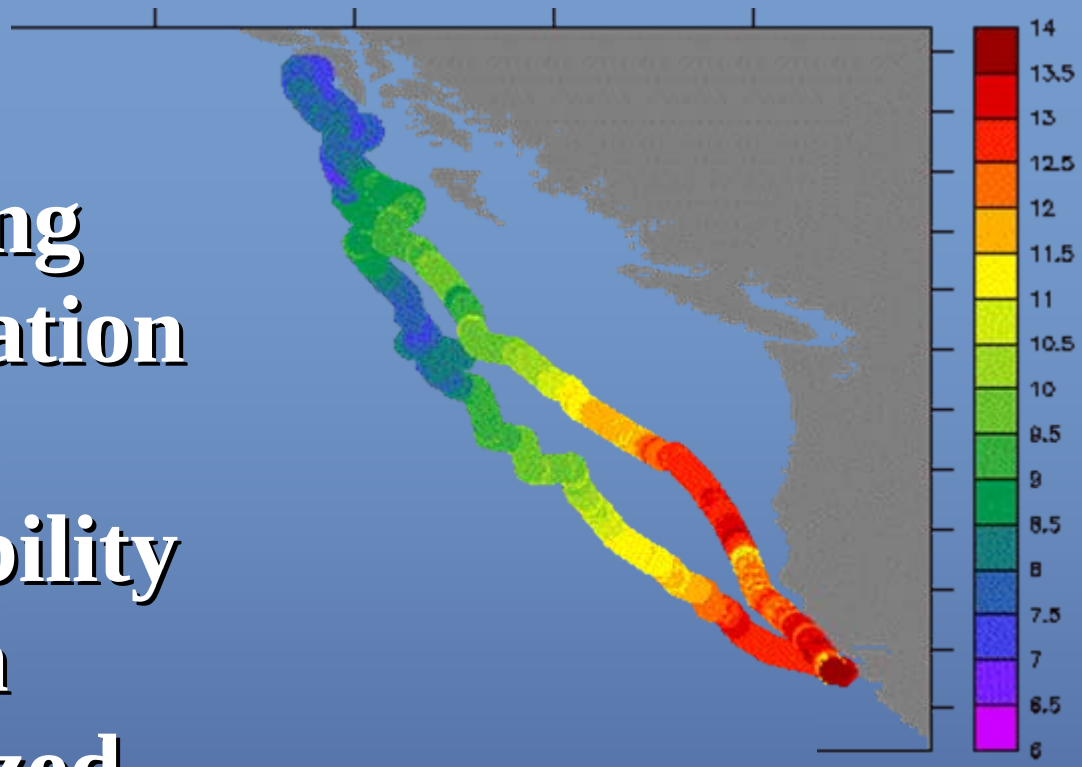
Simplifying data integration and interoperability through standardized data access and transport protocols



NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Environmental Research Division

Southwest Fisheries Science Center

Project Budget

Data acquisition

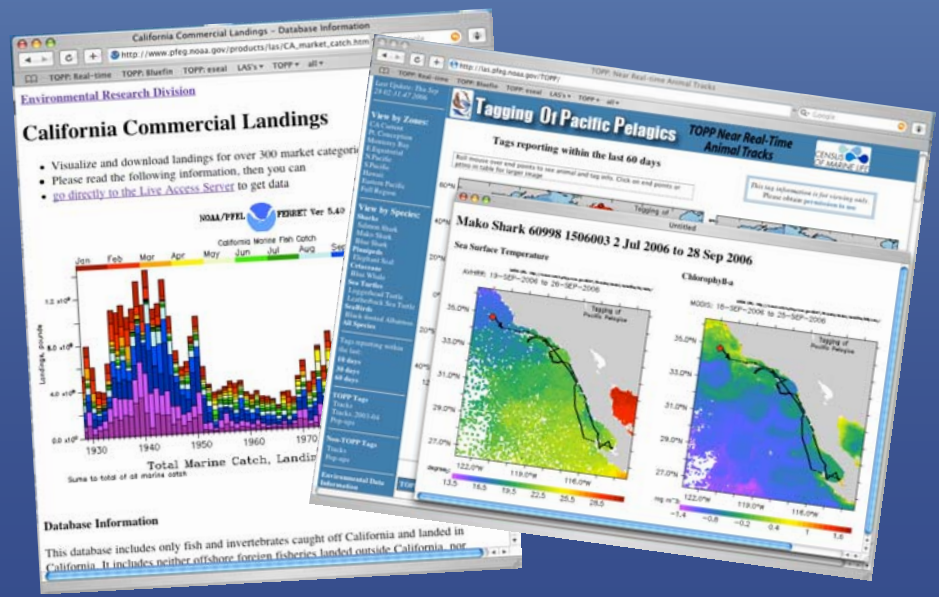
- Ship time
- Equipment
- Travel
- Scientist hours
- Careful sampling

Project Budget

Data display

- Web pages
- plots
- Some way to get some data

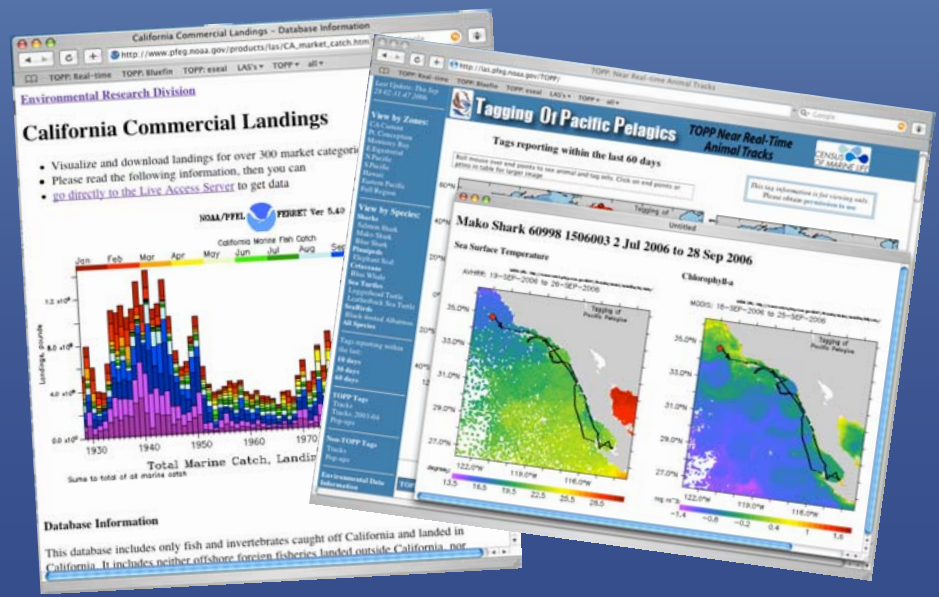
Data acquisition



Project Budget

Data display

Data acquisition

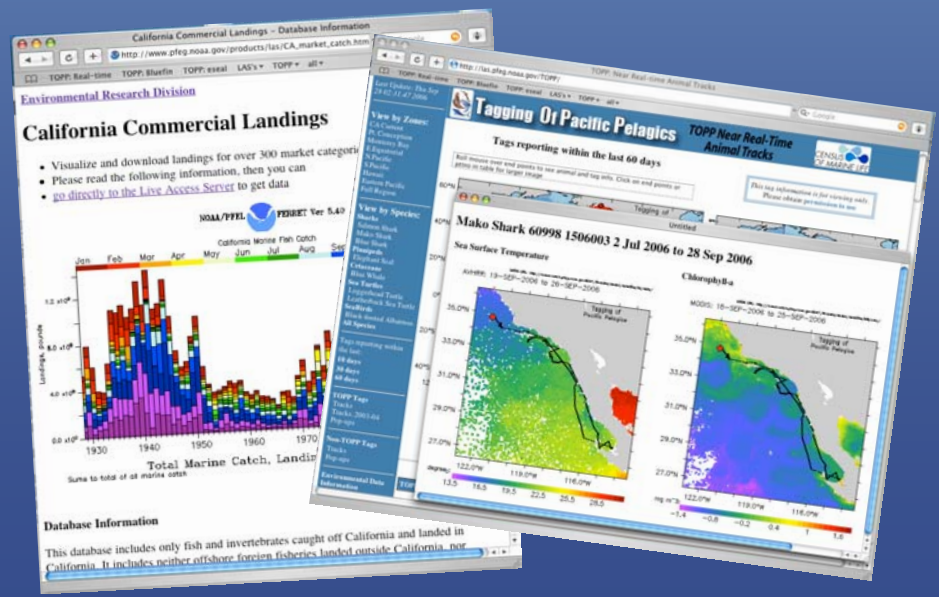


Project Budget

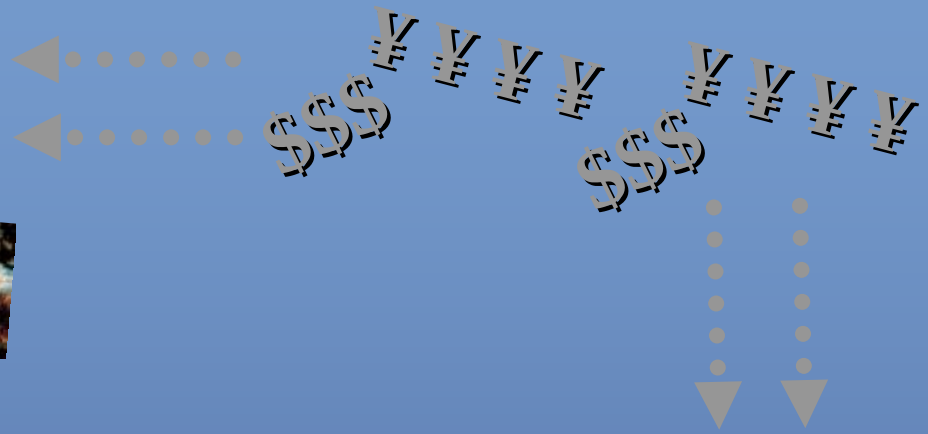
Data display (serving?)

Data acquisition

Can researchers get the data they need?

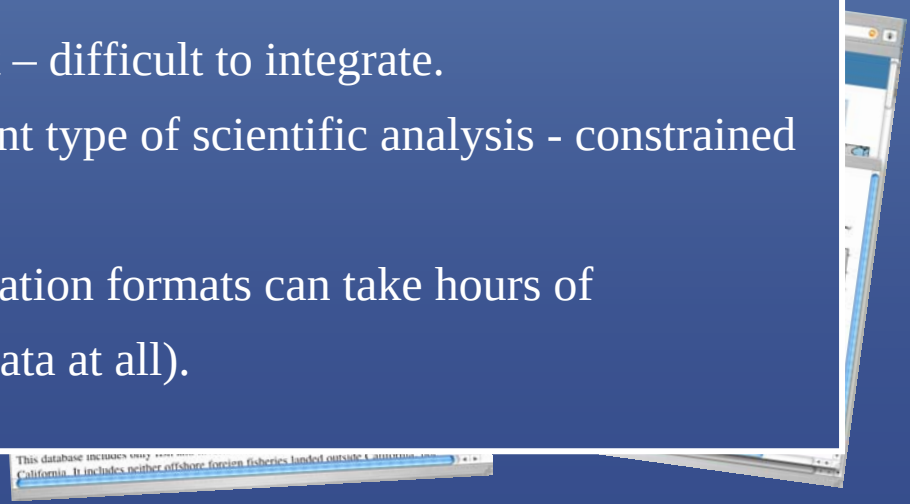


Project Budget



Data display (serving?)

- Images may or may not be an actual representation of the raw data
  - interpolated, smoothed, “shape files”
- Data formats vary from project to project – difficult to integrate.
- Often difficult to use the data in a different type of scientific analysis - constrained to parameters set up for web display
- Simple things like different time/date/location formats can take hours of unraveling (if available along with the data at all).



Project Budget

Data acquisition

Data transport

Data serving

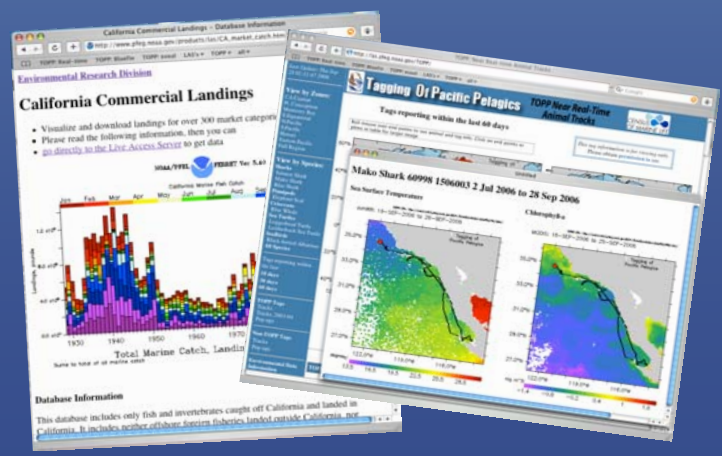
A small amount of time spent setting up efficient data transport can greatly reduce the time spent on serving data.

Why is data transport ignored?

Boring

Don’t know how

Don’t have a programmer

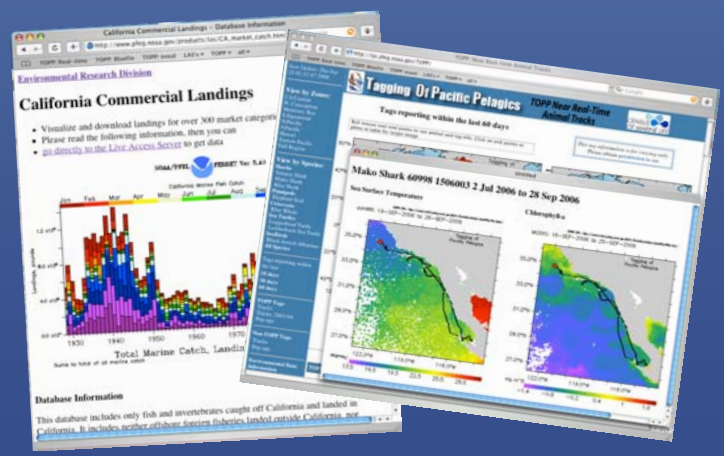


Project Budget

Data acquisition

Data transport

Data serving



A small amount of time spent setting up efficient data transport can greatly reduce the time spent on serving data.

Technology for data transport has improved and will continue to improve at a rapid pace. Many in the community have recognized the importance of efficient data transport for serving and sharing data so the task isn't as arduous as it once was.

Environmental Research Division

Southwest Fisheries Science Center

National Marine Fisheries Service

National Oceanographic and Atmospheric Administration

Pacific Grove, California USA

http://swfsc.noaa.gov/

(formerly PFEL: Pacific Fisheries Environmental Laboratory)

Host the NOAAWest Coast Regional Node of CoastWatch

http://coastwatch.pfel.noaa.gov/

ERD Data Products

~ 30 GB of data per day ingested into ERD servers

Primary focus:

Provide fisheries-related environmental data for

- **data integration to support ecosystem based management**
- **research on marine mammals and protected species**
- **studies in climate change and environmental variability**

Goal for our data service:

- **Reduce time investigators spend preparing data for analysis**
- **Provide consistent, easy to use formats that comply with recognized standards (IOOS)**
- **Provide ability to subset data rather than having to get the entire data set**

Who uses ERD data?

. . . many types of users with

- varying interests
- differing data requirements
- all levels of technological skill

Users include:

fisheries biologists
physical oceanographers
researchers in other fields
students
fishermen
general public

Numerous countries and affiliations

Why is ERD unique among data providers?

- **Maintain long, continuous time series of environmental variables and indices**
  - **Upwelling index**
- **Research to provide quality products and create new ones**
- **Tailor access to the average scientific investigator**
  - **Provide a user friendly delivery service on the Web**
  - **Provide data in forms that make it easy to access and subset**
- **Encourage and use recommended IOOS standards for data formats and service**
  - **OPeNDAP, Live Access Server , THREDDS**
  - **Roy Mendelssohn - member of the User Outreach Team of the Data and Communications Steering Committee for IOOS**
- **Collaboration with other data centers and research programs**
  - **Integration of environmental data with marine mammal and fisheries data**
  - **Interoperability of data systems within our organization and with outside partners**

Why is data transport layer so important?

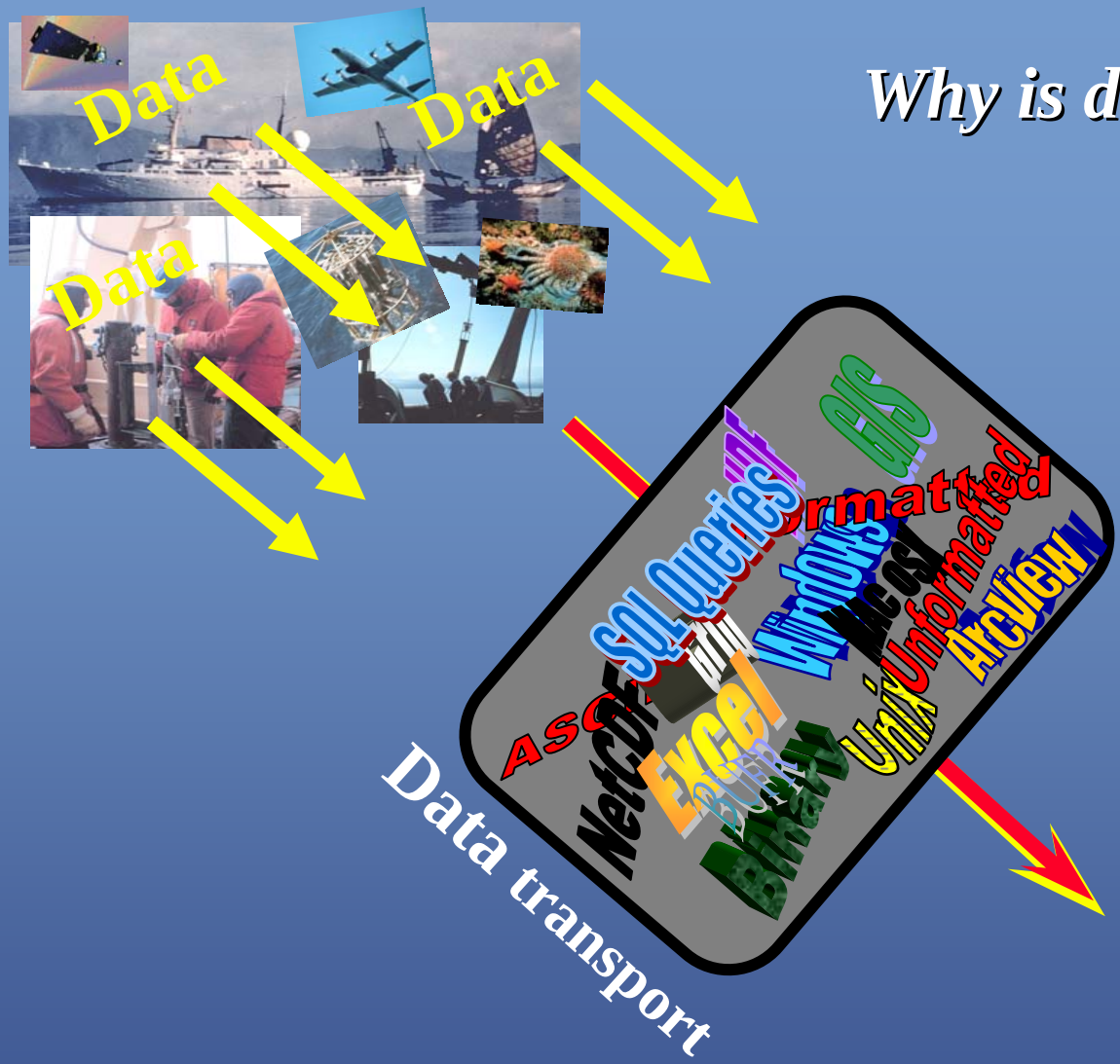
Data transport

A small amount of time spent setting up efficient data transport can greatly reduce the time spent on serving data.

Why is data transport layer so important?

Data transport

Data arrives in many formats



Why is data transport layer so important?

Put all the data into a "black box". Users and applications can make requests for data without needing to know the format of the data.

Why is data transport layer so important?

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Why is data transport layer so important?

Data

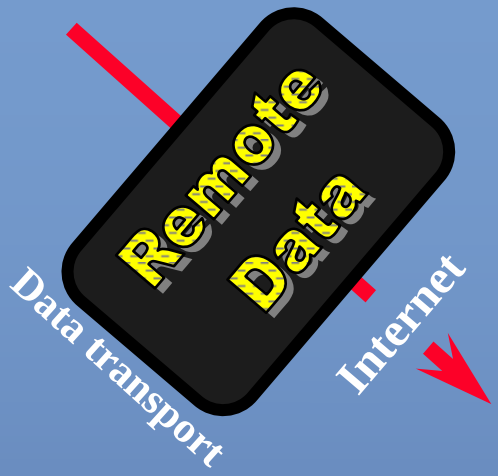
Data transport

Internet

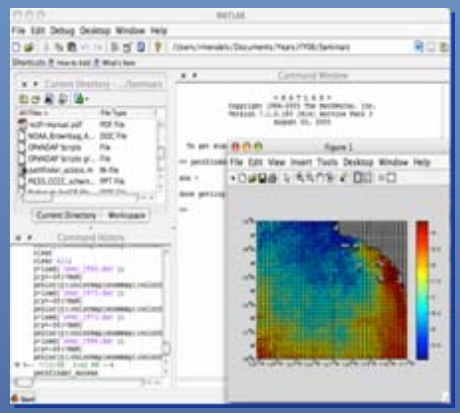
Users can use their favorite application to access data at their desktop

Developers can remotely access data directly in their code

Web browsers can access and subset remote data



Matlab



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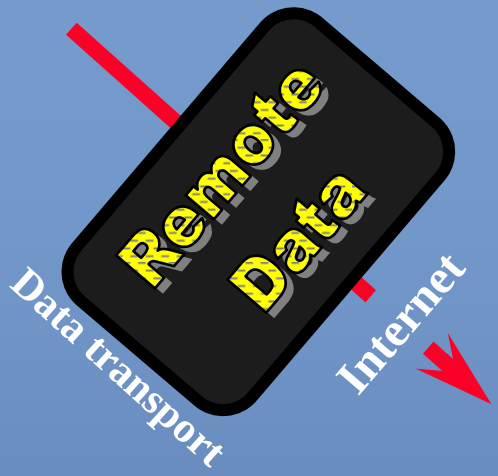
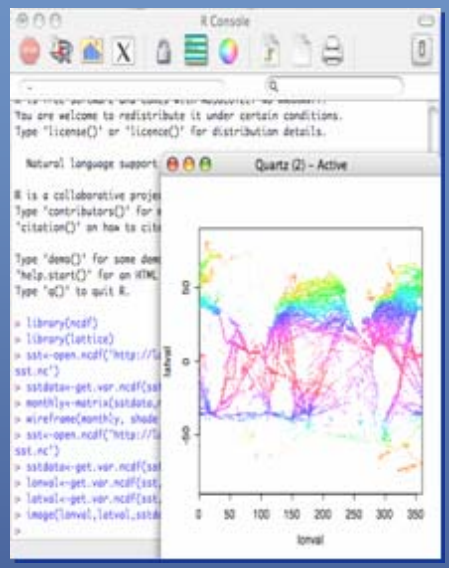
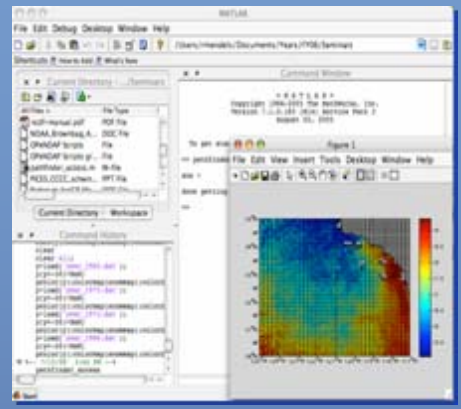


R



Matlab



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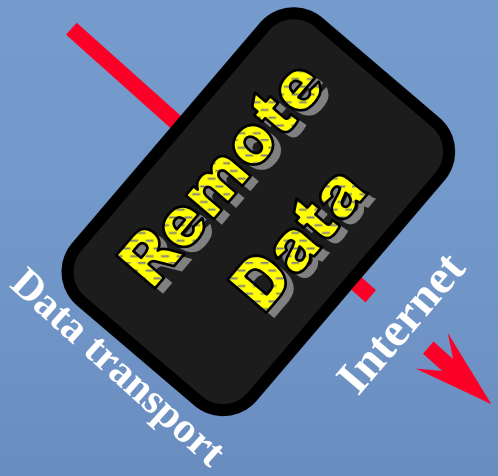
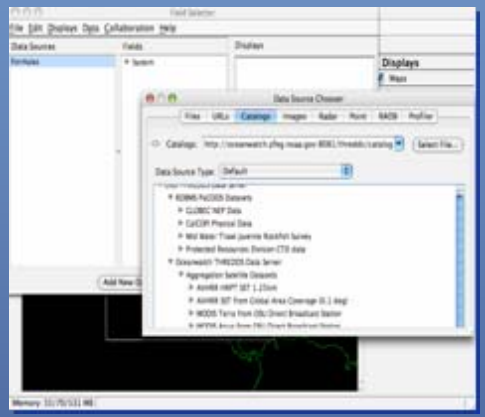
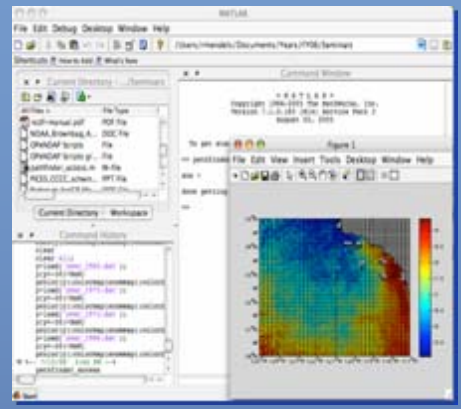


IDV



Matlab



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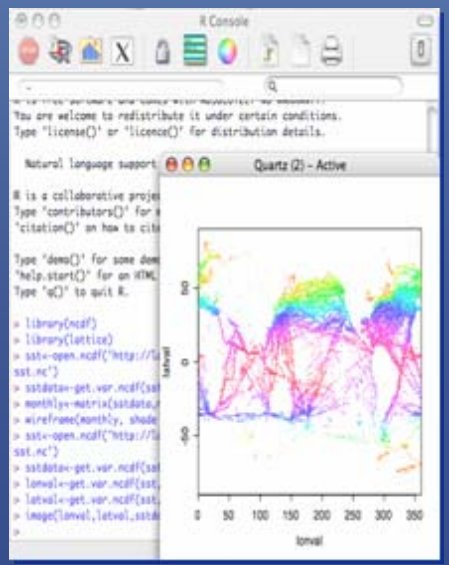
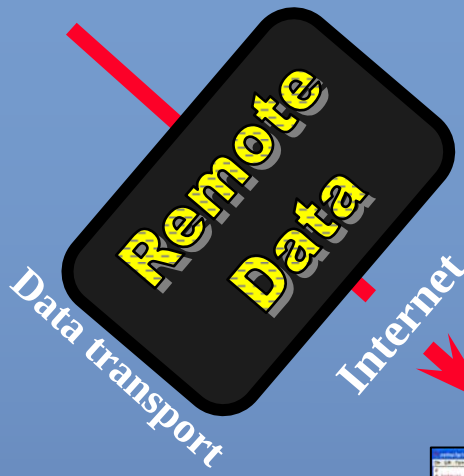
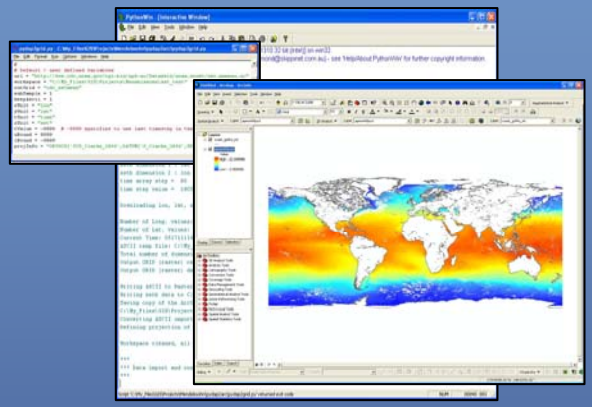




ArcGIS



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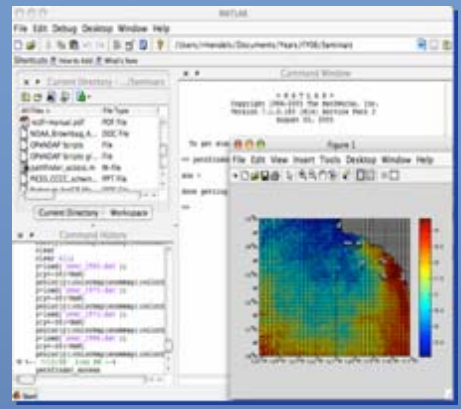

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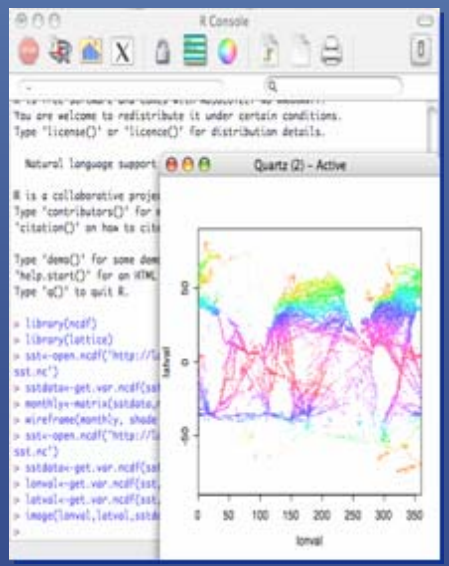

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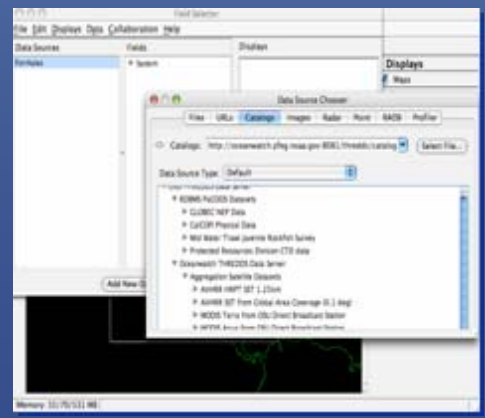
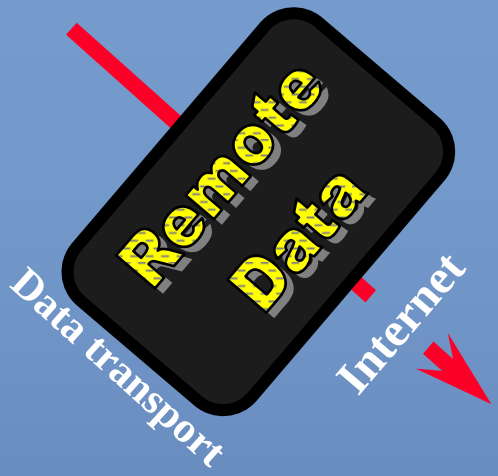
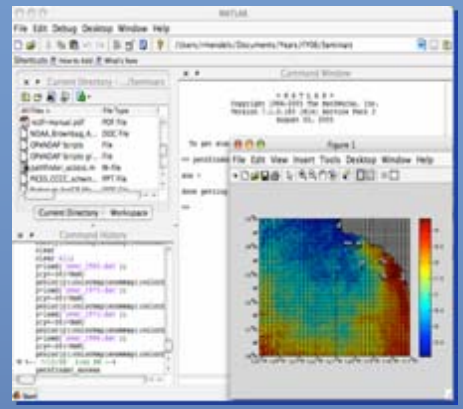




Any other OPeNDAP-enabled application such as Ferret, GRADs, etc.

