysis/visualization of remote data holdings makes exploration simple, quick and transparent

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http://www.unidata.ucar.edu/software/idv
IDV can publish data/displays on a RAMADDA server

http://www.unidata.ucar.edu/software/idv
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