

A Data Sharing Framework for the HYCOM/GODAE NOPP Project

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HYCOM Workshop, Aug. 21, 2003

Our goal:

- Create a framework for sharing data that permits HYCOM modeling projects (and others) to browse, analyze and inter-compare model outputs and compare to observations

Why is this important?

- Facilitate collaboration between partners
- Facilitate model validation
- Increase the visibility and prestige of the project

The HYCOM/NOPP-GODAE collaboration is composed of independent organizations

- participants are “peers” -- each site managing and serving its own data
- it must not be burdensome to participate in the data sharing framework

data sharing framework \neq data management

Services to be provided by the (mature) data sharing framework

1. Through a Web browser

- View model outputs from all sites
- Download arbitrary subsets of data
(in user-selectable formats)
- Compare data
(difference and overlay models and observations)
- Compute basic statistics
(area averages, variances, ...)
- GODAE inter-comparison metrics
(to be defined by participants...)

Services to be provided by the (mature) data sharing framework

2. At the desktop

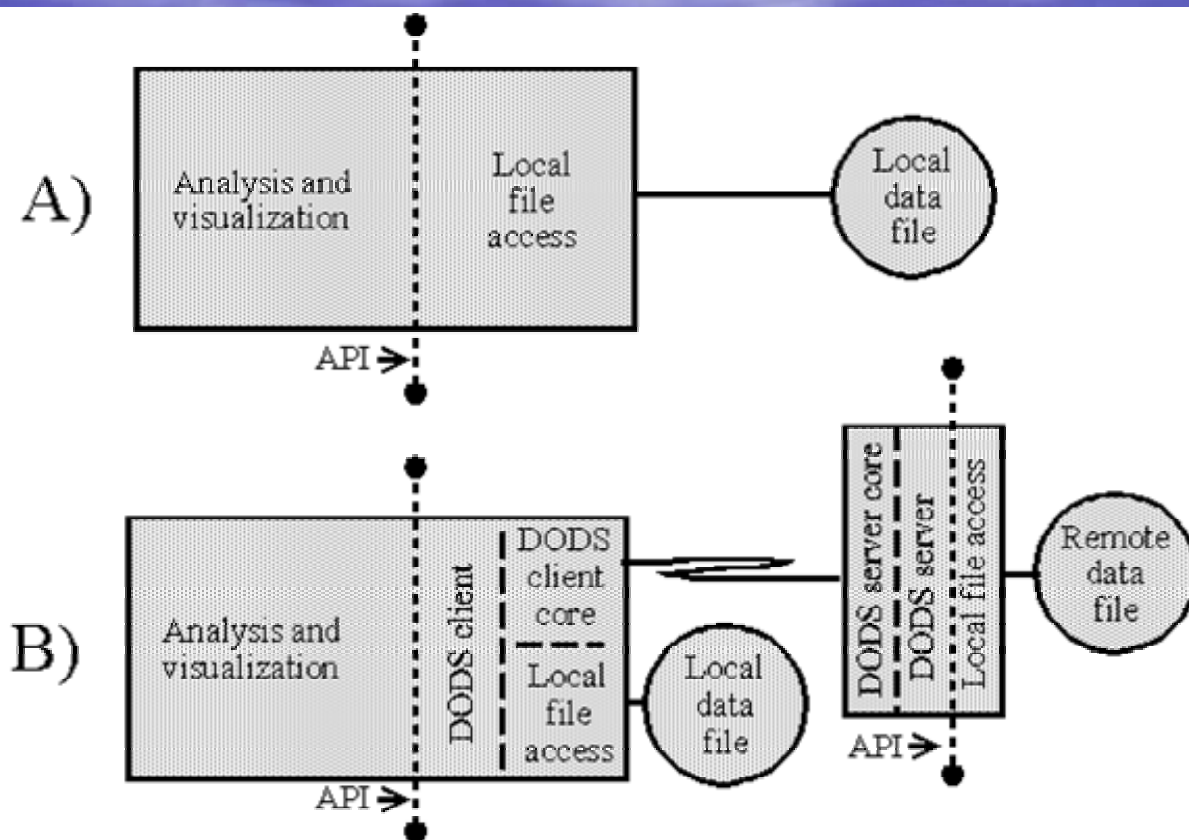
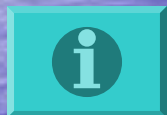
- HYCOM sites will continue to use their familiar software tools
(Matlab, IDL, Ferret, GrADS, IDV, ...)
 - The tools are “network-enabled” to open remote data sets much as they open local files.
 - Only requested subsets are transferred across the network.
- “Batch” commands will allow scripting of access to data subsets and graphics

Two core software components

1. OPeNDAP (a.k.a. "DODS")
transparent access to remote data
2. Live Access Server (LAS)
delivers "information products"

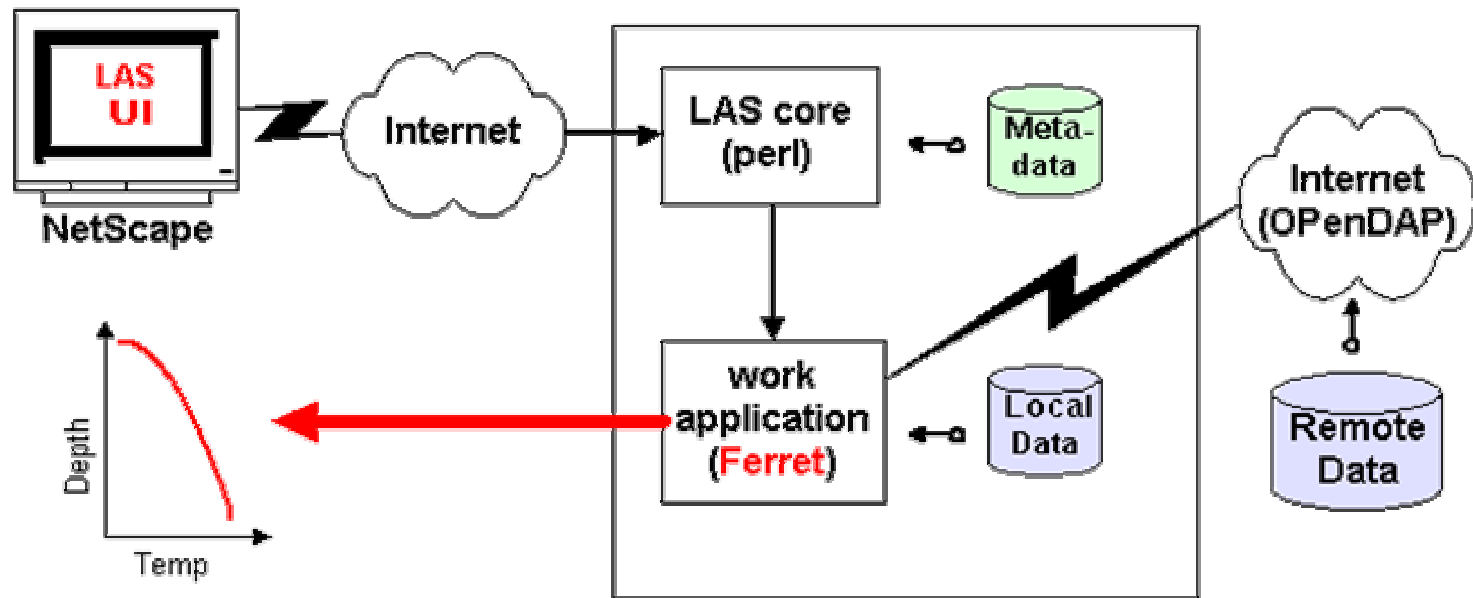
OPeNDAP provides access to remote binary data

- A. Original application
- B. OPeNDAP-enabled application



OPeNDAP middleware extends existing applications into network applications

LAS is an "Information Product Server"



Distributed data via OPeNDAP

Theme: configurability

- Metadata (XML) contains the "intelligence"
- Back end applications do the real work

Quick tour of LAS:

The following slides will show four LAS sites:

1. US GODAE modelers'
2. National Virtual Ocean Data System (NVODS)
3. World Ocean Data Base (NODC)
4. US JGOFS

US GODAE Model Results - Microsoft Internet Explorer

File Edit View Favorites Tools Help

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Address <http://ferret.pmel.noaa.gov/GODAE/servlets/dataset> Go Links >>

US GODAE Model Results

Search: Go

single data set

compare two

Datasets

Variables

Constraints

Output

Output Options

Previous Output

Define variable

About

Datasets

Click on a dataset to continue or an **i** for information about a dataset. [Help](#)

See the [note on units conversion](#) for discussion of data comparison issues.

Please select a dataset from below

Data from CDC

- i** [NODC World Ocean Atlas 1998](#)
- i** [NCEP Pacific Analysis](#)
- i** [Reynolds SST](#)
- i** [Reynolds Reconstructed SST](#)

Data from JPL

- i** [JPL Global Simulation](#)
- i** [JPL Global Assimilation \(adjoint\)](#)

Data from GFDL

- i** [GFDL Global Simulation](#)
- i** [GFDL Global Assimilation](#)

Data from NSIPP

- i** [POSEIDON Global Assimilation](#)

Data from HYCOM (sigma coords)

- i** [North Atlantic \(1/3 deg\)](#)
- i** [North Atlantic \(1/12 deg\)](#)

A horizontal timeline chart showing the availability of various datasets from 1980 to 2000. The x-axis is labeled with years: 1980, 1985, 1990, 1995, and 2000. Above the timeline, several colored bars represent the duration of different datasets: a black bar from approximately 1981 to 1999, an orange bar from 1981 to 1987, a green bar from 1982 to 1996, a red bar from 1992 to 1997, and a blue bar from 1992 to 2000. A large red arrow points from the left towards the start of the timeline at 1980.

