

The Many Facets of THREDDDS

Thematic Real-time Environmental Distributed Data Services

For March 2007
Unidata Policy Committee Meeting

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Motivation

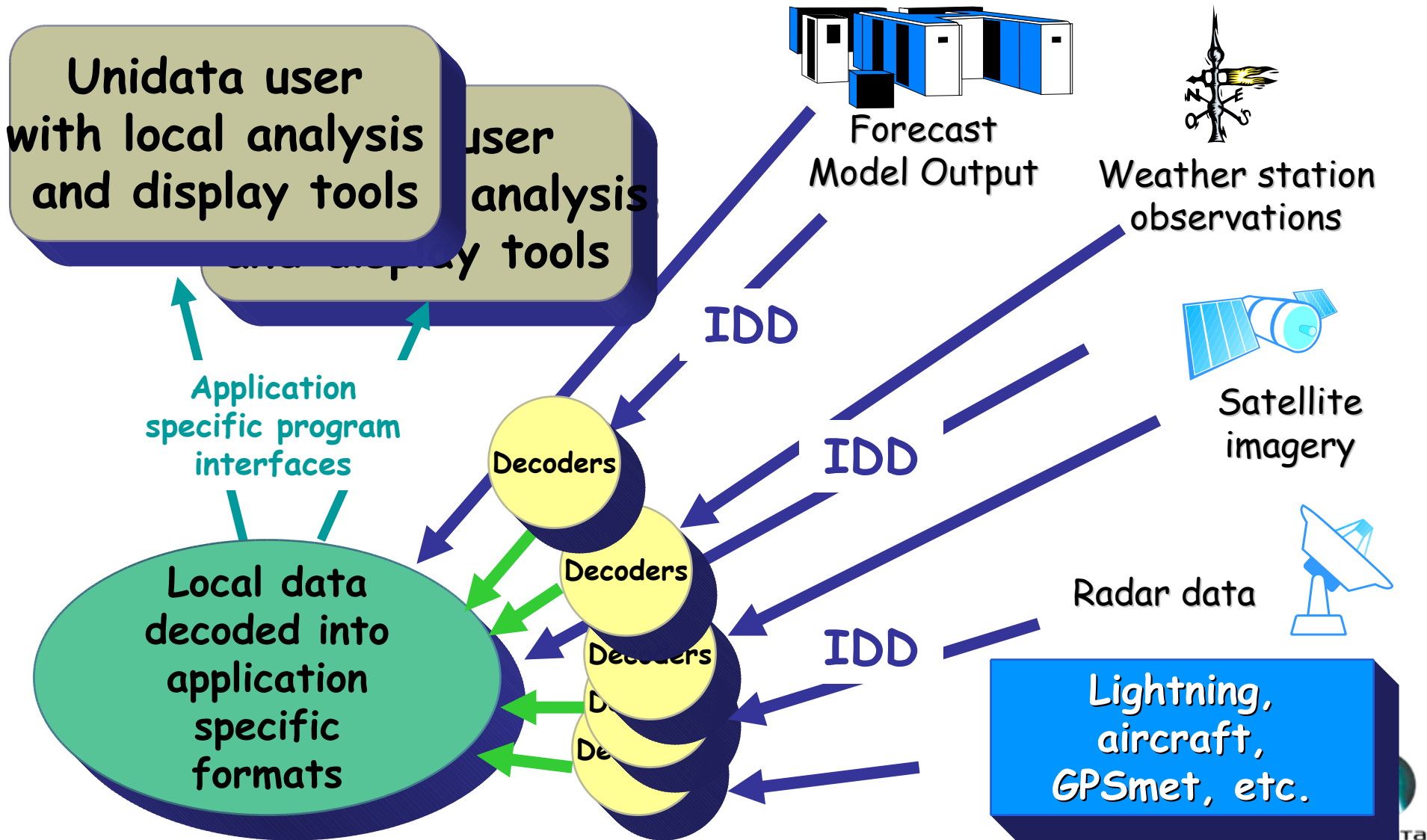
From the *Unidata 2003* proposal:

“utilizing the aggregate data holdings of all Unidata sites as a common resource, accessed via the Internet “(1997).

THREDDS Facets Topics

- THREDDS as:
 - A Catalog Service for Remote Data Access via ADDE & DODS/OPeNDAP
 - A Digital Library Collection
 - An Integrated Package for Serving Scientific Metadata and Data
 - A Working Platform for Standards-based Web Services
 - A Highly Collaborative Community Project
- Examples of search systems incorporating THREDDS
- Future options