Matlab



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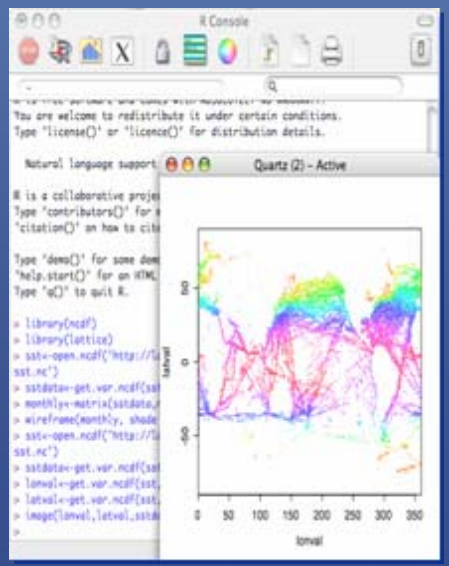
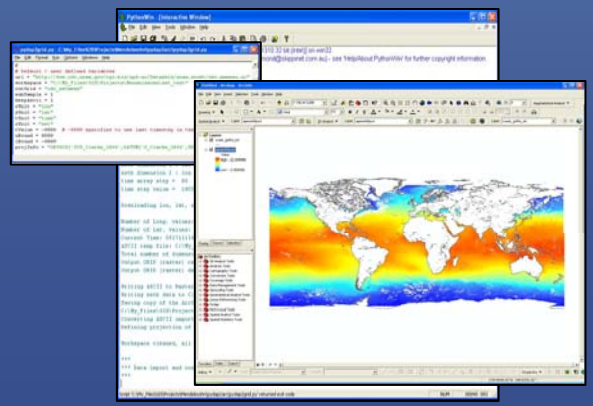


ArcGIS



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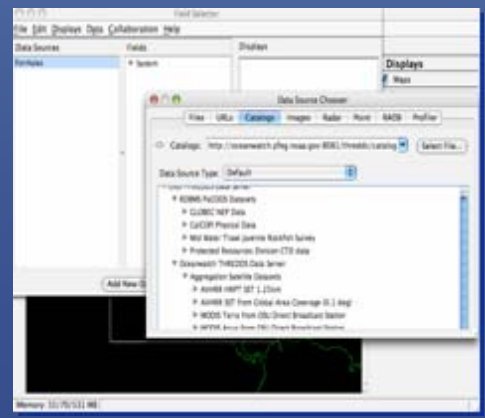
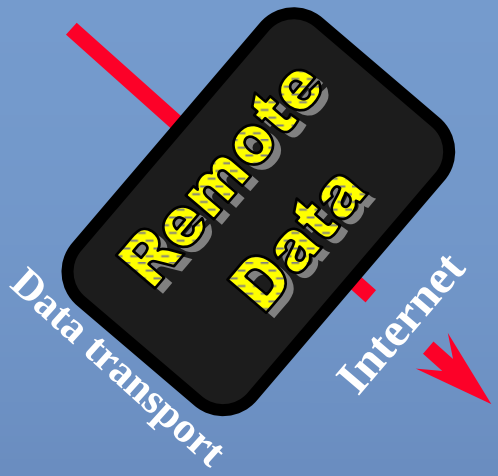
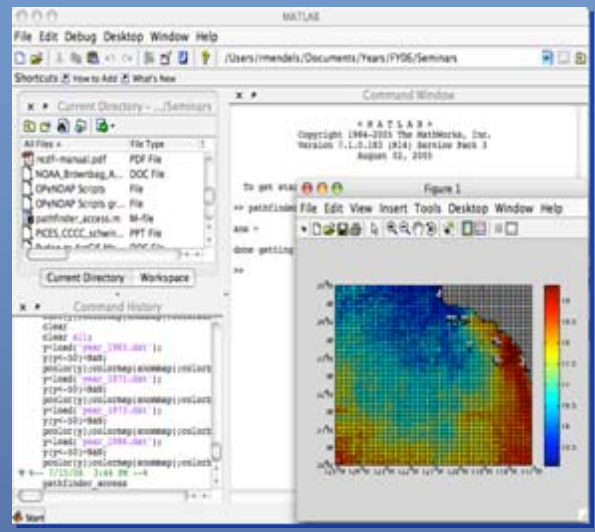


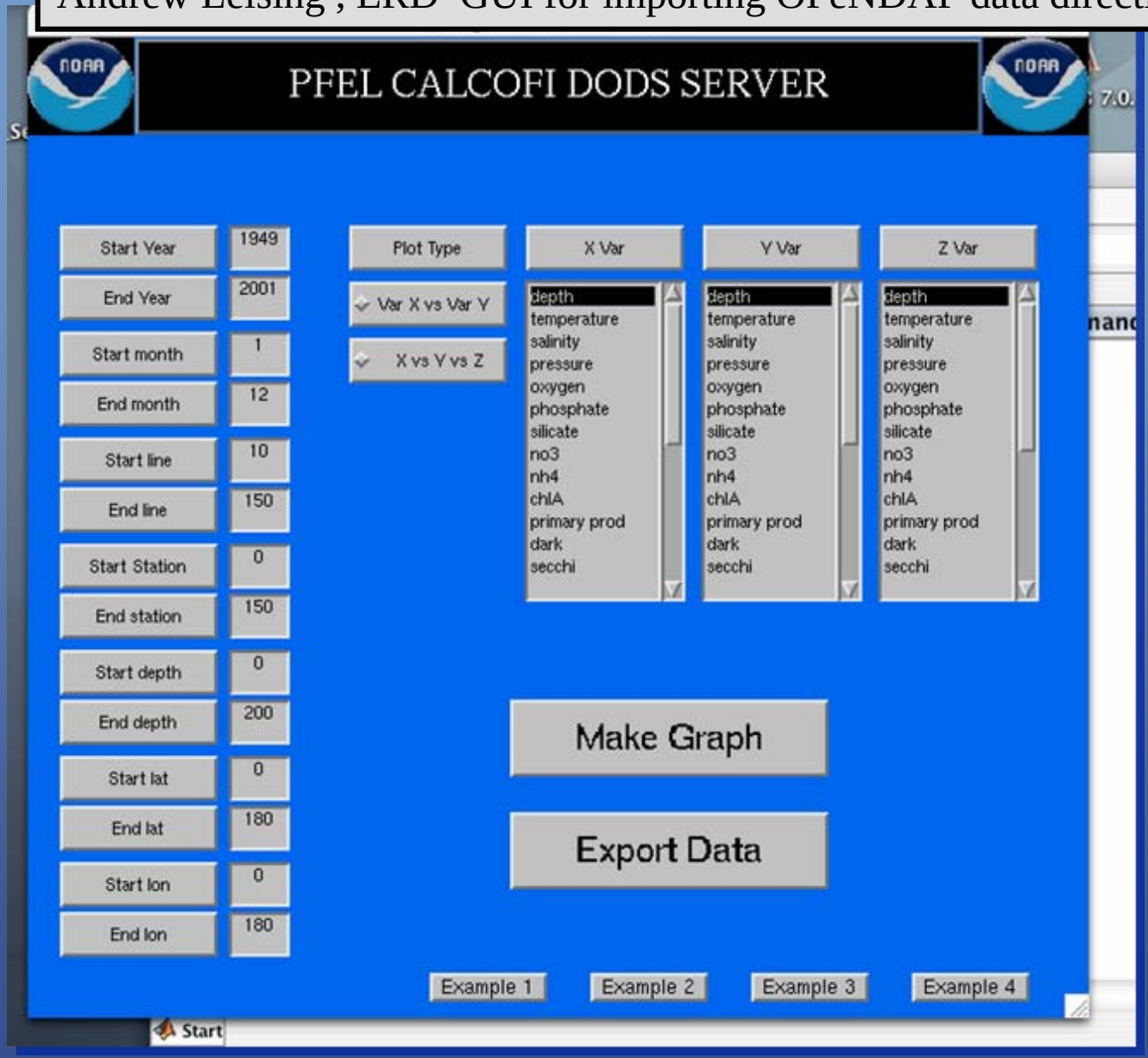


Matlab Example



```
sst=loaddods('http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/AG/tanm/8day?AGtanm[0:99][0:0][1090:1105][575:592]');
```

Andrew Leising , ERD GUI for importing OPeNDAP data directly into Matlab



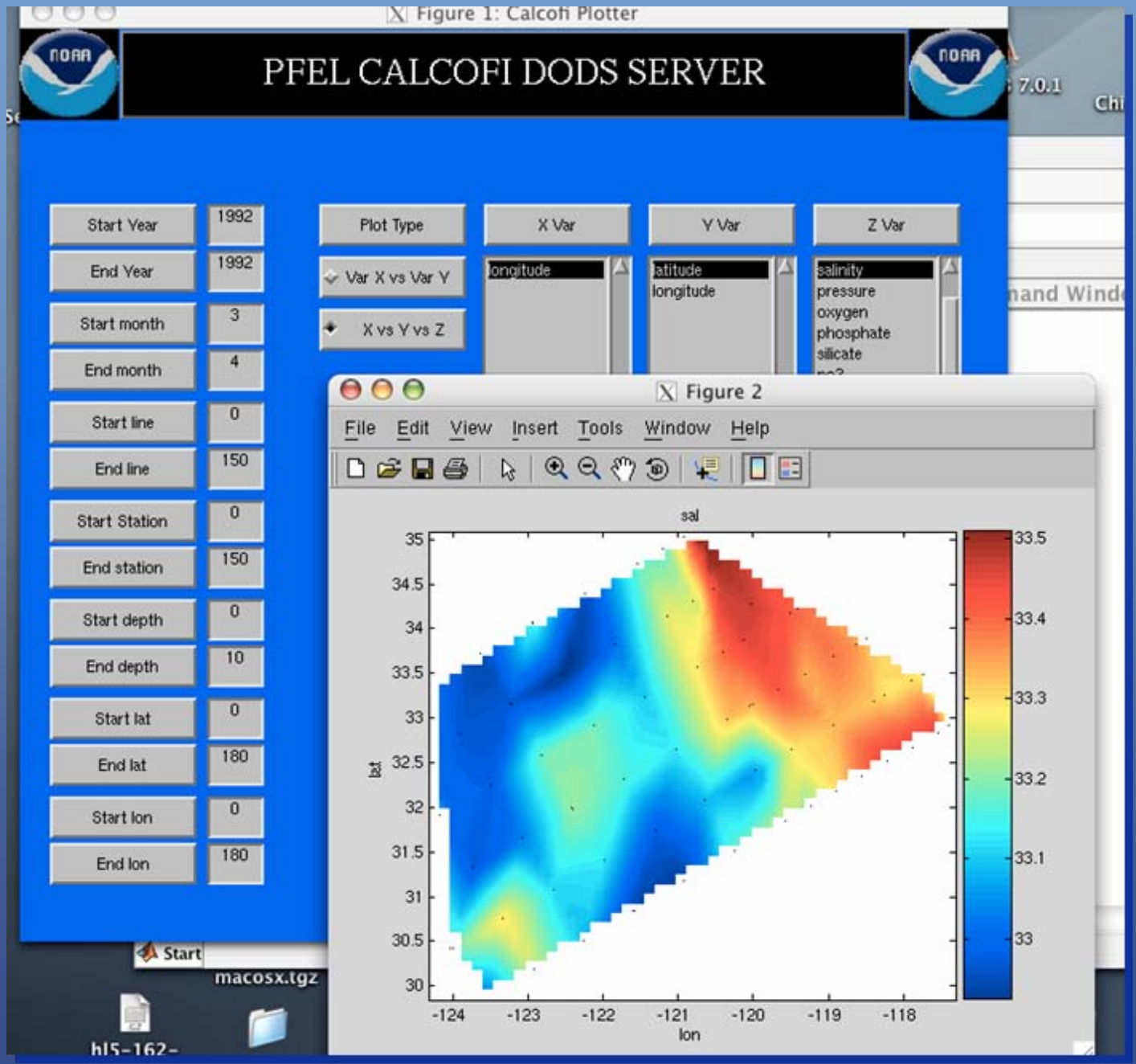


Figure 1: Calcofi Plotter
PFEL CALCOFI DODS SERVER
Start Year
1992
End Year
1992
Start month
3
End month
4
Start line
0
End line
150
Start Station
0
End station
150
Start depth
0
End depth
10
Start lat
0
End lat
180
Start lon
0
End lon
180
Plot Type
Var X vs Var Y
X vs Y vs Z
X Var
Y Var
Z Var
longitude
latitude
longitude
salinity
pressure
oxygen
phosphate
silicate
Figure 2
File Edit View Insert Tools Window Help
sal
lat
lon
35
34.5
34
33.5
33
32.5
32
31.5
31
30.5
30
-124
-123
-122
-121
-120
-119
-118
33.5
33.4
33.3
33.2
33.1
33
Start
macosx.tgz

Why is data transport layer so important?

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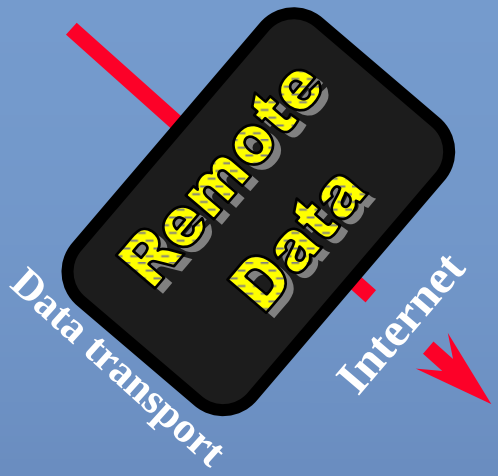
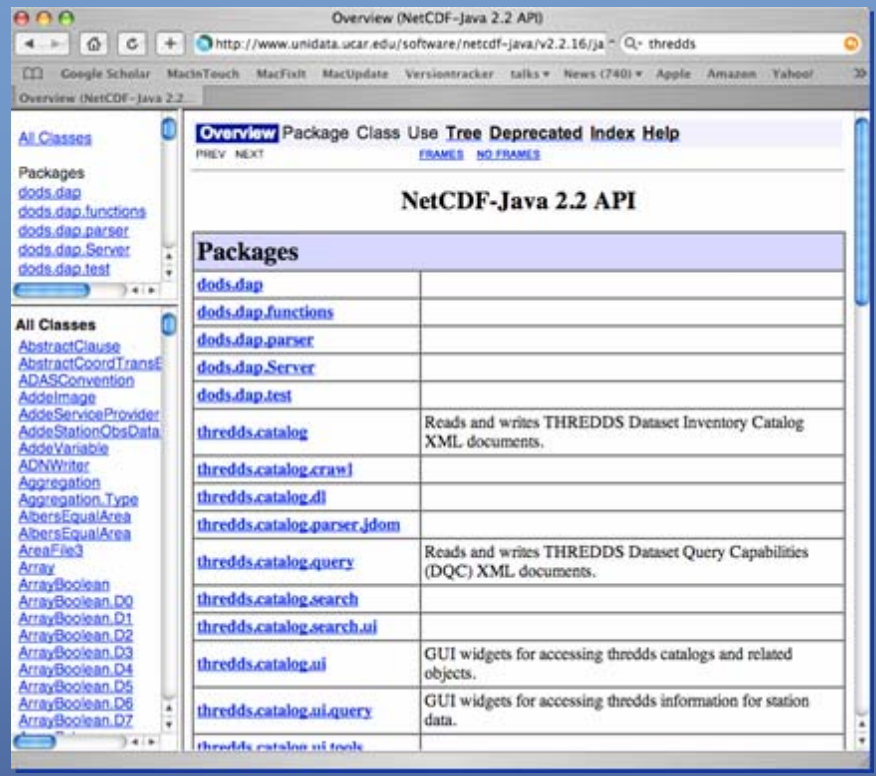


Java



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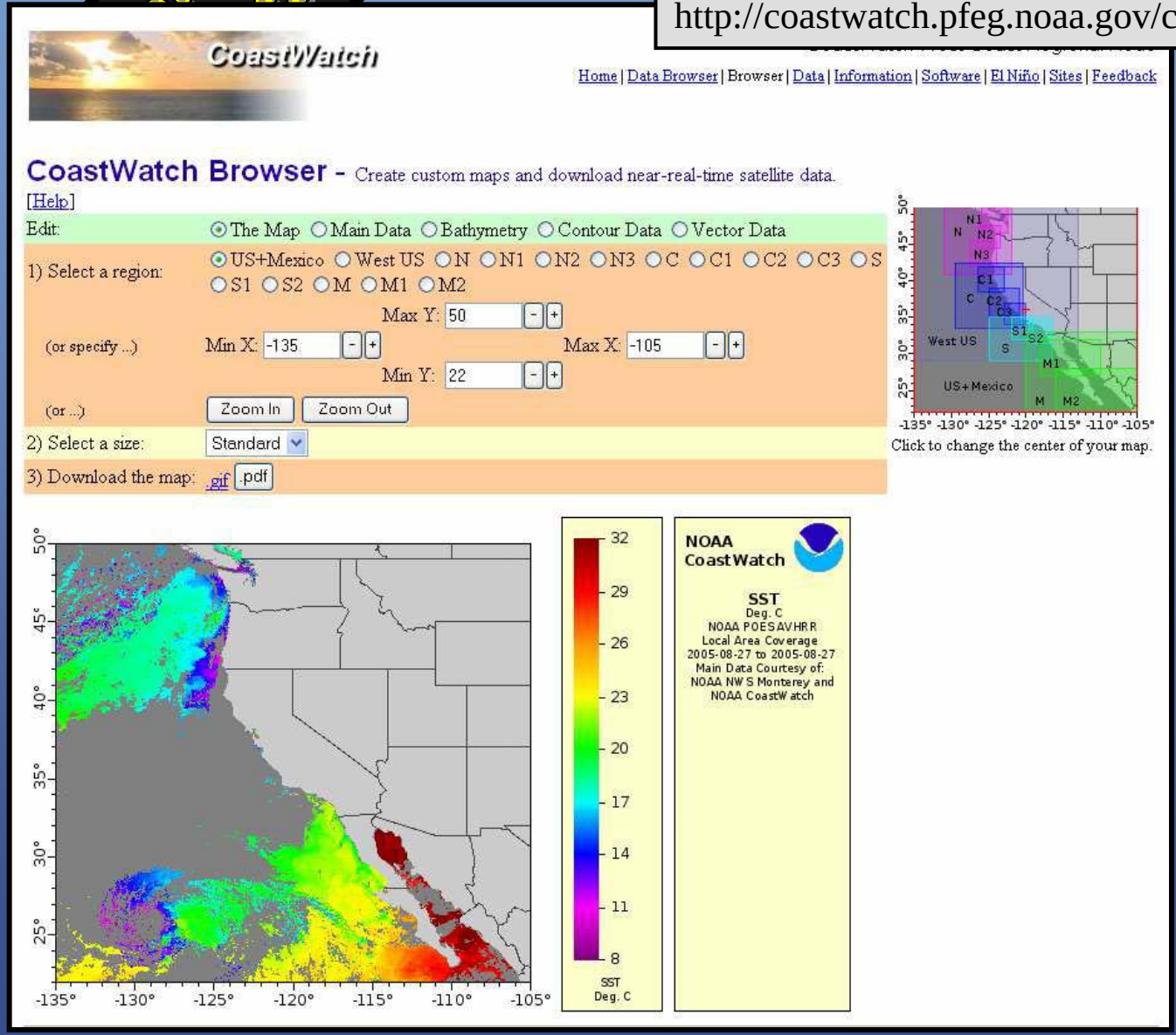
Java Development

http://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowser.jsp



Bob Simons, ERD

CoastWatch West Coast Regional Node

CoastWatch

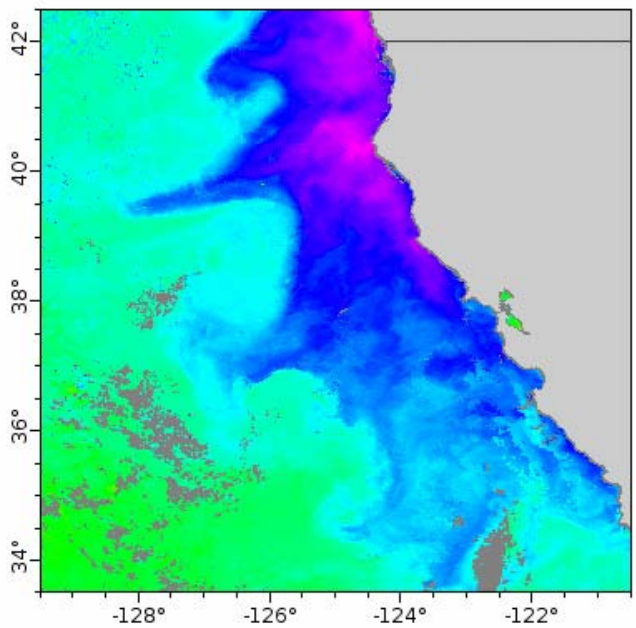
CoastWatch West Coast Regional Node

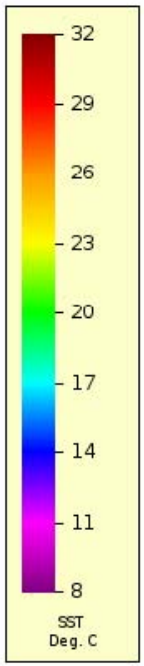
Home | Data Browser | Browser | Data | Information | Software | El Niño | Sites | Feedback

http://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowser.jsp

CoastWatch Browser - Create custom maps and download near-real-time satellite data. [Help]

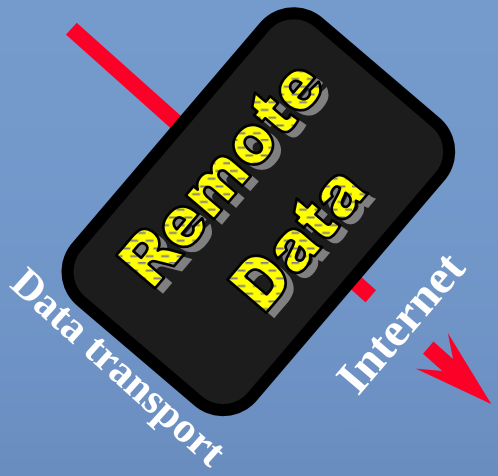
Edit:	○ Thc Map ◉ Main Data ○ Bathymctry ○ Contour Data ○ Vcctor Data
1) Select a data set:	○ None ◉ SST 1km ○ SST 11km* ○ SST Anom.* ○ Pathfinder SST ○ GOES SST ○ NASA Aqua Chl-*a* ○ OSU Aqua Chl-*a* ○ SeaWiFS Chl-*a* ○ Zonal Wind* ○ Merid Wind* ○ Div Wind* ○ Mod Wind* ○ Zonal Wind Stress* ○ Merid Wind Stress* ○ Mod Wind Stress* ○ Stress Curl* ○ Ekman Upwelling* ○ Zonal Ekman* ○ Merid Ekman* ○ Mod Ekman*
2) Select a time period:	○ pass ○ 1 day ○ 3 day ◉ 8 day ○ 14 day
3) Select an ending date:	2005-08-27 |< -100 - + +100 >|
4) Select a palette:	Rainbow Scale: Linear Min: 8.0 - + Max: 32.0 - +
5) Download the data:	.asc .grd .hdf .mat .xyz FGDC [Help]



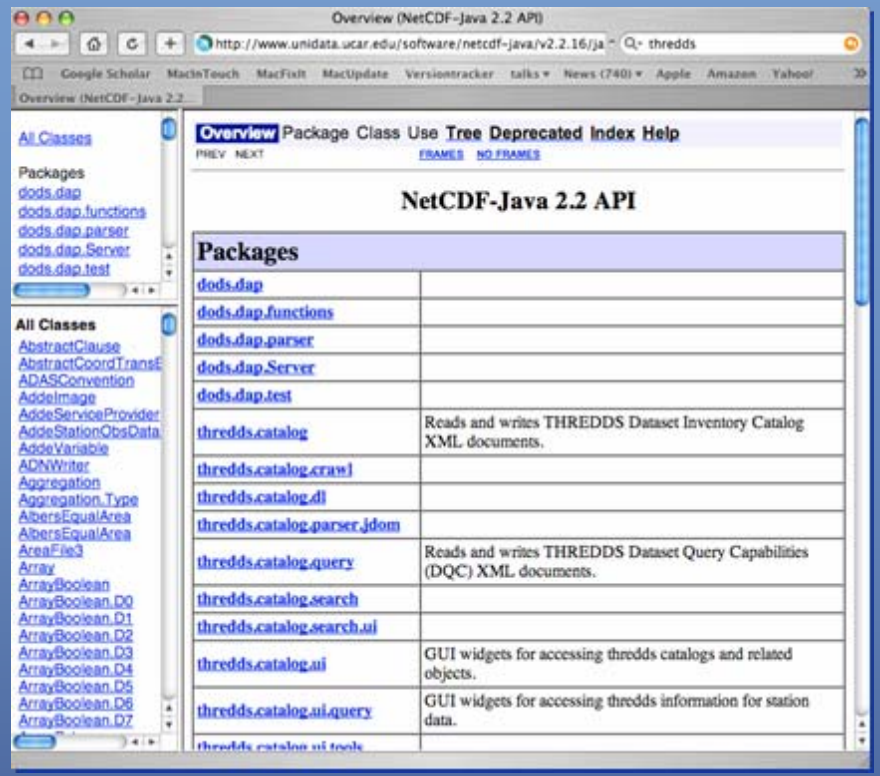


NOAA CoastWatch

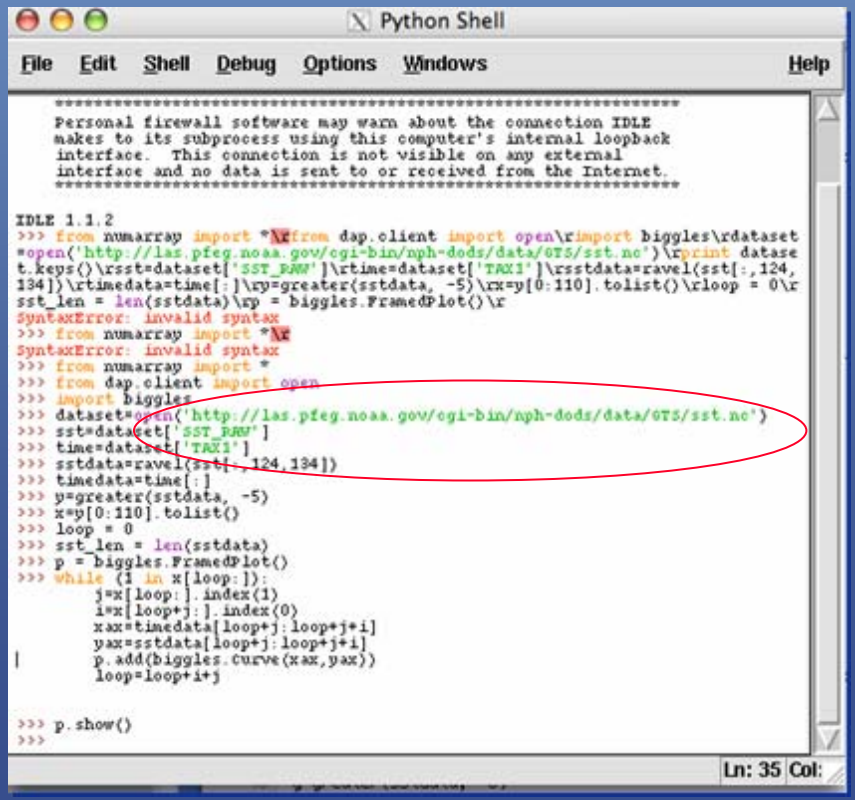
SST
Deg. C
NOAA POES AVHRR
Local Area Coverage
2005-08-20 to 2005-08-27
Main Data Courtesy of:
NOAA NWS Monterey and
NOAA CoastWatch



Java



Python



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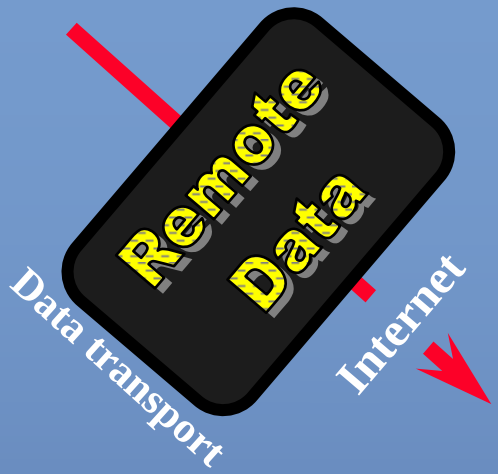
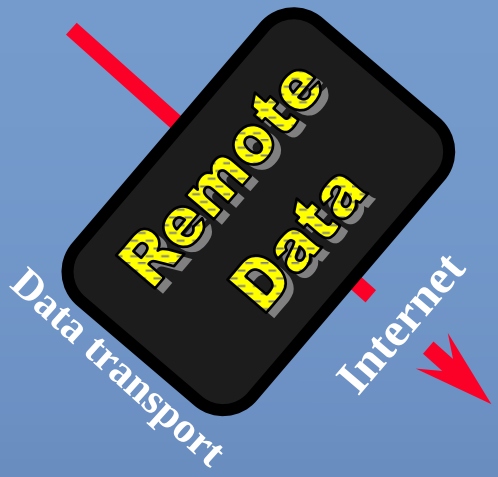


Web browsers can access and subset remote data



Web browsers can access and subset remote data

Most basic method of access:
DODS Dataset Form

DODS Dataset Query Form - Microsoft Internet Explorer

Address http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1day.html

File Edit View Favorites Tools Help

DODS Dataset Access Form

Tested on Netscape 4.61 and Internet Explorer 5.00.