Dataset	Start Year (approx.)	End Year (approx.)
Black Bar	1981	1999
Orange Bar	1981	1987
Green Bar	1982	1996
Red Bar	1992	1997
Blue Bar	1992	2000

Internet

US GODAE Model Results - Microsoft Internet Explorer

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Address <http://ferret.pmel.noaa.gov/GODAE/servlets/dataset?lastvar=1> Go Links »

US GODAE Model Results

Search: Go

single data set **compare two**

Datasets

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Define variable

About

Datasets > Ocean Models > JPL Global Assimilation (adjoint)

Select a variable and then click **Next >** to proceed to the Constraints page. [Help](#)

[Reset](#) | [Select all](#) | [Unselect all](#)

Dataset variable(s):

- ☐ Current vectors
- ☐ Current vectors (mean, annual)
- ☐ Current vectors (mean, multi-year)
- ☐ Salinity (10 day)
- ☐ Salinity (mean, annual)
- ☐ Salinity (mean, multi-year)
- ☐ Sea Surface Height (10 day)
- ☐ Sea Surface Height (mean, annual)
- ☐ Sea Surface Height (mean, multi-year)
- ☒ **Temperature (10 day)**
- ☐ Temperature (mean, annual)
- ☐ Temperature (mean, multi-year)
- ☐ Velocity (Meridional, 10 day)
- ☐ Velocity (Meridional, mean, annual)
- ☐ Velocity (Meridional, mean, multi-year)
- ☐ Velocity (Zonal, 10 day)
- ☐ Velocity (Zonal, mean, annual)
- ☐ Velocity (Zonal, mean, multi-year)

Next >

Next >

Done Internet

US GODAE Model Results - Microsoft Internet Explorer

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Address http://ferret.pmel.noaa.gov/GODAE/servlets/constrain?var=190 Go Links

US GODAE Model Results

Search: Go

single data set

compare two

Datasets

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About

1

Datasets > Ocean Models > JPL Global Assimilation (adjoint)

Variable(s): Temperature (10 day)

Select your desired view (geometry of output) and output (type of product). Then set the 4-D region (lon-lat-depth-time) and any additional constraints.

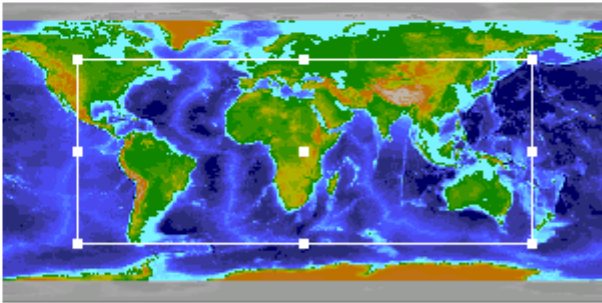
[Help](#)

Select view: xy (lat/lon) slice

Select output: Shaded plot (GIF)

Select region: Full Region

Don't use map applet



55.0 N

106.0 W 168.0 E

56.0 S

Select time: 15 Jan 1998 15-Jan-1998

Select depth: 5 5

US GODAE Model Results

Search: Gosingle
data
setcom-
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two

Datasets

Variables

Constraints

Output

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Previous Output

Define variable

About

[Datasets](#) > [Ocean Models](#) > [JPL Global Assimilation \(adjoint\)](#)Variable(s): **Temperature (10 day)**

You may modify the appearance of plots through the "Options" page.
The navigation bar on the left will take you directly to any LAS page.

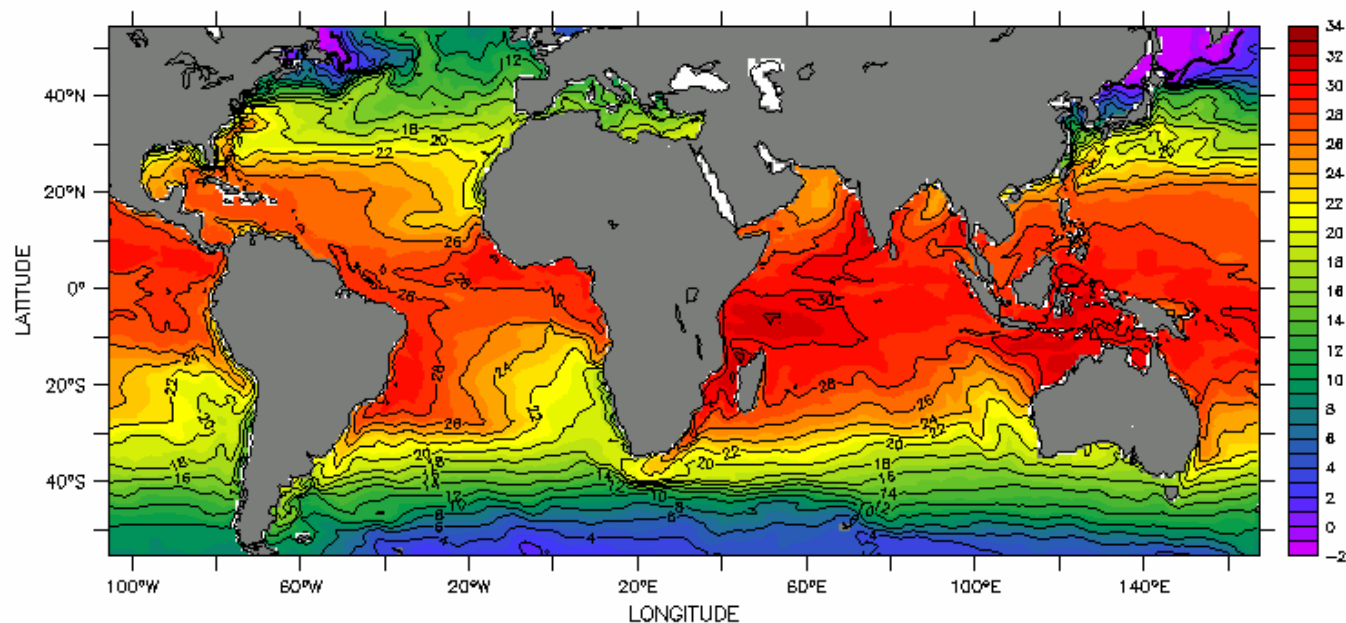
[Help](#)[Start Over >](#)