Typical IDD Data Handling at a Unidata Site



Remote “pull” Data Access

User with
local analysis
and display tools

Data via FTP, ADDE,
OPeNDAP protocols

Hydrologic
Data

Oceanographic
Data

Atmospheric
Data

IDD

IDD

IDD

IDD

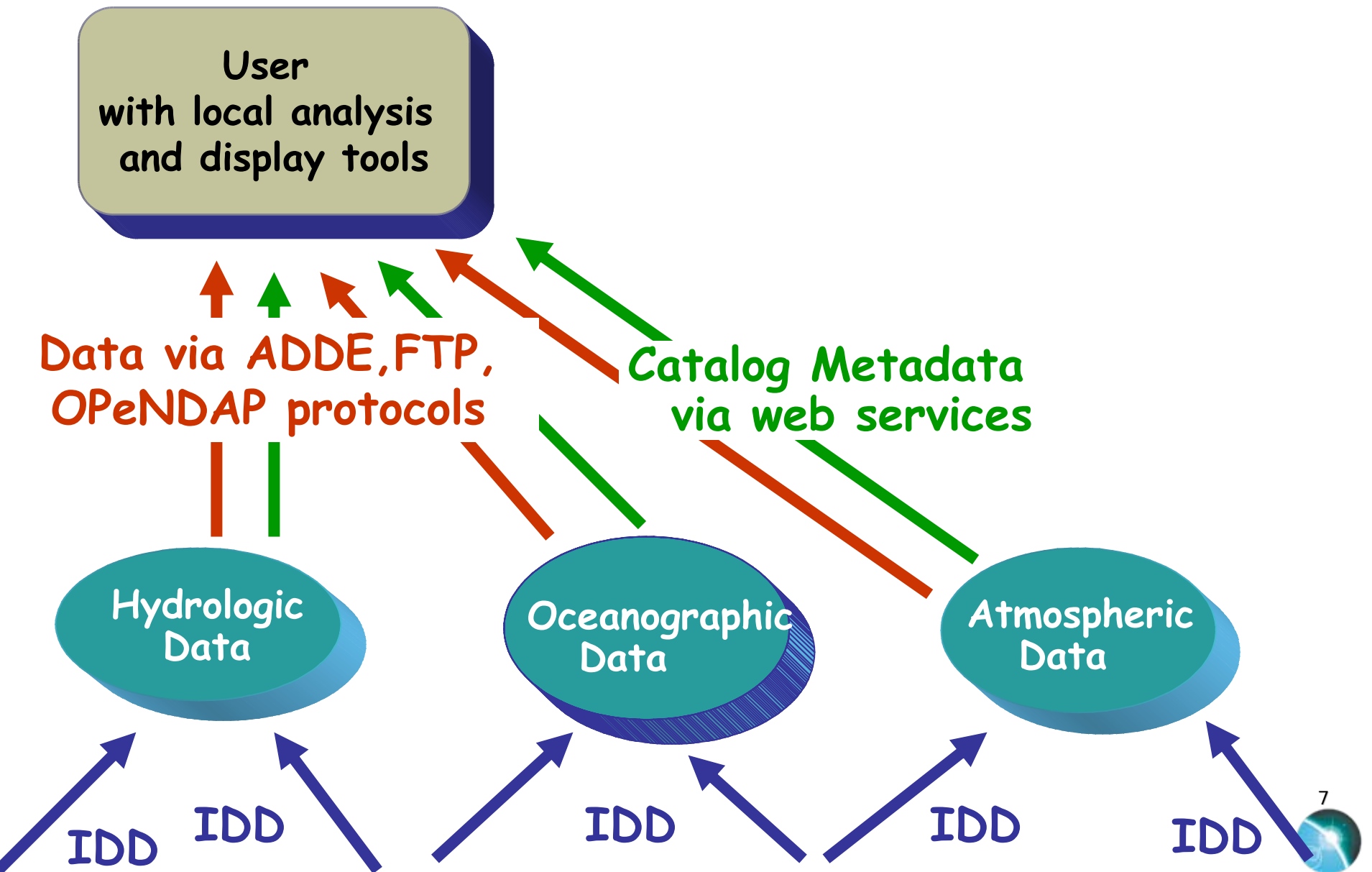
IDD

5

THREDDS as a Complement to ADDE & OPeNDAP

- ADDE and OPeNDAP provide access to remote datasets “as if on local disk”
- Data format transformations (decoding) and subsetting can be done on server side
- THREDDS provides catalogs that can be simple inventory lists of remote datasets
- Need for hierarchical catalogs of catalogs became apparent early on
- End result functions like remote file system

THREDDS Metadata & Remote Data



NAM CONUS 40km CONDUIT

Catalog

<http://motherlode.ucar.edu:8080/thredds/catalog>

Dataset



File Access

latest

NAM_CONUS_40km_conduit_20070225_1800.grib1

NAM_CONUS_40km_conduit_20070225_1200.grib1

NAM_CONUS_40km_conduit_20070225_0600.grib1

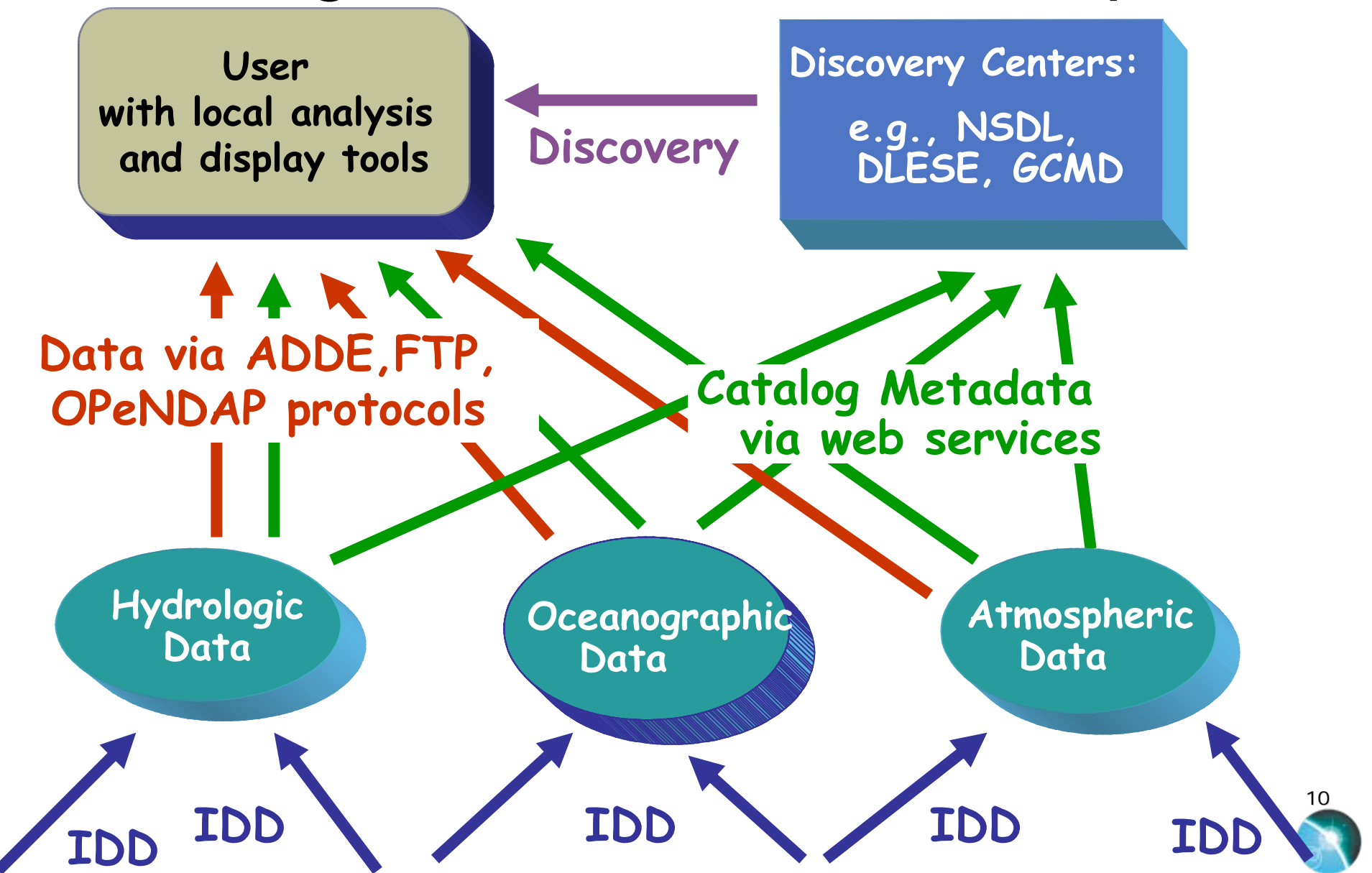
NAM_CONUS_40km_conduit_20070225_0000.grib1