Action: Get ASCII | Get Binary | Show Help

Data URL: http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1d

Global Attributes:

```
acknowledgement: "NOAA NESDIS"
cdm_data_type: "Grid"
cols: 7201
composite: "true"
contributor_name: "NOAA NODC"
```

Variables:

☐ **altitude**: Array of 32 bit Reals [altitude = 0..0]

altitude:

```
actual_range: 0.0, 0.0
fraction_digits: 0
long_name: "Altitude"
standard_name: "altitude"
units: "m"
```

☐ **lat**: Array of 32 bit Reals [lat = 0..3000]

lat:

```
actual_range: -75.0, 75.0
coordsys: "geographic"
fraction_digits: 2
```

DODS Dataset Query Form - Microsoft Internet Explorer

Address http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1day.html

File Edit View Favorites Tools Help

DODS Dataset Access Form

Tested on Netscape 4.61 and Internet Explorer 5.00.

☐ **lon**: Array of 32 bit Reals [lon = 0..7200]

lon:

```
actual_range: 0.0, 360.0
coordsys: "geographic"
fraction_digits: 2
long_name: "Longitude"
point_spacing: "even"
```

dsC/satellite/PH/ssta/1d

☐ **time**: Array of 64 bit Reals [time = 0..729]

time:

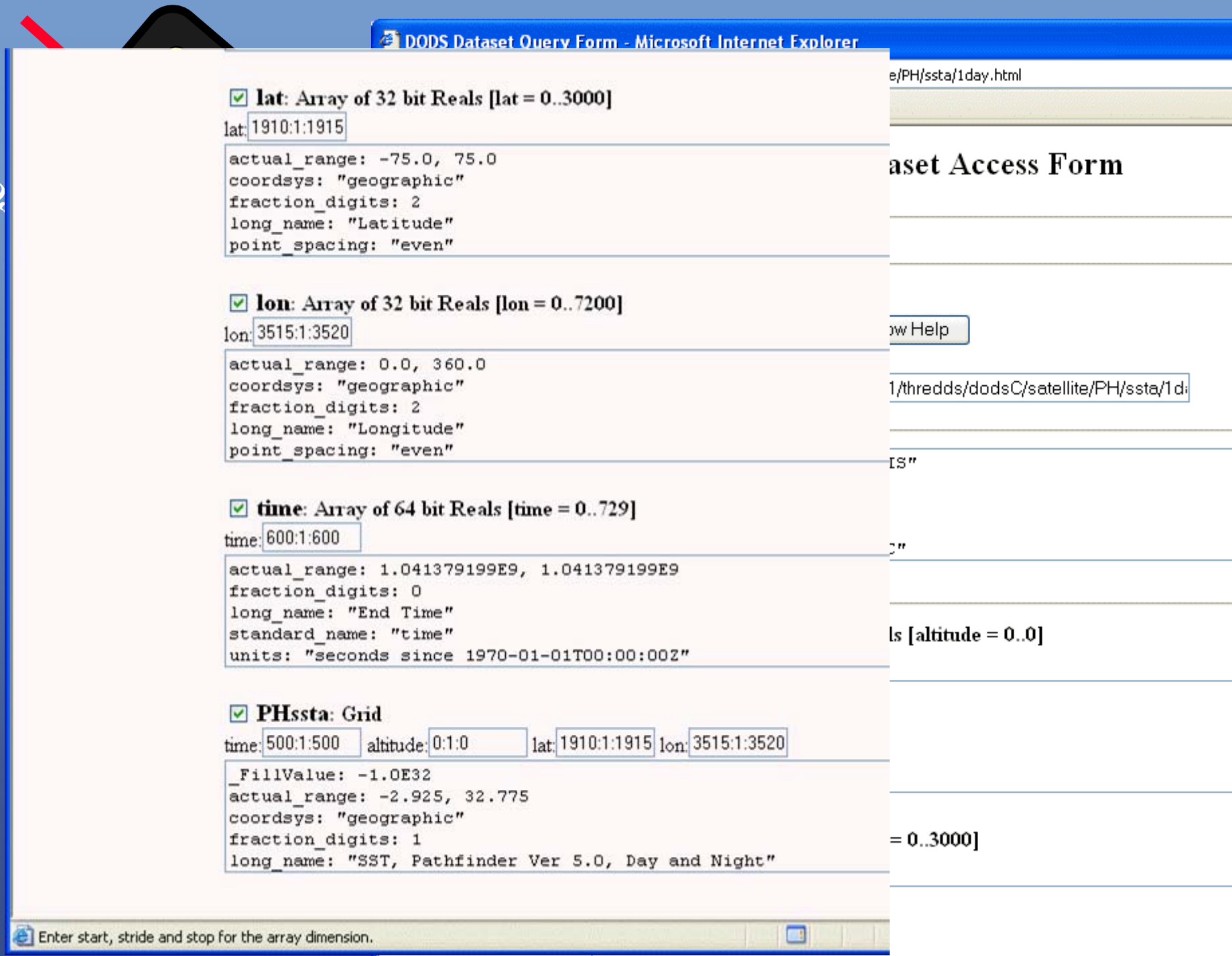
```
actual_range: 1.041379199E9, 1.041379199E9
fraction_digits: 0
long_name: "End Time"
standard_name: "time"
units: "seconds since 1970-01-01T00:00:00Z"
```

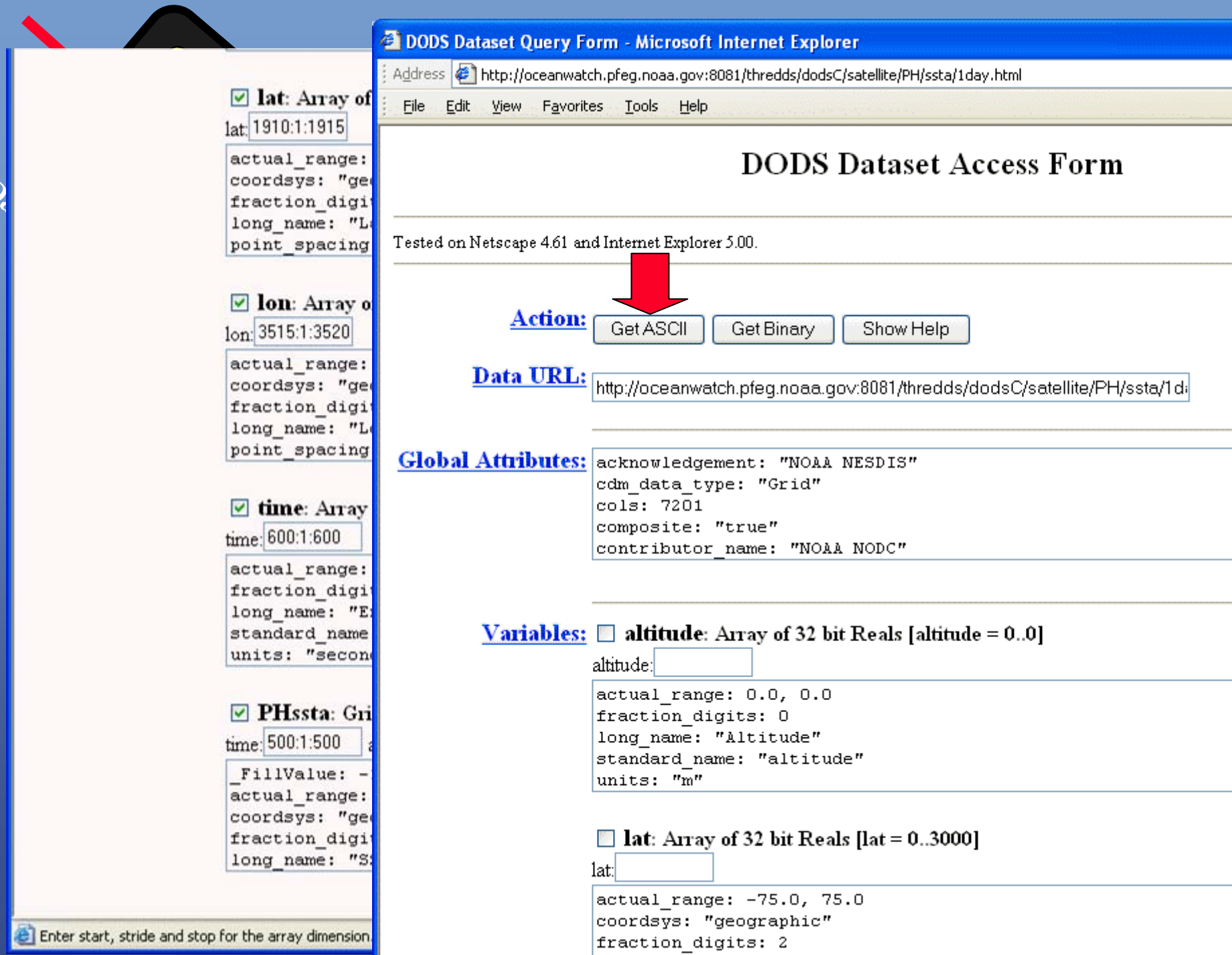
= 0..0]

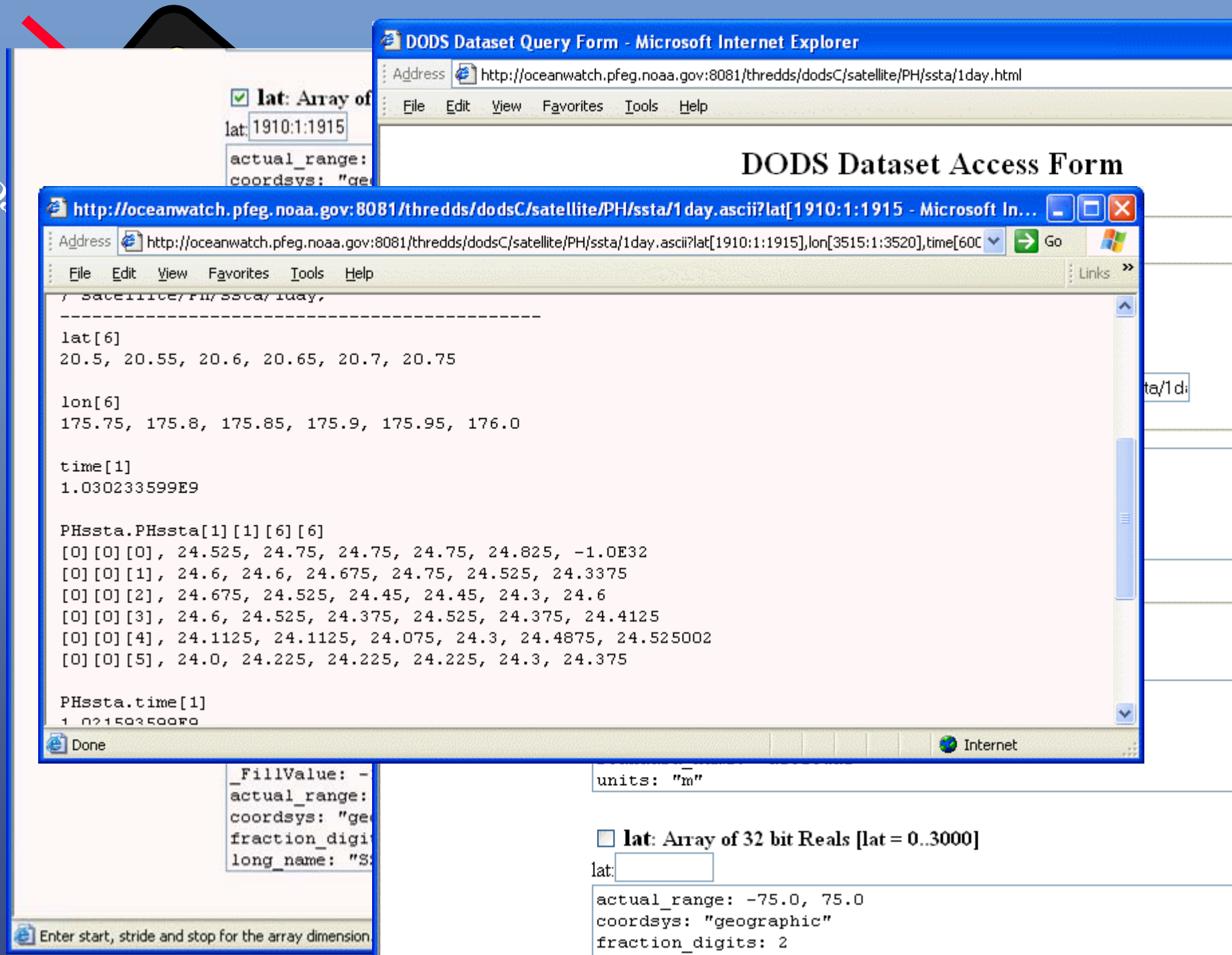
☐ **PHssta**: Grid

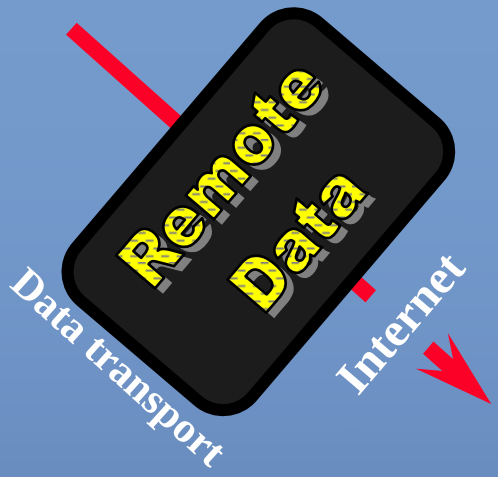
time: altitude: lat: lon:

```
_FillValue: -1.0E32
actual_range: -2.925, 32.775
coordsys: "geographic"
fraction_digits: 1
long_name: "SST, Pathfinder Ver 5.0, Day and Night"
```

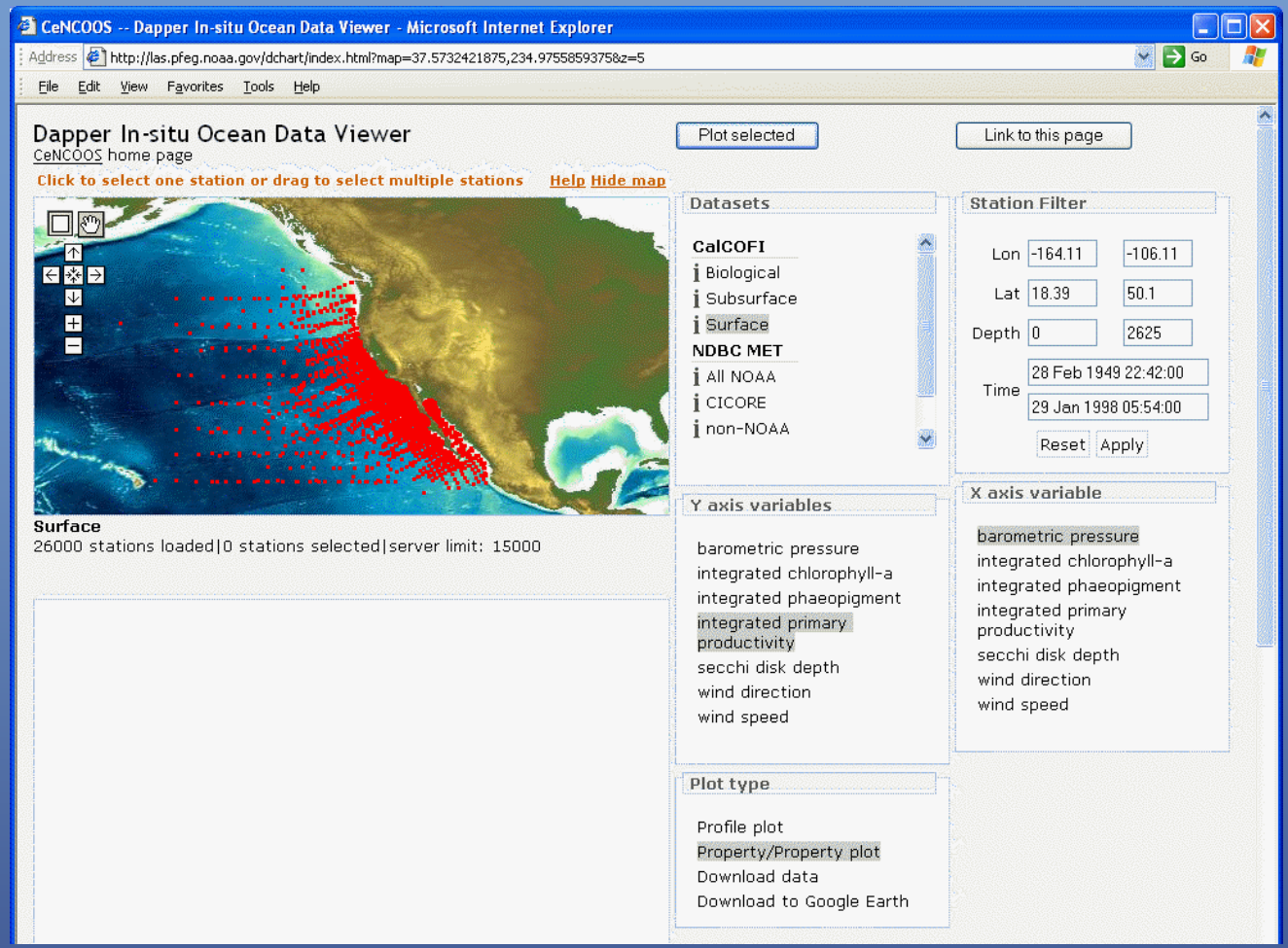

DODS Dataset Query Form - Microsoft Internet Explorer
lat: Array of 32 bit Reals [lat = 0..3000]
lat: 1910:1:1915
actual_range: -75.0, 75.0
coordsys: "geographic"
fraction_digits: 2
long_name: "Latitude"
point_spacing: "even"
lon: Array of 32 bit Reals [lon = 0..7200]
lon: 3515:1:3520
actual_range: 0.0, 360.0
coordsys: "geographic"
fraction_digits: 2
long_name: "Longitude"
point_spacing: "even"
time: Array of 64 bit Reals [time = 0..729]
time: 600:1:600
actual_range: 1.041379199E9, 1.041379199E9
fraction_digits: 0
long_name: "End Time"
standard_name: "time"
units: "seconds since 1970-01-01T00:00:00Z"
PHssta: Grid
time: 500:1:500
altitude: 0:1:0
lat: 1910:1:1915
lon: 3515:1:3520
_FillValue: -1.0E32
actual_range: -2.925, 32.775
coordsys: "geographic"
fraction_digits: 1
long_name: "SST, Pathfinder Ver 5.0, Day and Night"
Enter start, stride and stop for the array dimension.
e/PH/ssta/1day.html
aset Access Form
ow Help
1/thredds/dodsC/satellite/PH/ssta/1d
IS"
"
ls [altitude = 0..0]
= 0..3000]


DODS Dataset Query Form - Microsoft Internet Explorer
Address
http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1day.html
File Edit View Favorites Tools Help
DODS Dataset Access Form
Tested on Netscape 4.61 and Internet Explorer 5.00.
Action:
Get ASCII
Get Binary
Show Help
Data URL:
http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1d
Global Attributes:
acknowledgement: "NOAA NESDIS"
cdm_data_type: "Grid"
cols: 7201
composite: "true"
contributor_name: "NOAA NODC"
Variables:
altitude: Array of 32 bit Reals [altitude = 0..0]
altitude:
actual_range: 0.0, 0.0
fraction_digits: 0
long_name: "Altitude"
standard_name: "altitude"
units: "m"
lat: Array of 32 bit Reals [lat = 0..3000]
lat:
actual_range: -75.0, 75.0
coordsys: "geographic"
fraction_digits: 2
lat: Array of
lat: 1910:1:1915
lon: Array o
lon: 3515:1:3520
time: Array
time: 600:1:600
PHssta: Gri
time: 500:1:500
Enter start, stride and stop for the array dimension.


DODS Dataset Query Form - Microsoft Internet Explorer
Address http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1day.html
File Edit View Favorites Tools Help
DODS Dataset Access Form
http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1day.ascii?lat[1910:1:1915 - Microsoft In...
Address http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/PH/ssta/1day.ascii?lat[1910:1:1915],lon[3515:1:3520],time[60
Go
File Edit View Favorites Tools Help
Links
lat[6]
20.5, 20.55, 20.6, 20.65, 20.7, 20.75
lon[6]
175.75, 175.8, 175.85, 175.9, 175.95, 176.0
time[1]
1.030233599E9
PHssta.PHssta[1][1][6][6]
[0][0][0], 24.525, 24.75, 24.75, 24.75, 24.825, -1.0E32
[0][0][1], 24.6, 24.6, 24.675, 24.75, 24.525, 24.3375
[0][0][2], 24.675, 24.525, 24.45, 24.45, 24.3, 24.6
[0][0][3], 24.6, 24.525, 24.375, 24.525, 24.375, 24.4125
[0][0][4], 24.1125, 24.1125, 24.075, 24.3, 24.4875, 24.525002
[0][0][5], 24.0, 24.225, 24.225, 24.225, 24.3, 24.375
PHssta.time[1]
Done
Internet
lat: Array of
lat: 1910:1:1915
actual_range:
coordsys: "ge
_FillValue: -
actual_range:
coordsys: "ge
fraction_digi
long_name: "S
Enter start, stride and stop for the array dimension
units: "m"
lat: Array of 32 bit Reals [lat = 0..3000]
lat:
actual_range: -75.0, 75.0
coordsys: "geographic"
fraction_digits: 2



