

The NOAA National Operational Model Archive and Distribution System -NOMADS

- and -

Plans for a NOAA Climate Model Portal (NCMP)



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NOAA Global Interoperability Program Kickoff
NOAA Geophysical Fluid Dynamics Laboratory
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Outline

- ▶ **NOMADS**
 - Status Report
 - ECIP Reanalysis outputs
- ▶ **Why NCMP?**
- ▶ **Plans for NCMP**
 - a community approach
 - an architectural philosophy

NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center
U.S. Department of Commerce

NOAA National Operational Model Archive & Distribution System

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The NOAA National Operational Model Archive and Distribution System (NOMADS) is a Web-services based project providing both real-time and retrospective format independent access to climate and weather model data.

DOC > NOAA > NESDIS > NCDC

Search Field:
Search NCDC

NOMADS

The NOAA Operational Model Archive and Distribution System



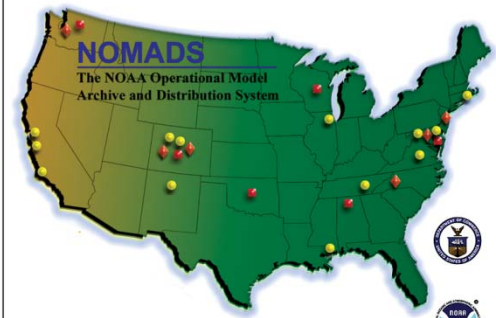
NOMADS: 10 years old?

➤ NOMADS is a distributed data access project for access to real-time and retrospective high volume numerical weather prediction and climate models. Conceived in 1999 operational in 2002 without directed funding.

(the power of collaborations!)

➤ NOAA's NCDC initiated NOMADS with NCEP and GFDL. The collaboration quickly grew. Founding member of GO-ESSP. Focus has been on weather and reanalysis. Plans to support climate models and associated observational data.

➤ Users can have access to data as input to their decision making processes this information is useful on time scales from days (weather) to months (El Nino) to decades (global warming).



NOMADS
The NOAA Operational Model
Archive and Distribution System

Core NOAA NOMADS Collaborators

- Climate Diagnostics Center (CDC) Boulder, CO
- Geophysical Fluid Dynamics Laboratory (GFDL) Princeton, NJ
- National Climatic Data Center (NCDC) Asheville, NC (Project Lead)
- National Centers for Environmental Prediction (NCEP) Camp Springs, MD
- Pacific Marine Environmental Laboratory (PMEL) Seattle, WA
- NOAA Forecast Systems Laboratory (FSL) Boulder, CO

External Core Collaborators


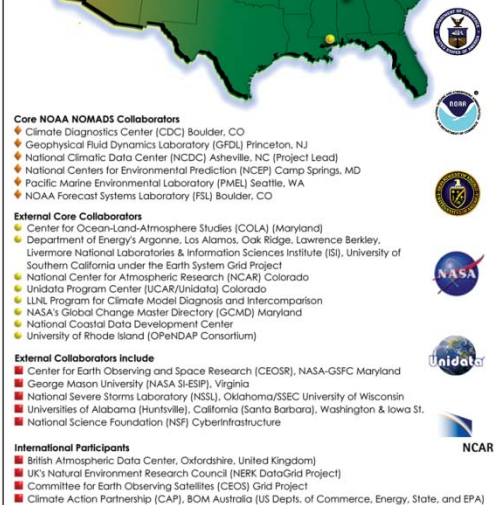
- Center for Ocean-Land-Atmosphere Studies (COLA) (Maryland)
- Department of Energy's Argonne, Los Alamos, Oak Ridge, Lawrence Berkeley, Livermore National Laboratories & Information Sciences Institute (ISI), University of Southern California under the Earth System Grid Project
- National Center for Atmospheric Research (NCAR) Colorado
- Unidata Program Center (UCAR/Unidata) Colorado
- LLNL Program for Climate Model Diagnosis and Intercomparison
- NASA's Global Change Master Directory (GCMD) Maryland
- National Coastal Data Development Center
- University of Rhode Island (OPeNDAP Consortium)

External Collaborators include

- Center for Earth Observing and Space Research (CEOSR), NASA-GSFC Maryland
- George Mason University (NASA SI-ESIP), Virginia
- National Severe Storms Laboratory (NSSL), Oklahoma/SSC University of Wisconsin
- Universities of Alabama (Huntsville), California (Santa Barbara), Washington & Iowa St.
- National Science Foundation (NSF) Cyberinfrastructure

International Participants

- British Atmospheric Data Center, Oxfordshire, United Kingdom
- UK's Natural Environment Research Council (NERC DataGrid Project)
- Committee for Earth Observing Satellites (CEOS) Grid Project
- Climate Action Partnership (CAP), BOM Australia (US Depts. of Commerce, Energy, State, and EPA)

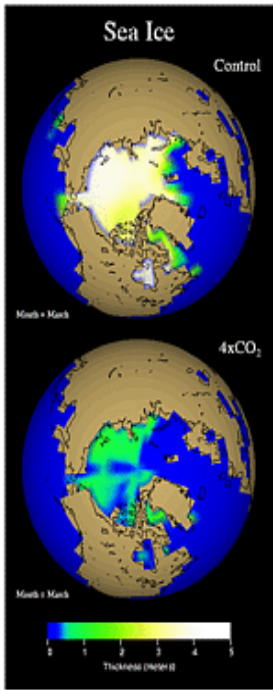


NOMADS
The NOAA Operational Model
Archive and Distribution System



NOMADS Goals

- Establish a unified climate and weather model archive providing format independent access to retrospective models
- promote model evaluation and community feedback
- foster research within the geo-science communities (ocean, weather, and climate) to study multiple earth systems using collections of distributed data
- develop institutional partnerships and access via distributed open standard technologies



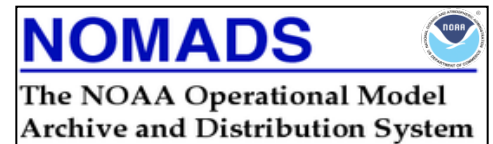
NOMADS Benefits

- ▶ NWS systems engineers informally studied the bandwidth “cost savings” obtained via the NOMADS vs. traditional “gateway” servers.
- ▶ In a nutshell, they found an overall savings of 80% of the volume by using NOMADS for the same services.
- ▶ “NOMADS” services (OPeNDAP, GDS, LAS, TDS, [ftp4u](#)) being considered for “NOAA NexGen”.



Priorities for Development at NCDC

- ▶ Prepare for servicing NOAA's next suite of Reanalysis projects (1.5 Petabytes).
- ▶ Climate and Weather Observing System Simulation Experiment Capability (OSSE's)
- ▶ New Data and Models:
 - Development of a Reanalysis Clearinghouse capability for an "on-going analysis of the climate system"
 - AR5 subsets, Regional Climate Models, TIGGE, YOTC
- ▶ Develop requirements for the NOAA Climate Model Portal (NCMP).



NOMADS now Operational in NWS. New “Ocean-NOMADS”

- ▶ Archive and limited real-time services:
 - National Climatic Data Center (NCDC) Asheville, NC
 - National Ocean Data Center (NODC) Charleston, SC
- ▶ Operational National Weather Service (NWS) real-time (R/T NOMADS) services:
 - Fort Worth, TX
 - Boulder, CO
 - Silver Spring, MD



NOAA NOMADS Services

- ▶ Near-real-time services supported by NCDC is available at <http://nomads.ncdc.noaa.gov/>. This server provides
 - access to most of NCEP's operational data sets
 - a long-term archive for all data sets
 - many other data sets (see <http://nomads.ncdc.noaa.gov/data.php?name=inventory>)
 - A non-operational research and development server (and developing ESG node) managed by NCDC is available at http://nomads6.ncdc.noaa.gov/ncep_data/index.html
- ▶ A real-time server supported 24x7 by NCEP is available at <http://nomads.ncep.noaa.gov/>. This server provides
 - access to NCEP's operational data sets as they are being generated
 - a short-term archive of up to a month for most data sets
 - 24x7 operational monitoring by NCEP staff
 - a geographically-diverse backup server to insure operational availability
- ▶ Four non-operational research and development servers used for customer testing of new products and services prior to operational implementation
 - These servers are not guaranteed to have current data and their content are supported only during business hours and on the basis of staff availability. Three non-operational research and development servers managed by NCEP are available at
 - http://nomad1.ncep.noaa.gov/ncep_data/index.html
 - http://nomad3.ncep.noaa.gov/ncep_data/index.html
 - http://nomad5.ncep.noaa.gov/ncep_data/index.html
- ▶ The new “Ocean-NOMADS at http://edac-dap2.northerngulfinstitute.org/ocean_nomads/. This server provides most NCEP and some Navy Ocean Models.