NAM_CONUS_40km_conduit_20070224_1800.grib1

THREDDS Catalogs as Collections of Metadata

- Catalogs are more than remote dataset lists:
 - containers for both discovery and use metadata
 - range from simple inventory lists with minimal data descriptions
 - to web documents with embedded interactive data analysis tools
 - mechanism for including datasets into digital libraries and other discovery centers (e.g. GCMD, NSDL, DLESE, NCAR CDP)
- First THREDDS NSDL “collections” grant in 2001

Original THREDDS Concept



THREDDS Metadata

- **What** property of the Earth, ocean, atmosphere do the numbers in the dataset represent (e.g. temperature, wind speed)?
- **What** are the units of measure?
- **Where** do the measurements or predictions apply?
- **When** were they taken or what time do they forecast?

GCMD “thredds” item

▣ Platforms/Sources

▣ Projects

▣ Geospatial One Stop
Projects

▣ Free text Search

▣ Portal Collaborations

▣ Help Center

▣ Questions?

Data Center

Data Center Name: [UCAR/UNIDATA >Unidata, University Corporation for Atmospheric Research](#) ⓘ

Data Center URL: <http://www.unidata.ucar.edu/>

Personnel

Name: [UNIDATA USER SUPPORT](#)

Email: support at unidata.ucar.edu

Contact Address:

UCAR Office of Programs

Unidata Program Center

P.O. Box 3000

City: Boulder

Province or State: CO

Postal Code: 80307-3000

Country: USA

Related URL

Content Type: GET DATA > **THREDDS** CATALOG

URL: <http://motherlode.ucar.edu:8080/thredds/catalog/fmrc/NCEP/DGEX/CONU...>

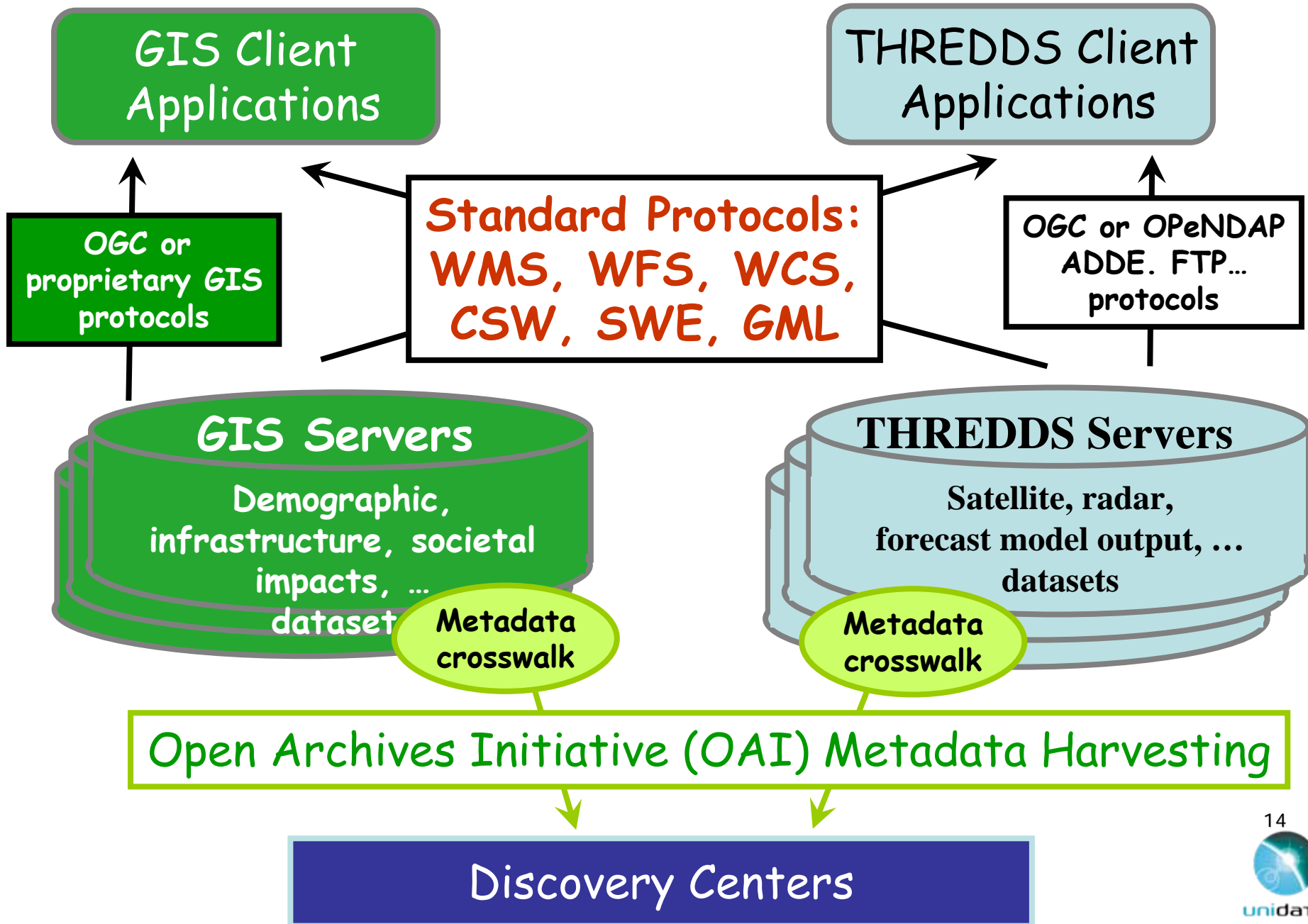
Content Type: GET DATA > **THREDDS** DIRECTORY