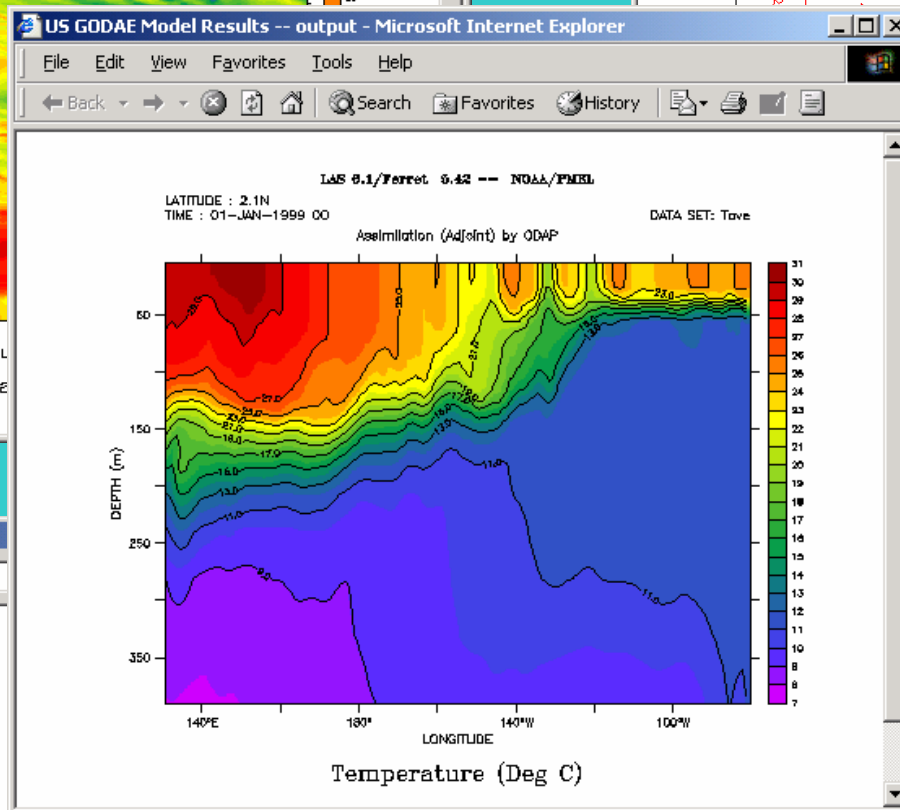
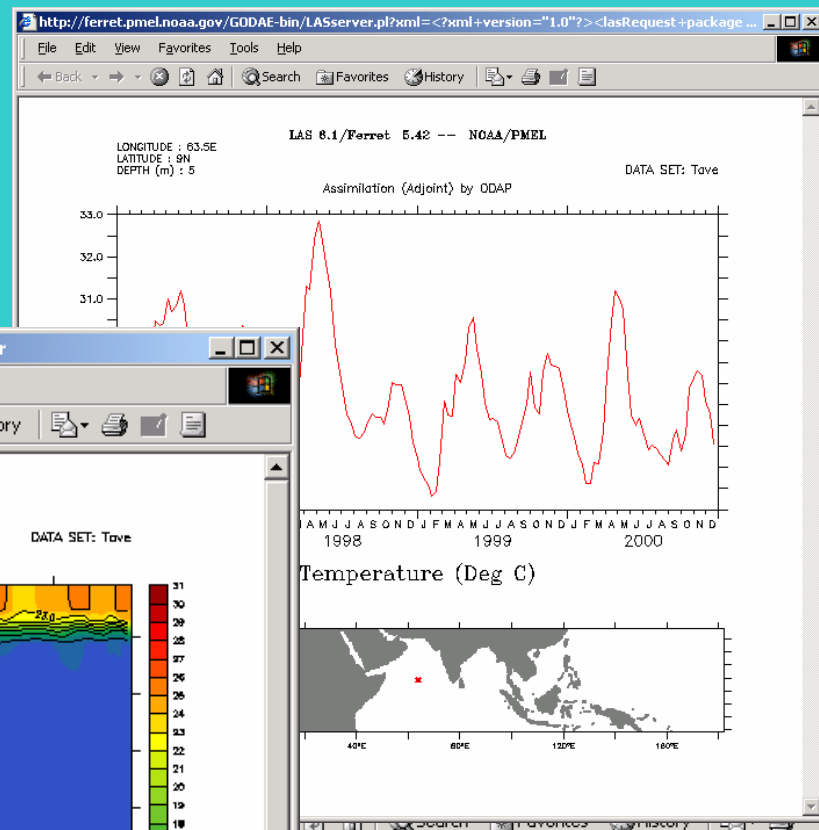
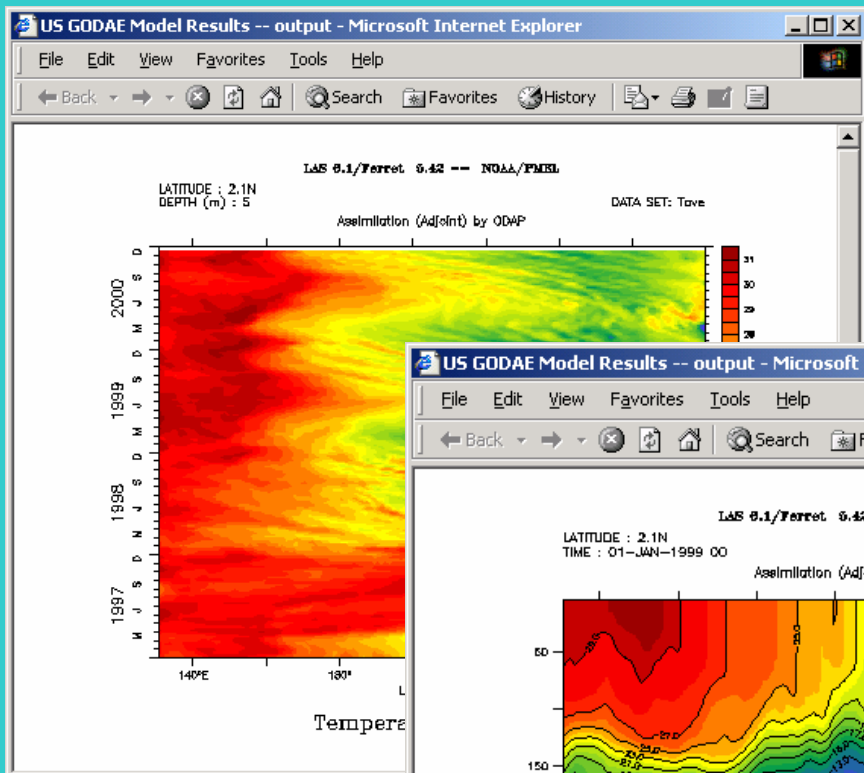
LAS 6.1/Ferret 5.52 -- NOAA/PMEL

DEPTH (m) : 5
TIME : 16-JAN-1998 00

DATA SET: Tave

Assimilation (Adjoint) by ODAP





Save As

Save in: My Computer

Local Disk (C:) Local Disk (D:) Removable Disk (5:)

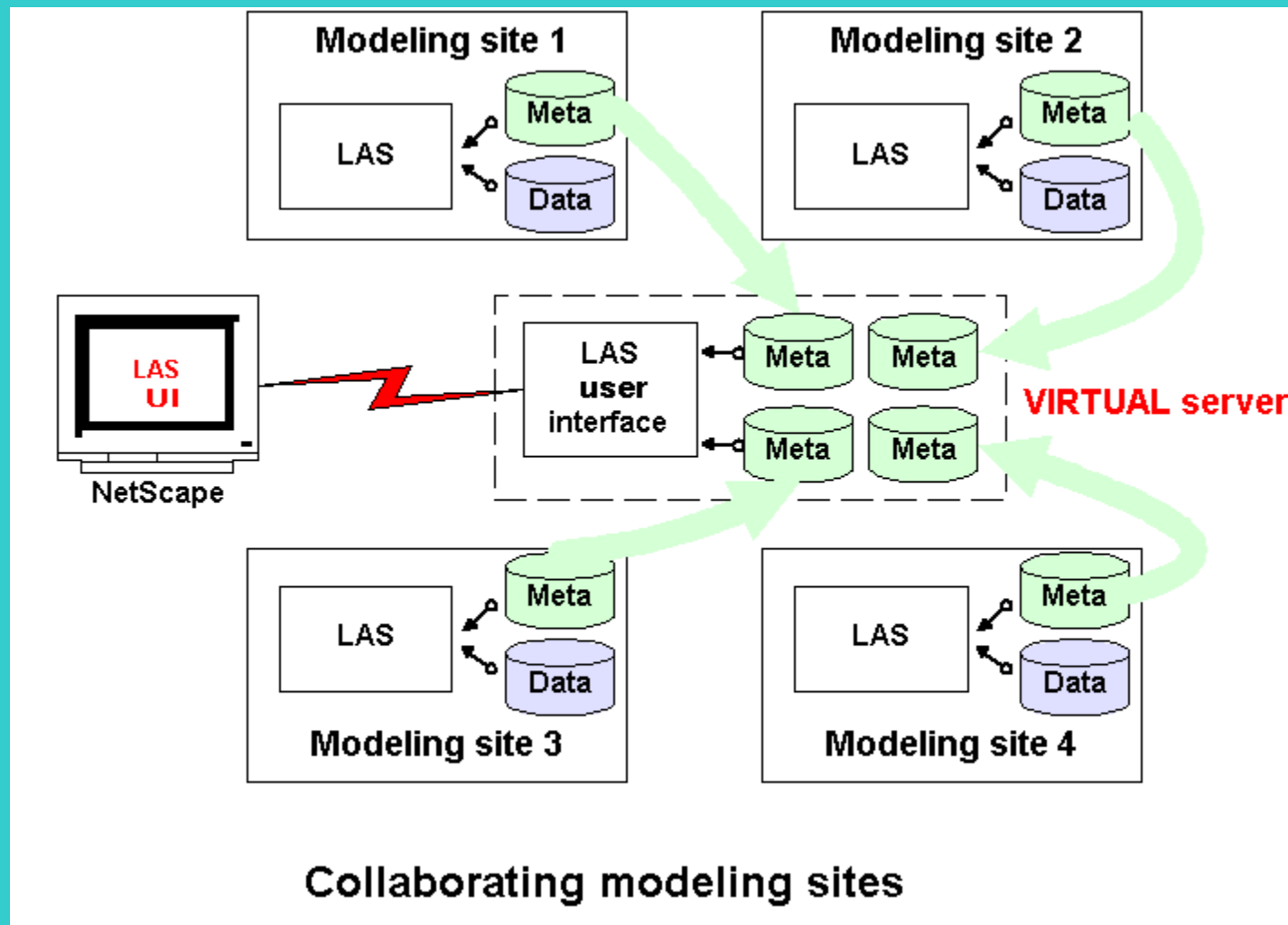
History Desktop My Documents My Computer My Network P...

File name: LASoutput.nc

Save as type: .nc Document

Save Cancel

	130.5E	132.5E	134.5E	136.5E	138.5E
	131	133	135	137	139
1:	29.37	28.93	28.75	28.87	29.07
2:	29.92	29.11	28.83	28.94	29.21
3:	29.80	29.17	28.97	28.99	29.48
4:	29.90	29.04	29.31	29.15	29.75
5:	29.88	29.50	29.52	29.26	29.73
6:	29.65	29.42	29.30	29.31	29.62
7:	29.03	29.09	28.94	29.09	29.23
8:	29.22	29.10	29.00	29.07	29.21
9:	29.76	29.34	29.30	29.44	29.48
10:	30.31	29.76	29.97	30.01	30.07
11:	29.86	29.73	29.60	29.56	29.57
12:	30.19	29.62	29.58	29.46	29.66
13:	30.67	29.86	29.82	29.83	29.96
14:	31.29	30.30	30.09	29.98	30.11
15:	30.96	30.54	30.31	29.85	29.87
16:	30.55	30.85	30.38	29.97	29.97



LAS "sisters" share metadata to form a unified (virtual) site.
OPeNDAP allows LAS to difference distributed fields.

US GODAE Model Results - Microsoft Internet Explorer

Address: http://ferret.pmel.noaa.gov/GODAE/servlets/dataset_compare2

US GODAE Model Results

Search:

single data set **compare two**

Dataset 1
Variable 1
Dataset 2
Variable 2
Constraints
Output
Output Options
Previous Output

1: [Datasets](#) > [Ocean Models](#) > [JPL Global Assimilation \(adjoint\)](#)
2: [Datasets](#)

Click on a dataset to continue or an **i** for information about a dataset. [Help](#)

See the [note on units conversion](#) for discussion of data comparison issues.