NOMADS Data at NCDC

NWP Model

- ▶ Global Forecast System (GFS), 1 and ½ degree
March 2004 – Present, October 2006 - Present
- ▶ NCEP Spectral Statistical Interpolation (SSI) Global Data
Assimilation System (GDAS) w/ restart files
January 2001 - Present
- ▶ North American Mesoscale (NAM, formally Eta) 12km
February 2005 - Present
- ▶ Rapid Update Cycle (RUC) 20km and 13km
January 2006 – Present, March 2007 - Present
- ▶ NCEP North American Regional Reanalysis (NARR) 30 years 32km
January 1979 - Present
- ▶ NCEP/NCAR/DOE R1 & R2 Global Reanalysis
Jan 1948 – Present, Jan 1979 - Present
- ▶ NCEP Global Ensembles
December 2007 - Present
- ▶ NCEP Climate Forecast System Reanalysis & Reforecast (CFSRR)
January 1979 – Present
- ▶ NCEP/CPC Climate Prediction Center Reanalysis (CPCR)
January 1944 – Present
- ▶ NCEP 20th Century Reanalysis
January 1891 - Present

In situ

- ▶ NCDC Global Historical Climate Network (GHCN) Temp/Precip
Jan 1880 – Present, Jan 1900 - Present
- ▶ NCDC Integrated Global Radiosonde Archive (IGRA) upper air
Varies by station
- ▶ NCDC Smith-Reynolds Extended Reconstructed and OI ¼ SST's
Jan 1854 – Present, Jan 1985 – Present
- ▶ Service Records Retention System (SRRS)
April 2001 - Present

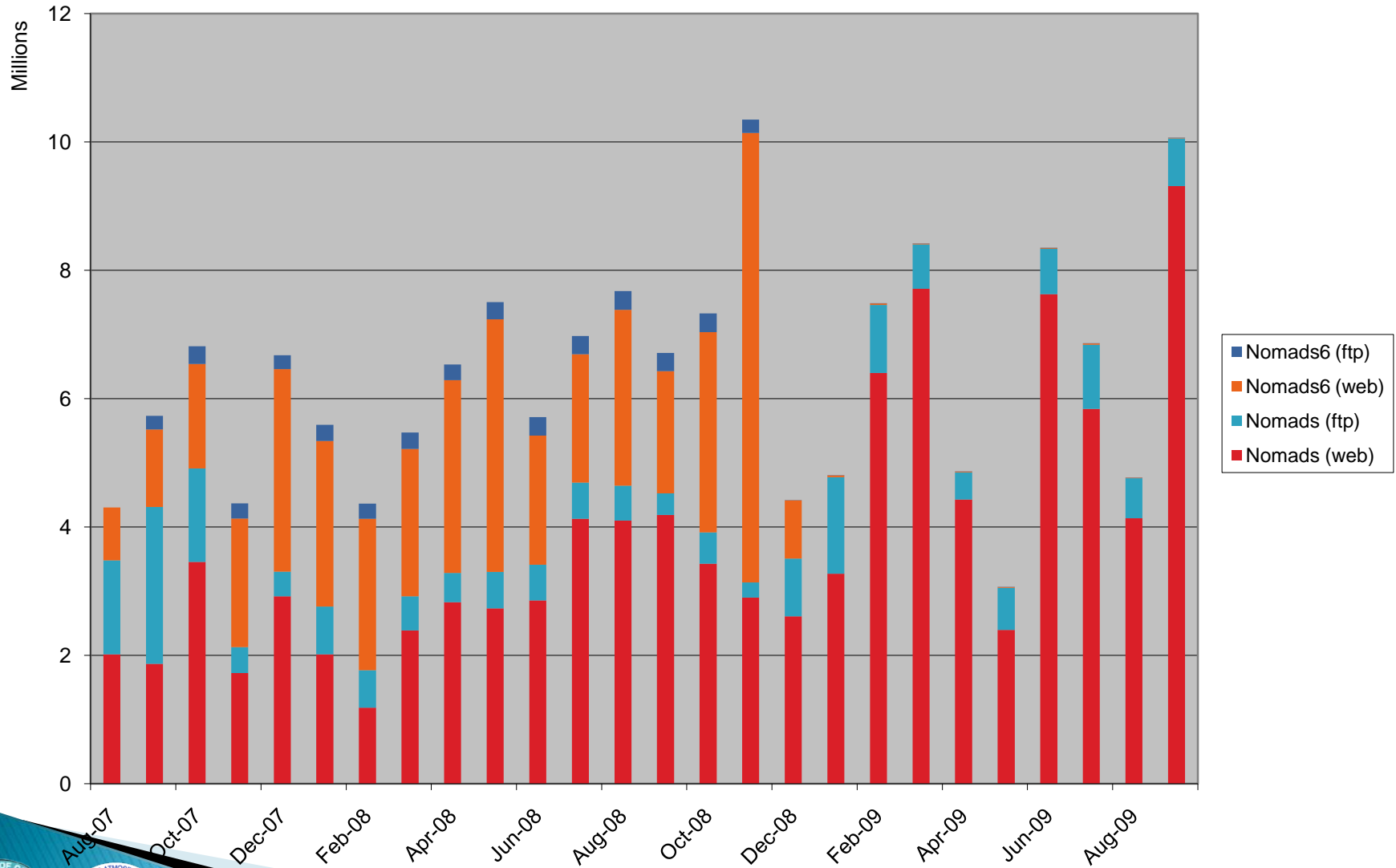
Climate Data / Coupled AOGCM

- ▶ Limited GFDL CM2.0 and CM2.1 Climate Experiments
Limited AR4
- ▶ Paleoclimate Model Intercomparison Project (PMIP)
AR4



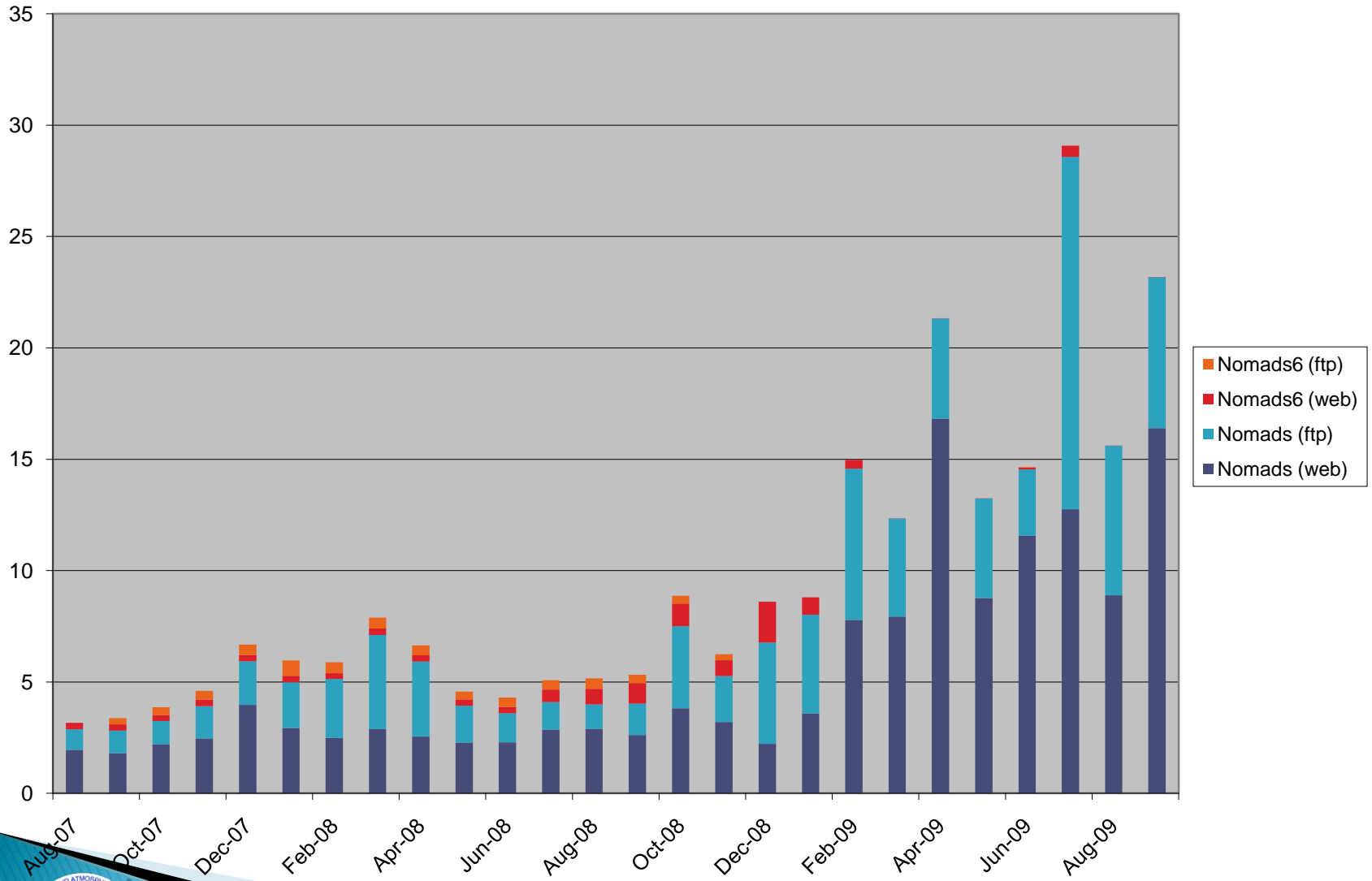
NCDC

NOMADS Model Data Requests (millions)