Web browsers can access and subset remote data



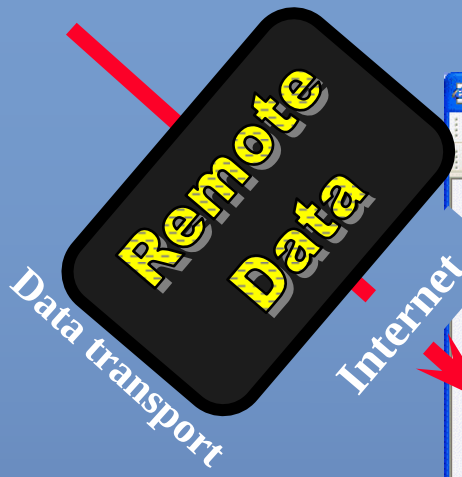
DChart

A Web interface for OPeNDAP/dapper in-situ data collections, Free/Open Source

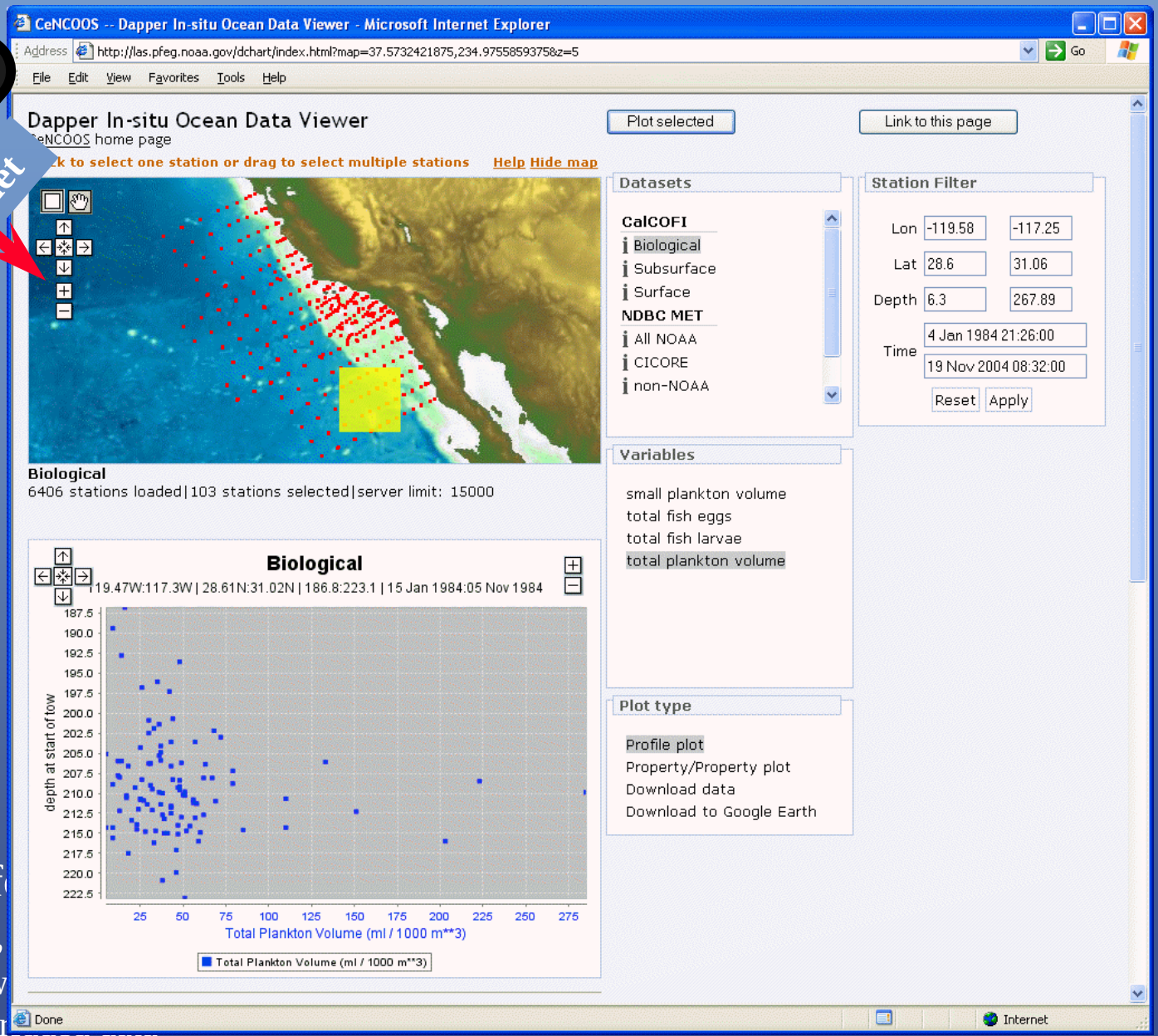
Joe Sirott, PMEL, NOAA

Dapper: OPeNDAP web server developed by the EPIC group at PMEL that provides networked access to in-situ and gridded data

http://www.epic.noaa.gov/epic/software/dchart/index.html



Web browsers can access and subset remote data



Dchart

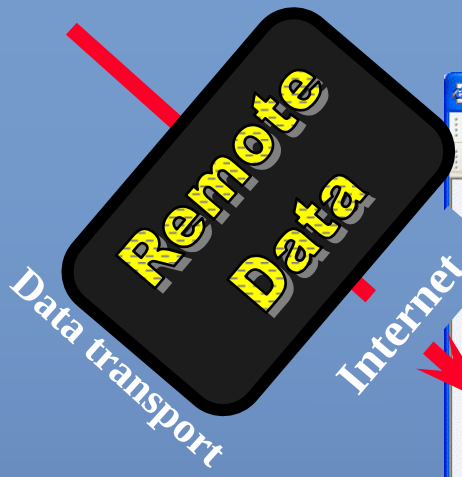
A Web interface f

Joe Sirott, PMEL,

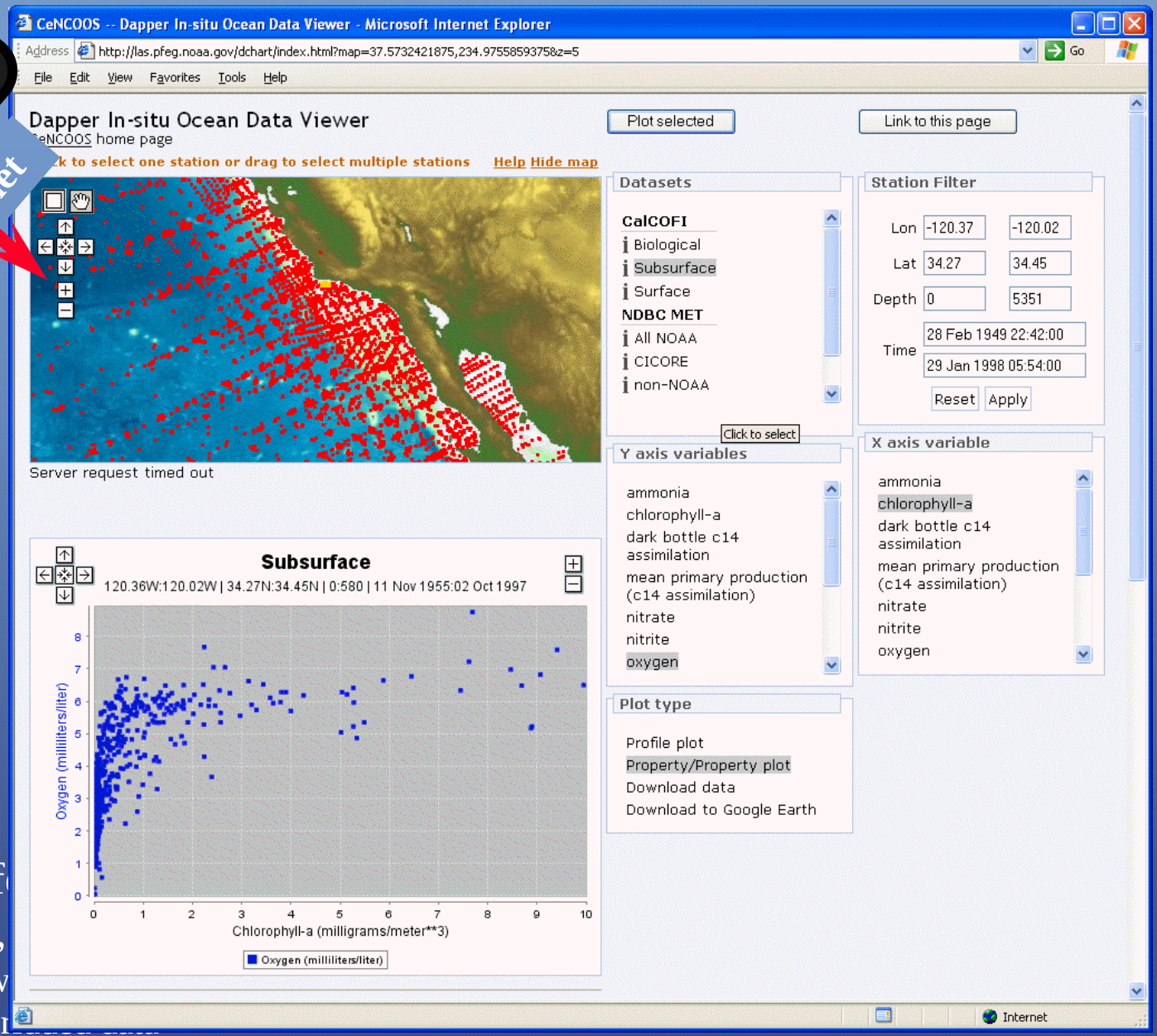
Dapper: OPeNDAP w

access to in-situ and gr

http://www.epic.noaa.gov/epic/software/dchart/index.html



Web browsers can access and subset remote data



Dchart

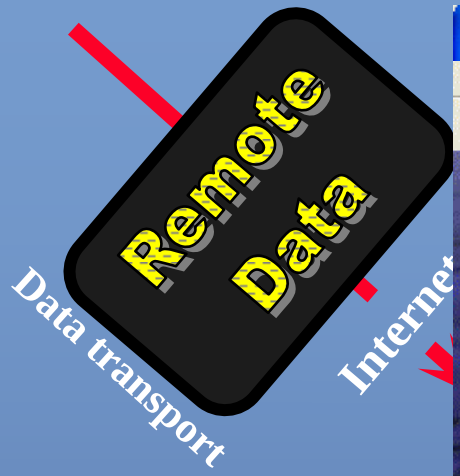
A Web interface f

Joe Sirott, PMEL,

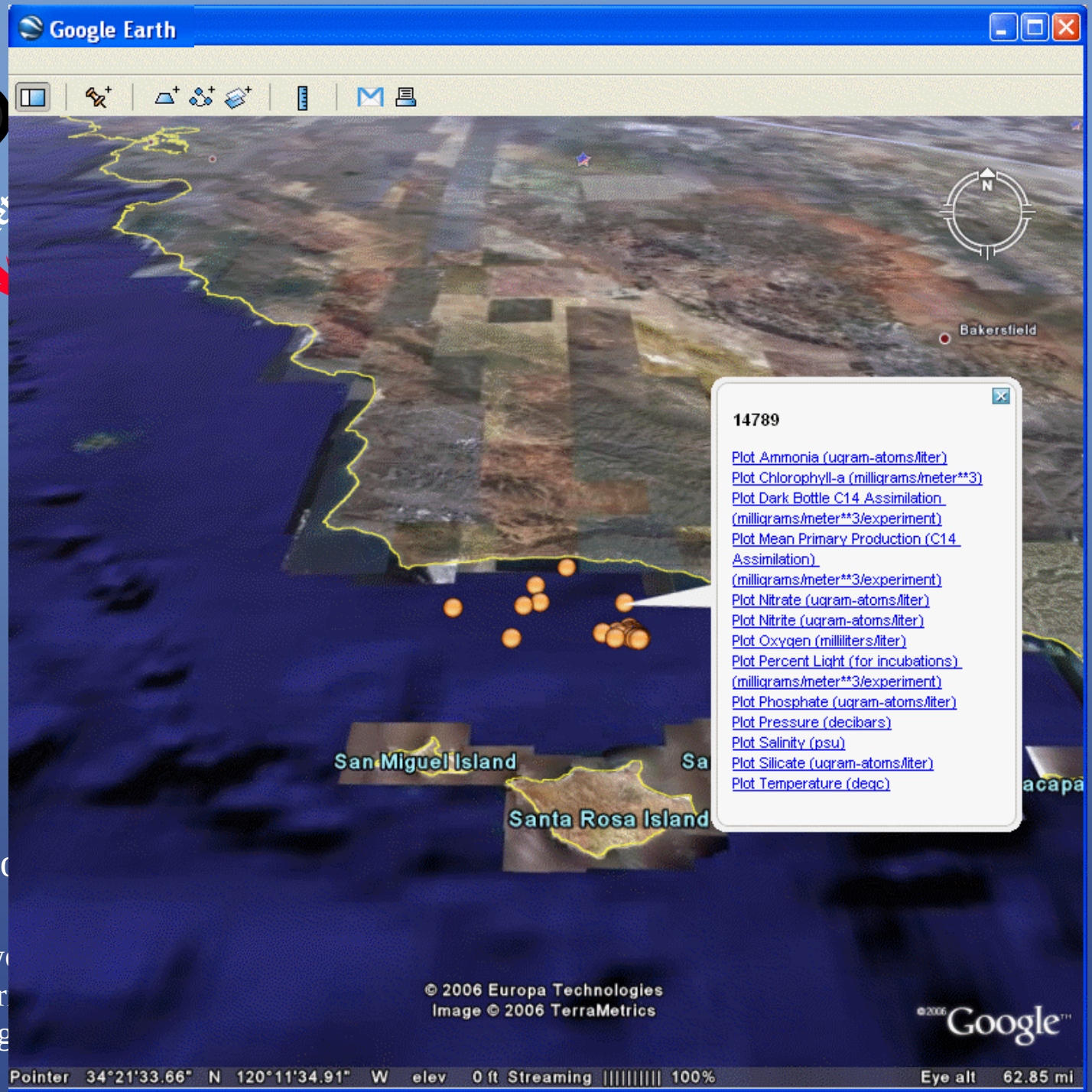
Dapper: OPeNDAP w

access to in-situ and gr

http://www.epic.noaa.gov/epic/software/dchart/index.html



Web browsers can access and subset remote data



Dchart

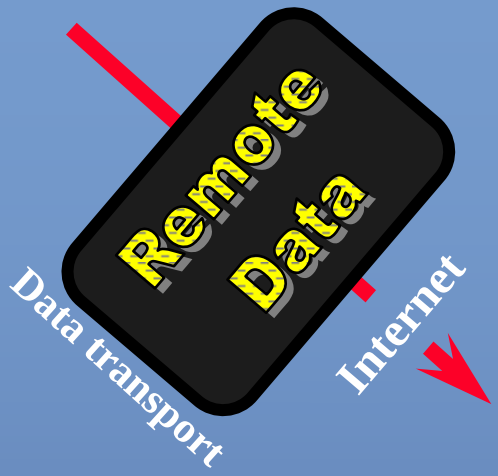
A Web interface fo

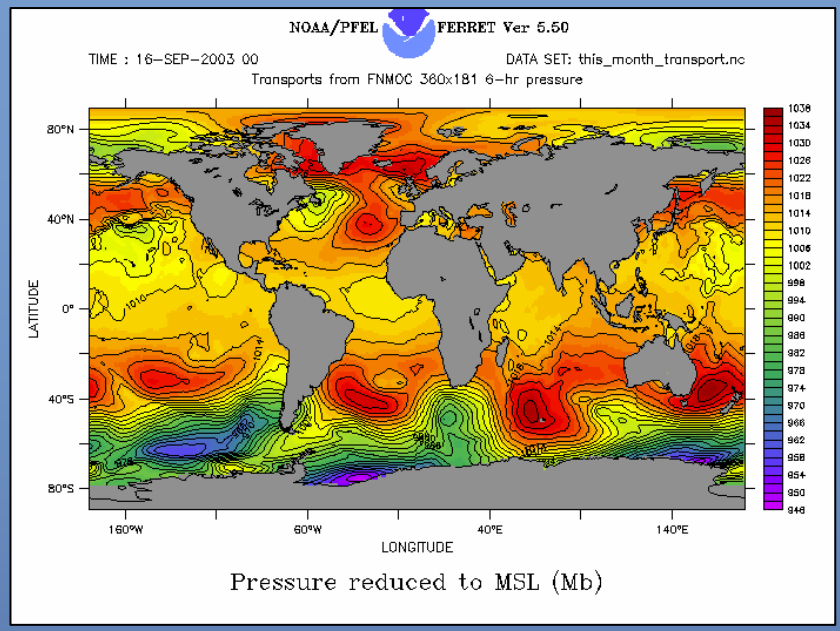
Joe Sirott, PMEL,

Dapper: OPeNDAP w

access to in-situ and gr

http://www.epic.noaa.g





Map

Time Series

Live Access Server

LAS Software developed at NOAA/PMEL

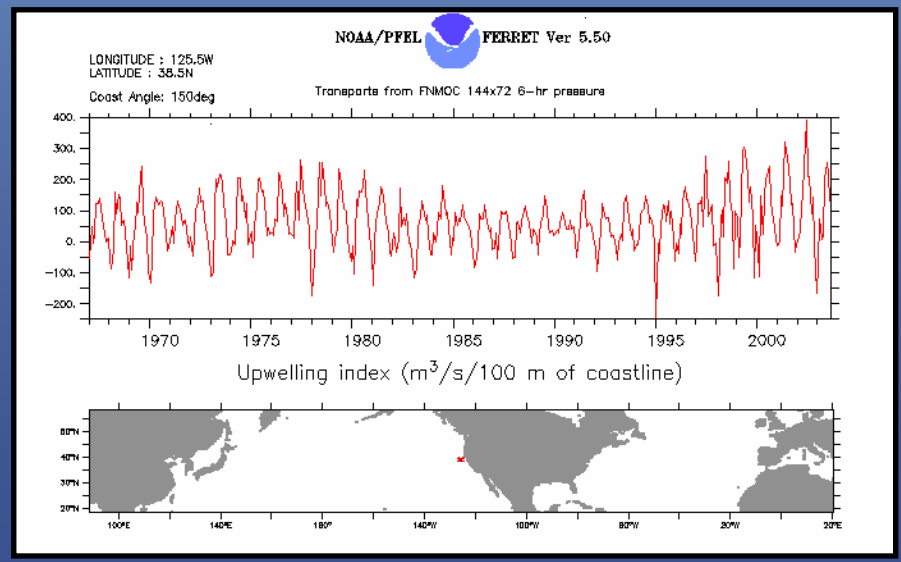
Jonathan Callahan, Steve Hankin

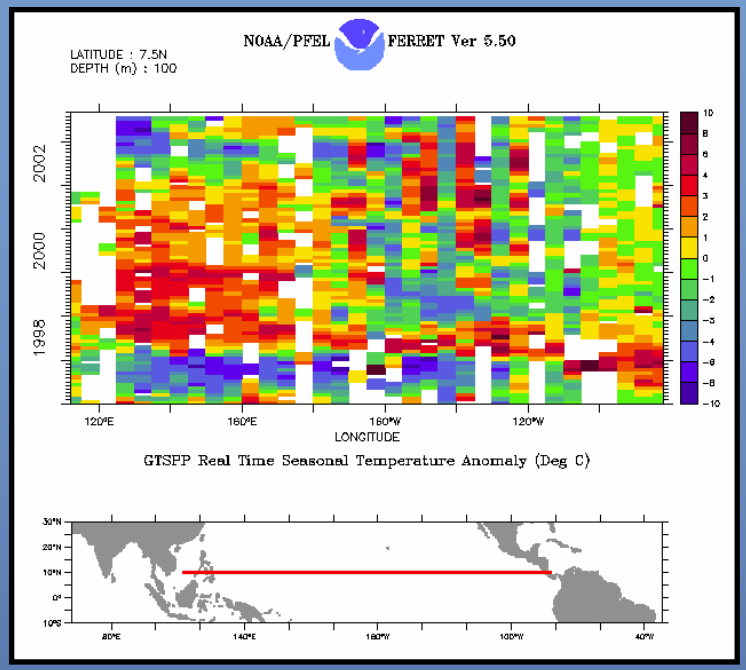
Free, open source software

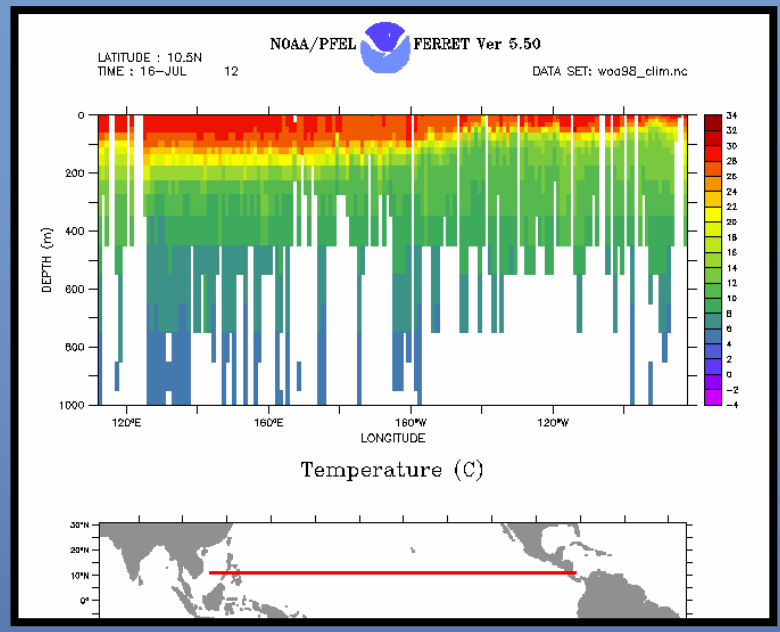
Appearance and output can be customized for project or dataset

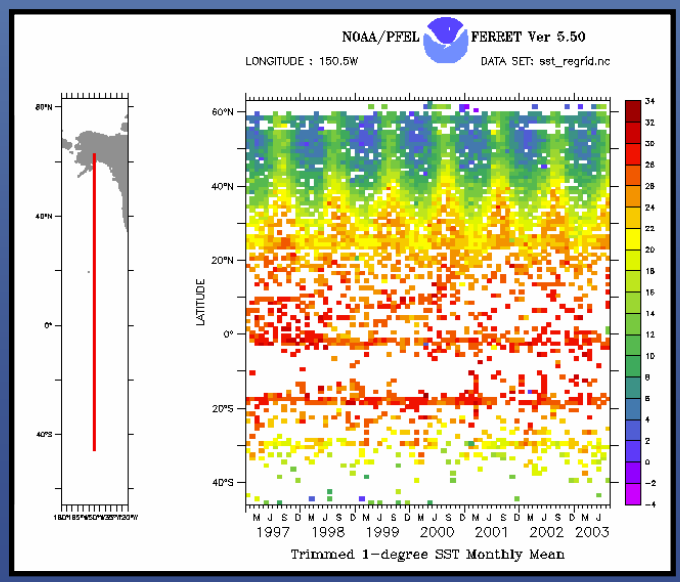
Users can obtain

- Custom subsets in time and space
- Custom graphics and file formats



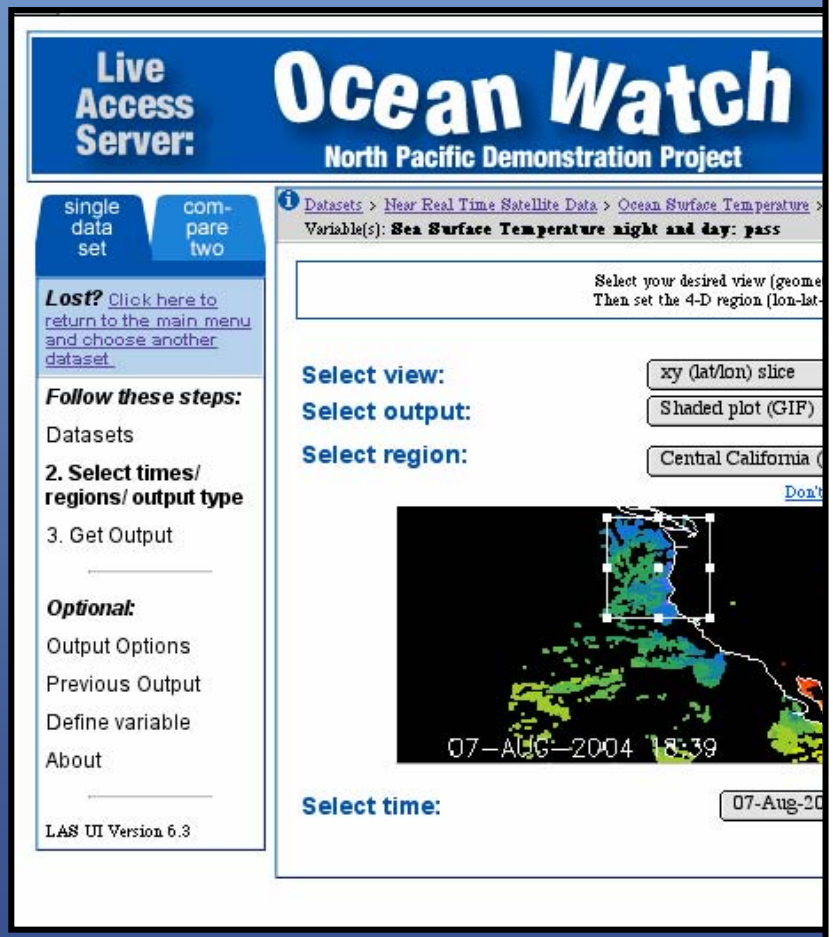


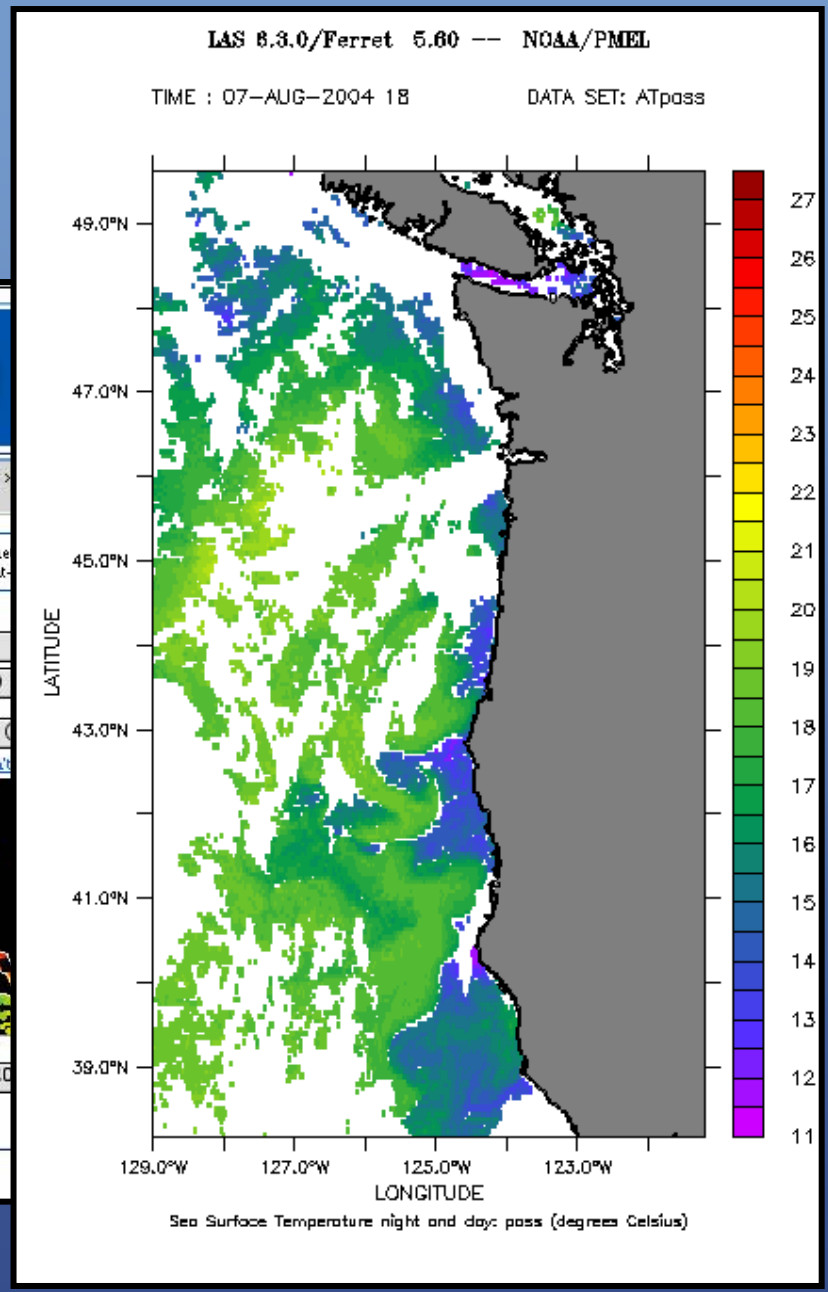




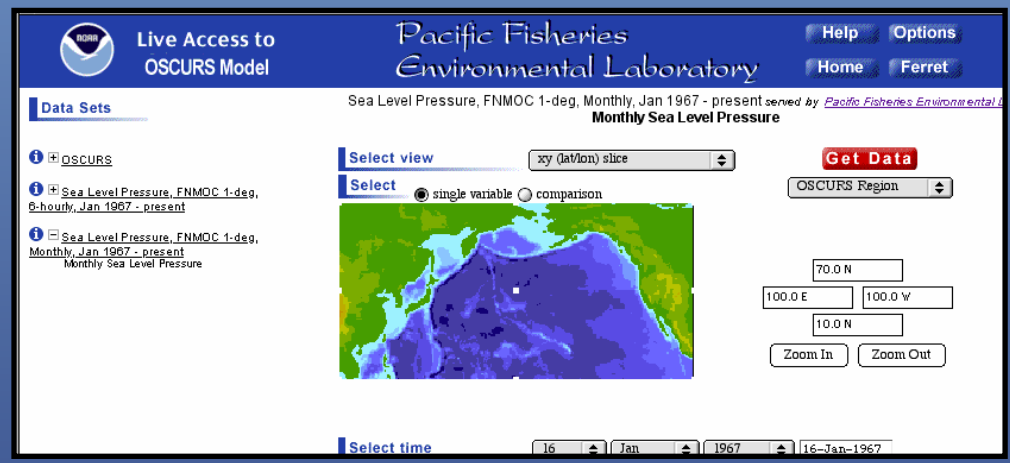
Slice/subset data in a multitude of ways and download in various user-friendly formats

Live Access Server
can be customized to serve a variety of data





Live Access Server
can be customized to serve a variety of data



OSCURS Model

Ocean Surface Current Simulator

- Developed by Jim Ingraham

  Alaska Fisheries Science Center

  Resource Ecology and Fisheries Management

- Input: daily FNMOC pressure, 1967 - present, updated monthly
- http://las.pfeg.noaa.gov/las_oscurs
- Model info: http://www.refm.noaa.gov/oscurs