Please select a dataset from below

Data from CDC
i [NODC World Ocean Atlas 1998](#)
i [NCEP Pacific Analysis](#)
i [Reynolds SST](#)
i [Reynolds Reconstructed SST](#)

Data from JPL
i [JPL Global Simulation](#)
i [JPL Global Assimilation \(adjoint\)](#)

Data from GFDL
i [GFDL Global Simulation](#)
i [GFDL Global Assimilation](#)

Data from NSIPP
i [POSEIDON Global Assimilation](#)

Data from HYCOM (sigma coords)
i [North Atlantic \(1/3 deg\)](#)
i [North Atlantic \(1/12 deg\)](#)

1980 1985 1990 1995 2000

US GODAE Model Results - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://ferret.pmel.noaa.gov/GODAE/servlets/constrain_compare?var=190 Go Links >>

US GODAE Model Results

Search: Go

single data set **compare two**

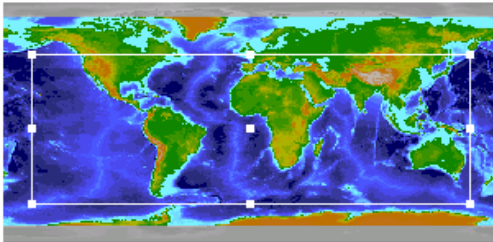
Dataset 1
Variable 1
Dataset 2
Variable 2
Constraints
Output
Output Options
Previous Output

1: [Datasets](#) > [Ocean Models](#) > [JPL Global Assimilation \(adjoint\)](#)
1: Variable(s): **Temperature (10 day)**
2: [Datasets](#) > [Ocean Models](#) > [POSEIDON Global Assimilation](#)
2: Variable(s): **Temperature**

Select your desired view (geometry of output) and output (type of product). Then set the 4-D region (lon-lat-depth-time) and any additional constraints. [Help](#)

Select view:
Select output:
Select region: Go

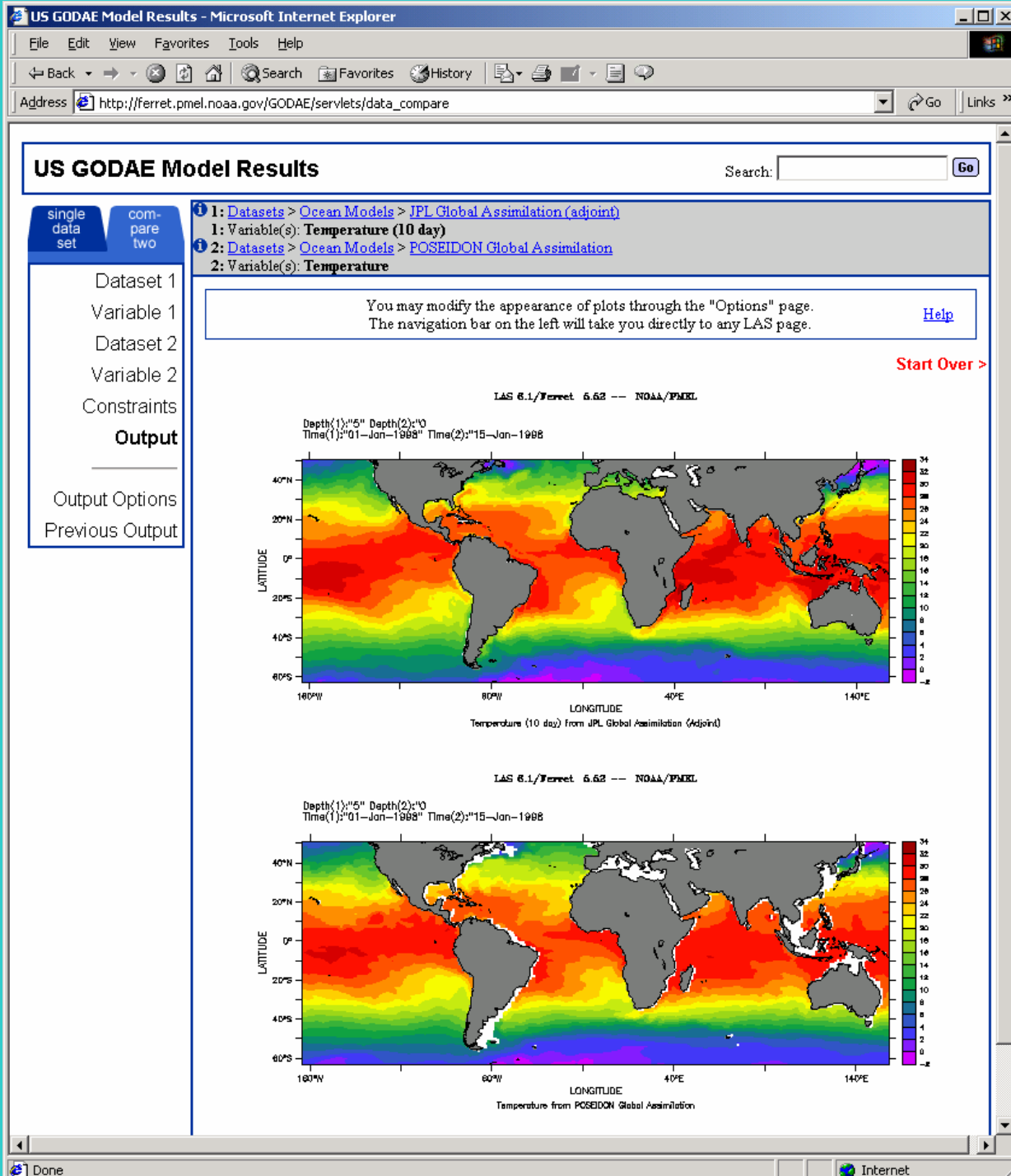
[Don't use map applet](#)



51.0 N
164.0 W 158.0 E
63.0 S
Zoom In Zoom Out

Select time for first variable: 01 Jan 1998 01-Jan-1998
Select depth for first variable: 5 5
Select time for second variable: 15 Jan 1998 15-Jan-1998
Select depth for second variable: 0 0

Internet



US GODAE Model Results - Microsoft Internet Explorer

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Address http://ferret.pmel.noaa.gov/GODAE/servlets/constrain_compare?var=190 Go Links

US GODAE Model Results

Search: Go

single data setcompare two

Dataset 1

Variable 1

Dataset 2

Variable 2

Constraints

Output

Output Options

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1: [Datasets](#) > [Ocean Models](#) > [JPL Global Assimilation \(adjoint\)](#)

1: Variable(s): **Temperature (10 day)**

2: [Datasets](#) > [Ocean Models](#) > [POSEIDON Global Assimilation](#)

2: Variable(s): **Temperature**

Select your desired view (geometry of output) and output (type of product). Then set the 4-D region (lon-lat-depth-time) and any additional constraints.

Select view:

xy (lat/lon) slice

Select output:

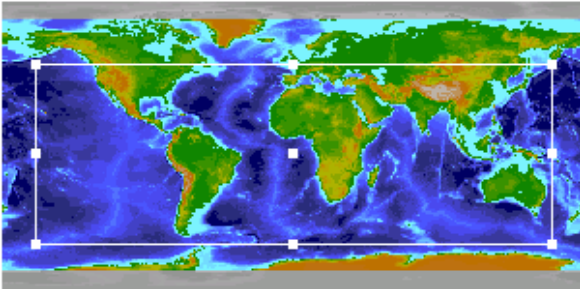
Comparison plot (GIF)

Select region:

Full Region

Go

Don't use map applet



51.0 N

164.0 W158.0 E

63.0 S

Zoom InZoom Out

Select time for first variable:

01Jan199801-Jan-1998

Select depth for first variable:

55

Select time for second variable:

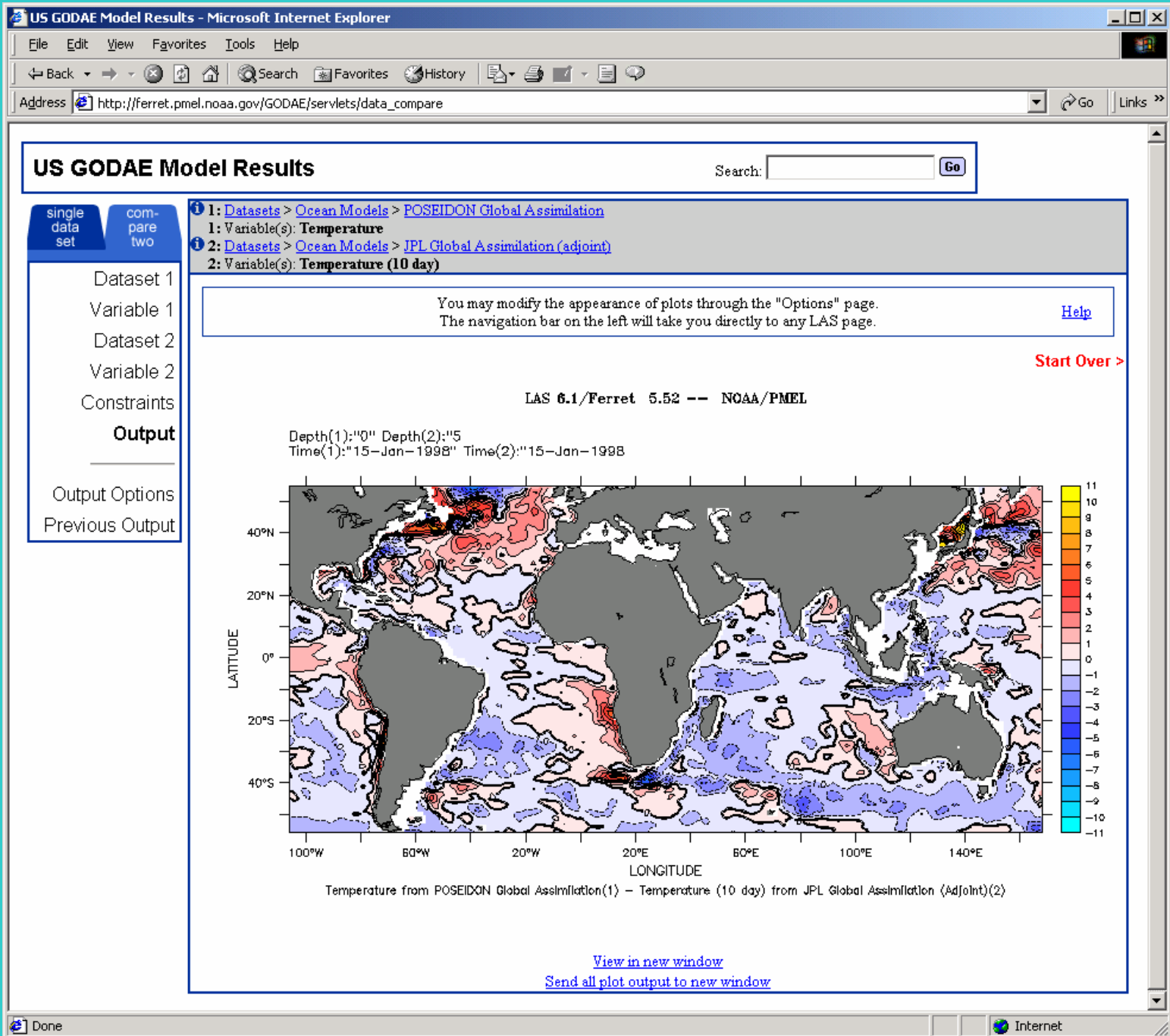
15Jan199815-Jan-1998

Select depth for second variable:

00

Next >

DoneInternet



US GODAE Model Results - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Copy Paste Address http://ferret.pmel.noaa.gov/GODAE/servlets/options_compare Go Links

US GODAE Model Results

Search: Go

single data set

compare two

Dataset 1

Variable 1

Dataset 2

Variable 2

Constraints

Output

Output Options

Previous Output

1: [Datasets](#) > [Ocean Models](#) > [POSEIDON Global Assimilation](#)
1: Variable(s): **Temperature**

2: [Datasets](#) > [Ocean Models](#) > [JPL Global Assimilation \(adjoint\)](#)
2: Variable(s): **Temperature (10 day)**

The following options are available for this variable/view/output product. [Help](#)
Modify them as desired or reset them to their default values.


Select options: Next >

? Plot size	800x600
? Interpolate data	No
? Show reference map	Default
? Land fill style	Default
? Contour fill style	Default
? Contour levels	(-11,-3,1)(0)(3,11,1)
? Fill levels	(-11,-3,1)(0)(3,11,1)
? Palette	light_centered
? Evaluate expression	<input type="text"/>
? Evaluate expression for comparison variable	<input type="text"/>

Done Internet

Go

Previous Output

 Internet

US GODAE Model Results

Address <http://ferret.pmel.noaa.gov/GODAE/servlets/analysis>

Search:

single data set **compare two**

Datasets
Variables
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Output Options
Previous Output
Define variable
About

1 Datasets > Ocean Models > POSEIDON Global Assimilation
Variable(s): **Temperature**

TODO -- snappy advice message goes here [Help](#)

Select analysis type:

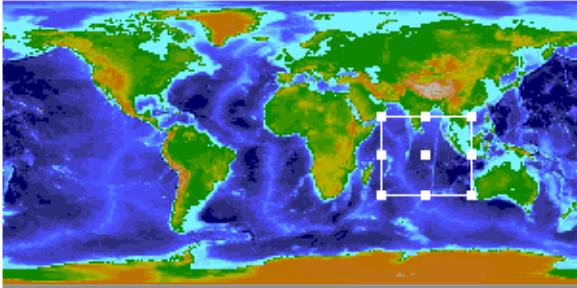
Name for this variable:

Apply to these axes: X ☒ Y ☒ Z ☐ T ☐

Mask: None ☒ Ocean ☐ Land ☐

Select range for applicable axis:

[Don't use map applet](#)