URL: <http://motherlode.ucar.edu:8080/thredds/catalog/fmrc/NCEP/DGEX/CONU...>

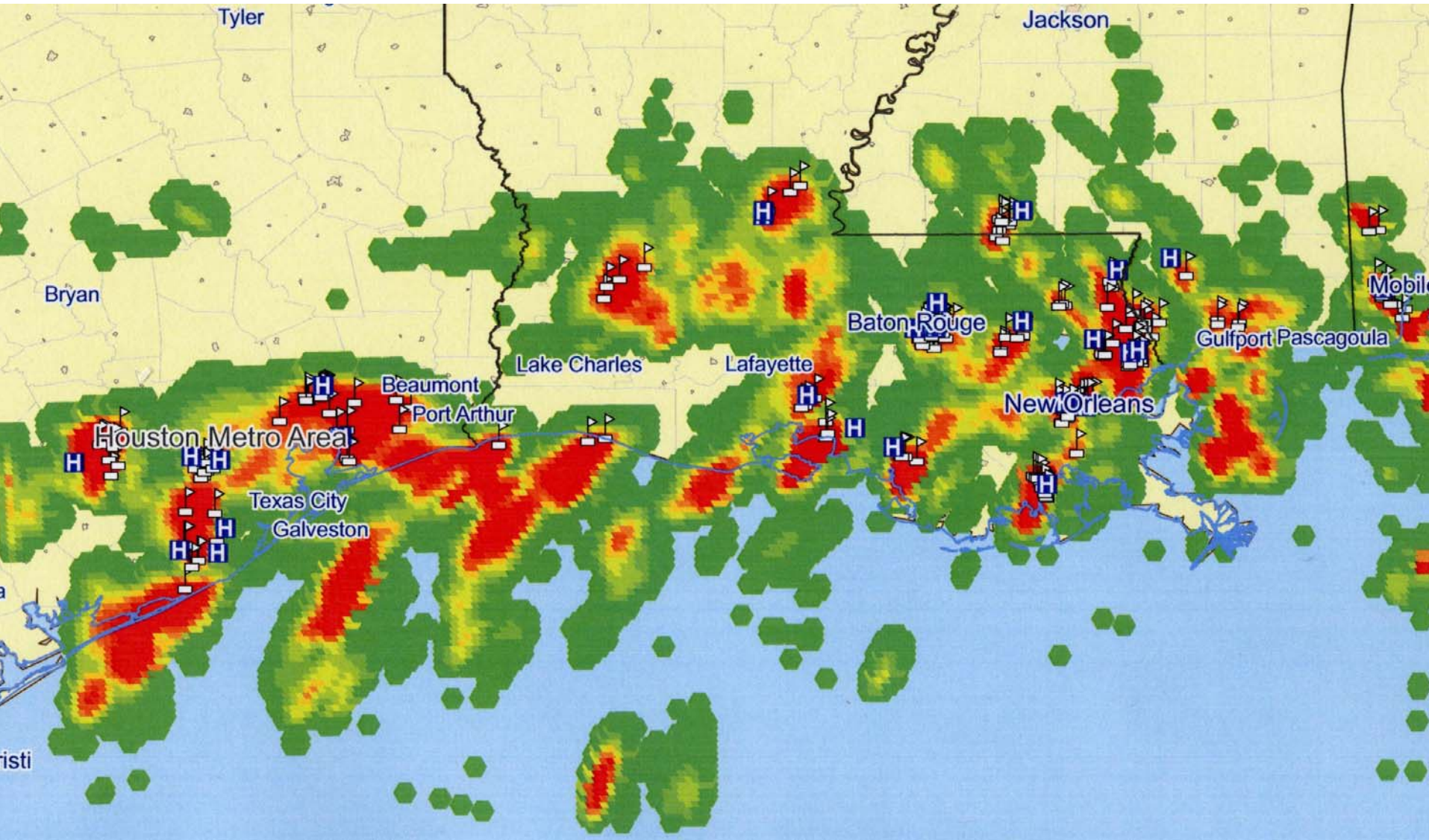
Interoperability with Other Disciplines: Different Ways of Thinking about Data

- To the GIS (solid earth, hydrology, and societal impacts) community, the world is:
 - A collection of static *features* (e.g., roads, lakes, plots of land) with geographic footprints on the Earth (surface).
 - The *features* are discrete objects with attributes which can be stored and manipulated conveniently in a **database**.
- To the fluids (atmosphere and oceans) communities, the world is:
 - A set of *parameters* (e.g., pressure, temperature, wind speed) which vary as continuous functions in 3-dimensional space and time.
 - The behavior of the *parameters* in space and time is governed by a set of **equations**.
 - Data are simply discrete points in the mathematical function space.