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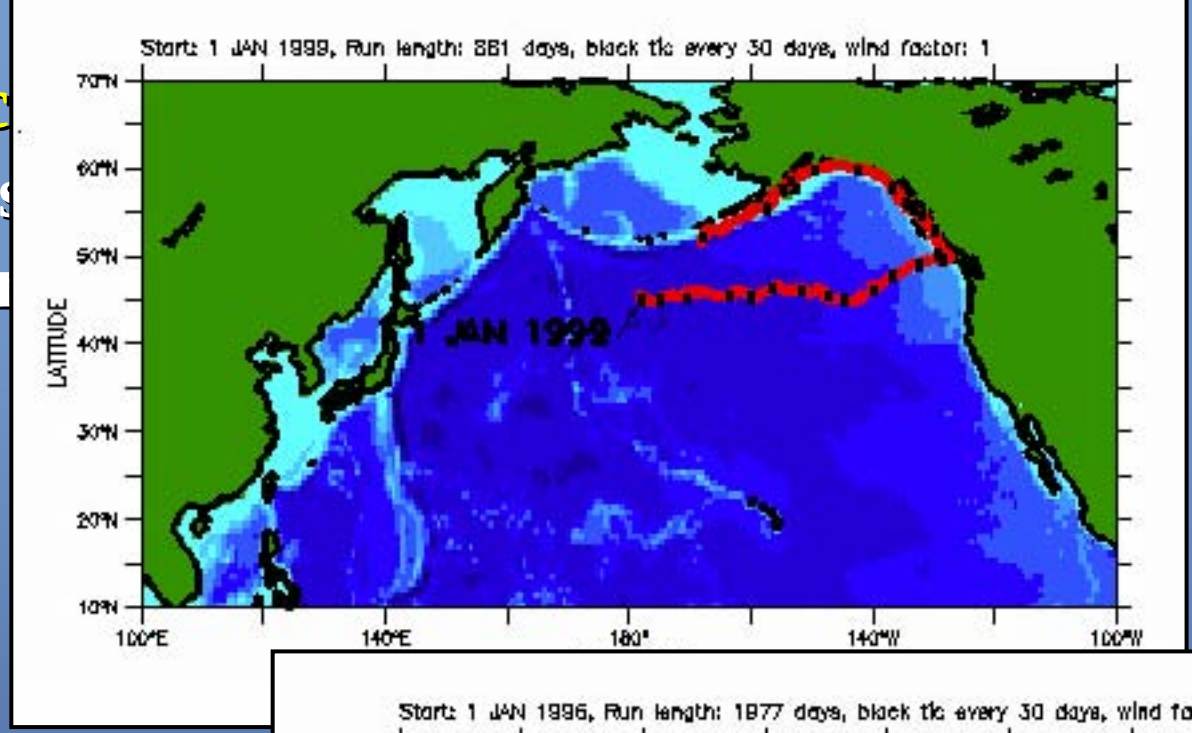

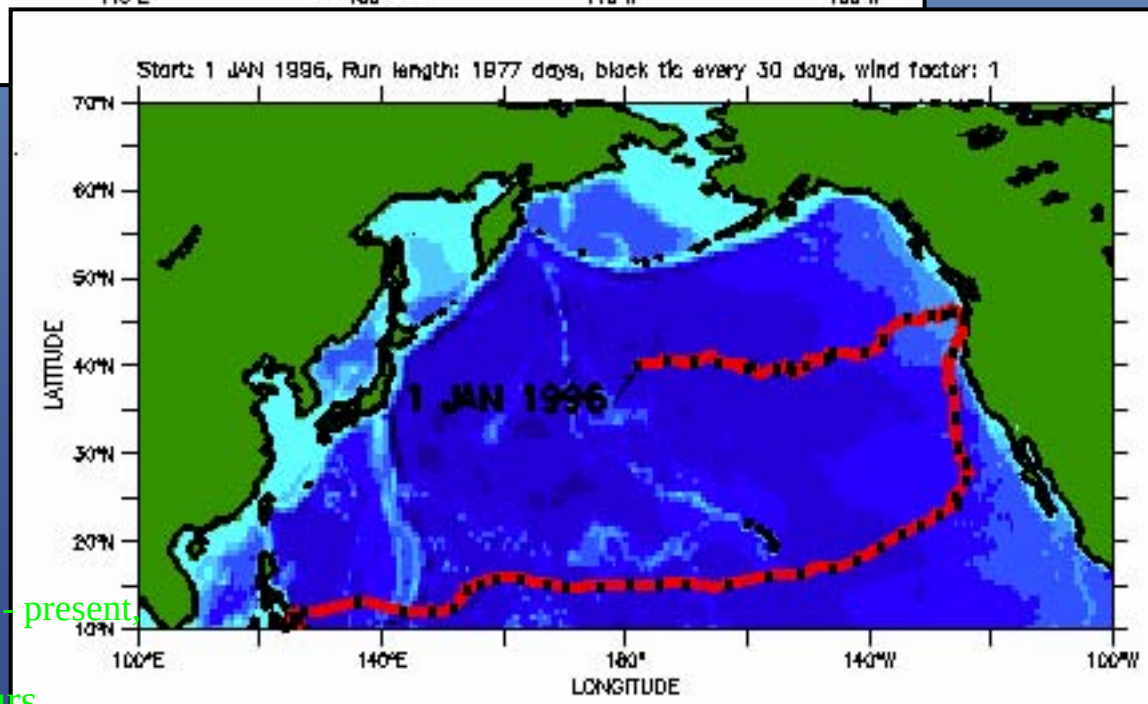

OSCURS Model, Release: 178 W, 40 N

OSCURS Model

Ocean Surface Current Simulator

- Developed by Jim Ingraham

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- Input: daily FNMOC pressure, 1967 - present, updated monthly
- http://las.pfeg.noaa.gov/las_oscurs
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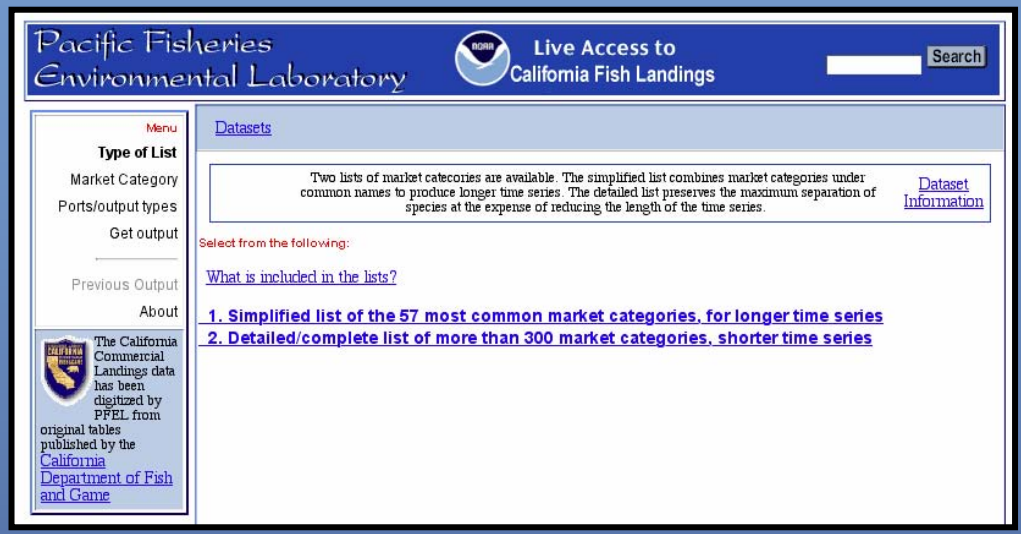
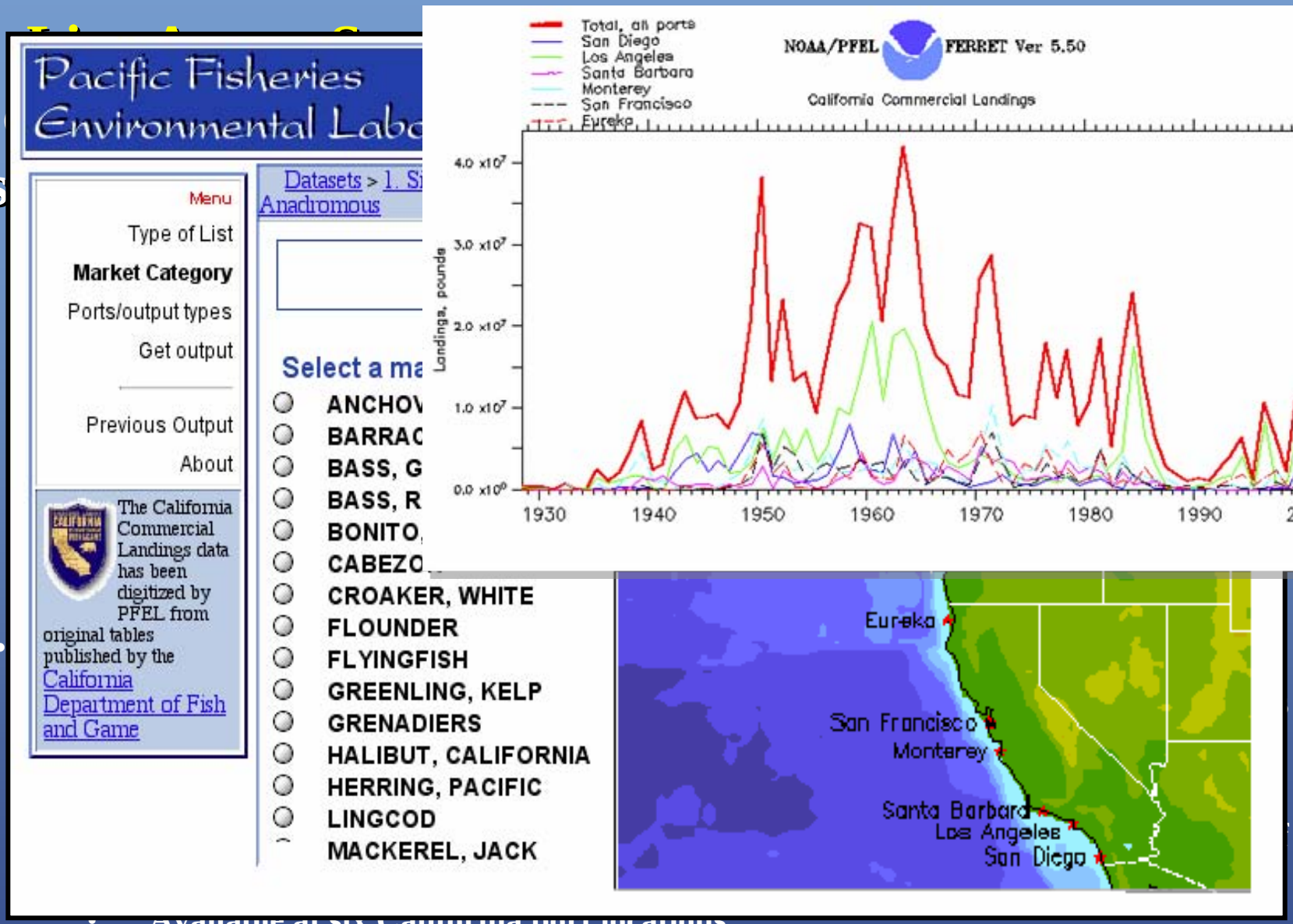
Live Access Server can be customized to serve a variety of data



- California Fish Landings data 1928-2002 (PaCOOS)
  - Historical time series of monthly regional commercial fish and shellfish landings in California from 1928 to 2002.
  - collected and compiled by California Department of Fish and Game
  - provide the longest possible time series of California fish landings for analysis of the effect of climate variability on fishes.
  - Available at six California port locations
  - Jan Mason, ERD

- Available at six California port locations
- Jan Mason, ERD



- Available at six California port locations
- **Jan Mason, ERD**

Pacific Fisheries Environmental Labo

Menu

Type of List

Market Category

Ports/output types

Get output

Previous Output

About

The California

Datasets > 1. Si
Anadromous

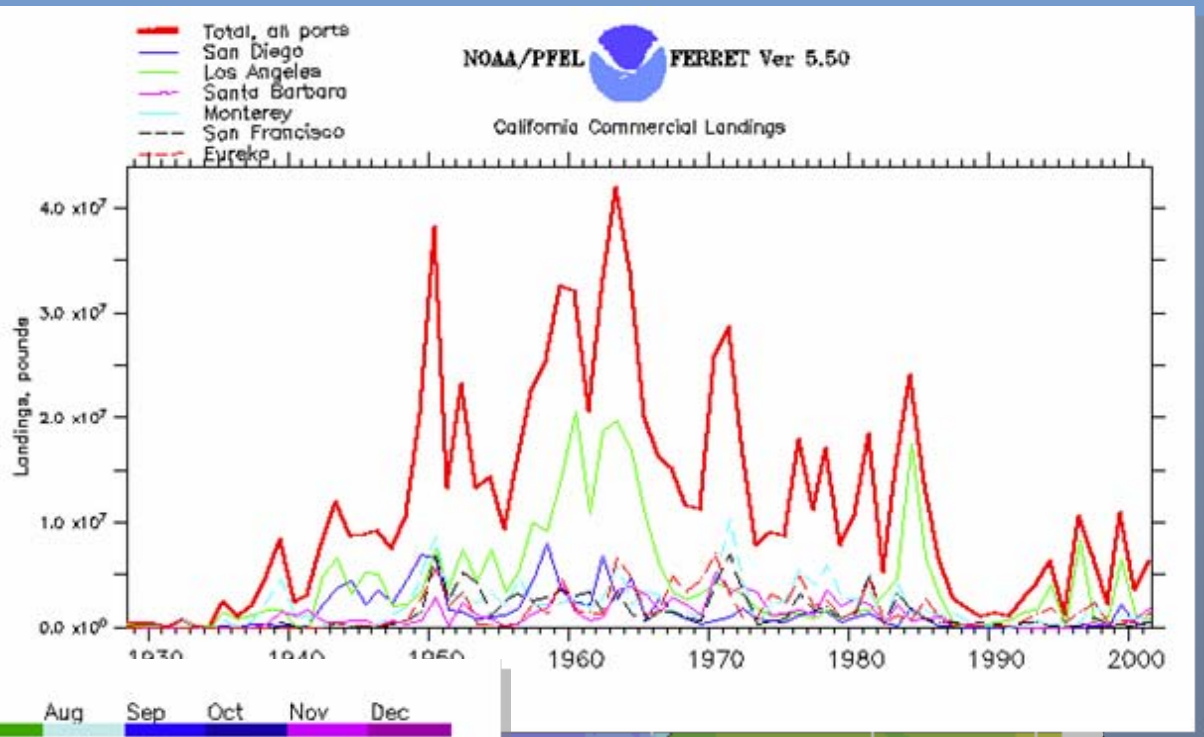
Select a ma

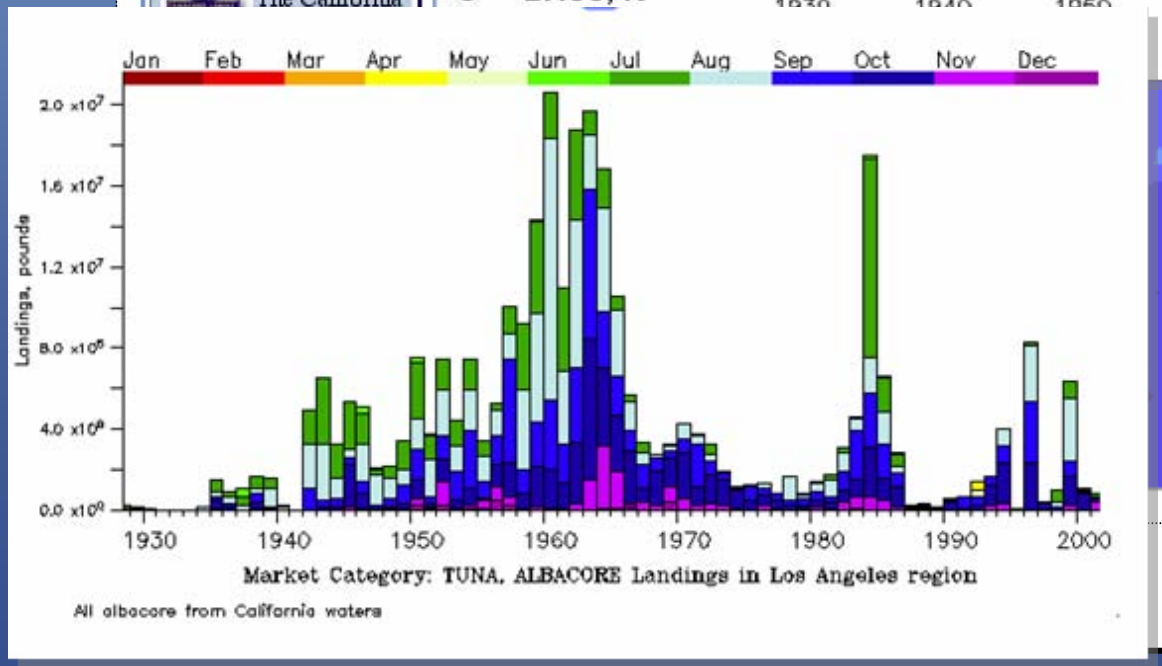
ANCHOV

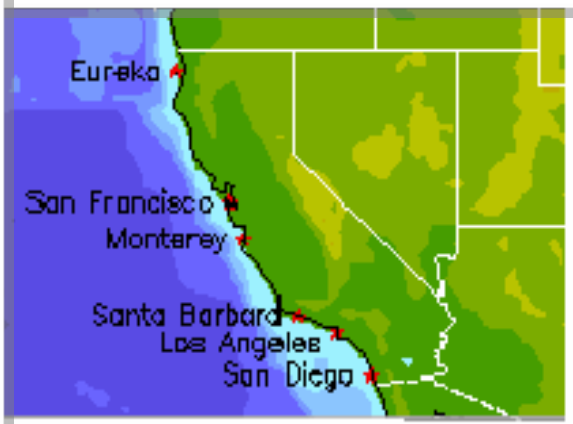
BARRAC

BASS, G

BASS, R



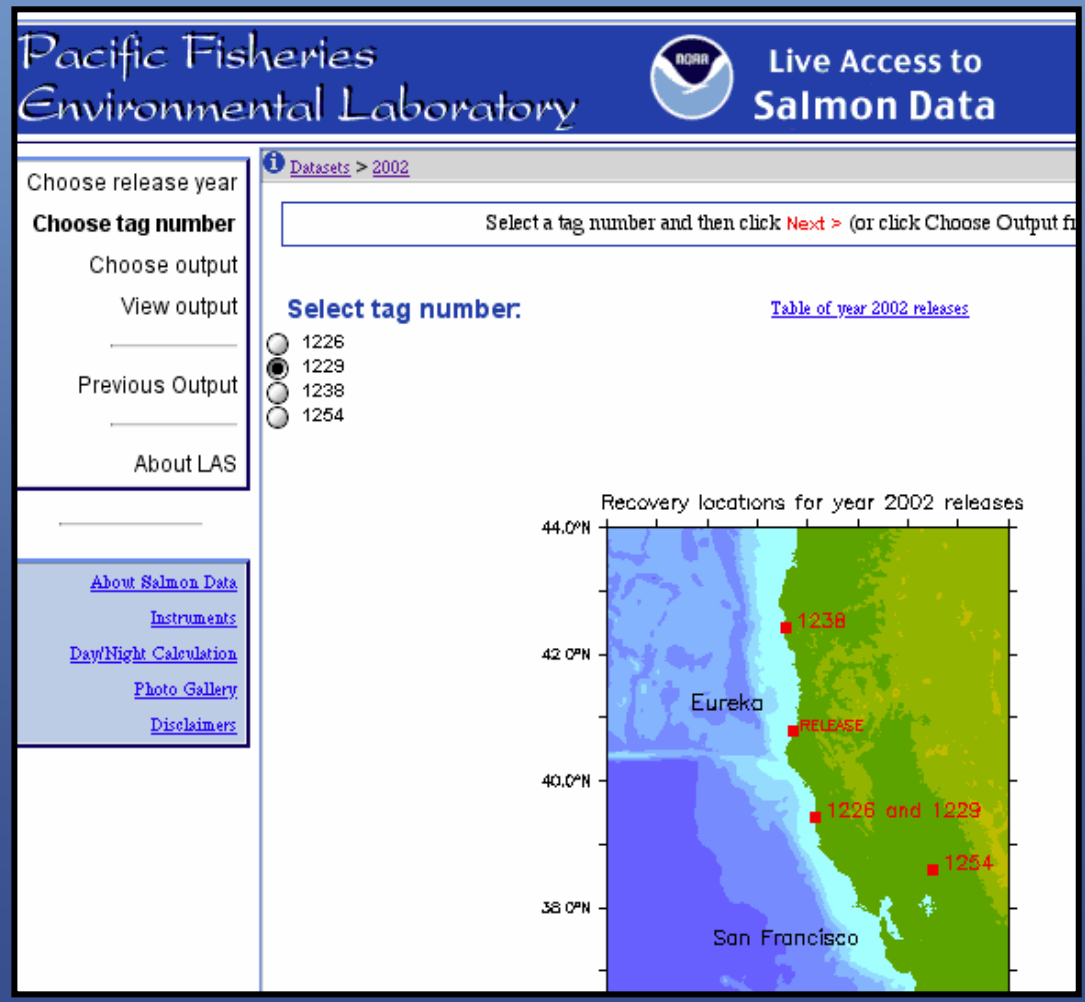




Live Access Server can be customized to serve a variety of data

Salmon Tag Data

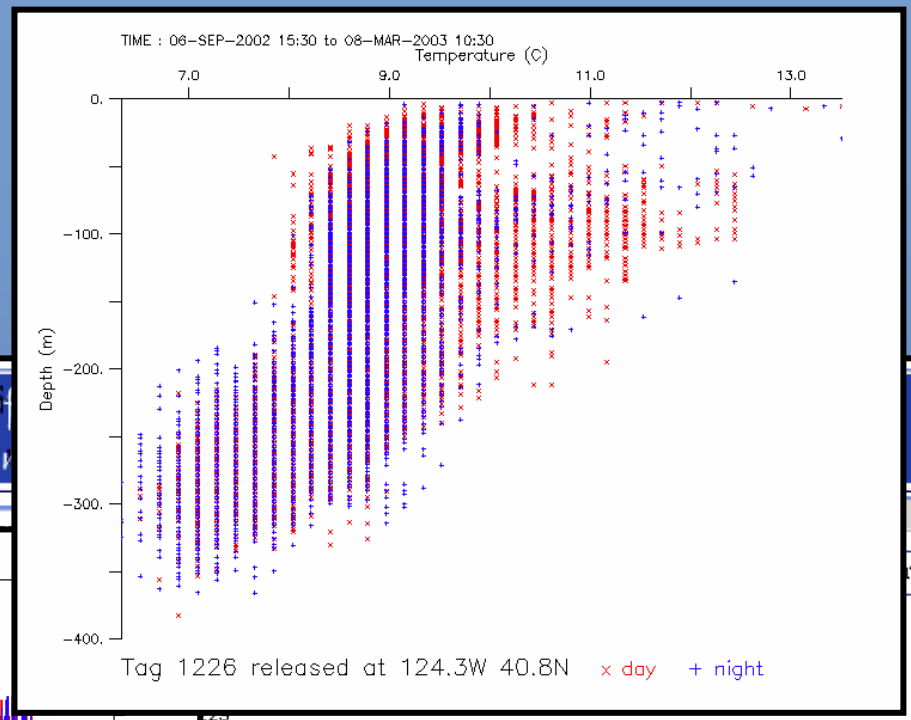
George Watters, ERD

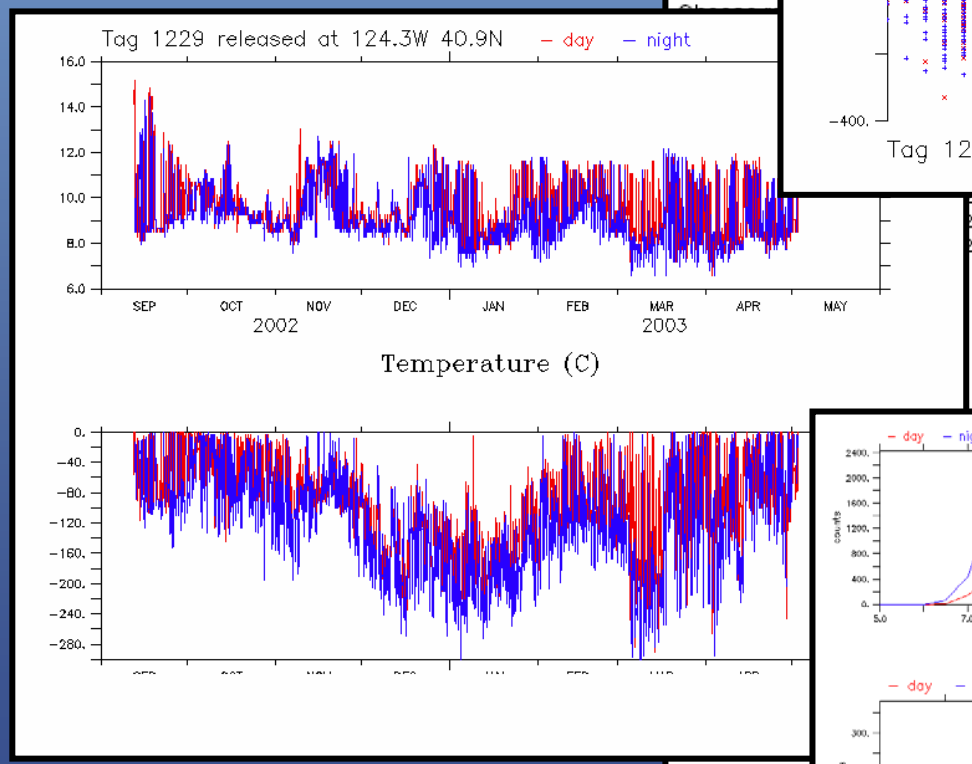


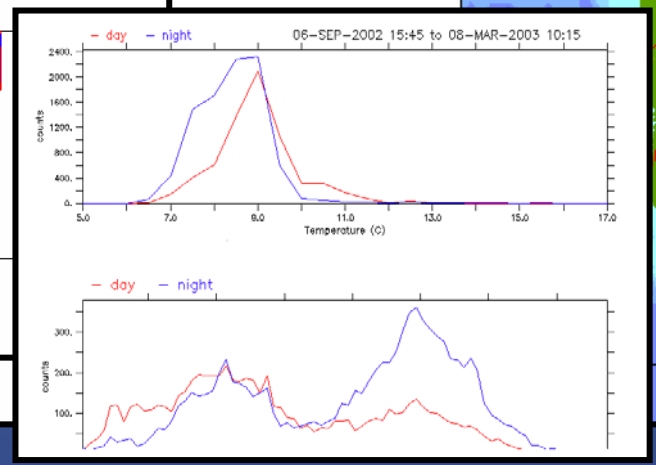
Live Access Server can be customized to serve a variety of data

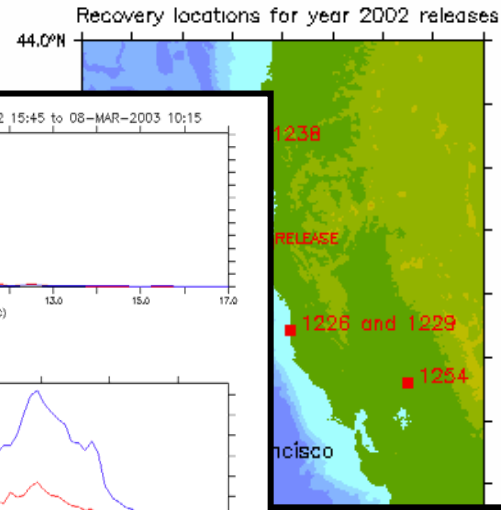
Salmon Tag Data

George Watters, ERD









Live Access Server can be customized to serve a variety of data

- **Tagging of Pacific Pelagics (TOPP) PACOOS Partner**
  - aimed at understanding the migration patterns of large open-ocean animals in the North Pacific basin
  - part of Census of Marine Life
  - 4000+ tags/ 20+ species

Last Update: Mon Aug 29 02:30:27 2005

Tagging Of Pacific Pelagics

TOPP Near Real-Time Animal Tracks

CENSUS OF MARINE LIFE

View by Zones:
California/Baja
Pt. Conception
Monterey Bay
OR/WA/BC
E.Equatorial
Gulf of Alaska
Aleutians
Hawaii
Eastern Pacific
Full Region

View by Species:
Sharks
Blue Shark
Mako Shark
Salmon Shark
Common Thresher
Pinnipeds
Elephant Seal
California Sea Lion
Cetaceans
Blue Whale
Humpback Whale
Sea Turtles
Leatherback Sea Turtle
SeaBirds
Sooty Shearwater
All Species