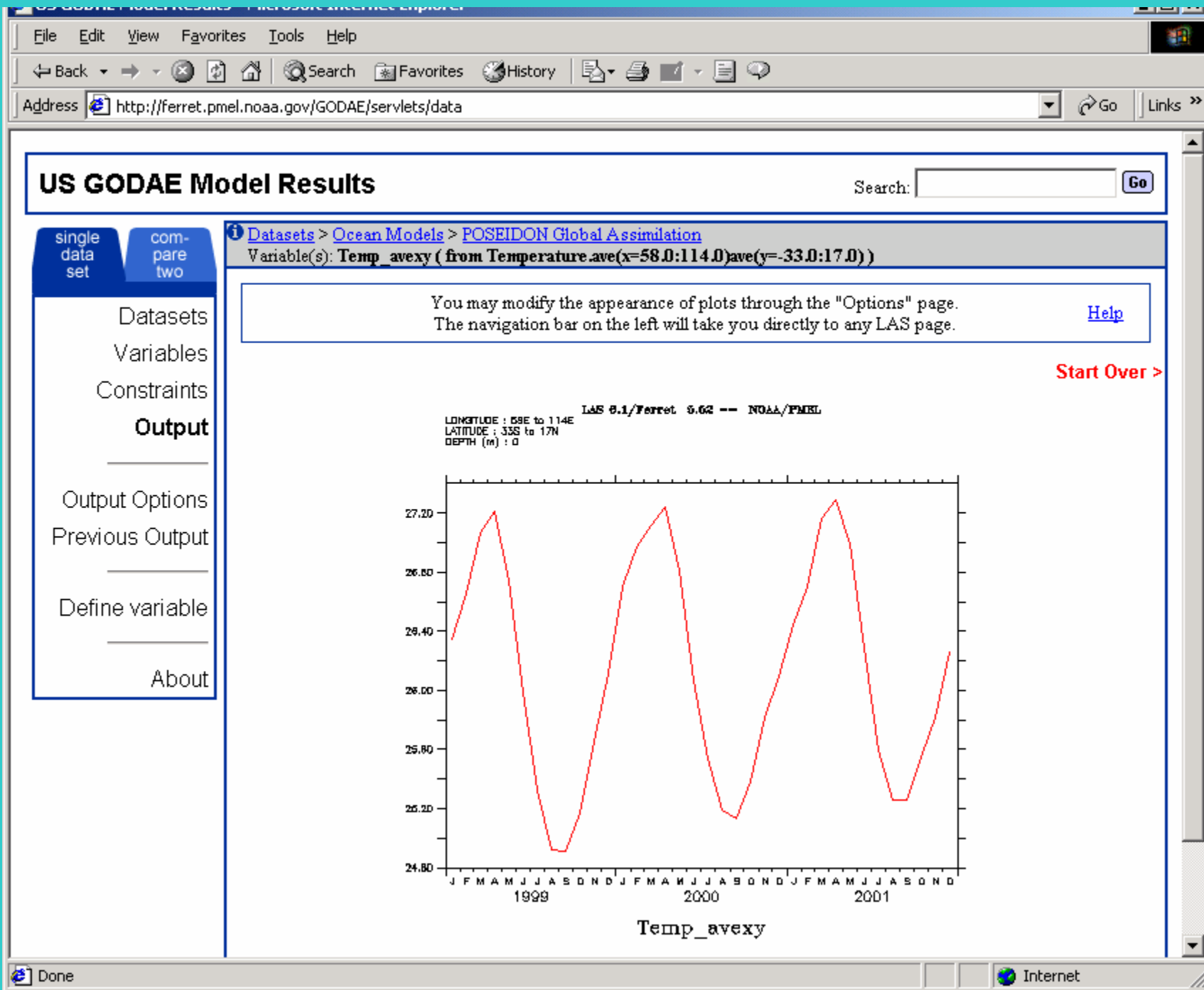


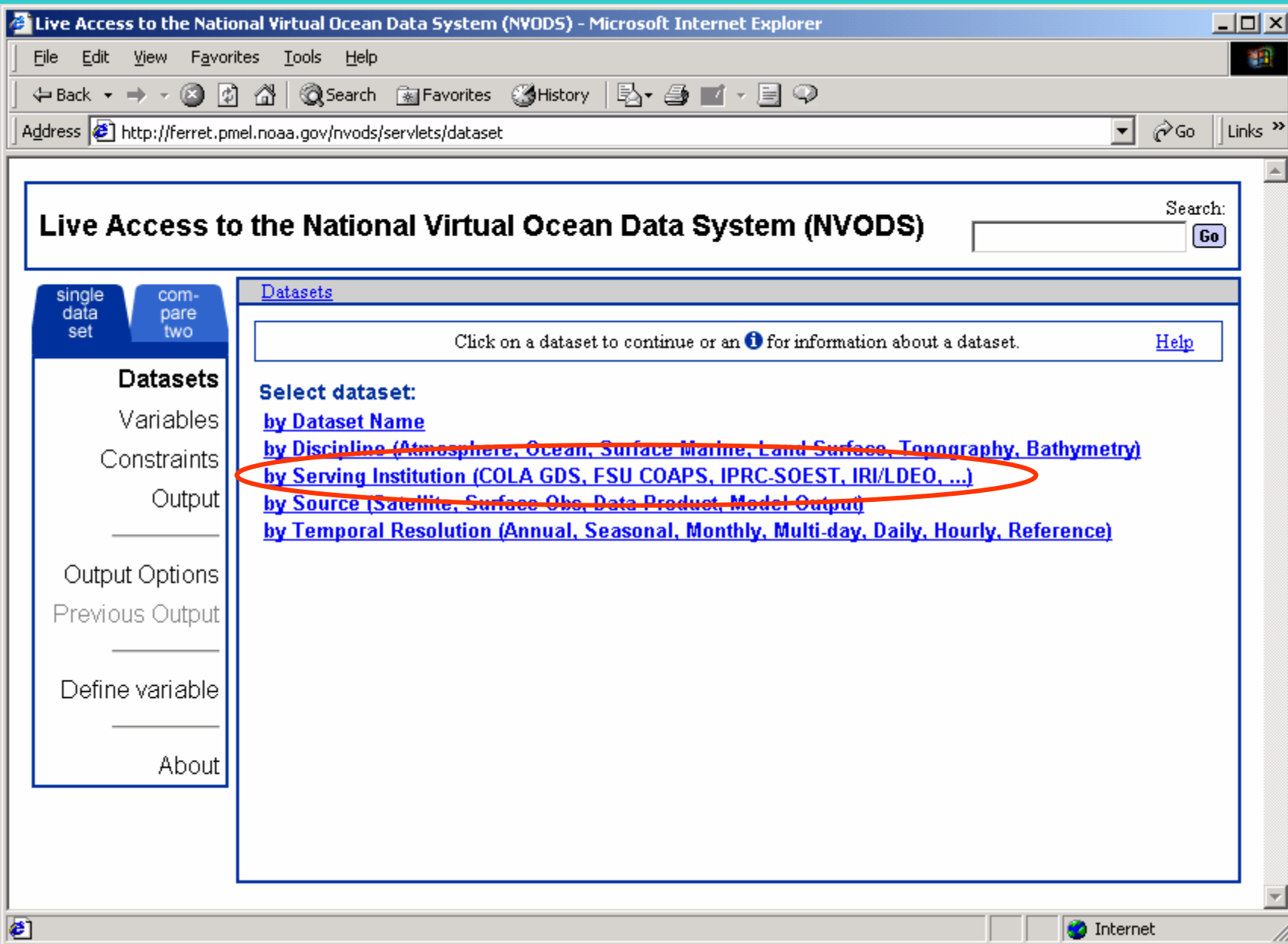
Z range: to

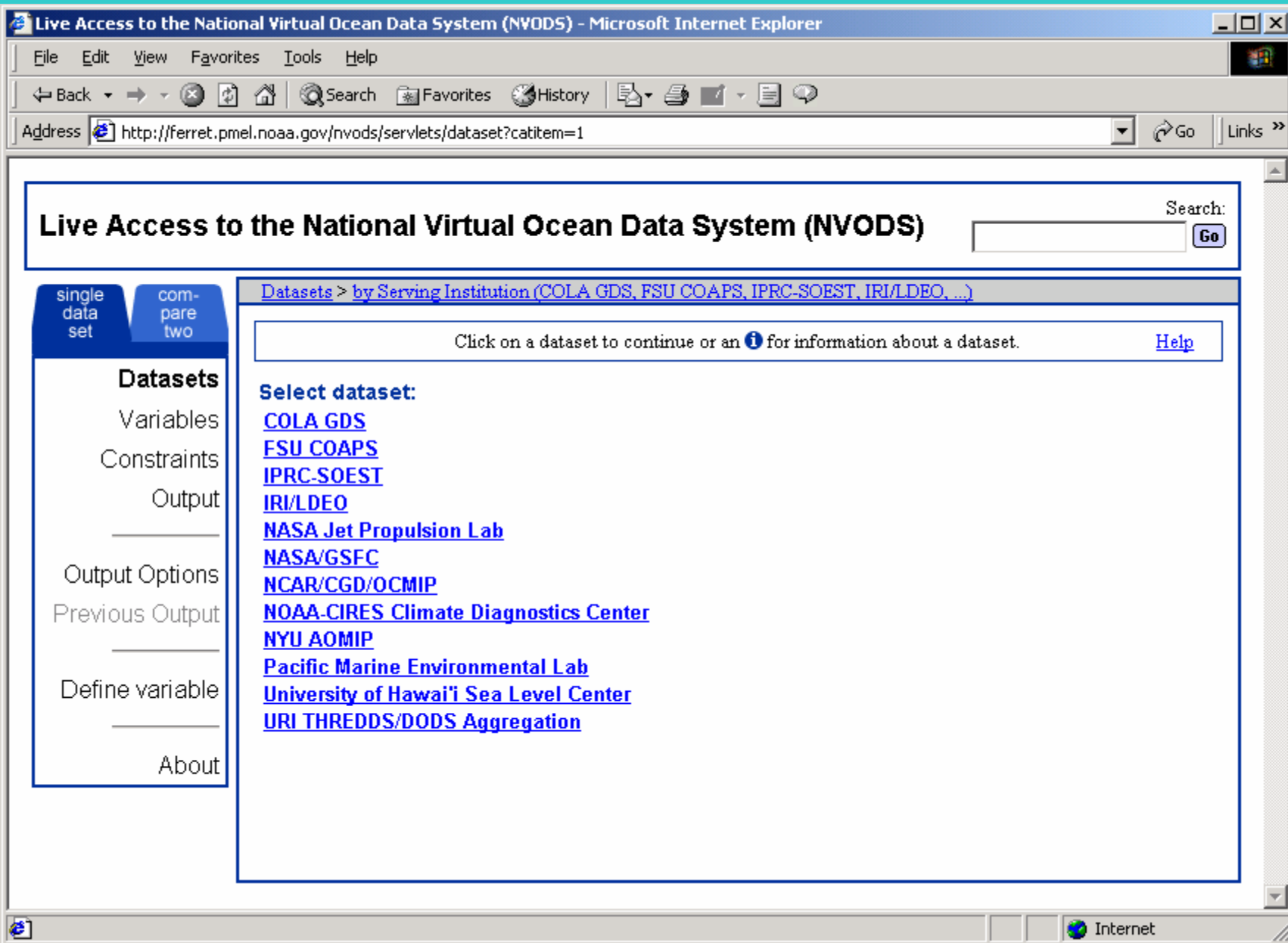
T range: to

[Next >](#)
[Cancel >](#)

Internet







[Datasets](#) > [Ocean Models](#) > [JPL Global Assimilation \(adjoint\)](#)
Variable(s): **Temperature (10 day)**

Info for JPL Global Assimilation (adjoint) - Microsoft Internet Explorer

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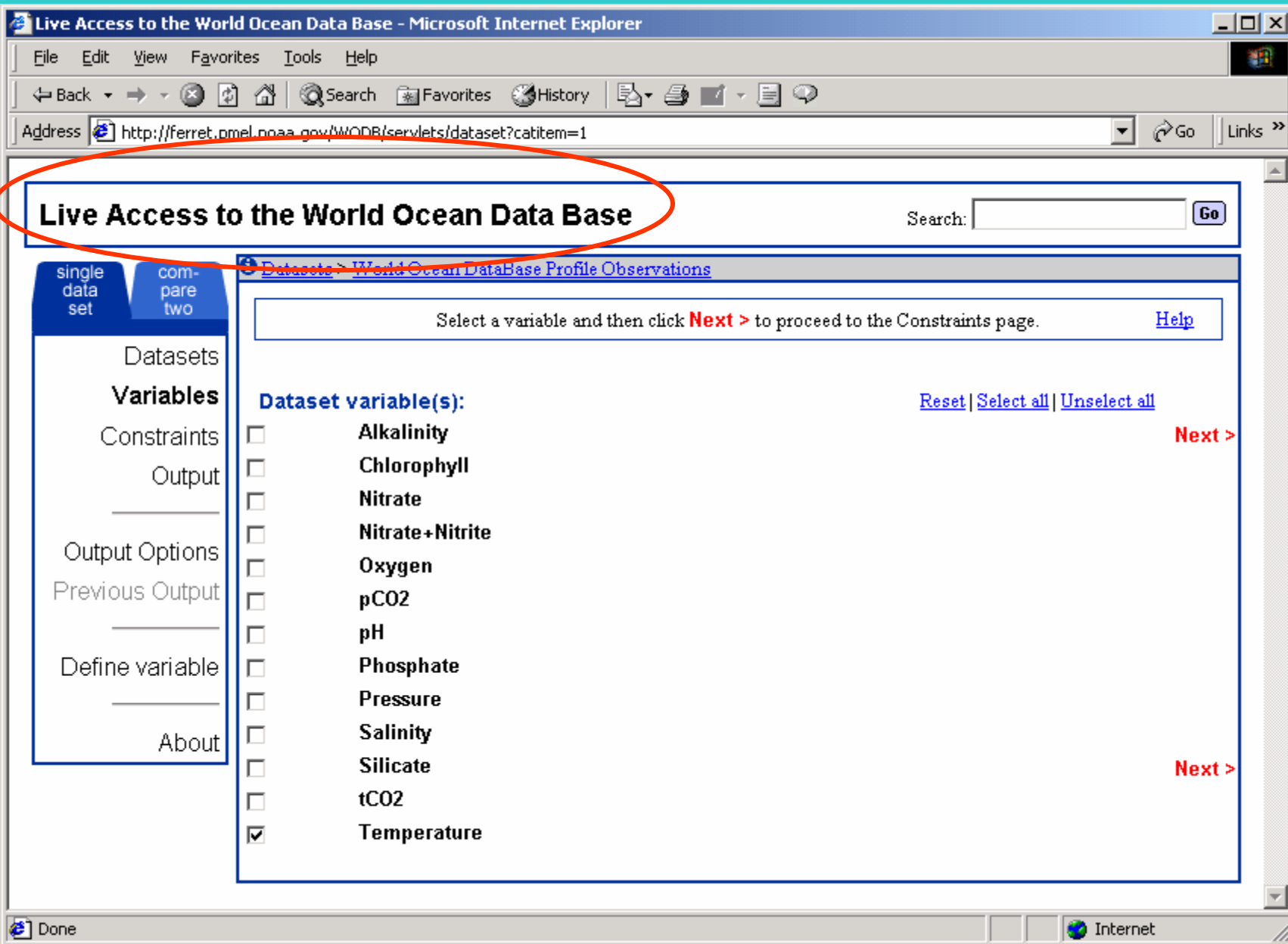
Address <http://ferret.pmel.noaa.gov/GODAE/servlets/metadata?catitem=183> Go