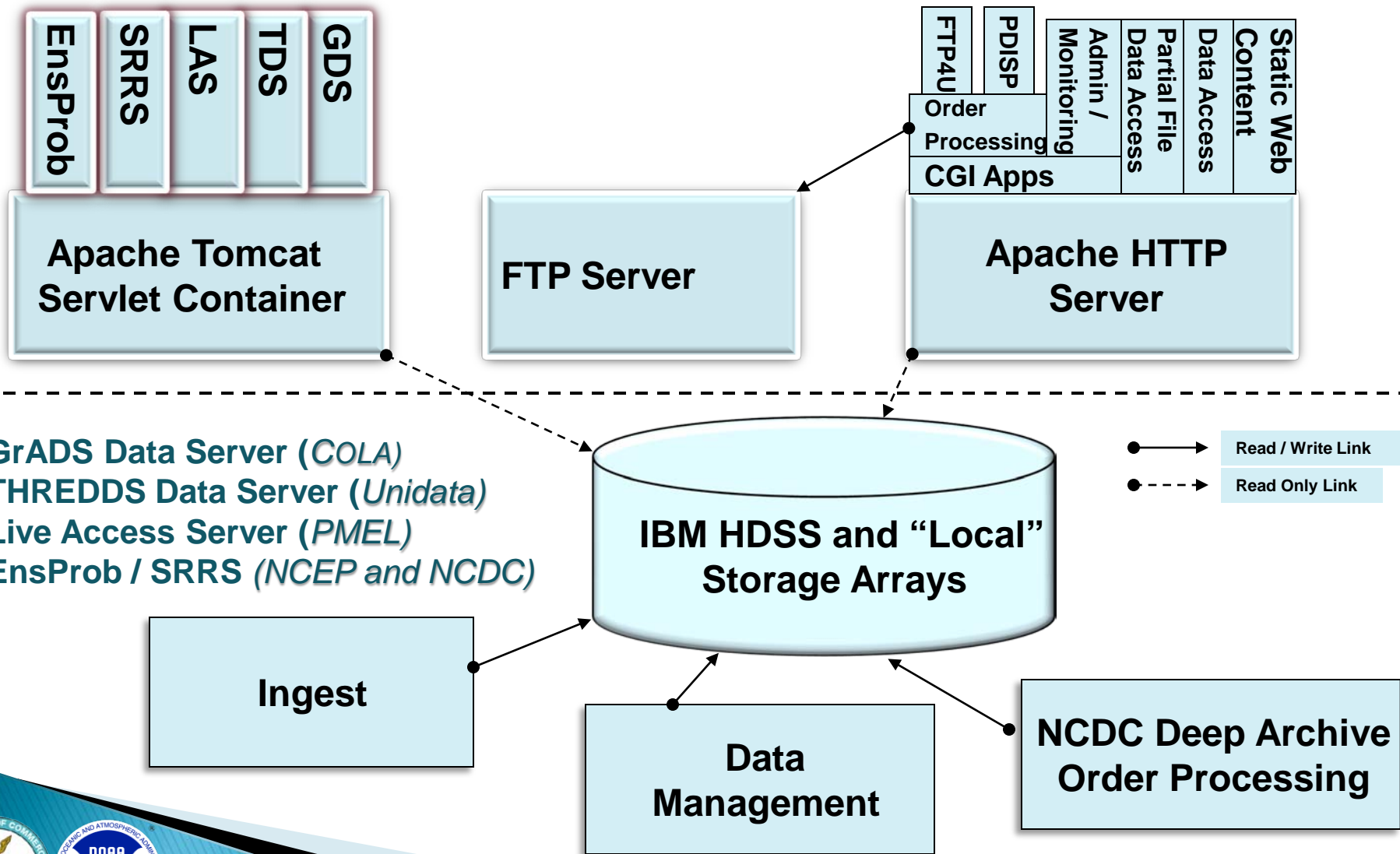


NCDC

NOMADS Model Data Downloads (TB)



NOMADS Architecture



NOMADS Ensemble Probability Tool

PDF's on the fly

NOMADS Ensemble
Probabilities on the fly:

20 model runs

30 fcst projections

10 days of forecast

The NOMADS Ensemble Probability Tool is a tool that is designed to allow users to interrogate the NCEP Global Ensemble model. The tool allows the user to describe a set of conditions and determine the probability that that set of conditions will occur at a given location.

The NOMADS Ensemble Probability Tool queries the 21 member GFS ensemble dataset located on the NCEP NOMADS High Availability server. The data is passed via OpenDAP back to the application, where it is read using the Java NetCDF library, and then the probabilities are calculated.

For more information, please see our [help page](#).

Where

Station ID
 Lat (-90 to 90) Lon (-180 to 180)

When

Latest model run (2009 Oct. 23 06z)
 Year Month Date Model Run

What

Air Temperature at 2 meter height
 6 hour Highest temperature
 6 hour Lowest temperature
 Precipitation
 Wind at 10 meter height
 Cloud Cover
 Air Temperature at 850 millibar pressure level
 Convective Available Potential Energy (CAPE)

Request

Location:
Asheville, Asheville Regional Airport, NC, United States (35-25-55N, 082-32-15W)
Time:
Oct 23, 2009 06z
Event:
where the highest temperature is greater than 65 degrees F.

Progress

Results

Probability that the event will occur

NOMADS Ensemble Probability Tool

Probability that the following event will occur:
where the highest temperature is greater than 65 degrees F.

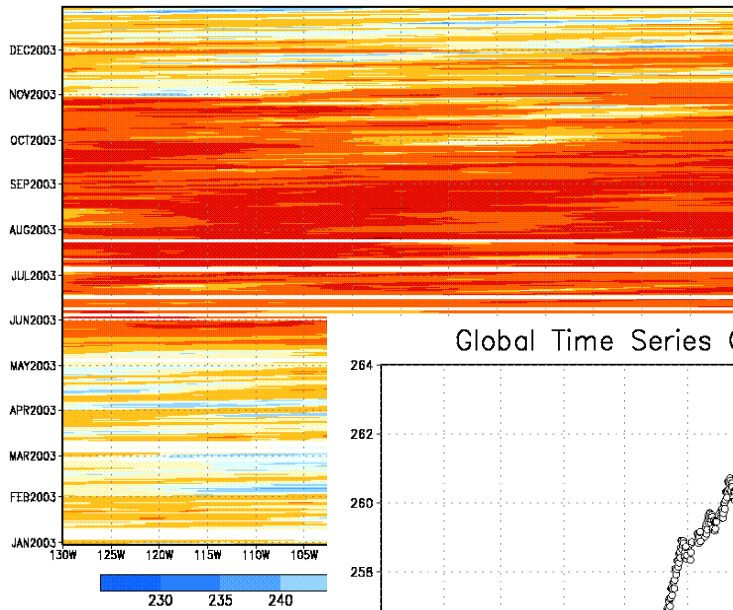
At the location:
Asheville, Asheville Regional Airport, NC, United States (35-25-55N, 082-32-15W)