Tags reporting within the last:
10 days
30 days
60 days

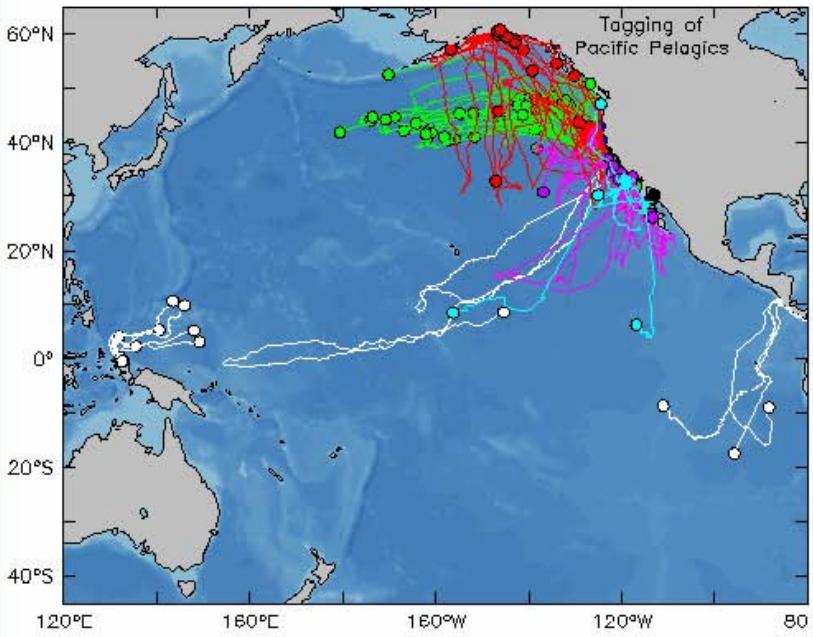
TOPP Tags
Tracks
Pop-ups

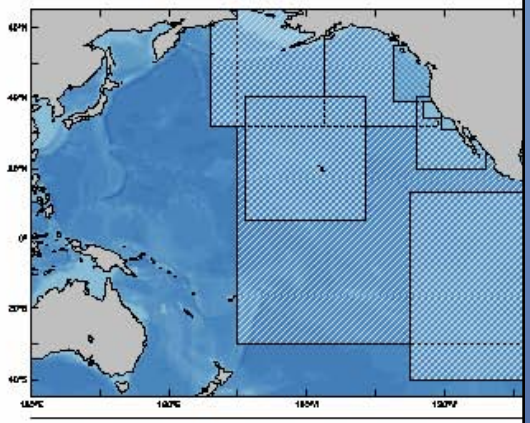
Non-TOPP Tags
Tracks
Pop-ups

Environmental Data

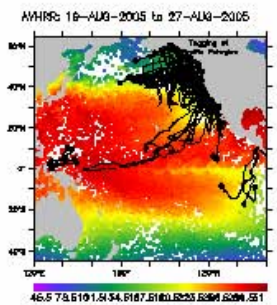
Tags reporting within the last 60 days

Roll mouse over end points to see animal and tag info.
Click on end points or pttno in table for larger image

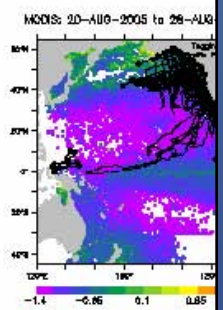




AVHRR SST

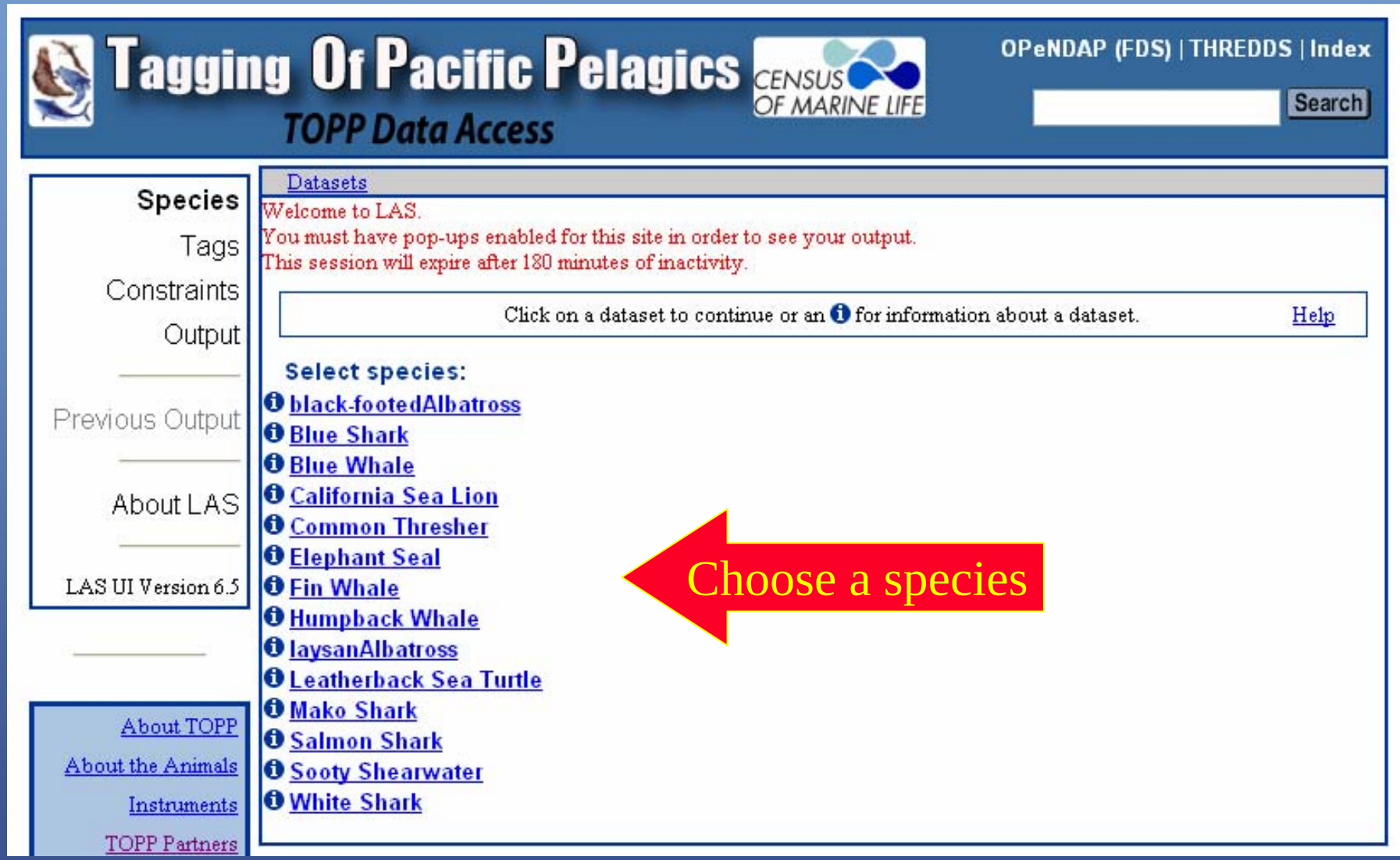


MODIS Chloroph



Browse near-realtime TOPP data with environmental data
Updated nightly (automatically)

http://las.pfeg.noaa.gov/TOPP


Tagging Of Pacific Pelagics
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CENSUS OF MARINE LIFE
OPeNDAP (FDS) | THREDDS | Index
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About TOPP
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Datasets
Welcome to LAS.
You must have pop-ups enabled for this site in order to see your output.
This session will expire after 180 minutes of inactivity.
Click on a dataset to continue or an for information about a dataset.
Help
Select species:
black-footedAlbatross
Blue Shark
Blue Whale
California Sea Lion
Common Thresher
Elephant Seal
Fin Whale
Humpback Whale
laysanAlbatross
Leatherback Sea Turtle
Mako Shark
Salmon Shark
Sooty Shearwater
White Shark
Choose a species

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Welcome to LAS.
You must have pop-ups enabled for this site in order to see
This session will expire after 180 minutes of inactivity.

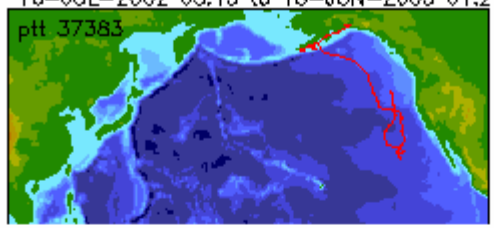
Click on a dataset to continue o

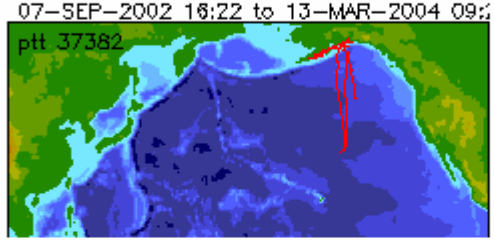
Select species:

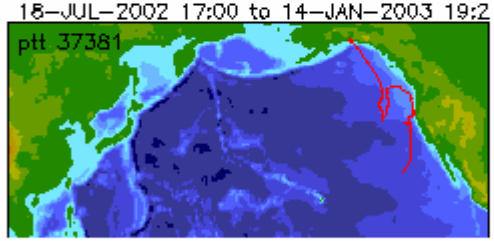
- black-footedAlbatross
- Blue Shark
- Blue Whale
- California Sea Lion
- Common Thresher
- Elephant Seal
- Fin Whale
- Humpbac
- laysanAlb
- Leatherba
- Mako Sha
- Salmon Shark
- Sooty Shearwater
- White Shark

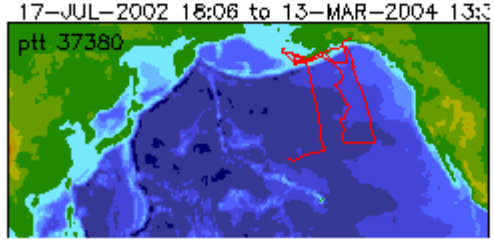
Choose an individual animal

Deployment Table

01
16-JUL-2002 05:15 to 18-JUN-2003 01:2


02
07-SEP-2002 16:22 to 13-MAR-2004 09:2


03
18-JUL-2002 17:00 to 14-JAN-2003 19:2


04
17-JUL-2002 18:06 to 13-MAR-2004 13:3


05
11-SEP-2002 18:55 to 21-FEB-2003 10:

Funded by:

Tagging of Pacific Pelagics

Live Access to TOPP Data

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Datasets > Salmon Shark
Variable(s): **04**

Choose type of plot

Select yo … n region and time limits for the download. Help

Track plots
Lagrangian Time Series plots
Text Output

Select type of output: Track plots Next >

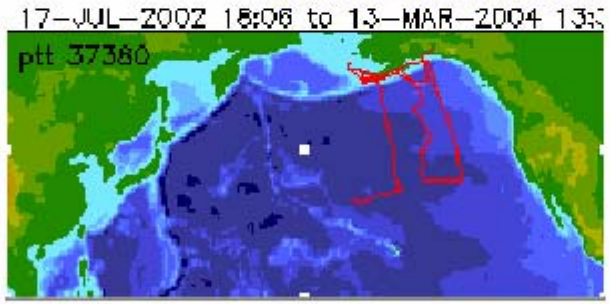
Select environmental data to display with track: with bathymetry

Choose environmental data

with bathymetry
with Pathfinder SST 8-day
with SeaWiFS Chlorophyll-a 8-day
with Sea Level Pressure
with Surface Wind

Select region using menu or map (track plot only): Gulf of Alaska

(Click here to disable map applet)



70.0
100.0 E
100.0 W
10.0 N
Zoom In
Zoom Out

Select time range: 01 Jan 2002 01-Jan-2002 to 31 Dec 2004 31-Dec-2004

Choose time and region for subset

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Variable(s): **04**

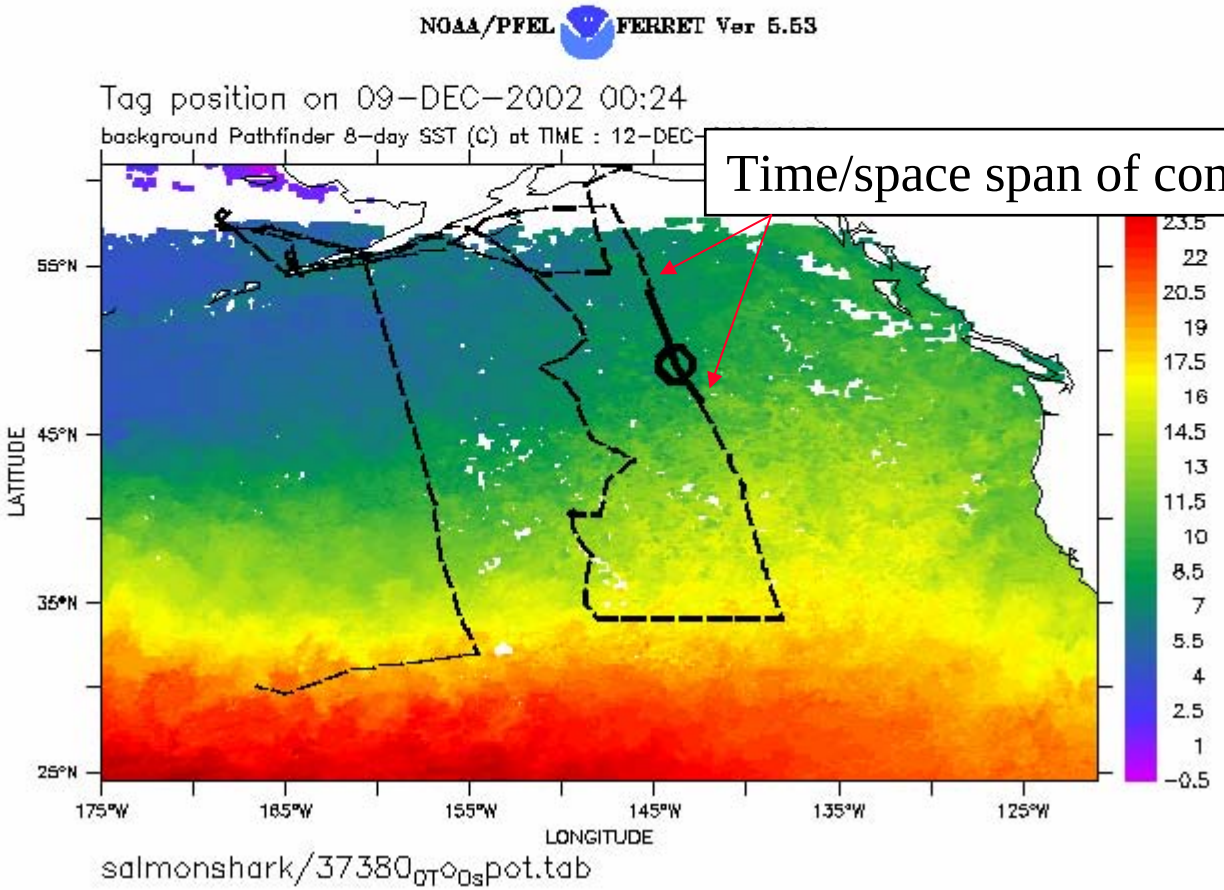
You may modify the appearance of plots through the "Options" page.
you directly to any LAS page.

Help

Start Over >

Salmon Shark track with SST

Time/space span of composite



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Tagging of Pacific Pelagics

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Variable(s): **04**

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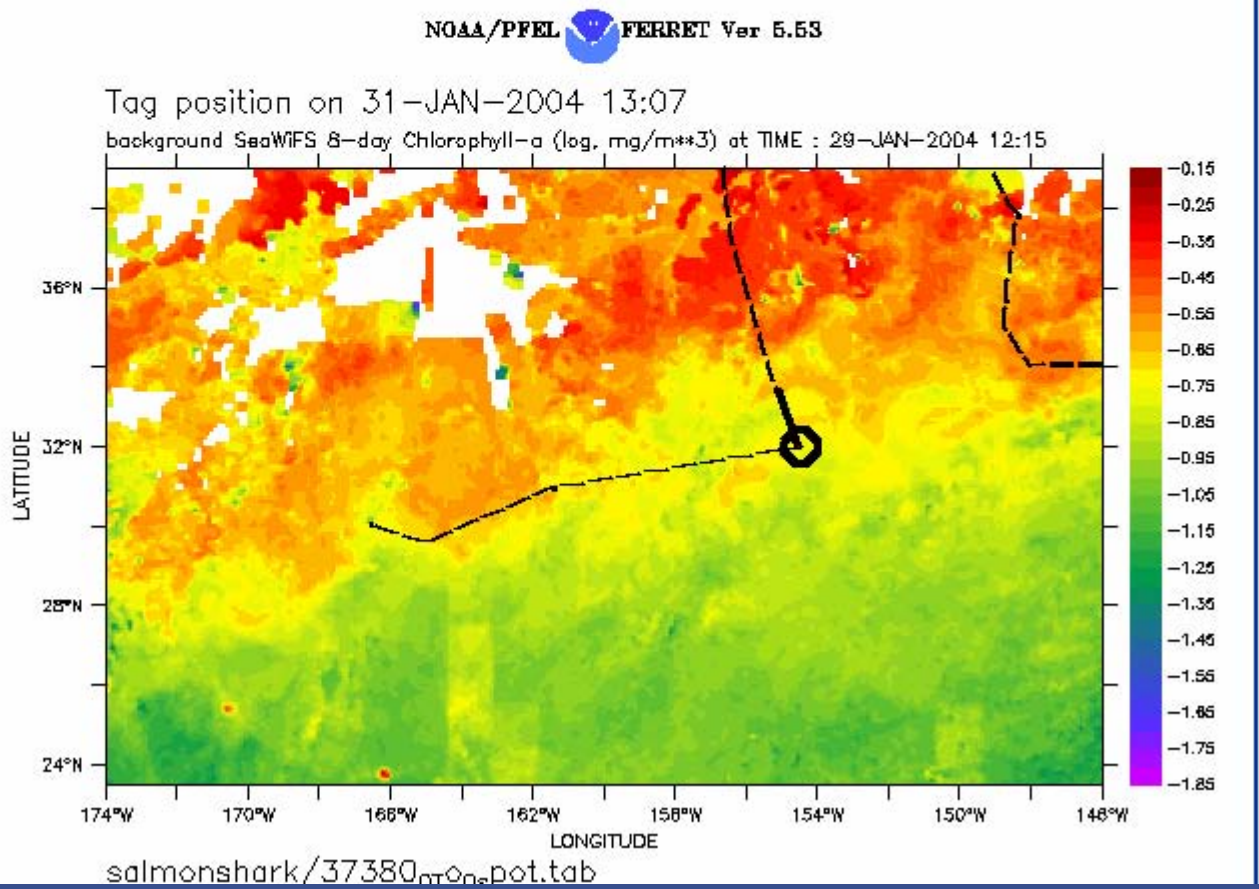
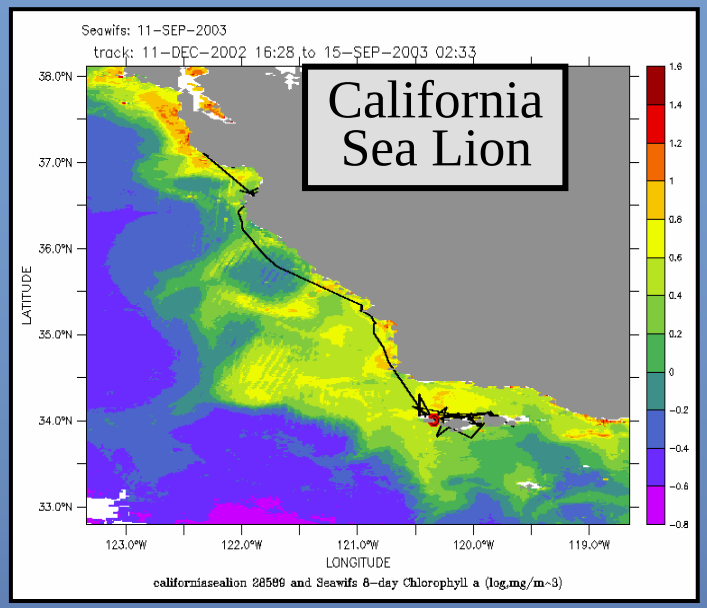
take you directly to any LAS page.

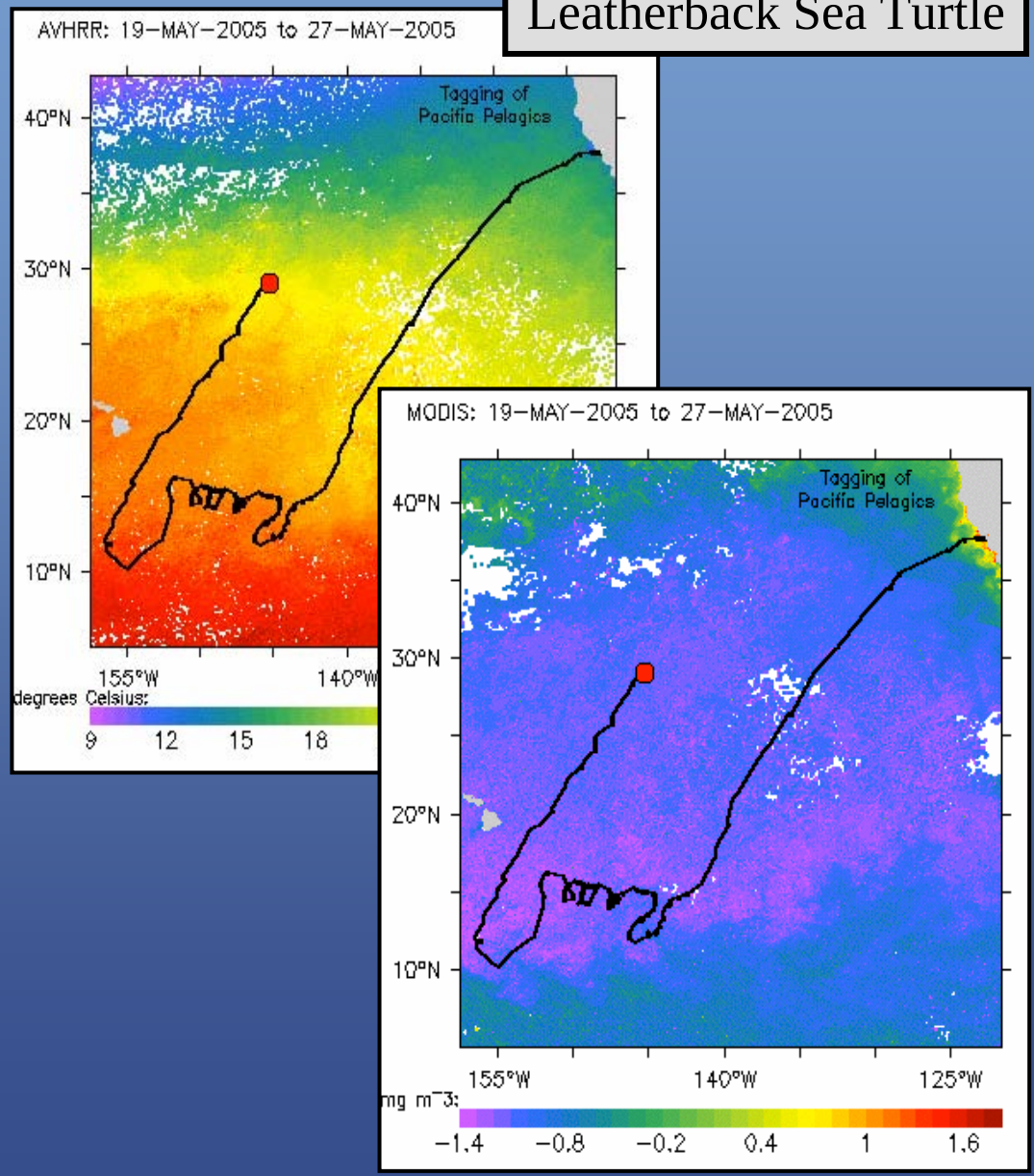
Help

Start Over >

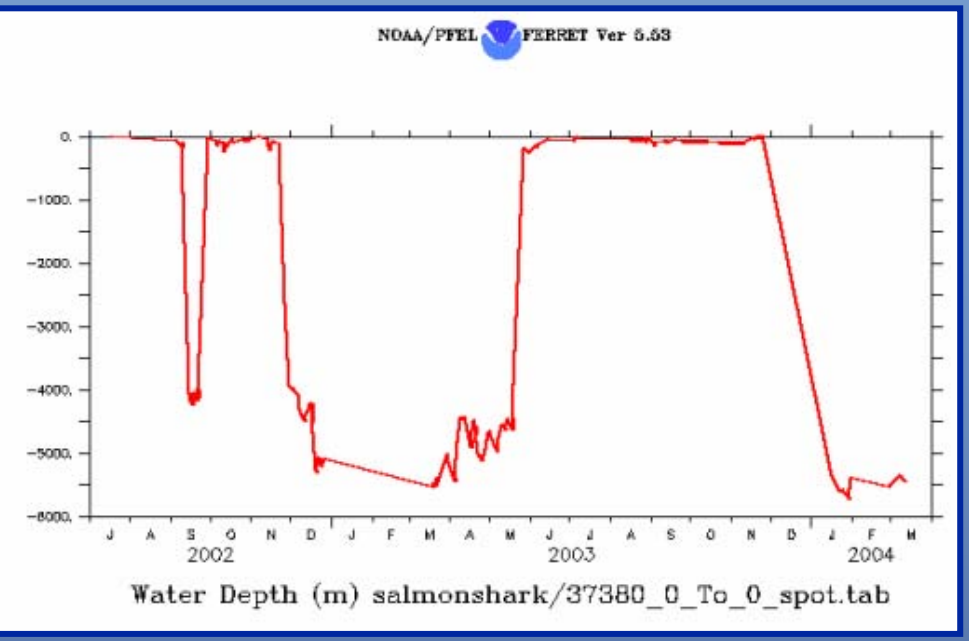
Subset region of interest

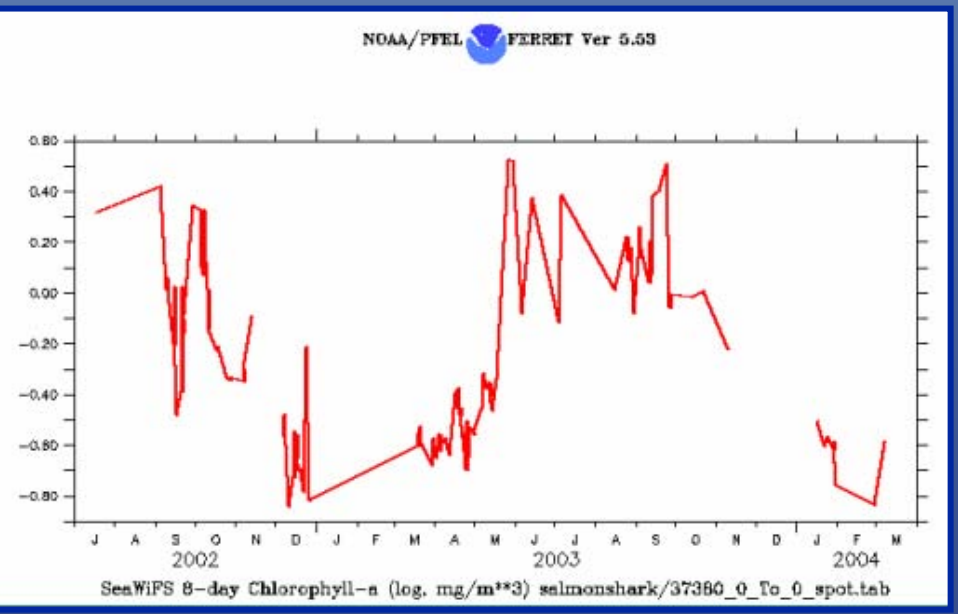


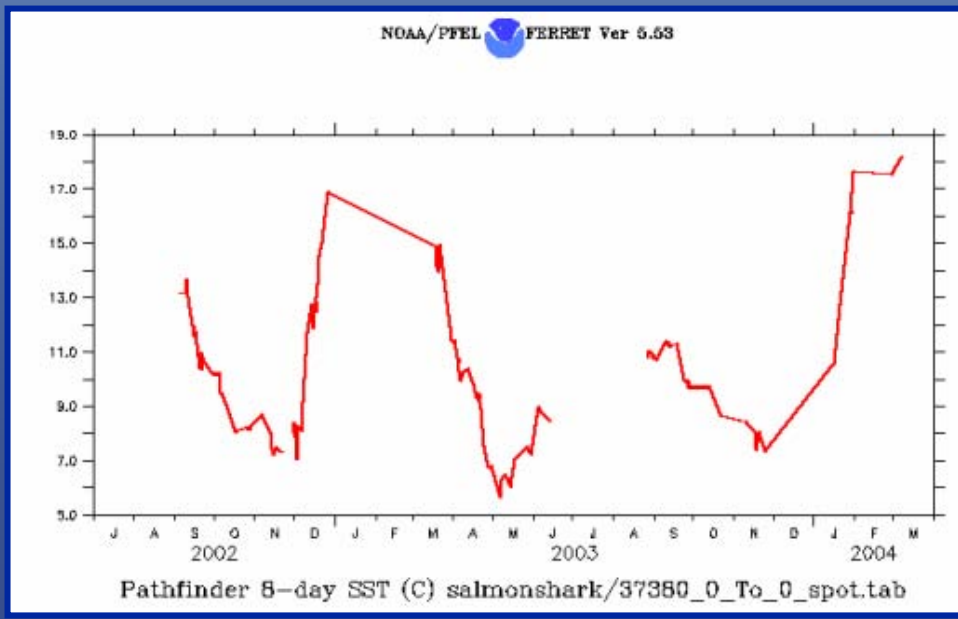

Seawifs: 11-SEP-2003
track: 11-DEC-2002 16:28 to 15-SEP-2003 02:33
California Sea Lion
38.0°N
37.0°N
36.0°N
35.0°N
34.0°N
33.0°N
LATITUDE
123.0°W
122.0°W
121.0°W
120.0°W
119.0°W
LONGITUDE
californiasealion 28589 and Seawifs 8-day Chlorophyll a (log,mg/m^3)