JPL Global Assimilation (adjoint) ([more...](#))

Served by: [Pacific Marine Environmental Lab](#)

Variables

Name	DODS URL (if available)					
	X range	Y range	Z range	T range	Units	DODS
Current vectors	0.5:359.5	-79.5:78.5	5:5615	01-Jan-1997:31-Dec-2000		
Current vectors (mean, annual)	0.5:359.5	-79.5:78.5	5:5615	year 1997:year 2000		
Current vectors (mean, multi-year)	0.5:359.5	-79.5:78.5	5:5615	1997 to 2000:1997 to 2000		
Current vectors (mean, 10 day)	0.5:359.5	-79.5:78.5	5:5615	01-Jan-1997:31-Dec-2000	DDT	



Live Access to the World Ocean Data Base - Microsoft Internet Explorer

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Address <http://ferret.pmel.noaa.gov/WODB/servlets/constrain?var=14> Go Links »

Live Access to the World Ocean Data Base

Search: Go

single data set

compare two

Datasets

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Define variable

About

1 Datasets > [World Ocean DataBase Profile Observations](#)

Variable(s): **Temperature**

Select your desired view (geometry of output) and output (type of product). Then set the 4-D region (lon-lat-depth-time) and any additional constraints. [Help](#)

Select view: Longitude Latitude

Select output: Metadata plot (GIF)

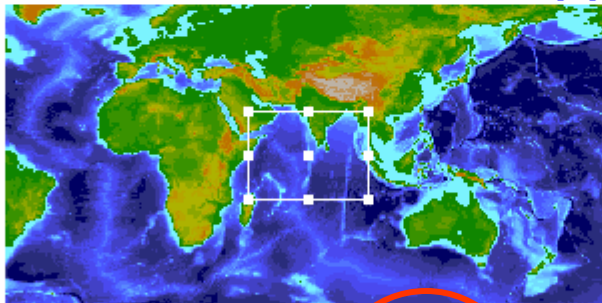
Select region: No Regions Available [Don't use map applet](#)

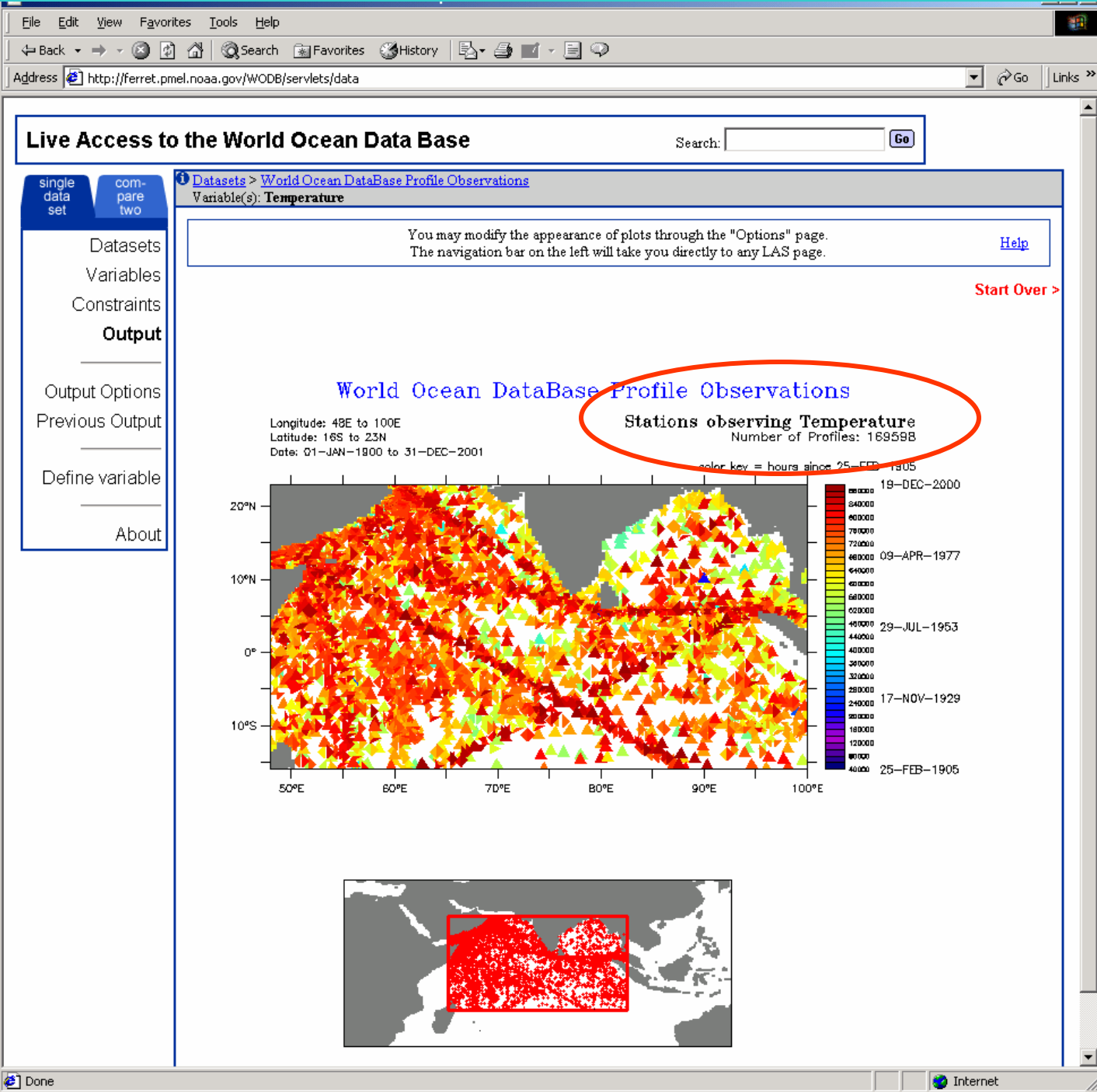
Select time range: 01 Jan 1900 to 31 Dec 2001

Select depth range: 0 to 5900

23.0 N
48.0 E 100.0 E
16.0 S

Next >





Search: Go

com-
pare
two

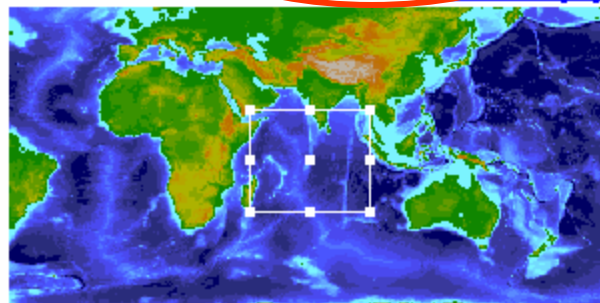
About

Variable(s): **Temperature**

[Help](#)