For the GENS model run at the given time:
Oct 23, 2009 06z

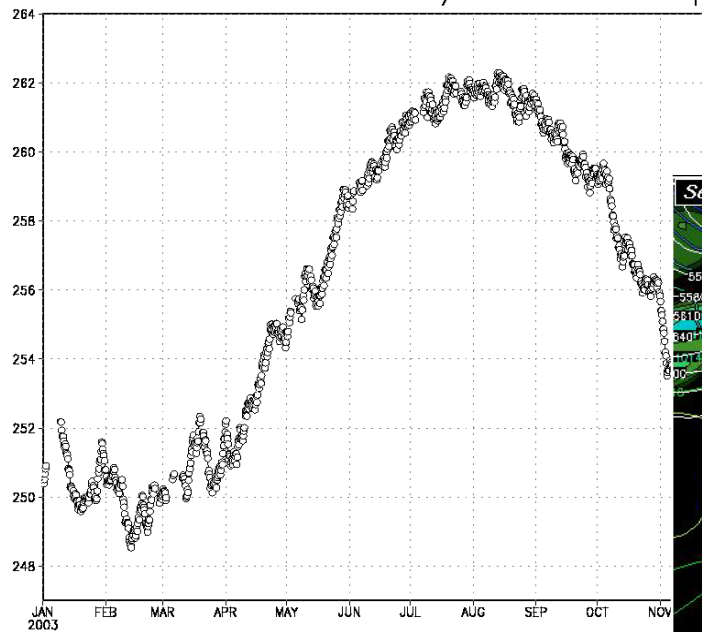


NOMADS Output Samples

30 degree lat CONUS Hovmoller 500mb ANAL 2003

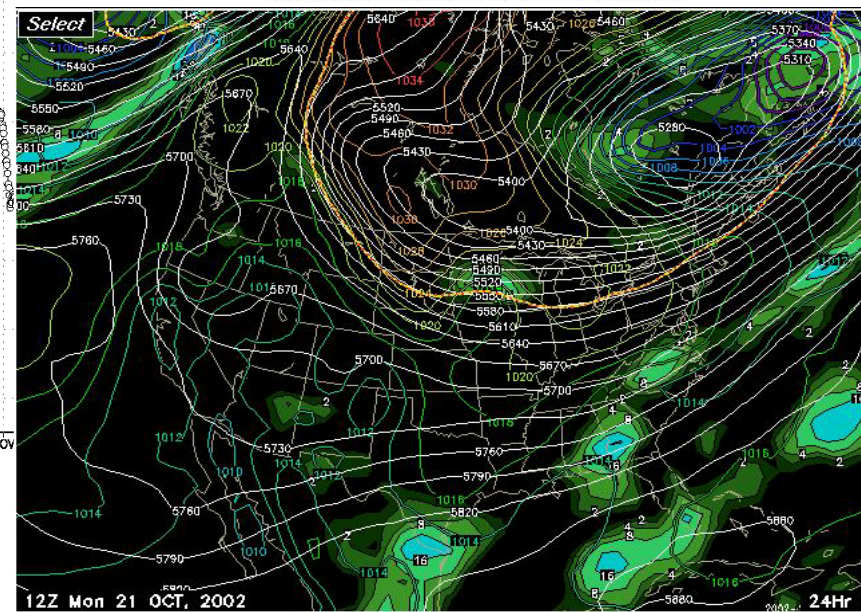
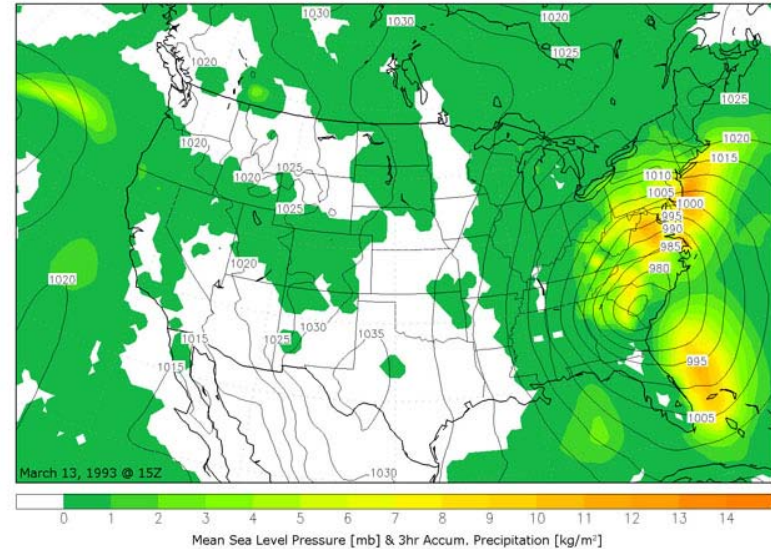


Global Time Series GFS/AVN 500mb Temp



Server side graphics


Storm of the Century
North American Regional Reanalysis




New NOAA Reanalysis Projects

<http://nomads.ncdc.noaa.gov/NOAAReanalysis/>

- 1) Historical SFC Reanalysis (Compo et al.)
 - 1850 to present. ~60TB
- 2) Post WW-II Reanalysis (NCEP/CPC)
 - 1944 to present. ~235TB
- 3) Climate Forecast System Reanalysis and Reforecast (CFSRR) Project (Saha et al.)
 - 1978-2009 modern era Reanalysis and Seasonal Reforecast ~250TB




NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)




National Climatic Data Center
U.S. Department of Commerce

The NOAA Reanalysis Community Forum




NCDC

National Climatic Data Center



NCEP

National Centers for Environmental Prediction



CIRES

Earth System Research Laboratory

Overview

NOAA is the lead agency responsible for monitoring and predicting climate variability over the globe extending from daily, monthly, seasonal and longer time scales. A key requirement for meeting NOAA's responsibility is the availability of historical analysis (also referred to as reanalysis) for the ocean, the atmosphere, land, and cryosphere.

Reanalysis is crucial for monitoring climate variability and its trends. At the same time, reanalysis, by providing a comprehensive spatial and temporal depiction of the state of the climate system, is also essential for improving seasonal prediction and validation activities. Advances in models, improved data assimilation methods, and new data sources make it desirable and feasible for NOAA to develop and continually update global reanalysis datasets.

Reanalysis Product Suite

NOAA's next reanalysis product suite is currently underway. NOAA is developing three new reanalysis datasets on three different time scales:

1. the coupled Climate Forecast System Reanalysis and Reforecast (CFSRR) 1979-present,
2. the Climate Prediction Center Reanalysis (CPCR) 1950-present, and
3. the 20th Century Reanalysis 1850-present.

New: working for distributed access at NCAR !



Bulk Request Front-End

A standard offline data request enables more capabilities, but takes longer to process and time series are limited.

Selecting 'Bulk Request' removes most of the selection options, but delivers unaltered .tar files from the archive to a FTP server via HDSS.

Select a date range

From: Year Month Day
2009 September 30
To: Year Month Day
2009 September 30

Bulk Order Bulk Request

A bulk data request retrieves .tar files containing all available variables and forecast hours for the selected date range. All bulk requests are pulled from the offline archive.

Cycles

All
 0000 0600 1200 1800

Forecast Hours

All
 000 003 006 009 012 015 018 021
 024 027 030 033 036 039 042 045
 048 051 054 057 060 063 066 069
 072 075 078 081 084 087 090 093
 096 099 102 105 108 111 114 117
 120 123 126 129 132 135 138 141
 144 147 150 153 156 159 162 165
 168 171 174 177 180

Build Options [explanation](#)

- Generate control file for analysis fields over all cycles
 Generate QuickPlots for supported datasets

Submit Data Request

[Select New Model or Grid](#)

RESET

Select a date range

From: Year Month Day
2009 September 30
To: Year Month Day
2009 September 30

Bulk Order Bulk Request

A bulk data request retrieves .tar files containing all available variables and forecast hours for the selected date range. All bulk requests are pulled from the offline archive.

Cycles

All
 0000 0600 1200 1800

Forecast Hours

Build Options [explanation](#)

Submit Data Request

[Select New Model or Grid](#)

RESET

New NOMADS-Next Backend

- ▣ NCDC NOMADS : PERL Module
 - ▣ Allows both front-end CGI and back-end data management systems integrated access to dataset configuration and metadata, module and API functions, with minimal third party dependencies.
 - ▣ Contains over 85 independent and reusable functions
 - ▣ Easier to install and update
 - ▣ Integrates a system-wide XML dataset configuration file which can be utilized by any front or back-end application using the module.
 - ▣ Deprecates the previous NOMADS back-end which consisted of numerous script tool packages, which were often incompatible with each other and were generally not reusable code.

- ▣ NOMADS – Hierarchal Access System (N-HAS) for HDSS Deep Archive
 - ▣ PERL module in development: built on top of NCDC NOMADS
 - ▣ Covers the existing primary N-HAS processes: gather/submit/process/deliver, with disk checks and throttles to prevent overloading.
 - ▣ [gather] Collects data requests from any machine capable of taking them.
 - ▣ [submit] Builds then sends a HAS request using the NCDC NOMADS dataset config file.
 - ▣ [process] Breaks apart and processes archive files and places the results onto the stage disk
 - ▣ [deliver] Completes data requests to their machine of origin.
 - ▣ Will support differentiation between offline and bulk data requests

NCMP Introduction

Objectives

The FY10-FY14 National Climate Model Portal (NCMP) will:

- Ensure readiness of access to NOAA’s next generation Climate and Weather reanalysis
 - Increase capacity to handle large data volumes and high user demand
 - Develop enhanced access trees for public and NOAA Operational and Research Centers.
- ▶ Provide long term stewardship of NOAA’s models
- ▶ Develop and staff a model “HelpDesk” capability to ensure model data output is used appropriately to reduce errors and public expectation of model results.
- ▶ Leverage existing efforts under GEO-IDE and community efforts such as GIP and GO-ESSP.