Leatherback Sea Turtle
AVHRR: 19-MAY-2005 to 27-MAY-2005
Tagging of Pacific Pelagics
40°N
30°N
20°N
10°N
155°W
140°W
degrees Celsius:
9
12
15
18
MODIS: 19-MAY-2005 to 27-MAY-2005
Tagging of Pacific Pelagics
40°N
30°N
20°N
10°N
155°W
140°W
125°W
mg m^-3:
-1.4
-0.8
-0.2
0.4
1
1.6

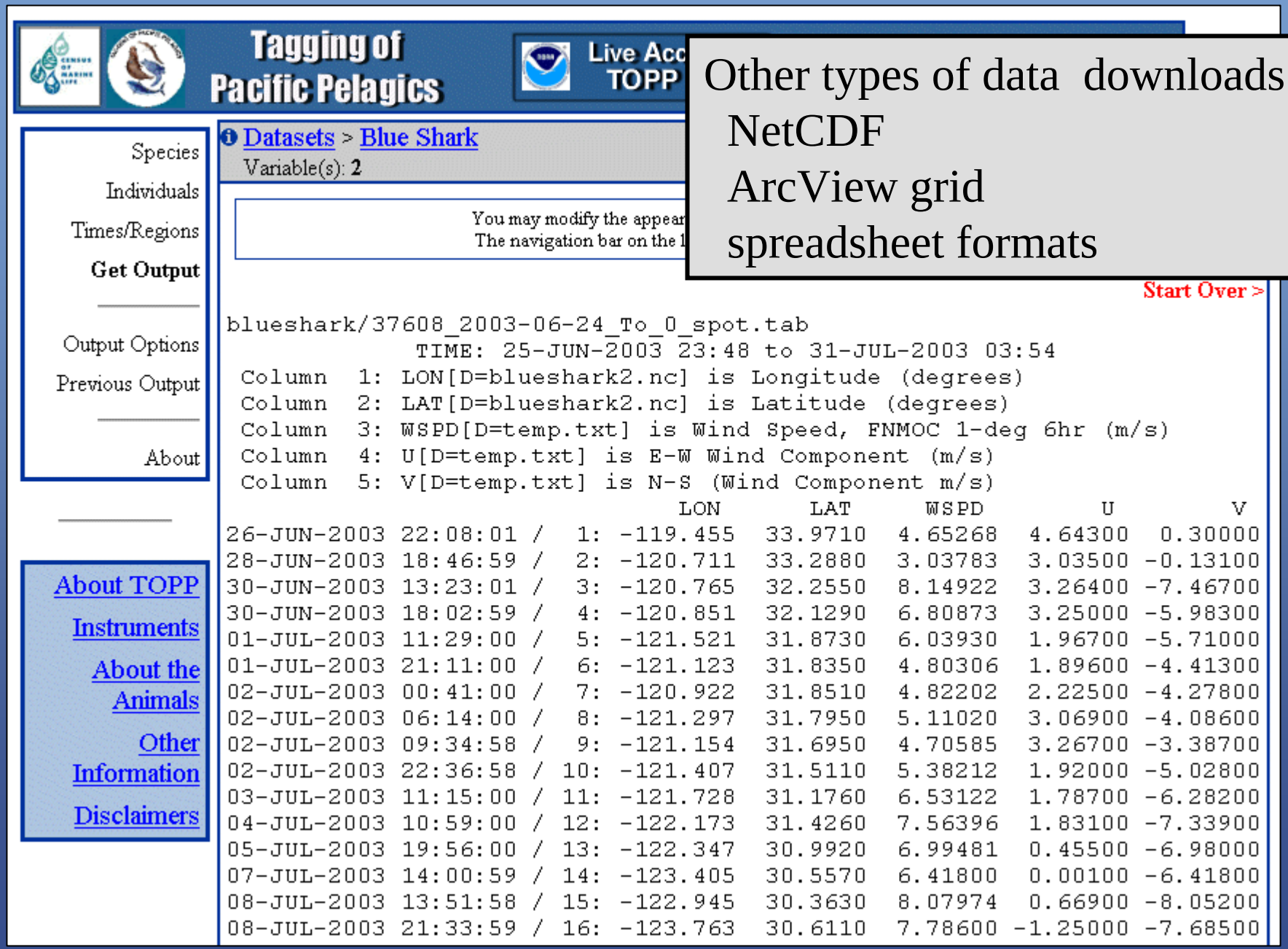
Lagrangian Time Series







Text download

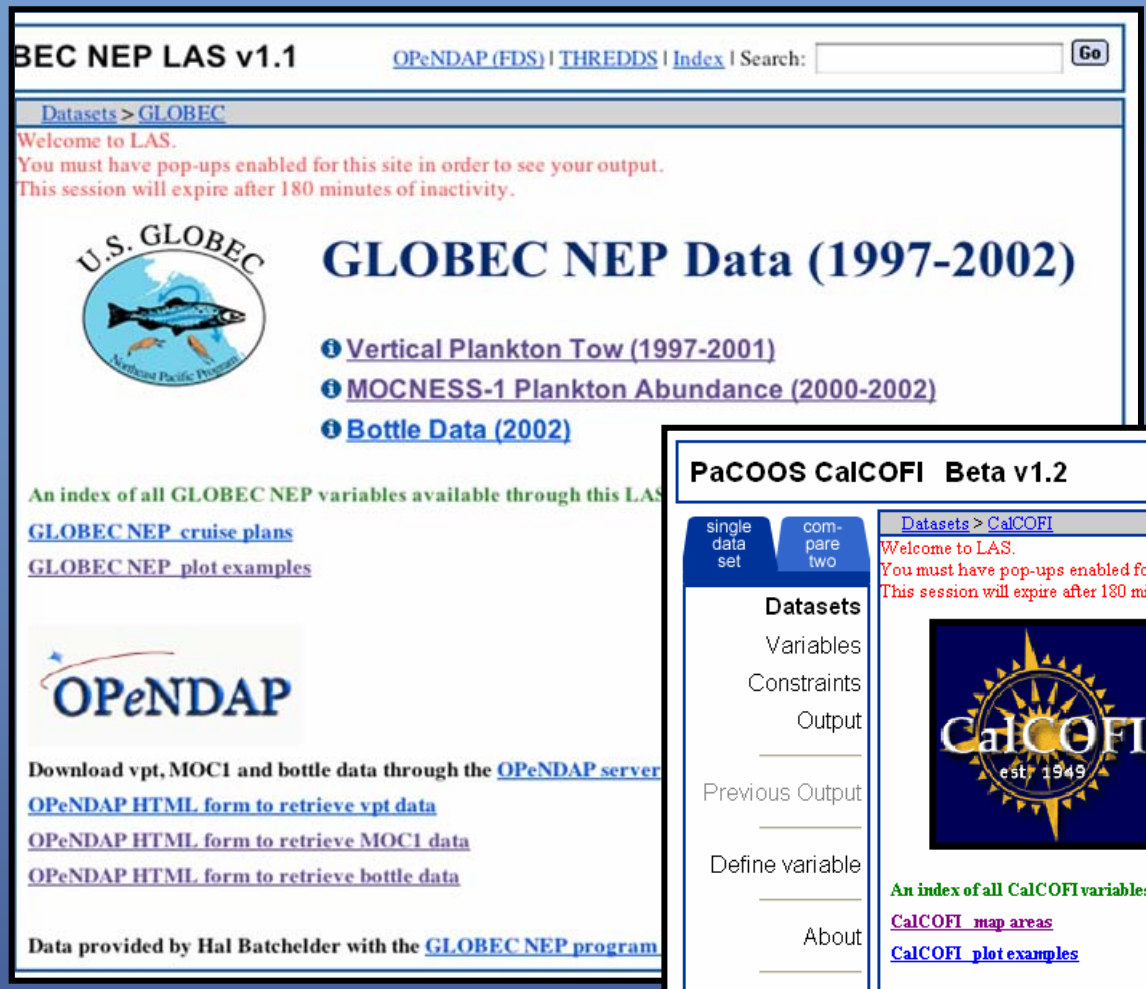


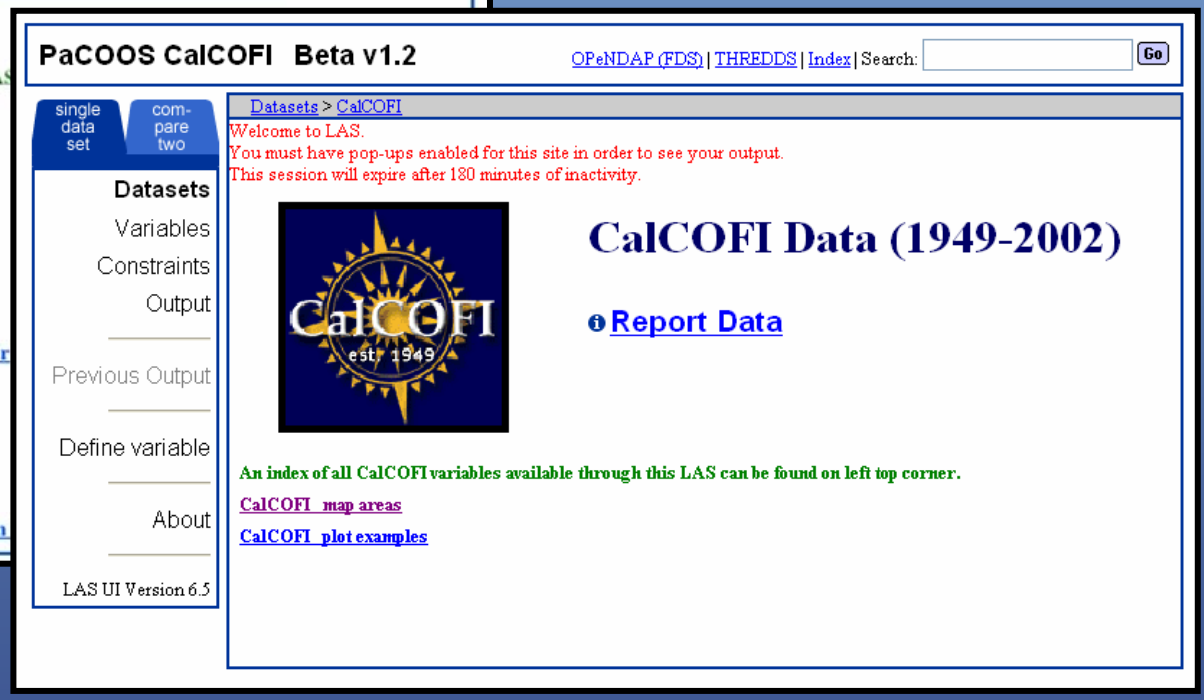
Other types of data downloads:

- NetCDF
- ArcView grid
- spreadsheet formats

PaCOOS LAS

Pacific **C**oast
Ocean **O**bserving **S**ystem
Live Access Servers: work of
Jerome King, ERD





State, Academic, and NGO partners
IOOS Regional Associations

Ecosystem approach to the CCS

ICOOS Data Integration Grant

PaCOOS LAS

Pacific **C**oast
Ocean **O**bserving **S**ystem
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Jerome King, ERD

BEC NEP LAS v1.1 OPeNDAP (FDS) | THREDDS | Index | Search: Go

Datasets > GLOBEC

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U.S. GLOBEC Northeast Pacific Program

GLOBEC NEP Data (1997-2002)

- Vertical Plankton Tow (1997-2001)
- MOCNESS-1 Plankton Abundance (2000-2002)
- Bottle Data (2002)

An index of all GLOBEC NEP variables available through this LAS

GLOBEC NEP cruise plans
GLOBEC NEP plot examples

OPeNDAP

Download vpt, MOC1 and bottle data through the OPeNDAP server

OPeNDAP HTML form to retrieve vpt data
OPeNDAP HTML form to retrieve MOC1 data
OPeNDAP HTML form to retrieve bottle data

Data provided by Hal Batchelder with the GLOBEC NEP program

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single data set | compare two

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Datasets > CalCOFI

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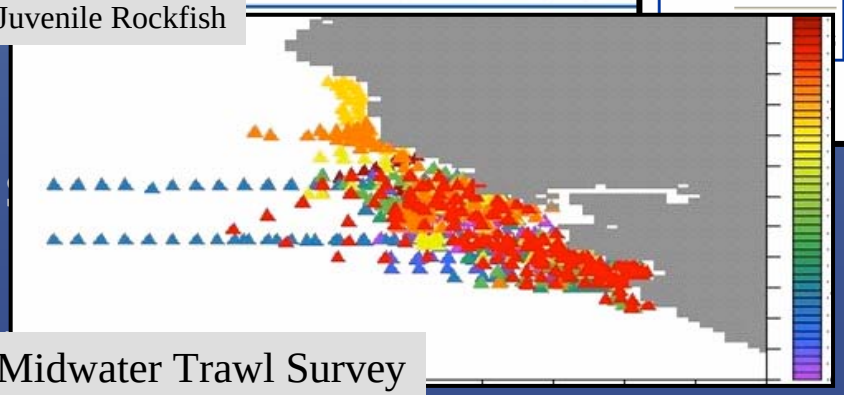
CalCOFI est. 1949

CalCOFI Data (1949-2002)

- Report Data

An index of all CalCOFI variables available through this LAS can be found on left top corner.

CalCOFI map areas
CalCOFI plot examples



Juvenile Rockfish

Midwater Trawl Survey

ICOOS Data Integration Grant

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single data set | compare two

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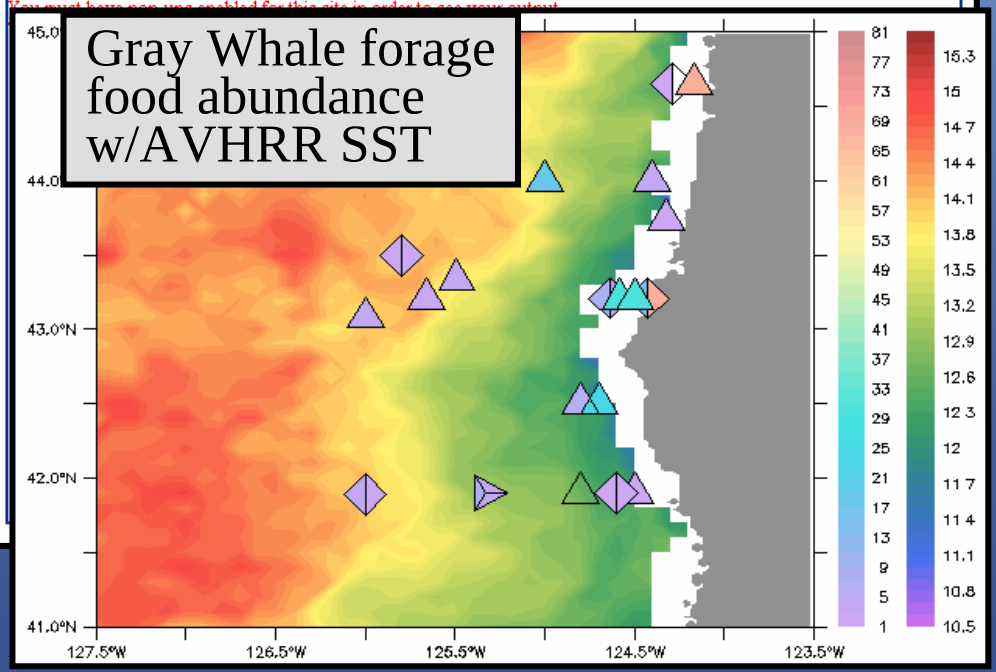
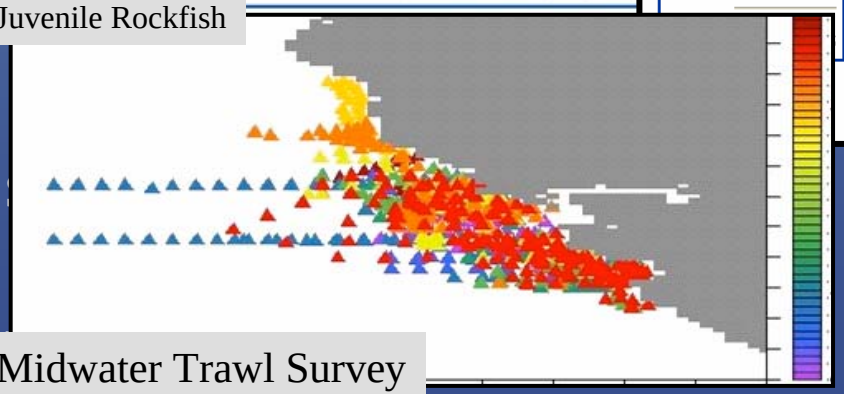
Datasets > CalCOFI

Welcome to LAS.