No Regions Available

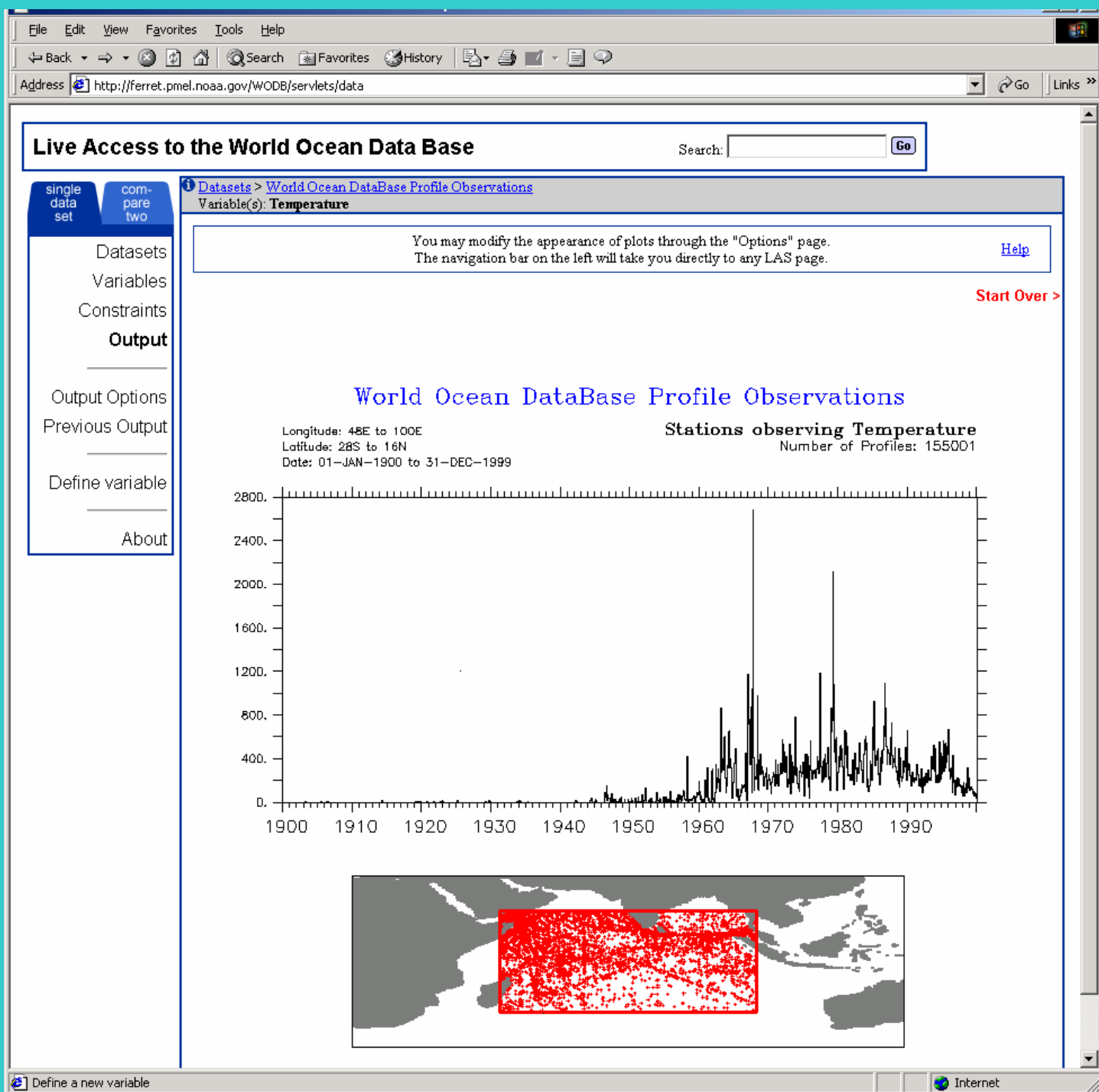
Next >



Zoom Out

31-Dec-1999

5900



Live Access Server - Microsoft Internet Explorer

File Edit View Favorites Tools Help

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Address <http://ferret.pmel.noaa.gov/JGOFS/servlets/constrain?var=49&var=83> Go Links

Live Access Server

Search: Go

single data set

compare two

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Define variable

About

[Datasets](#) > [U.S. JGOFS Arabian Sea Bottle Data](#)

Variable(s): **iodide concentration**, **temperature**, from CTD, IPTS-68 (2 selected)

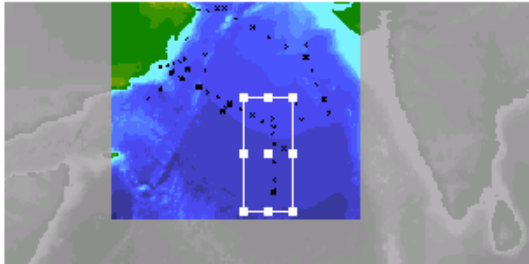
Select your desired view (geometry of output) and output (type of product). Then set the 4-D region (lon-lat-depth-time) and any additional constraints. [Help](#)

Select view: Latitude-Depth

Select output: Property/property plot (GIF)

Select region: Full Region

[Don't use map applet](#)



16.40000000

63.0 E 66.5 E

8.6 N

Select time range: 01 Jan 1995 01-Jan-1995 to 31 Dec 1995 31-Dec-1995

Select depth range: 0 0 to 900 900

Select Constraints:

Apply: ☐ alloxanthin

Apply: ☐ Standard Station = A

Apply: ☒ Cruise ID = PC1 TTN-043 (Jan-08:Feb-05)

[Next >](#)

Internet

"Batch" access to data

Query available data sets:

```
>lasls http://cpu/LAS
```

Query variables in data set "model_1":

```
>lasls http://cpu/LAS model_1
```

Query space-time domain:


```
>lasls http://cpu/LAS model_1 sst
```

Request a subset of data as a file: ("asc" for ASCII format)

```
>lasget -x 20:60 -y 20:60 -t 11-Dec-2000 -f asc  
http://cpu/LAS model_1 sst
```

Priorities for implementation:

ASAP:

- Draft guidelines for model output providers
- Install DODS and/or LAS servers at HYCOM sites
- Create initial HYCOM-LAS data sharing Web site 

Advanced features to follow:

- ...

Priorities for implementation (cont)

Advanced features:

- Reference data sets
 - from US GODAE Server and NVO DS (OPeNDAP)
- Curvilinear coordinate support
 - Native coordinate graphics
 - On-the-fly regridding to other coordinates
(will eliminate need for rectilinear outputs)
- 5-D data set management
- GODAE comparison metrics
- Include assimilated observations
- Model-to-data comparison
- RMS error/skill
- HYCOM model diagnostics

14 pg European GODAE/LAS guidelines document

GODAE Data Sharing Pilot Project

22 October, 2002

Abstract

On June 12, 2002 the GODAE Data and Product Server Workshop was held in Biarritz, France (<http://www.bom.gov.au/GODAE/Projects/ServerWS/>). The goals of the workshop included "to develop a strategy for adoption of agreed data and serving standards, including approaches for developing a broader-based community standard." A consensus emerged from that Workshop to begin a GODAE Data Sharing Pilot Project based upon the OPeNDAP data transfer protocol and the Live Access Server (LAS) for browsing and intercomparison of data on the Web. This document describes the project's background, its goals, and the software components and data standards that must be implemented to participate in the DS Pilot.

1. Background

1.1. Statement of Problem

The Global Ocean Data Assimilation Experiment (GODAE) is an effort to enhance the effectiveness of operational ocean modeling and state estimation activities through international cooperation. Through shared access to the pipeline of data from participating GODAE sites, including observations, products, and forecasts, and attendant modeling and data management techniques, such as quality control, data assimilation, and model physics, the community can more rapidly advance the state of ocean modeling and achieve a useful, operational, global ocean modeling capability.

GODAE is a loose collaboration of volunteer organizations. There is no central organization with a mandate or funding to support the collaboration, nor with the authority to impose uniform data standards. Thus, a data sharing strategy which can succeed must permit the participants to operate with great independence. The participating GODAE sites will be peer-to-peer in the sense that each

... our European partners are well underway ...

Standardisation, Harmonisation, Consistency between european ocean model outputs within the frame of MERSEA - models MERCATOR, TOPAZ, FOAM and MFS - and use of the powerfull tools OPeNDAP/LAS in order to extract, visualise and intercomapre

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1. Standardise and describe ocean model outputs - in term of format

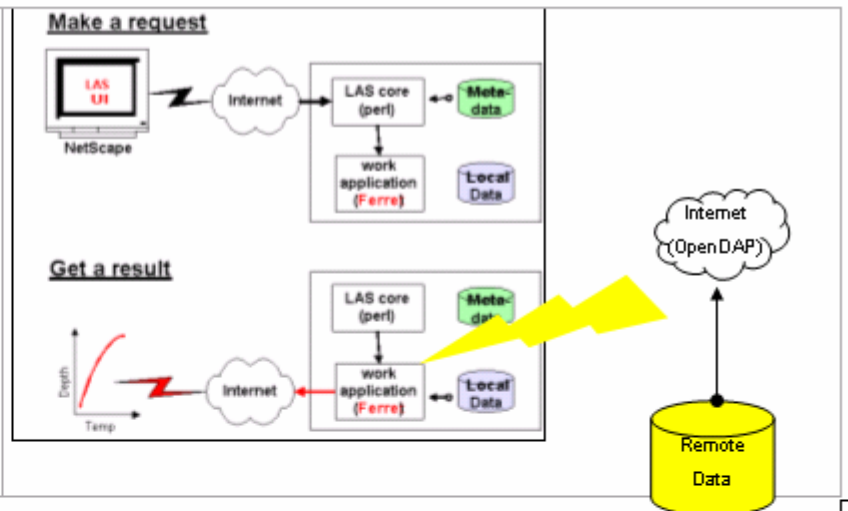


- To ensure an international use and intercomparison of model outputs, they should be harmonised in terms of format and organisation, what I called, following international 'GODAE' rules that is

- (3d) NetCDF format with COARDS convention and more
- Distributed in an OpenDAP aggregation server
- Served via a LAS plus FERRET (ie browsable and intercomparable)

⇒ But care should be taken when producing the file for granular volume or size and name of variables to keep coherence between NetCDF and GRIB format (for easy conversion from one to the others and the use of existing libraries)

⇒ Care should be taken also when defing the headers.



- For the organisation, we suggest a file per target area, per model configuration, per variable, per day following the name convention :

[model]_[config]_[target_area]_[parameter]_[file-date]_[bulletin_date].nc

Note : According to those data and for MERCATOR, we have 137 Mb pe file with a grid resolution of 1/10°, so for a day, the volume would be 3288 Mb (137 Mo x 8 parameters x 3 time - 1 analyse and 2 forecasts), for 6 months of data (183 days) 587,6 Gb or on the order of a terabytes per year.



Questions?

OPeNDAP: distributed access to data and metadata