The investment will be distributed between technical portal architecture development, archive access and stewardship capabilities and a customer service “HelpDesk”.



NCMP Introduction

FY10 Program

- ▶ Initially this program will provide NOAA's sole portal into the following climate model reanalysis products with a volume of approximately 1.5 petabytes:
 - Coupled Climate Forecast System Reanalysis and Reforecast (CFSRR) dataset, a “modern era reanalysis”. It is the first coupled 30 year global reanalysis of the atmosphere, ocean, land, and cryosphere (sea ice) ever developed by NOAA;
 - Climate Prediction Center Reanalysis (CPCR), a historical upper-air (RAOB) reanalysis that is a long time series (1908-1958);
 - The 20th Century Reanalysis Project Surface Pressure Reanalysis (1850 to present) by the Earth System Research Laboratory (ESRL).
- ▶ The development of a coordinated NOAA Climate Model capability including GIP and others including existing external partners at NASA, NSF, Unidata, LLNL (PCMDI), and International.



NCMP Introduction

Why NCMP?

- ▶ Community building and collaborations are required in the era of 150PB model output data streams- digital libraries, distributed data access and processing.
- ▶ Adaptation of modeling capabilities to CLASS (backend data storage) infrastructure a priority not currently being addressed.
- ▶ To advance collaborations. To include:
 - GIP
 - NESII
 - Earth Systems Modeling Framework (ESMF);
 - Earth Systems Grid (ESG);
 - iRODS and other community based distributed access technologies;
- ▶ Historical access a key in improving models
- ▶ Users at all levels of expertise expect easy access.
- ▶ Not only retrieve data, but request NOAA provide answers to questions for various Stakeholders: Energy Sector; Agriculture; Transportation; Civil Engineering



NCMP Introduction

National Academies of Science Recommendation

- ▶ **National Academies of Sciences, National Research Council, Board of Atmospheric Sciences and Climate:**

“Completing the Forecast: Characterizing and Communicating Uncertainty for Better Decisions Using Weather and Climate Forecasts”

The NOAA National Operational Model Archive and Distribution System (NOMADS) should be maintained and extended to include (a) long-term archives of global and regional ensemble forecasting systems and their native resolution, and (b) re-forecast datasets to facilitate post-processing”¹

- ▶ **NCMP will be an extension and an expansion of NOMADS:**



NCMP Design Elements

Presentation Layer

3) Expert

Modeler Access {1.3.1}

Ensemble Diagnostics {1.3.2}

Observation System Simulation Experiment (OSSE) capability (1.3.3)

Sub-setting data, & datasets for targeted orders {1.3.4}

model diagnostics, uncertainty PDF's generation, downscaling, Regional Climate users; impacts, initialization access, etc.

{2.4}

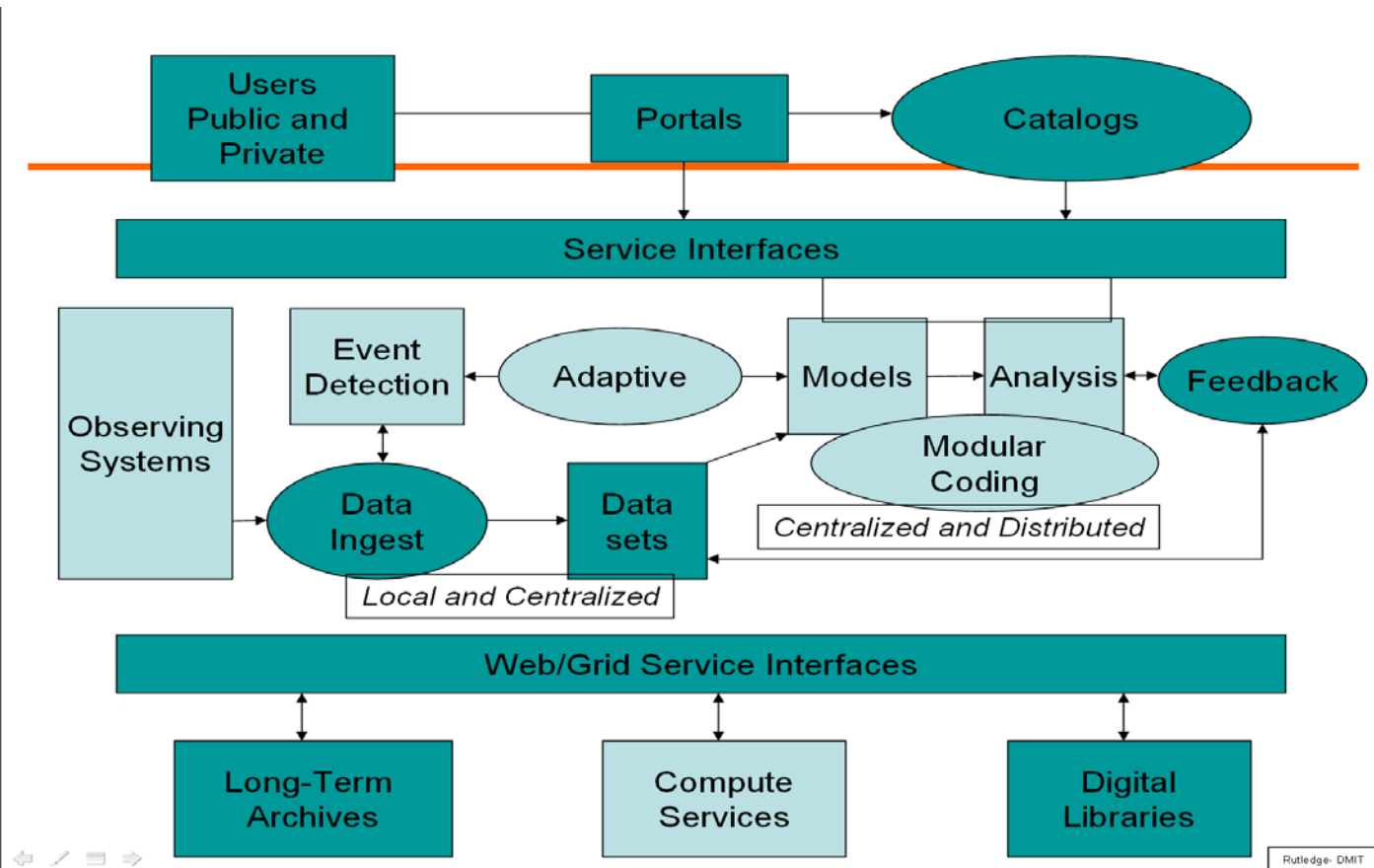
Broadcast
{4.5}

- Provide **simple**, predefined weather information (reports, charts, visuals, etc.) for general public consumption. Provide little or no options while requesting the data.
- Provide **targeted**, predefined weather information (reports, charts, visuals, etc.) for specific educational and industry requirements such as agriculture and insurance. Provide access to only a few sub-setting options.
- Provide **expert** access to the full range of NOMADS capabilities for scientists and meteorologists. Allow sub-setting along 5 dimensions: longitude, latitude, level, time (2), and variable.