THREDDS/GIS Interoperability



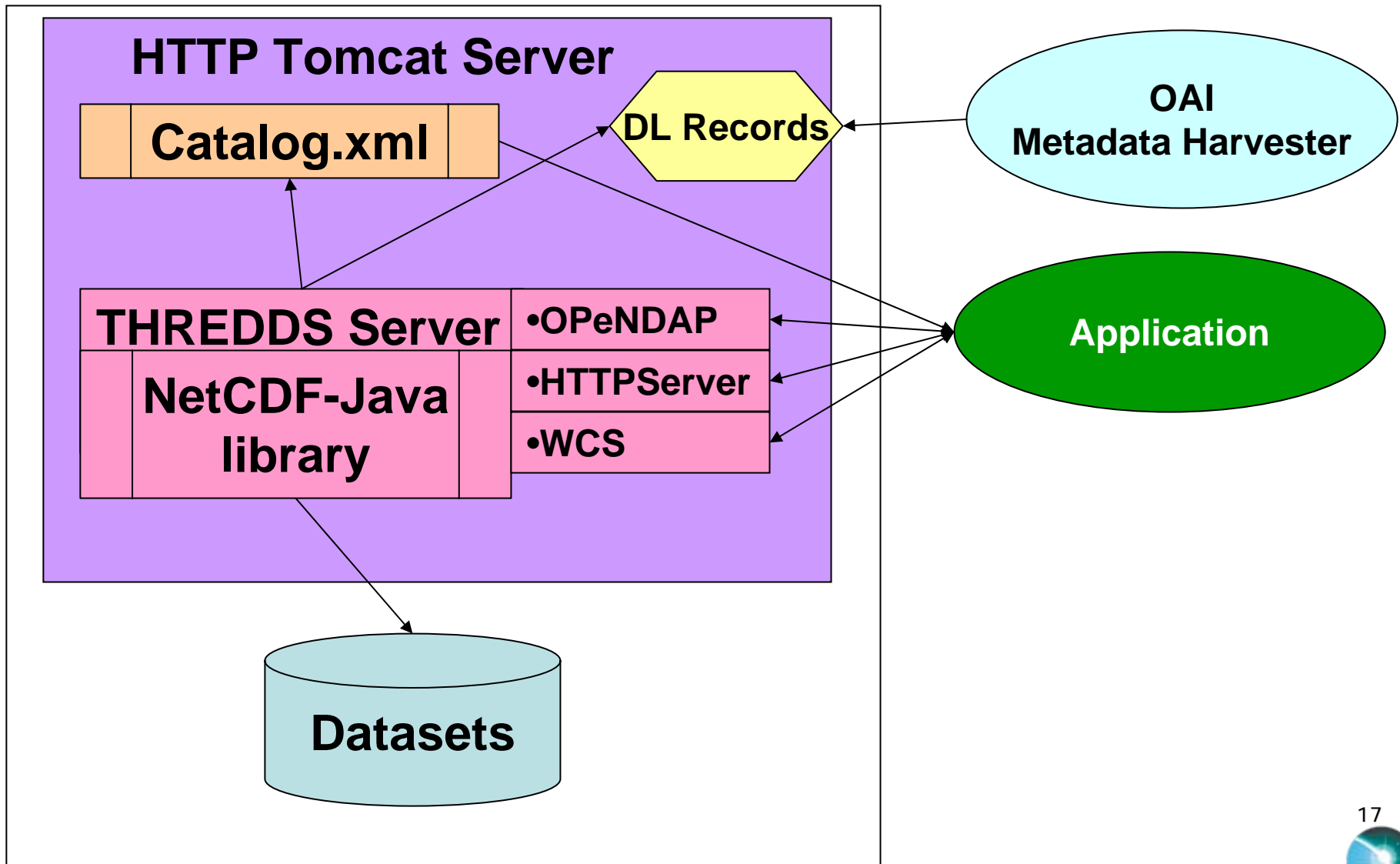
ESRI arcGIS THREDDs Integration: Schools in LEAD Forecast Rainstorm Area



TDS: THREDDS Data Server

- Integrated package of services
- Data access
 - OPeNDAP
 - Web Coverage Service (WCS)
 - netCDF subset service
- Rudimentary processing
 - Format transformations
 - Subsetting variables, space, time
- THREDDS catalogs
- Open Archives (OAI) harvesting

THREDDS Data Server Architecture



Common Data Model

- Combine best characteristics of netCDF, OPeNDAP, and HDF data models
- Maintain simple, elegant data access interface of netCDF
- Add useful capabilities from OPeNDAP and HDF such as:
 - Character strings
 - Structures
- Provides common model for data exchange

THREDDS as a Team Effort

- **UPC**
 - coordinates collaborative activities
 - develops and supports catalog generation and service technologies
- **Community** implements servers
(e.g., several dozen ADDE servers made available as part of Unidata McIDAS distribution)
- **Partners**
 - as data providers, tool builders, interoperability experts from **academia, government, industry**
 - represent **several disciplines**

THREDDS Data Provider Partners

- **University of Alabama Huntsville**
- **ARM** Atmospheric Radiation Measurement)
- **CDC**, the Climate Diagnostic Center
- **COLA**, Center for Oceans Land Atmosphere
- **University of Florence**
- **GMU**, George Mason University
- **IRI/LDEO**, International Research Institute/Lamont Doherty Earth Observatory
- **ESG**, the Earth System GRID (NCAR/SCD)
- **IRIS DMC**, Incorporated Research Institutes for Seismology Data Management Center
- **NCAR**, the National Center for Atmospheric Research
- **NCDC**, the National Climatic Data Center
- **NGDC**, National Geophysical Data Center
- **NOMADS**, NOAA Operational Model Archive and Distribution System,
- **University of Oklahoma**
- **PMEL**, the Pacific Marine Environment Laboratory
- **FNMOG**, Fleet Numerical Meteorological and Oceanographic Center
- **SSEC**, the Space Science and Engineering Center., U. of Wisconsin-Madison
- **Unidata Community ADDE servers**
- **CIRESIN** Consortium for International Earth Science Information Network)
- **CUAHSI** Consortium of Universities for Advancement of Hydrologic Science
- **ESIG** NCAR Environmental Societal Impacts Group
- **Earthscope** UCAR UNAVCO
- **GEON** GEOphysical Network UCSD San Diego Supercomputer Center
- **ESRI** GIS Community

THREDDS partners: Analysis/Display Tool Builders

- **Data Discovery Toolkit and Foundry** (New Media Studio).
- **GDS**, GrADS/DODS Server (COLA)
- **IDV**, Integrated Data Viewer (Unidata Program Center)
- **INGRID (IRI/LDEO)**, International Research Institute/Lamont Doherty Earth Observatory,)
- **LAS**, Live Access Server (PMEL, the Pacific Marine Environment Laboratory)
- **VGEE**, Virtual Geophysical Exploration Environment (NCAR, DLESE, U. of Illinois, Unidata, many collaborators)
- **WXWISE Applets (SSEC)**, the Space Science and Engineering Center., U. of Wisconsin-Madison, Tom Whittaker)