- LDM
- NCDC ftp
- CLASS
- others

NCMP Conceptual Design

NCMP addressing a gap for model services in NOAA: GEO-IDE *
 Green boxes indicate collaborative scope of NCMP



Rutledge- DMIT



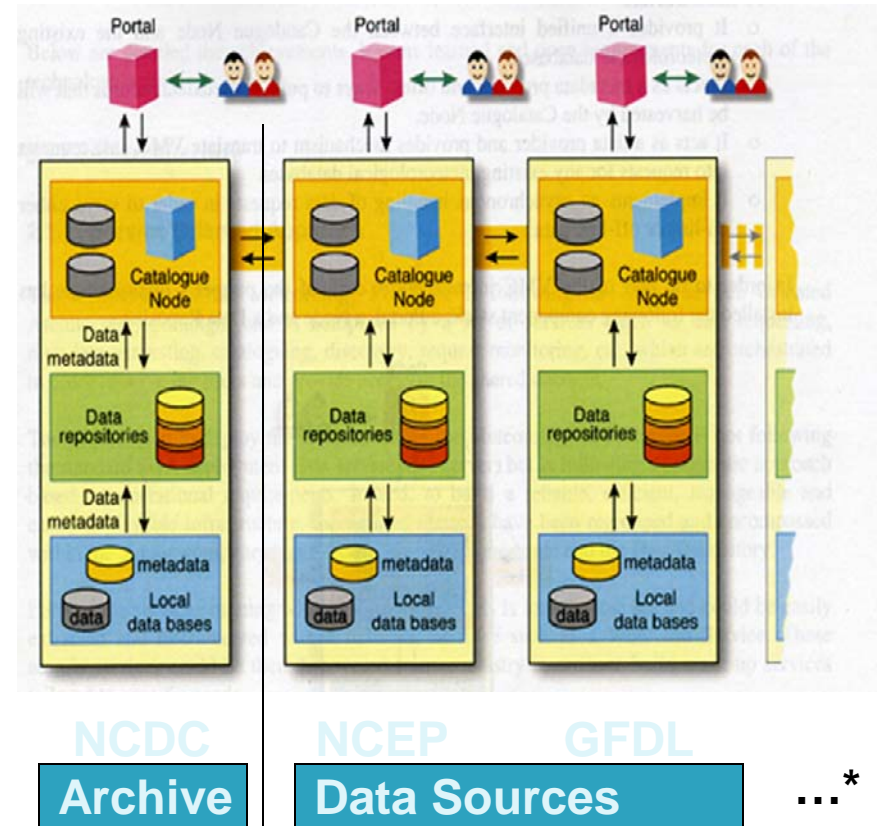
NCMP Introduction

Architectural Fit: Phase 1: An Earth System Grid Node

The initial NCMP architecture is based on NOMADS and on the DOE ESG: a (advanced) Portal, the ESG/TDS Catalog Node, and the (local) Data Repository.

- 1) The Portal is the user's real-time interface to the system, manage requests, download data, receive user input and catalog browsing.
- 2) The Catalog Node advance and leverage ESG/TDS. Heart of collaboration and concentrates on connecting partners, metadata, search and discovery and secure peer-to-peer connectivity.
- 3) the Data Repository will be based on advanced real-time access components, advancements to CLASS, and will also use the Data Center IT infrastructure for long term storage and access

Generalized Schematic



NCDC
Archive

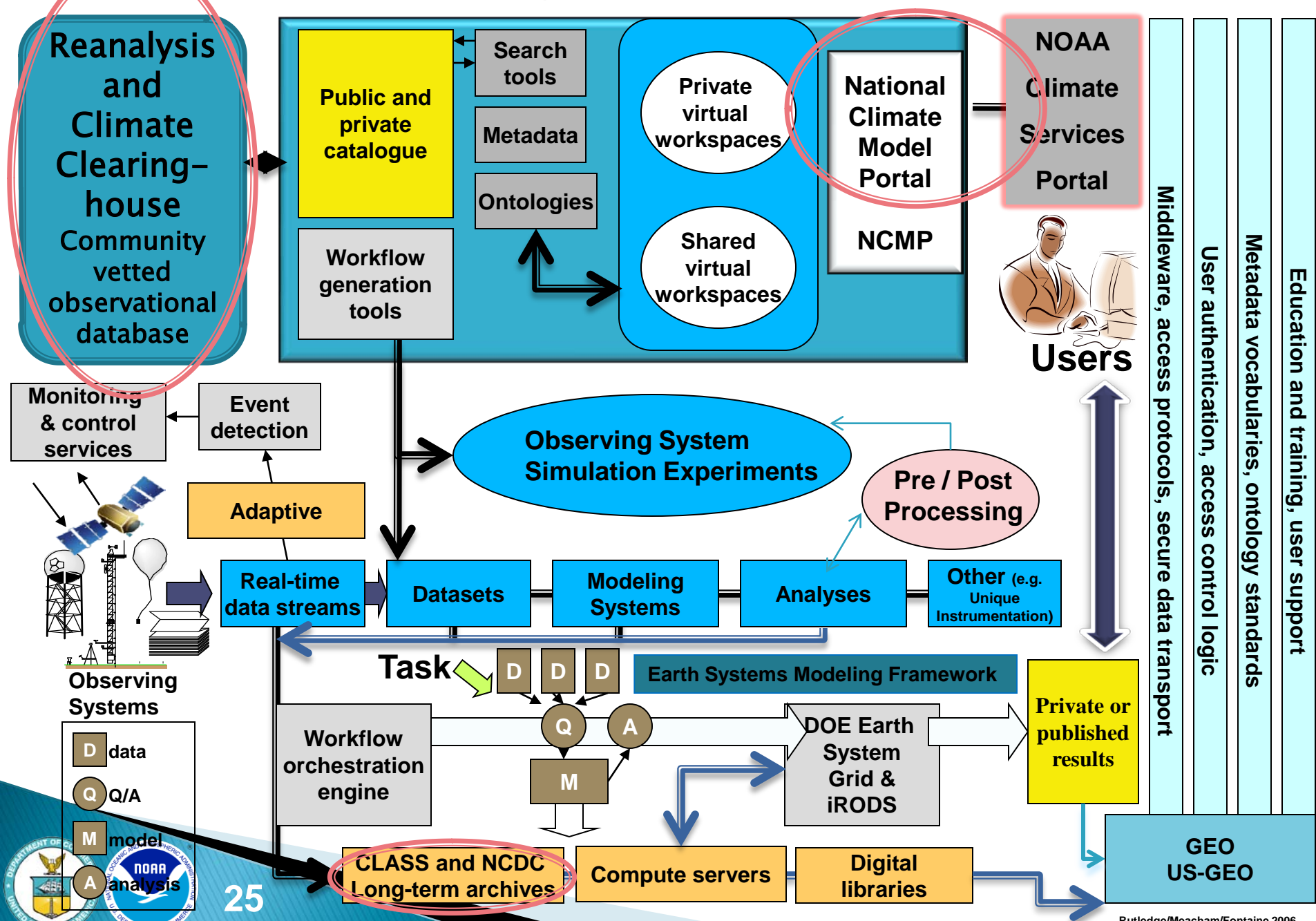
NCEP
Data Sources

GFDL

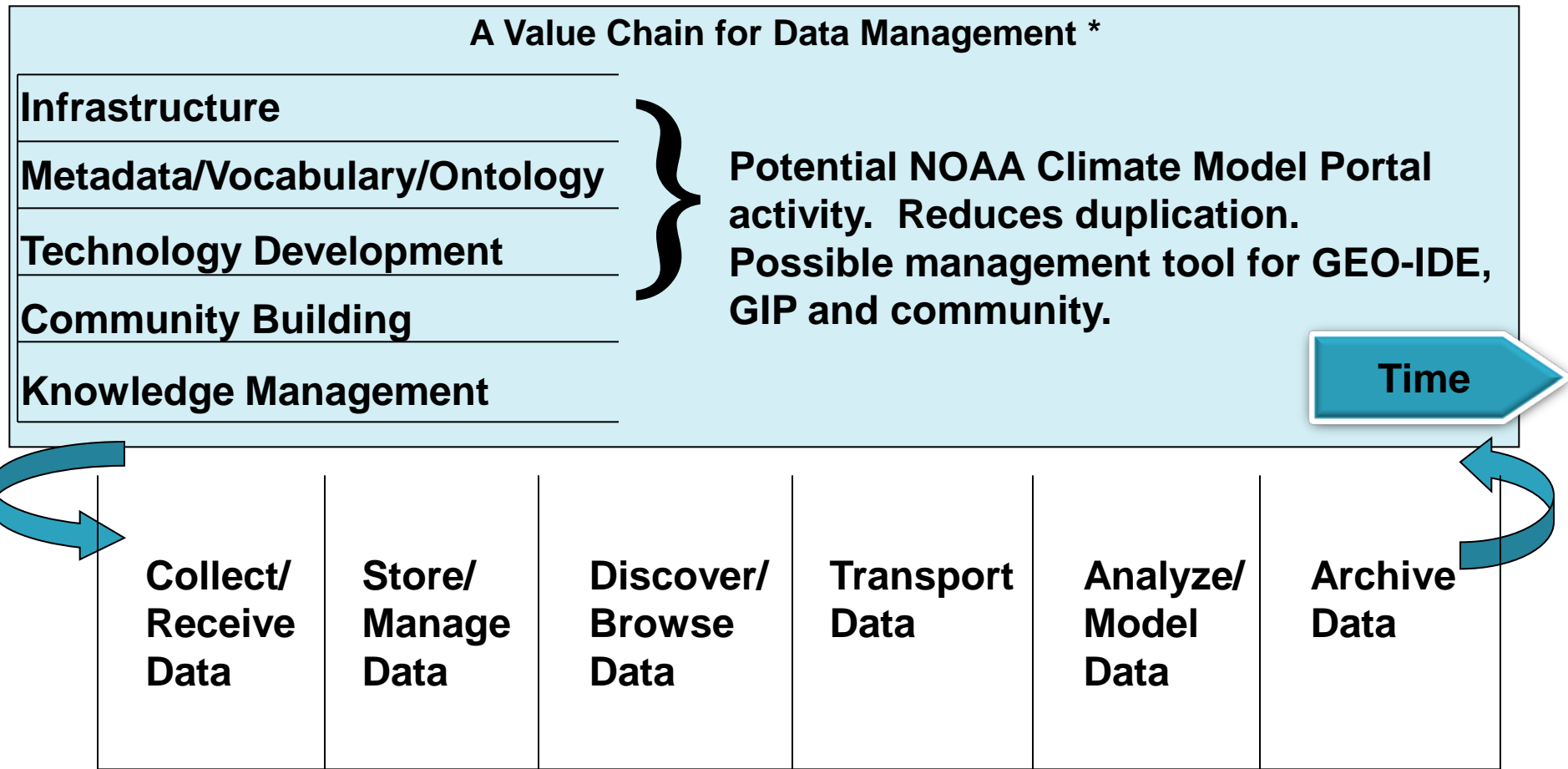
...*

- Collaborators may include EPA, DOI, NASA & other US-GEO participants

A US-GEO Modeling Infrastructure Vision of the Future



Leveraging NOAA's Resources and Managing Community Activities ?



Functions

Functions add value to the raw material (in this case, data) to produce a product for Policy and Management Decisions

It is an iterative spiral approach



NCMP Architecture and Data Management Philosophy

- ▶ Different combinations of community assets will solve different problems
- ▶ Can be tailored to current near-term solutions
- ▶ Effective use of existing portals for data access and distribution, and for existing transport technologies will increase chances of success.
- ▶ NCMP will participate in a broader NOAA-wide framework for a comprehensive suite of modeling services.

Next Steps for NCMP

- ▶ Establish a NOAA Climate Model Portal Governance Team
 - How best to collaborate; define requirements & coordinate?
- ▶ Develop “sector-based” front end
- ▶ Support CF via grants / NOAA Climate Institute
- ▶ Develop Charter, Project Plan; Establish Collaborators
 - Advance NOAA collaborations and coordinate w/ NESII
 - Participate in GIP and GEO-IDE.
 - Workshops proposed: GO-ESSP; Model-to-Obs wkshp for CMIP
- ▶ Establish a joint CLASS and Data Center user requirements team to develop Level-1 (A-SPEC) access requirements for model data.



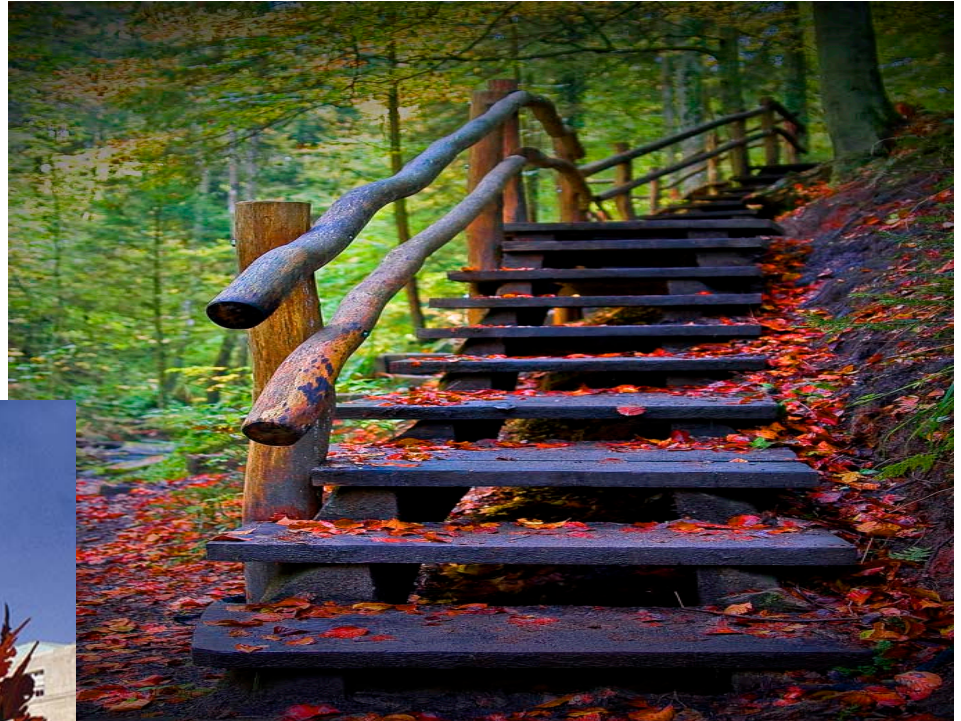
In Summary

- ▶ NOMADS “bulk-order” ftp capability providing basic user access for high volume NOAA ECIP reanalysis output completed.
- ▶ NOMADS to evolve to NCMP and partner across NOAA’s modeling efforts, leveraging resources and assets.
- ▶ NCMP to develop and support a model “HelpDesk” at NCDC in collaboration with NOAA partners.

THANK – YOU !

QUESTIONS ?

Glenn.Rutledge@noaa.gov



**In development:
NCDC Spring 2010 model - to-
Obs Inter-comparison
Workshop to support CMIP**



Massive Data volume: CFSRR

- ▶ Coupled Climate Forecast System (CFS) Reanalysis and Reforecast (CFSRR) (Atm - Ocn - Land – Sealce) in two projects:
 - Reanalysis: 31-year (1979-2009) T384L64 (~32 km and 64 hybrid layers for the atmosphere, 0.5° and 40 levels for the ocean, 4 soil levels)
To be released in Jan 2010 via NOMADS / NCDC and NCAR (tbd)
 - Reforecast: 28-year (1982-2009) T126L64 (~32 km and 64 hybrid layers for the atmosphere, 0.5° and 40 levels for the ocean, 4 soil levels) 6 hourly Reforecast for 1 year
- ▶ Approximately ~500 Terabytes in GRIB2.
- ▶ NCDC and NCEP seeking community input for access priorities to this massive dataset. For the NOMADS Survey site see:

<http://nomads.ncdc.noaa.gov/NOAAREanalysis/>

CFS Reanalysis Monthly Means

CFS Reanalysis Monthly Mean Files (22 file types):			
FILE NAME FIELD	FILE NAME FIELD DEFINITION	GRID RESOLUTION	VERTICAL LEVELS
diabf	Full-Resolution 3-D Diabatic Heating and Moistening Rates	1.0 x 1.0 Deg Lat/Lon	37 Pressure (hPa) Levels
diabl	Low-Resolution 3-D Diabatic Heating and Moistening Rates	2.5 x 2.5 Deg Lat/Lon	37 Pressure (hPa) Levels
egyh	High-Resolution 3-D Forecast Energetics Data	0.5 x 0.5 Deg Lat/Lon	37 Pressure (hPa) Levels
egyhnl	High-Resolution 3-D Analysis Energetics Data	0.5 x 0.5 Deg Lat/Lon	37 Pressure (hPa) Levels
egyl	Low-Resolution 3-D Forecast Energetics Data	2.5 x 2.5 Deg Lat/Lon	37 Pressure (hPa) Levels
egylnl	Low-Resolution 3-D Analysis Energetics Data	2.5 x 2.5 Deg Lat/Lon	37 Pressure (hPa) Levels
flxf	Full-Resolution Surface and Radiative Fluxes	T382 Gaussian	N/A
flxl	Low-Resolution Surface and Radiative Fluxes	T62 Gaussian	N/A
ipvh	High-Resolution 3-D Forecast Isentropic Data	0.5 x 0.5 Deg Lat/Lon	16 Isentropic (K) Levels
ipvhnl	High-Resolution 3-D Analysis Isentropic Data	0.5 x 0.5 Deg Lat/Lon	16 Isentropic (K) Levels
ipvl	Low-Resolution 3-D Forecast Isentropic Data	2.5 x 2.5 Deg Lat/Lon	16 Isentropic (K) Levels
ipvlnl	Low-Resolution 3-D Analysis Isentropic Data	2.5 x 2.5 Deg Lat/Lon	16 Isentropic (K) Levels
ocnf	Full-Resolution 3-D Ocean data	1.0 x 1.0 Deg Lat/Lon	40 Depth (m) Levels
ocnh	High-Resolution 3-D Ocean data	0.5 x 0.5 Deg Lat/Lon	40 Depth (m) Levels
pgbh	High-Resolution 3-D Forecast Pressure Level Data	0.5 x 0.5 Deg Lat/Lon	37 Pressure (hPa) Levels
pgbhnl	High-Resolution 3-D Analysis Pressure Level Data	0.5 x 0.5 Deg Lat/Lon	37 Pressure (hPa) Levels
pgbl	Low-Resolution 3-D Forecast Pressure Level Data	2.5 x 2.5 Deg Lat/Lon	37 Pressure (hPa) Levels
pgblnl	Low-Resolution 3-D Analysis Pressure Level Data	2.5 x 2.5 Deg Lat/Lon	37 Pressure (hPa) Levels
splanl	High-Resolution Surface Analysis Data	T382 Gaussian	N/A
sp1f	High-Resolution Surface Forecast Data	T382 Gaussian	N/A
sp1l	Low-Resolution Surface Forecast Data	T62 Gaussian	N/A
sp1nl	Low-Resolution Surface Analysis Data	T62 Gaussian	N/A