- **ArcGIS** (ESRI GIS Clients (ESRI, Inc.)
- **OGC** Clients (Open GIS Consortium)
- **MyWorld** (Northwestern educational GIS Client)

THREDDS Interoperability Partners

- **ADDE**, Abstract Data Distribution Environment (University of Wisconsin – Madison,)
- **DIMES**, Distributed Metadata System (George Mason University)
- **DODS/OPeNDAP/Aggregation Server**, Distributed Oceanographic Data System/Open source Project for a Network Data Access Protocol (University of Rhode Island, Unidata)
- **DLESE**, (Digital Library for Earth System Education)
- **ESML**, Earth System Markup Language (University of Alabama-Huntsville)
- **GCMD**, (Global Change Master Directory)
- **OGC and ISO Standards** (University of Florence)

- **ADL** (Gazetteer Services The University of California, Santa Barbara)
- **DLESE Evaluation Services** (The University of Colorado CIRES)
- **DLESE Data Services** (TERC)
- **DLESE Program Center** Digital Library for Earth System Education
- **ESRI**
- **OPeNDAP** (The University of Rhode Island Open source Project for a Network Data Access Protocol -- formerly DODS)
- **LAITS** (Laboratory for Advanced Information Technology and Standards, George Mason University)
- **NSDL Evaluation Services** (University of Colorado)
- **OGC** (Open GIS Consortium,)
- **SWEET** (Semantic Web for Earth and Environmental Terminology)

THREDDDS in Action

- Portal interfaces
 - Unidata Motherlode
 - NCDC
 - PMEL Live Access Server
- Programmatic web services interfaces
 - IDV
 - arcGIS
 - IDL
 - Gi-GO
- Discovery
 - NCAR CDP
 - UAH NOESIS
 - George Mason

Projects Related to THREDDS

<http://www.unidata.ucar.edu/projects/THREDDS/GALEON/Reports/RelatedTechnologies.html>

- [GALEON/WCS](#)
- **NASA/GMU ACCESS Geosciences Catalogs CSW (Catalog Services for the Web)**
- [GI-Go](#) (Catalog browser and data access client)
- [netCDF](#) (Java netCDF is basis for THREDDS Data Service)
- [HDF](#) (HDF5 access via TDS)
- [ADDE](#) (Client/server protocol, part of McIDAS)
- [CF \(and COARDS\) Conventions for netCDF](#)
- [Live Access Server \(LAS\)](#) (Incorporates THREDDS catalog system, deployed at hundreds of sites)
- [Community Data Portal at NCAR](#)
- [MMI](#) (Marine Metadata Interoperability project)
- [SWEET](#) (Semantic Web for Earth and Environmental Terminology)
- [ESIP Federation Service Collaboration Demos](#) (includes TDS/WCS services)
- [ESRI ArcGIS 9.2 netCDF Interface](#) (works with TDS datasets)

Summary

- “Seamless” access to historical data at remote sites: *Client/server with ADDE and OPeNDAP*
- Discovery and use of remote data: *THREDDS catalogs*
- Interoperability with GIS data systems: Web Coverage (and other) standard services
- UPC develops core technologies, coordinates team projects, supports integrated packages
- Community deploys
- Partners as data provider, discovery centers, client implementers

Recent (last week) Developments

- Gi-GO catalog metadata and data access client from U of Florence partners
- Standards-based catalog generator and client from George Mason University/NASA ACCESS project partners
- Invitation to participate in ESIP Federation proposal to NSF NSDL data-centric Pathway. (Google likely partner.)

Resulting Policy Issue

Roles of UPC, Unidata community, and partnerships in data search systems

Until now, the UPC has worked with partners for data discovery. Should we become more active?

Future Possibilities

- UPC continues developing infrastructure and capitalizing on partnerships with search experts
- UPC takes more active role in providing search services
- UPC and Unidata community focus more resources on creating metadata content for metadata catalogs

One Approach

- New slot or redirection of staff to establish a “data czar” position with responsibilities to:
- Know what datasets are important, and document their characteristics: size, format, data types, availability, etc.
- Work with community to add metadata to THREDDS catalogs.
<http://cdp.ucar.edu/>
- Create a datapedia, and get others in the community to contribute to it.
- Be a resource for developers needing to access the data.

When this is actually rolling in a couple years then search systems will be more effective

Direct Access to Examples


- <http://motherlode.ucar.edu:8080/thredds/topcatalog.html>
- <http://nomads.ncdc.noaa.gov:8085/thredds/>
- <http://motherlode.ucar.edu:8080/thredds/catalog.html>
- <http://www.unidata.ucar.edu/projects/THREDDS/DataPublications/>
- <http://www.unidata.ucar.edu/projects/THREDDS/DataPublications/EarlyLEAD/EarlyLEAD.xml>
- <http://lead4.unidata.ucar.edu:8080/thredds/catalog/model/UCA R/UNIDATA/WRFNMM/catalog.xml>
- <http://localhost:8080/thredds/catalog.html>
- <http://noesis.itsc.uah.edu/>
- <http://gcmd.nasa.gov>
- <http://cdp.ucar.edu/>
- <http://zeus.pin.unifi.it/projects/gi-go/gi-go.jnlp>