2TB

CFSRR Hi- Priority Time Series

CFS Reanalysis Timeseries Files (77 file types):		
FILE NAME FIELD	FILE NAME FIELD DEFINITION	GRID RESOLUTION
chi200	Velocity Potential at 200 hPa	0.5 x 0.5 Deg Lat/Lon
chi850	Velocity Potential at 850 hPa	0.5 x 0.5 Deg Lat/Lon
dlwsfc	Surface Downward Long Wave Flux	T382 Gaussian
dswsfc	Surface Downward Short Wave Flux	T382 Gaussian
gflux	Ground Heat Flux	T382 Gaussian
icecon	Ice Concentration	T382 Gaussian
icethk	Ice Thickness	T382 Gaussian
ipv450	Potential Vorticity at 450 K Isentropic Level	0.5 x 0.5 Deg Lat/Lon
ipv550	Potential Vorticity at 550 K Isentropic Level	0.5 x 0.5 Deg Lat/Lon
ipv650	Potential Vorticity at 650 K Isentropic Level	0.5 x 0.5 Deg Lat/Lon
lhtfl	Latent Heat Flux	T382 Gaussian
ocndt20c	Depth of 20C Isotherm	0.5 x 0.5 Deg Lat/Lon
ocnheat	Ocean Heat Content	0.5 x 0.5 Deg Lat/Lon
ocnmid	Ocean Mixed Layer Depth	0.5 x 0.5 Deg Lat/Lon
ocsal15	Ocean Salinity at Depth of 15m	0.5 x 0.5 Deg Lat/Lon
ocsal5	Ocean Salinity at Depth of 5m	0.5 x 0.5 Deg Lat/Lon
ocnslh	Sea Level Height	0.5 x 0.5 Deg Lat/Lon
ocnsst	Sea Surface Temperature	0.5 x 0.5 Deg Lat/Lon
ocnt15	Ocean Potential Temperature at Depth of 15m	0.5 x 0.5 Deg Lat/Lon
ocnu15	Ocean Zonal (u) Current at Depth of 15m	0.5 x 0.5 Deg Lat/Lon
ocnu5	Ocean Zonal (u) Current at Depth of 5m	0.5 x 0.5 Deg Lat/Lon
ocnv15	Ocean Meridional (v) Current at Depth of 15m	0.5 x 0.5 Deg Lat/Lon
ocnv5	Ocean Meridional (v) Current at Depth of 5m	0.5 x 0.5 Deg Lat/Lon
ocnv55	Ocean Vertical Velocity at Depth of 55 m	0.5 x 0.5 Deg Lat/Lon
prate	Precipitation Rate	T382 Gaussian
pressfc	Surface Pressure	T382 Gaussian
prmsl	Mean Sea Level Pressure	T382 Gaussian
psi200	Streamfunction at 200 hPa	0.5 x 0.5 Deg Lat/Lon
psi850	Streamfunction at 850 hPa	0.5 x 0.5 Deg Lat/Lon
pwat	Precipitable Water	T382 Gaussian
q2m	2m Specific Humidity	T382 Gaussian
q500	Specific Humidity at 500 hPa	0.5 x 0.5 Deg Lat/Lon
q700	Specific Humidity at 700 hPa	0.5 x 0.5 Deg Lat/Lon
q850	Specific Humidity at 850 hPa	0.5 x 0.5 Deg Lat/Lon
q925	Specific Humidity at 925 hPa	0.5 x 0.5 Deg Lat/Lon
runoff	Ground Runoff	T382 Gaussian
shtfl	Sensible Heat Flux	T382 Gaussian

snohf	Snow Phase-Change Heat Flux	T382 Gaussian
soilm1	Soil Moisture Level 1 on T382 Gaussian Grid	T382 Gaussian
soilm1x0.5	Soil Moisture Level 1 on 0.5 x 0.5 Deg Lat/Lon Grid	0.5 x 0.5 Deg Lat/Lon
soilm2	Soil Moisture Level 2 on T382 Gaussian Grid	T382 Gaussian
soilm2x0.5	Soil Moisture Level 2 on 0.5 x 0.5 Deg Lat/Lon Grid	T382 Gaussian
soilm3	Soil Moisture Level 3 on T382 Gaussian Grid	T382 Gaussian
soilm3x0.5	Soil Moisture Level 3 on 0.5 x 0.5 Deg Lat/Lon Grid	0.5 x 0.5 Deg Lat/Lon
soilm4	Soil Moisture Level 4 on T382 Gaussian Grid	T382 Gaussian
soilm4x0.5	Soil Moisture Level 4 on 0.5 x 0.5 Deg Lat/Lon Grid	0.5 x 0.5 Deg Lat/Lon
soilt1	Soil Temperature Level 1	T382 Gaussian
swe	Snow Water Equivalent	T382 Gaussian
swex0.5	Snow Water Equivalent x 0.5	0.5 x 0.5 Deg Lat/Lon
t1000	Temperature at 1000 hPa	0.5 x 0.5 Deg Lat/Lon
t2	Temperature at 2 hPa	0.5 x 0.5 Deg Lat/Lon
t200	Temperature at 200 hPa	0.5 x 0.5 Deg Lat/Lon
t50	Temperature at 50 hPa	0.5 x 0.5 Deg Lat/Lon
t500	Temperature at 500 hPa	0.5 x 0.5 Deg Lat/Lon
t700	Temperature at 700 hPa	0.5 x 0.5 Deg Lat/Lon
t850	Temperature at 850 hPa	0.5 x 0.5 Deg Lat/Lon
tmax	Maximum 2m Air Temperature	T382 Gaussian
tmin	Minimum 2m Air Temperature	T382 Gaussian
tmp2m	2m Air Temperature	T382 Gaussian
tmphy1	Temperature at Hybrid Level 1	T382 Gaussian
tmprfc	Surface Temperature	T382 Gaussian
ulwsfc	Upward Long Wave Radiation at the Surface	T382 Gaussian
ulwtoa	Upward LW at the Top of Atmosphere	T382 Gaussian
uswsfc	Upward SW at the Surface	T382 Gaussian
uswtoa	Upward SW at the Top of Atmosphere	T382 Gaussian
vel500	Vertical Velocity at 500 hPa	0.5 x 0.5 Deg Lat/Lon
wnd1000	Zonal (u) and Meridional (v) Wind at 1000 hPa	0.5 x 0.5 Deg Lat/Lon
wnd10m	Zonal (u) and Meridional (v) Wind at 10m	T382 Gaussian
wnd200	Zonal (u) and Meridional (v) Wind at 200 hPa	0.5 x 0.5 Deg Lat/Lon
wnd500	Zonal (u) and Meridional (v) Wind at 500 hPa	0.5 x 0.5 Deg Lat/Lon
wnd700	Zonal (u) and Meridional (v) Wind at 700 hPa	0.5 x 0.5 Deg Lat/Lon
wnd850	Zonal (u) and Meridional (v) Wind at 850 hPa	0.5 x 0.5 Deg Lat/Lon
wndstrs	Zonal (u) and Meridional (v) Wind Stress at the Surface	T382 Gaussian
z1000	Geopotential at 1000 hPa	0.5 x 0.5 Deg Lat/Lon
z200	Geopotential at 200 hPa	0.5 x 0.5 Deg Lat/Lon
z500	Geopotential at 500 hPa	0.5 x 0.5 Deg Lat/Lon
z700	Geopotential at 700 hPa	0.5 x 0.5 Deg Lat/Lon
z850	Geopotential at 850 hPa	0.5 x 0.5 Deg Lat/Lon

20TB