Motherlode Portal Catalog of Catalogs


Catalog <http://motherlode.ucar.edu:8080/thredds/topcata>


Dataset


 List of THREDDS catalogs


 Fleet Numerical Meteorology

 Fleet Numerical Meteorology and Oceanography Center server 1/


 Fleet Numerical Meteorology and Oceanography Center server 2/

 Fleet Numerical Meteorology and Oceanography Center ARGO server 1/


 Fleet Numerical Meteorology and Oceanography Center ARGO server 2/


 IRI/LDEO Climate Data Library/


 NCAR Data Portal/

 NOAA/NCDC NOMADS

 NCDC NOMADS Data Server/

 NCDC NOMADS Data Server 2/

 Ocean Watch SWFSC/Environmental Research Division)/

 Satellite-Derived Oceanographic Data Sets/


 University of Alabama Huntsville POND server/


NCDC Server


Catalog <http://nomads.ncdc.noaa.gov:9091/dods/thredds>


Dataset

Si


 NCDC NOMADS GrADS Server 2


 GDAS-BUFR/

 GFDL-CM2.1-DATASETS/

 IGRA_MONTHLY_RAObs/


 IGRA_STATION_RAObs/


 NCEP_GFS/

 NCEP_GFS_ANALYSIS/

 NCEP_NAM/

 NCEP_NAM_ANALYSIS/

 NCEP_NARR-A_MONTHLY/

 NCEP_NARR-A_MONTHLY_3hr/

NCEP NAM Individual Run

Dataset: [File_Access/NAM_CONUS_40km_conduit_20070225_1800.grib1](#)

- *Data format:* GRIB-1
- *Data size:* 455.0 Mbytes
- *Data type:* Grid
- *Naming Authority:* edu.ucar.unidata
- *ID:* fmrc/NCEP/NAM/CONUS_40km/conduit/files/NAM_CONUS_40km_conduit_20070225_1800.grib1

Documentation:

- **summary:** Individual data file, which comprise the Forecast Model Run Collection.
- **summary:** Model runs are made at 00Z, 06Z, 12Z, and 18Z and have analysis and forecasts every 3 hours out to 84 hours.
- **summary:** NCEP North American Model : AWIPS 212 (R) Regional - CONUS - Double Resolution. Horizontal = 185 by 129 points, resolution 40.63 km LambertConformal projection. Vertical = surface, 1000 to 50 hPa pressure levels, layers, and depth.
- **summary:** NCEP Nonhydrostatic Mesoscale Model (NMM) and Gridpoint Statistical Interpolation (GSI) analysis, running in the Weather Research and Forecasting (WRF) infrastructure.
- [COMET MetEd \(Meteorology Education and Training\) documentation](#)
- [NCEP Model documentation](#)
- **rights:** Freely available
- **processing_level:** Transmitted through Unidata Internet Data Distribution.
- **processing_level:** Read by CDM Forecast Model Run Collection.

Access:

1. **OPENDAP:**
http://motherlode.ucar.edu:8080/thredds/dodsC/fmrc/NCEP/NAM/CONUS_40km/conduit/files/NAM_CONUS_40km_conduit_20070225_1800.grib1
2. **HTTPServer:**
http://motherlode.ucar.edu:8080/thredds/fileServer/fmrc/NCEP/NAM/CONUS_40km/conduit/files/NAM_CONUS_40km_conduit_20070225_1800.grib1
3. **WCS:** http://motherlode.ucar.edu:8080/thredds/wcs/fmrc/NCEP/NAM/CONUS_40km/conduit/files/NAM_CONUS_40km_conduit_20070225_1800.grib1
4. **NetcdfServer:**
http://motherlode.ucar.edu:8080/thredds/ncServer/fmrc/NCEP/NAM/CONUS_40km/conduit/files/NAM_CONUS_40km_conduit_20070225_1800.grib1

NetCDF Subset Server

NetCDF Grid Subset Server

Select Grids, optionally bounding box and time range. A NetCDF file using CF-1 Conventions is returned.

Dataset: `NAM_CONUS_40km_conduit_20070225_1800.grib1`

Base Time: `2007-02-25T18:00:00Z`

Available Forecast Hours= (0.0 3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 45.0 48.0 51.0 54.0 57.0 60.0 63.0 66.0 69.0 72.0 75.0 78.0 81.0 84.0)

Select Grid(s):

- Absolute_vorticity
- Accumulated_snow
- Albedo
- Baseflow-groundwater_runoff
- Best_4-layer_lifted_index
- Blackadars_mixing_length_scale
- Brunt-Vaisala_frequency2
- Categorical_freezing_rain
- Categorical_freezing_rain_surface
- Categorical_ice_pellets
- Categorical_rain
- Categorical_rain_surface
- Categorical_snow
- Clear_sky_upward_solar_flux
- Cloud_ice
- Cloud_ice_hybrid
- Cloud_water
- Cloud_water_hybrid
- ...

Bounding Box (decimal degrees):

West Longitude:

East Longitude:

North Latitude:

South Latitude:

Forecast Hours:

Starting:

Ending:

Add Lat/Lon variables if needed

Catalog of catalogs in XML (programmatic interface)

```
- <catalog name="THREDDS Top Catalog, points to other THREDDS catalogs" version="1.0.1">
- <dataset name="List of THREDDS catalogs">
  - <dataset name="Fleet Numerical Meteorology">
    <catalogRef xlink:href="http://usgodae1.usgodae.org/catalog.xml" xlink:title="Fleet Numerical Meteorology and Oceanography Ce
    name=""/>
    <catalogRef xlink:href="http://usgodae2.usgodae.org/catalog.xml" xlink:title="Fleet Numerical Meteorology and Oceanography Ce
    name=""/>
    <catalogRef xlink:href="http://usgodae1.usgodae.org/argo_catalog.xml" xlink:title="Fleet Numerical Meteorology and Oceanograp
    ARGO server 1" name=""/>
    <catalogRef xlink:href="http://usgodae2.usgodae.org/argo_catalog.xml" xlink:title="Fleet Numerical Meteorology and Oceanograp
    ARGO server 2" name=""/>
  </dataset>
  <catalogRef xlink:href="http://iridl.ldeo.columbia.edu/SOURCES/thredds.xml" xlink:title="IRIDLDEO Climate Data Library" name=""/>
  <catalogRef xlink:href="http://dataportal.ucar.edu/metadata/ucar.thredds" xlink:title="NCAR Data Portal" name=""/>
- <dataset name="NOAA/NCDC NOMADS">
  <catalogRef xlink:href="http://nomads.ncdc.noaa.gov:9090/dods/thredds" xlink:title="NCDC NOMADS Data Server" name=""/>
  <catalogRef xlink:href="http://nomads.ncdc.noaa.gov:9091/dods/thredds" xlink:title="NCDC NOMADS Data Server 2" name=""/>
</dataset>
<catalogRef xlink:href="http://oceanwatch.pfeg.noaa.gov/thredds/catalog.xml" xlink:title="Ocean Watch SWFSC/Environmental Res
```

Catalog of catalogs in IDV (Catalog from within a Client)

The screenshot displays the Unidata IDV - Dashboard interface. The title bar reads "Unidata IDV - Dashboard". Below the title bar is a menu bar with "File", "Edit", "Displays", "Data", "Tools", and "Help". A toolbar contains various icons for file operations and data manipulation. Below the toolbar are four tabs: "Quick Links", "Data Chooser" (which is active), "Field Selector", and "Displays".

On the left side, there is a vertical navigation menu with the following items: "Files", "URLs", "Catalogs" (highlighted), "Images", "Radar", "Point", "RAOB", "Profiler", and "Directory".

The main content area shows the "Data Chooser" tab. It features a "Catalogs:" label followed by a text input field containing the URL: `http://motherlode.ucar.edu:8080/thredds/topcatalog.xml`. Below this is a "Data Source Type:" dropdown menu currently set to "I'm Feeling Lucky".

The main content area displays a list of THREDDS catalogs:

- List of THREDDS catalogs
 - Fleet Numerical Meteorology
 - IRI/LDEO Climate Data Library
 - NCAR Data Portal
 - NOAA/NCDC NOMADS
 - Ocean Watch SWFSC/Environmental Research Division)
 - Satellite-Derived Oceanographic Data Sets
 - University of Alabama Huntsville POND server
 - Unidata THREDDS/IDD Server (motherlode)
 - Unidata LEAD catalogs

TDS-related Search Systems

- George Mason/NASA Catalog Services for the Web collaborative project
- NCAR Community Data Portal
- Global Change Master Directory
- UAH NOESIS Earth system search system

NCAR CDP Data Search



New CDP data portal release: the newest 4.0 release of CDP is based on a completely renovated software infrastructure. Please notify any problems to [CDP support](#)










The Community Data Portal (CDP) is a collection of earth science datasets from NCAR, UCAR, UOP, and participating organizations in the following research

[easy search](#) [advanced search](#)

Search for Earth Science datasets by metadata keyword:

[Search](#)

[browse](#)

-  [ACD](#) : Atmospheric Chemistry Models, Data Sets and Visualization Tools
-  [MILAGRO](#) : Milagro field campaign
 -  Requires CDP login and Milagro membership ([Click here to request access](#))
-  [CGD](#) : Climate and Global Dynamics Division
-  [CME](#) : Carbon in the Mountains Experiment
-  [COLA](#) : Center for Ocean-Land-Atmosphere studies
-  [CU/CIRES/ENLIL](#) : Heliospheric Model
-  [ECMWF](#) : ERA40 Datasets
 -  Requires [ECMWF membership](#)

GCMD Search for “thredds”



Global Change Master Directory
a directory to Earth science data and services

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- ▣ Agriculture
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- ▣ Human Dimensions
- ▣ Hydrosphere
- ▣ Land Surface
- ▣ Oceans
- ▣ Paleoclimate
- ▣ Solid Earth
- ▣ Spectral/Engineering
- ▣ Sun-Earth Interactions

- ▣ Data Centers
- ▣ Locations



[Freetext='thredds']

Refine by Category

Please select a field

Refine by Free text

31 Titles Match Your Query

Showing 1 through 31 of 31

1. [NDFD-CONUS 5km \[edu.ucar.unidata-fmrc-NCEP-NDFD-CONUS 5km\]](#)
1073 by 689 points, resolution 5 km. Models are run daily at 12Z. Forecasts every 6 hours from 90 to 180 hours.

2. [NCEP-DGEX-CONUS 12km \[edu.ucar.unidata-fmrc-NCEP-DGEX-CONUS 12km\]](#)
NCEP Model output Grid 185 (C) horizontal = 491 by 303 points, resolution 12 km, LambertConformal projection. Model runs are made at 6 and 18Z, with forecasts starting at 84 hours,

...



UAH NOESIS Earth System Search



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Search

Number of Results:
134

Definition:

1. Any disturbed state of the atmosphere, especially as affecting the earth's surface, implying inclement and possibly destructive weather. There are at least three somewhat different viewpoints of storms. 1) In synoptic meteorology, a storm is a complete individual disturbance identified on synoptic charts as a complex of pressure, wind, clouds, precipitation, etc., or identified by such mesometeorological means as radar or sferics. Thus, storms range in scale from tornadoes and thunderstorms, through tropical cyclones, to widespread extratropical cyclones. 2) From a local and special interest viewpoint, a storm is a transient occurrence identified by its most destructive or spectacular aspect(s). In this manner we speak of rainstorms, windstorms, hailstorms, snowstorms, etc. Notable special cases are blizzards, ice storms, sandstorms, and duststorms. 3) To a hydrologist, "storm" alludes primarily to the space- and time-distribution of rainfall over a given region. See local storm, severe storm. 2. See magnetic storm 3. (Also called storm wind, violent storm.) In the Beaufort wind scale, a wind with a speed from 56 to 63 knots (64 to 72 mph) or Beaufort Number 11 (Force 11).

Source: <http://amsglossary.allenpress.com/glossary>

Query:
storm

Refine Search

+Atmospheric Circula...

+storm

- Sand Storm
- Tornado
- Dust Storm
- Thunderstorm

Related Terms

+Phenomena

- Wind
- Rain
- Cloud

Search Results

[NCDC Storm Events-Select State](#)

NCDC

NOAA Logo, National Environmental Satellite, Data, and Information Service. National Climatic Data Center, U.S. Department of Commerce. ... Storm Events.

...

<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>

[NCDC Storm Events-FAQ Page](#)

NCDC

... Storm Data FAQ Page. When does data become available? ... More Notes An Episode is an entire storm system and can contain many different types of events. ...

<http://www.ncdc.noaa.gov/oa/climate/sd/sdfaq.html>

Filter by Engine

- + All
- + Web
 - Google - 10
 - Yahoo - 2
 - Ask.com - 10
- + Data
 - NCDC - 10
 - NASA GCMD - 50
- + Publications
 - AMS - 10
 - Elsevier - 13
 - Springer - 10