Gray Whale forage food abundance w/AVHRR SST



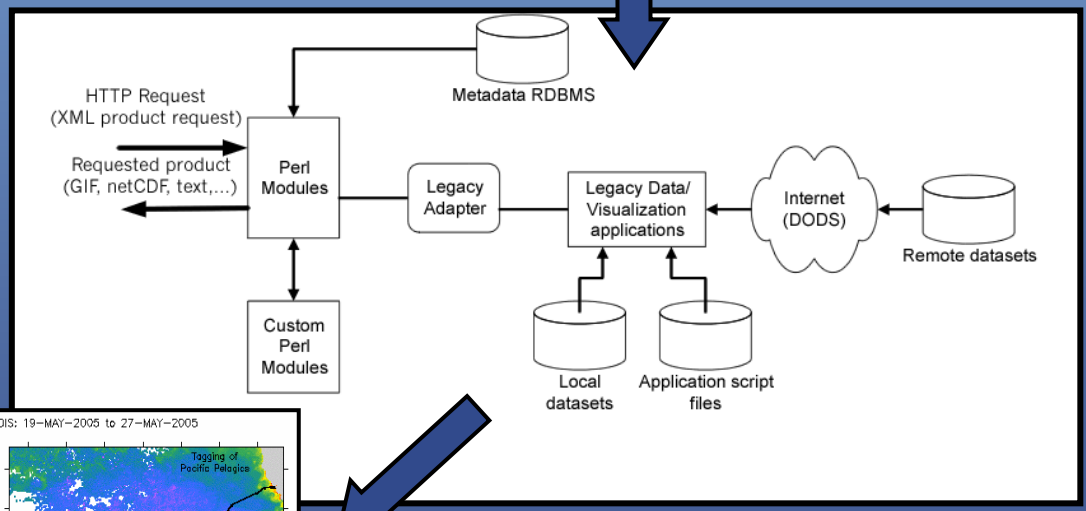
Juvenile Rockfish



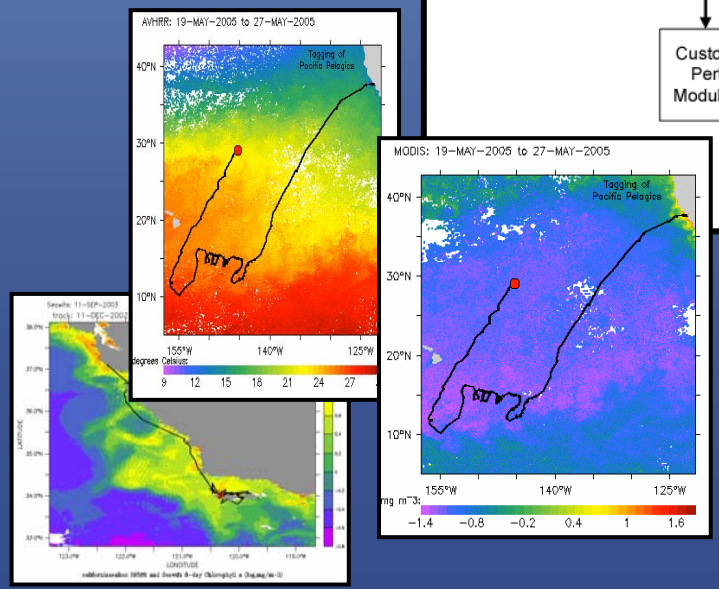
Midwater Trawl Survey

ICOOS Data Integration Grant

XML Request

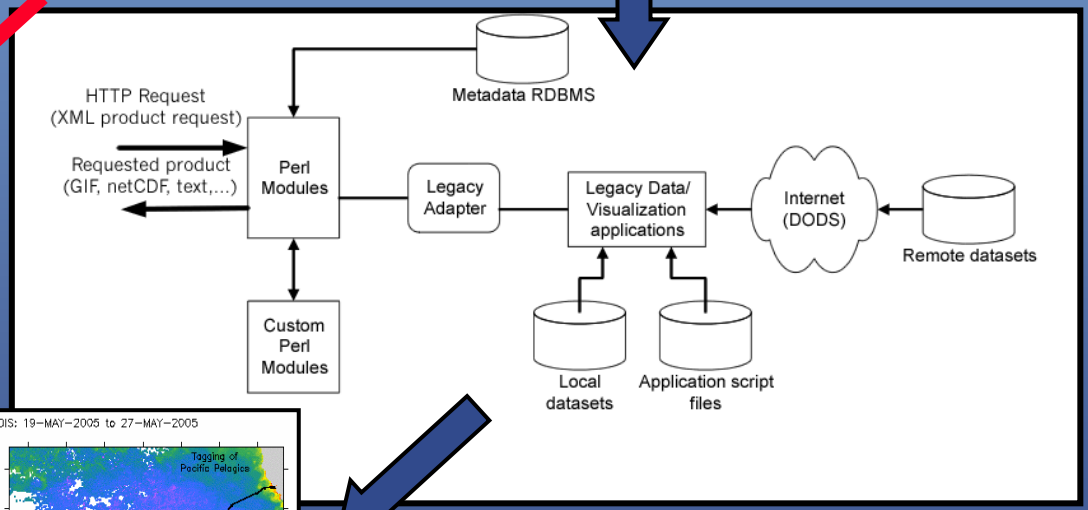


User Interface

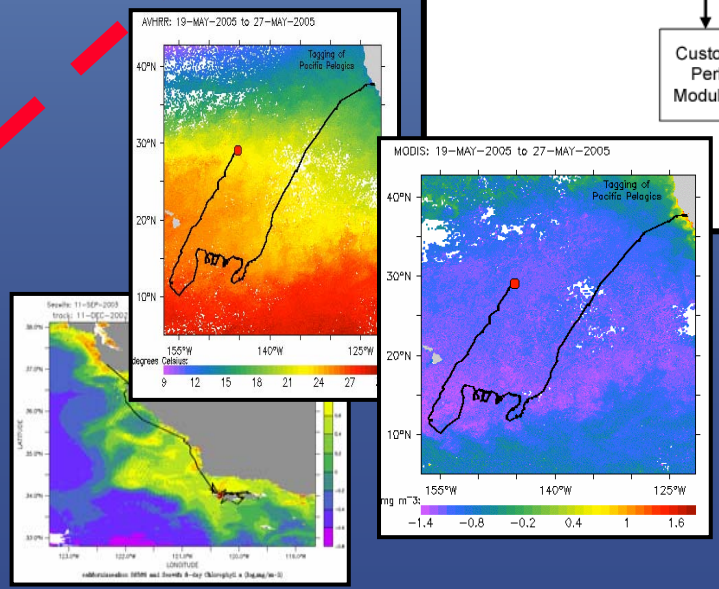


Product Server

XML Request



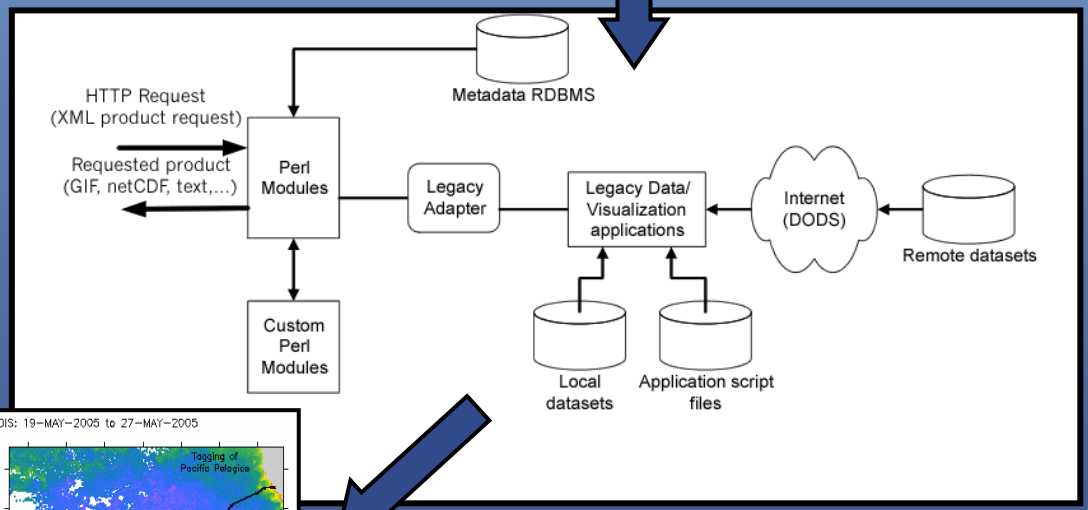
User Interface

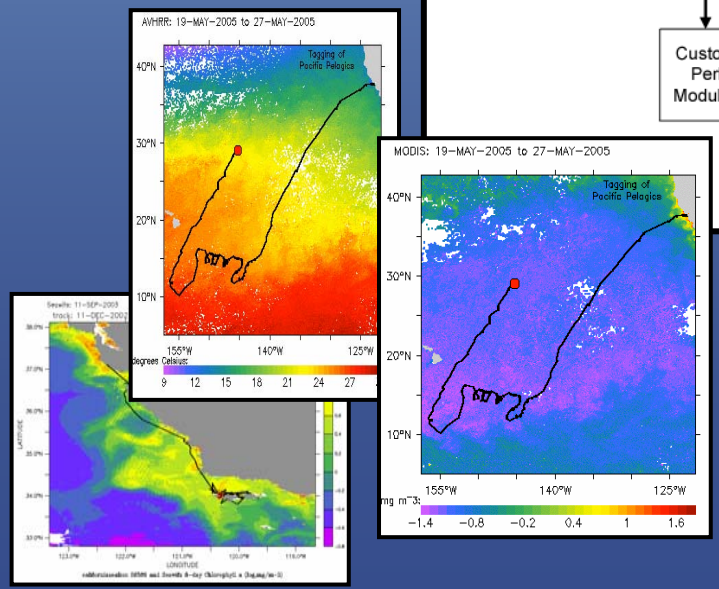


Product Server

JavaScript

XML Request

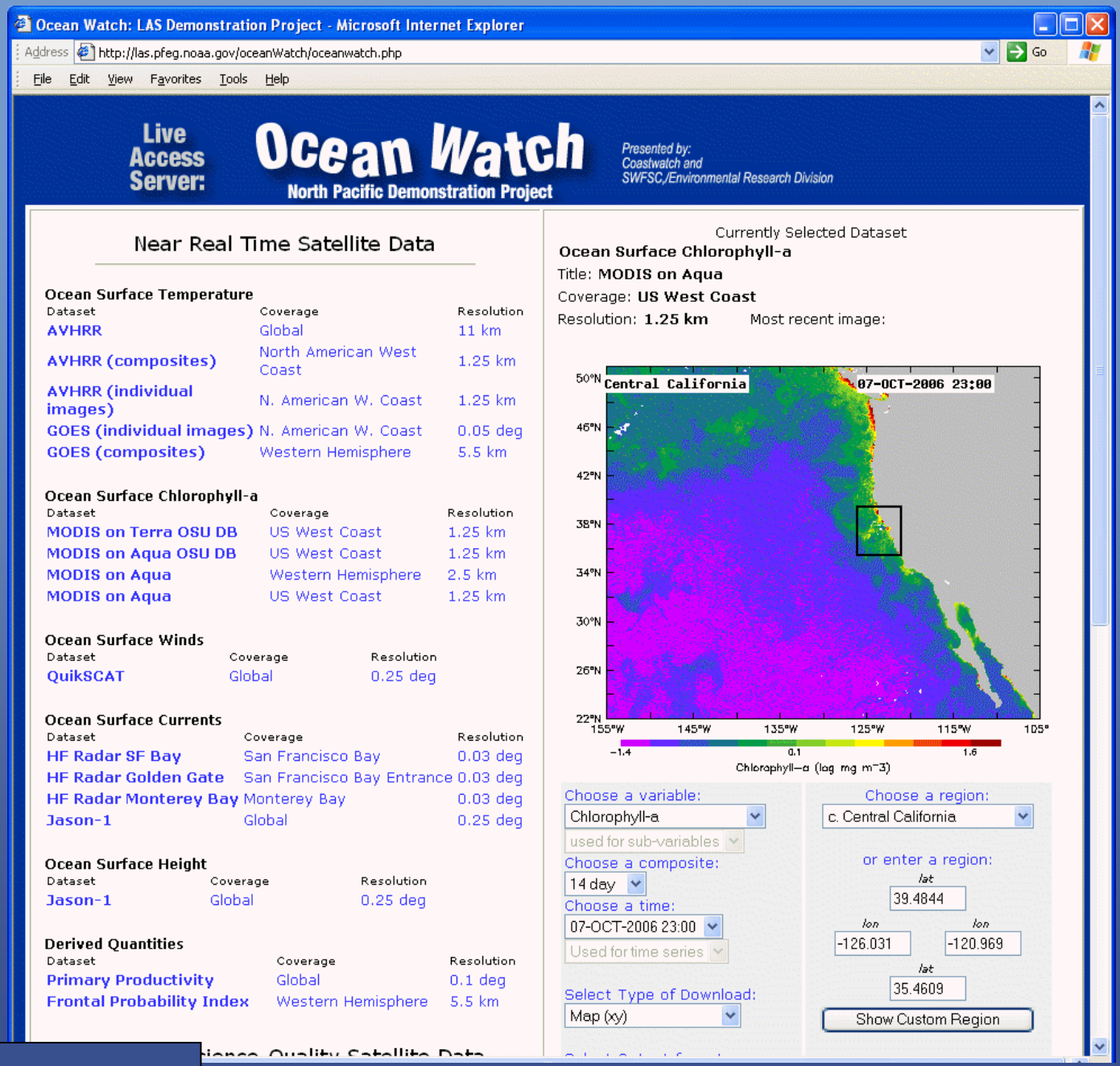




Product Server

Javascript, PHP

xml requests sent to LAS Product server

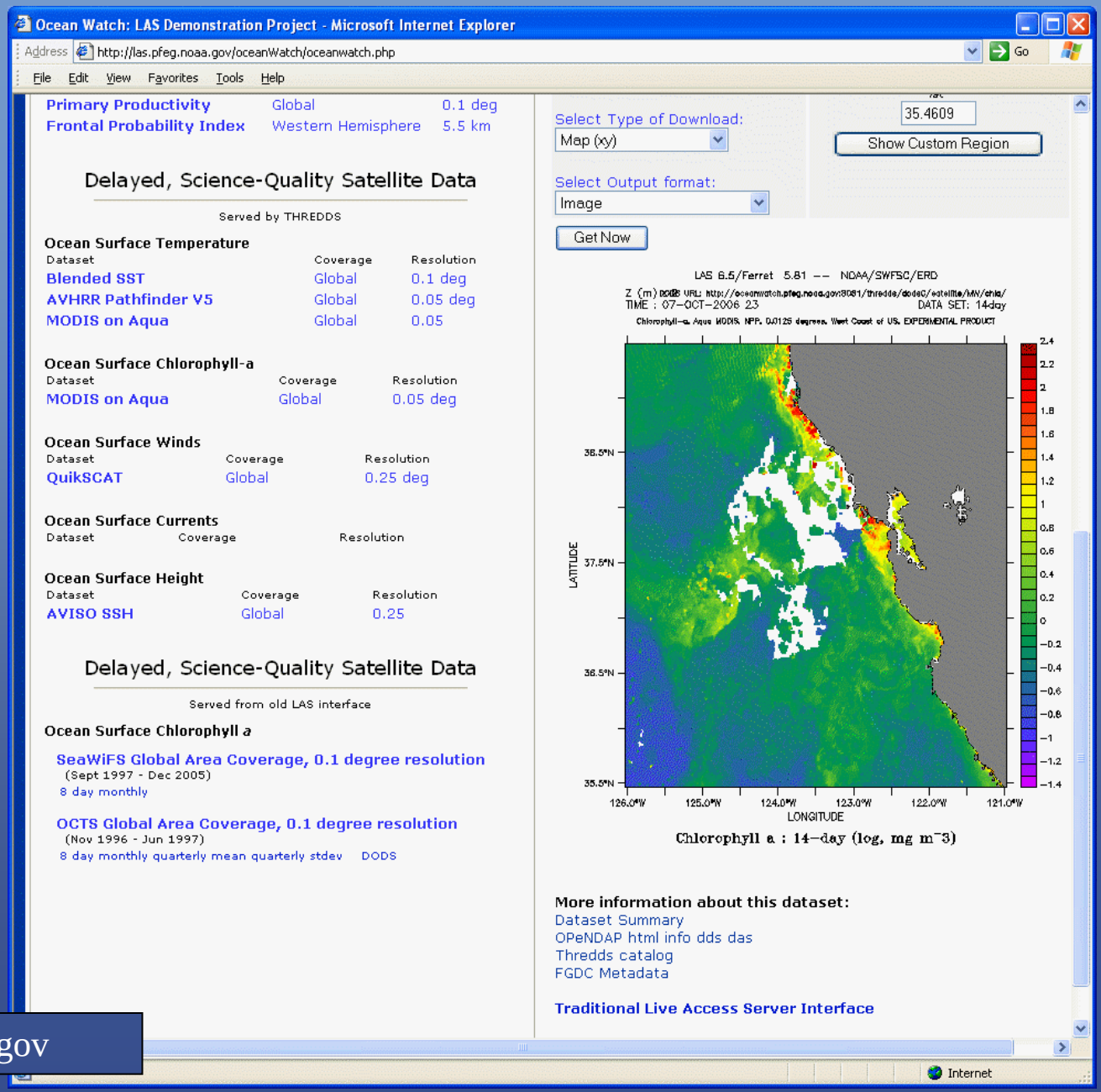


http://oceanwatch.pfeg.noaa.gov

Javascript, PHP

xml requests sent to LAS Product server

http://oceanwatch.pfeg.noaa.gov



Why is data transport layer so important?

Data

Data transport

Internet

Users can use their favorite application to access data at their desktop

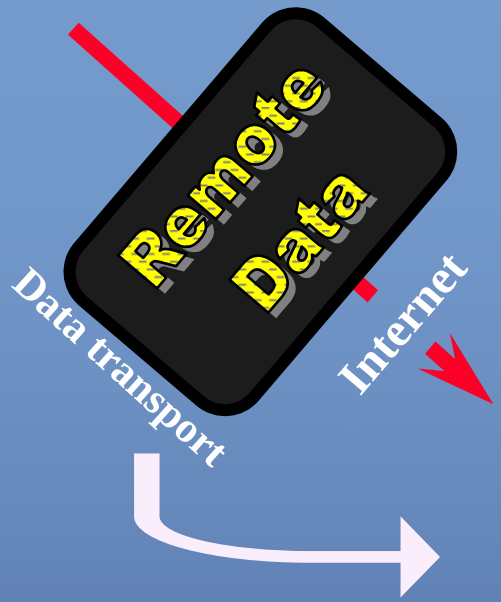
Developers can remotely access data directly in their code

Web browsers can access and subset remote data

Simplifies all aspects of scientific data networking, allowing simple access to remote data

Protocol for requesting and transporting data across the web

http://www.opendap.org



Available DAP Servers - Microsoft Internet Explorer

Address http://opendap.org/faq/whatServers.html

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OPeNDAP

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- Support
- FAQs
- What is the OPeNDAP Software?
- What servers are available?
- What clients are available?
- How do I build DODS/OPeNDAP software?
- Supported platforms
- Special issues for the SGI/IRIX platform
- Servers that limit access

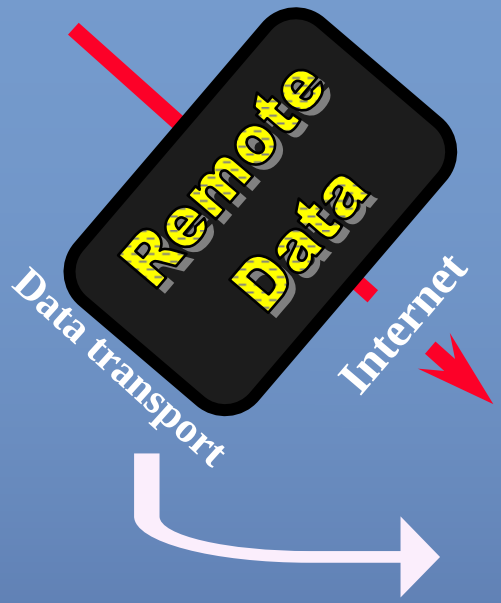
Available DAP Servers

Currently available DAP servers:

OPeNDAP netCDF Server	makes netCDF data available
OPeNDAP HDF Server	makes HDF 4 data available
OPeNDAP RDBS Server	makes RDBMS data available (requires JDBC)
OPeNDAP Test Server	The test server serves pseudo-data. Very useful when you want to test client software on a data structure for which you don't have an example.
OPeNDAP JGOFS Server	makes JGOFS data available
OPeNDAP FreeForm Server	Makes data available via DODS using the FreeForm software package. It is easy to use this to serve home-grown data formats.
Unidata Aggregation Server	Use this to aggregate multiple data sources. This server works with local netCDF file as well as data accessible from a DAP-compliant server.
COLA GrADS Data Server (GDS)	The GDS makes data available using GrADS. The types of data that can be served include GRIB, netCDF, HDF, and GrADS binary.
OPeNDAP Matlab Server	makes Matlab binary data available
OPeNDAP DSP Server	makes DSP data available
NOAA/PMEL/EPIC Dapper Server	makes in-situ data in various netCDF formats available

Internet

http://www.opendap.org



THREDDS

Thematic Realtime Environmental Distributed Data Services

goal is to simplify the discovery and use of scientific data and to allow scientific publications and educational materials to reference scientific data.

http://www.unidata.ucar.edu/projects/THREDDS/

THREDDS (Thematic Realtime Environmental Distributed Data Services) - Microsoft Internet Explorer

Address http://www.unidata.ucar.edu/projects/THREDDS/

File Edit View Favorites Tools Help

Unidata

Providing data, tools, and community leadership for enhanced Earth-system education and research

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- CommunitE-letter
- Unidata Seminar Series
- Unidata Events
- Community Announcements
- Job Opportunities

ToolBox
- Downloads
- Data
- Software Tools
- Support
- Mailing Lists
- RSS Feeds

DisplayAnalysis
- GEMPAK
- McIDAS
- IDV

THREDDS

The THREDDS (Thematic Realtime Environmental Distributed Data Services) project is developing middleware to bridge the gap between data providers and data users. The goal is to simplify the discovery and use of scientific data and to allow scientific publications and educational materials to reference scientific data. The mission of THREDDS is for students, educators and researchers to publish, contribute, find, and interact with data relating to the Earth system in a convenient, effective, and integrated fashion. Just as the World Wide Web and digital-library technologies have simplified the process of publishing and accessing multimedia documents, THREDDS is building infrastructure needed for publishing and accessing scientific data in a similarly convenient fashion.

THREDDS News and Announcements

Posted: 2006-08-14
New THREDDS Data Server (TDS), Version 3.12
A new, stable release of the THREDDS Data Server (3.12) is now available. This is mainly a bug fix and performance release. We now recommend that you upgrade to Tomcat 5.5/JDK 1.5, as this is reputably more stable in a production environment. However, you can still use Tomcat 5.0/JDK 1.4. Please see the change log for a list of new features.

Posted: 2005-10-24
New Unidata THREDDS/IDD Server available
Access the data catalog as HTML or XML.

Posted: 2005-07-12
NcML-G and NcML-Gml is now available
The NcML GIS extensions have been developed to facilitate interoperability between the earth sciences and the GIS communities.

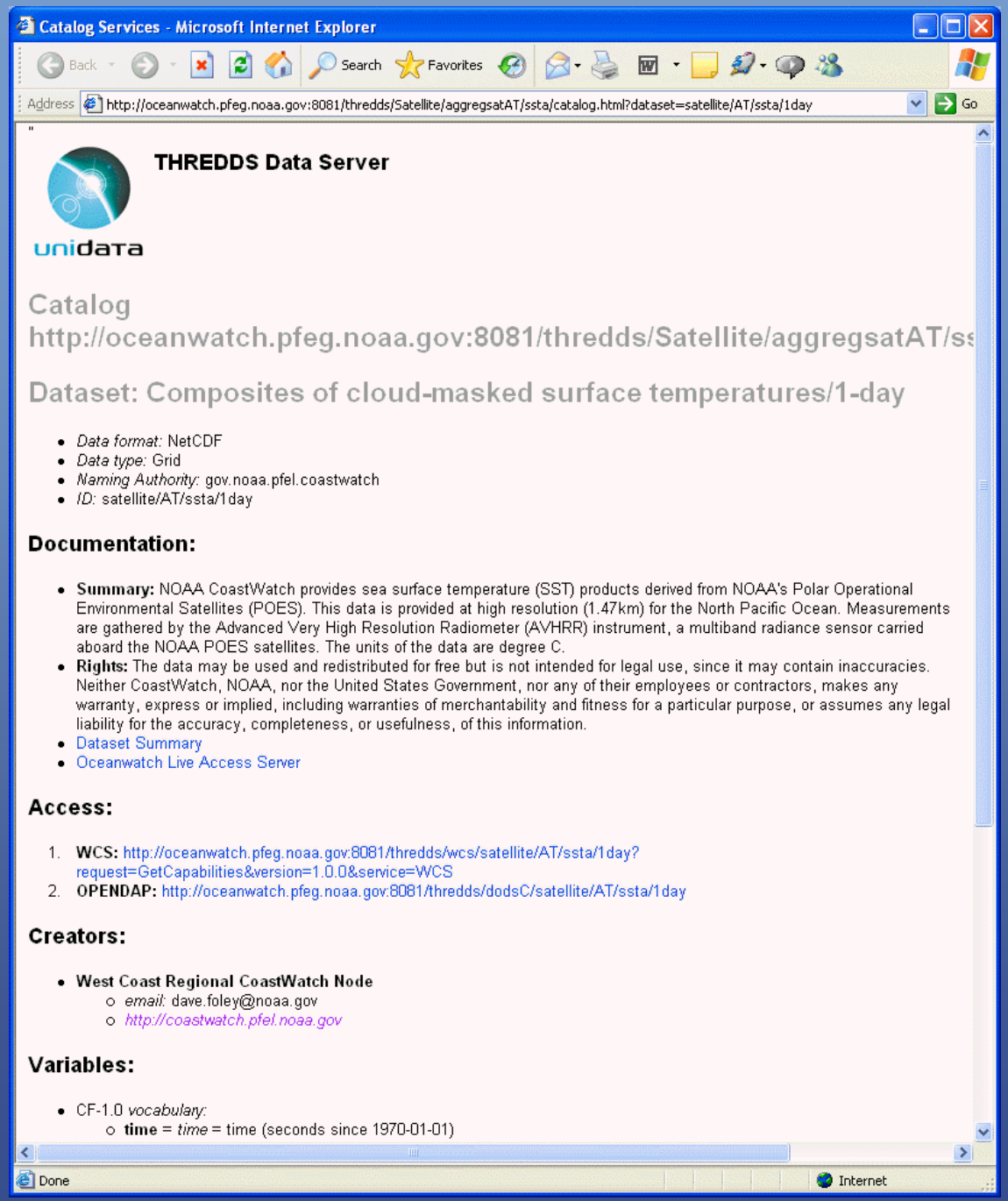
more ...

Current Status
- Technical Status Page
- Community Status Page (operational data and catalog services and clients)
- The modest THREDDS staff at the UPC is not attempting to solve this huge problem on its own. A large and important set of collaborating partners has joined in the effort.

Get Involved
- Subscribe to the THREDDS mailing list
- Search or browse the THREDDS mailing list archives

THREDDS Publications
- "THREDDS Incorporating Real-time Environmental Data and Interactive Analysis Tools Into NSDL" in the Journal of Online Digital Information.
- IDV enabled compound documents

Internet


Catalog Services - Microsoft Internet Explorer
Back
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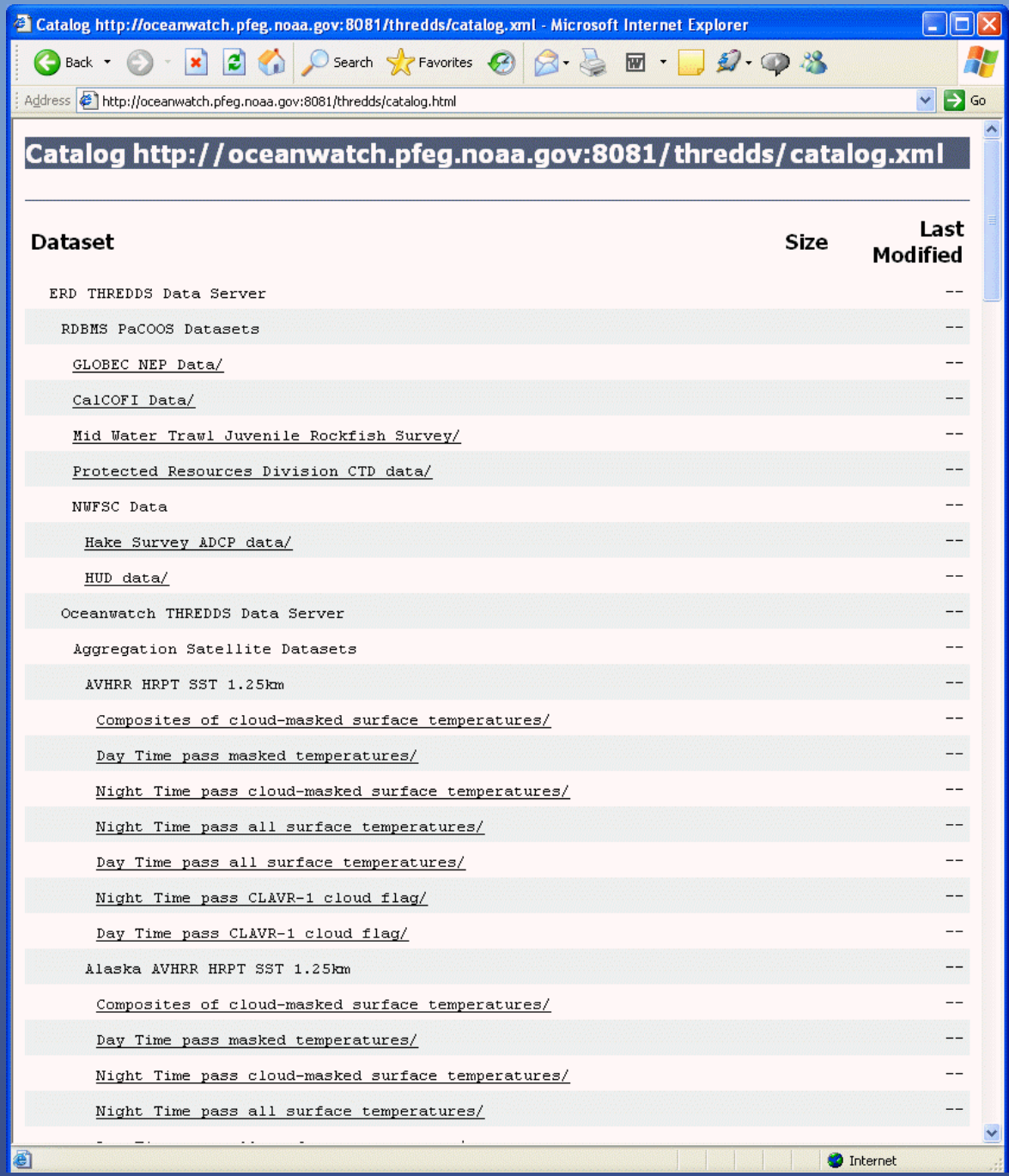
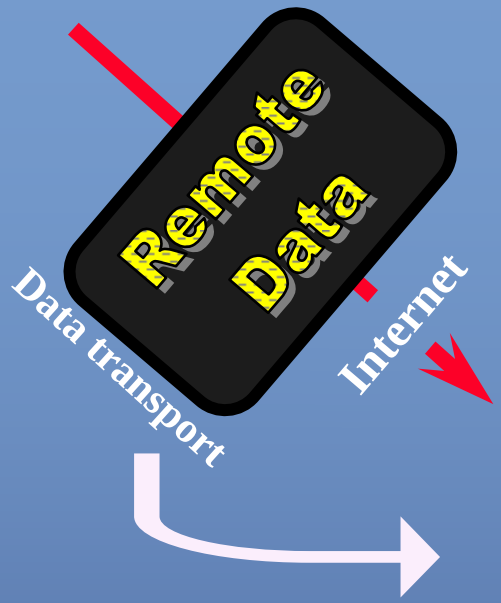
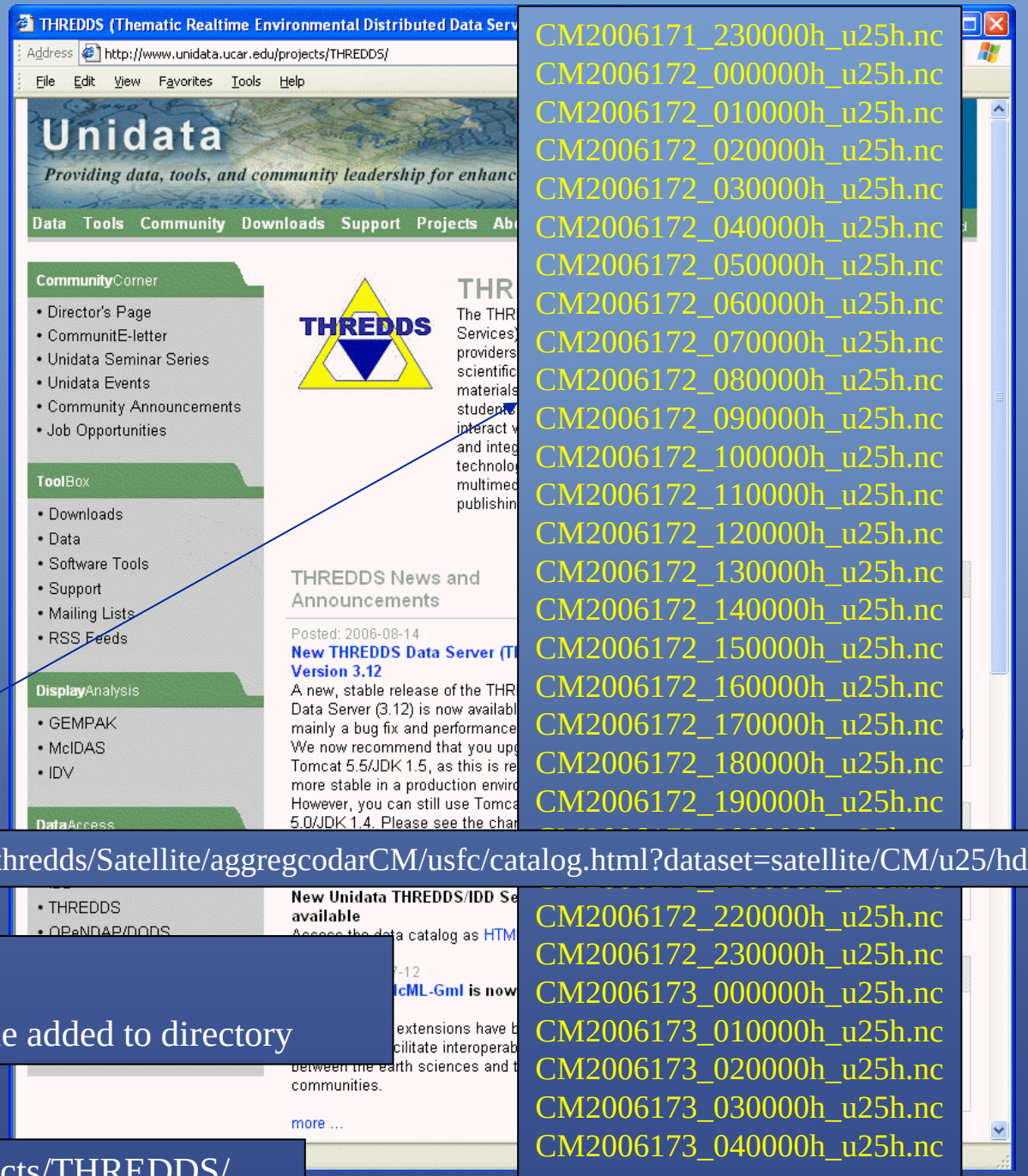
Address
http://oceanwatch.pfeg.noaa.gov:8081/thredds/Satellite/aggregsatAT/ssta/catalog.html?dataset=satellite/AT/ssta/1day
Go
"
THREDDS Data Server
unidata
Catalog
http://oceanwatch.pfeg.noaa.gov:8081/thredds/Satellite/aggregsatAT/ss
Dataset: Composites of cloud-masked surface temperatures/1-day
Data format: NetCDF
Data type: Grid
Naming Authority: gov.noaa.pfel.coastwatch
ID: satellite/AT/ssta/1day
Documentation:
Summary: NOAA CoastWatch provides sea surface temperature (SST) products derived from NOAA's Polar Operational Environmental Satellites (POES). This data is provided at high resolution (1.47km) for the North Pacific Ocean. Measurements are gathered by the Advanced Very High Resolution Radiometer (AVHRR) instrument, a multiband radiance sensor carried aboard the NOAA POES satellites. The units of the data are degree C.
Rights: The data may be used and redistributed for free but is not intended for legal use, since it may contain inaccuracies. Neither CoastWatch, NOAA, nor the United States Government, nor any of their employees or contractors, makes any warranty, express or implied, including warranties of merchantability and fitness for a particular purpose, or assumes any legal liability for the accuracy, completeness, or usefulness, of this information.
Dataset Summary
Oceanwatch Live Access Server
Access:
1. WCS: http://oceanwatch.pfeg.noaa.gov:8081/thredds/wcs/satellite/AT/ssta/1day?request=GetCapabilities&version=1.0.0&service=WCS
2. OPENDAP: http://oceanwatch.pfeg.noaa.gov:8081/thredds/dodsC/satellite/AT/ssta/1day
Creators:
West Coast Regional CoastWatch Node
email: dave.foley@noaa.gov
http://coastwatch.pfel.noaa.gov
Variables:
CF-1.0 vocabulary:
time = time = time (seconds since 1970-01-01)
Done
Internet


Catalog http://oceanwatch.pfeg.noaa.gov:8081/thredds/catalog.xml - Microsoft Internet Explorer
Back
Search
Favorites
Address
http://oceanwatch.pfeg.noaa.gov:8081/thredds/catalog.html
Go
Catalog http://oceanwatch.pfeg.noaa.gov:8081/thredds/catalog.xml
Dataset
Size
Last Modified
ERD THREDDS Data Server --
RDBMS PaCOOS Datasets --
GLOBEC NEP Data/ --
CalCOFI Data/ --
Mid Water Trawl Juvenile Rockfish Survey/ --
Protected Resources Division CTD data/ --
NWFSC Data --
Hake Survey ADCP data/ --
HUD data/ --
Oceanwatch THREDDS Data Server --
Aggregation Satellite Datasets --
AVHRR HRPT SST 1.25km --
Composites of cloud-masked surface temperatures/ --
Day Time pass masked temperatures/ --
Night Time pass cloud-masked surface temperatures/ --
Night Time pass all surface temperatures/ --
Day Time pass all surface temperatures/ --
Night Time pass CLAVR-1 cloud flag/ --
Day Time pass CLAVR-1 cloud flag/ --
Alaska AVHRR HRPT SST 1.25km --
Composites of cloud-masked surface temperatures/ --
Day Time pass masked temperatures/ --
Night Time pass cloud-masked surface temperatures/ --
Night Time pass all surface temperatures/ --
Internet



THREDDS Aggregation



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http://oceanwatch.pfeg.noaa.gov:8081/thredds/Satellite/aggregcodarCM/usfc/catalog.html?dataset=satellite/CM/u25/hday

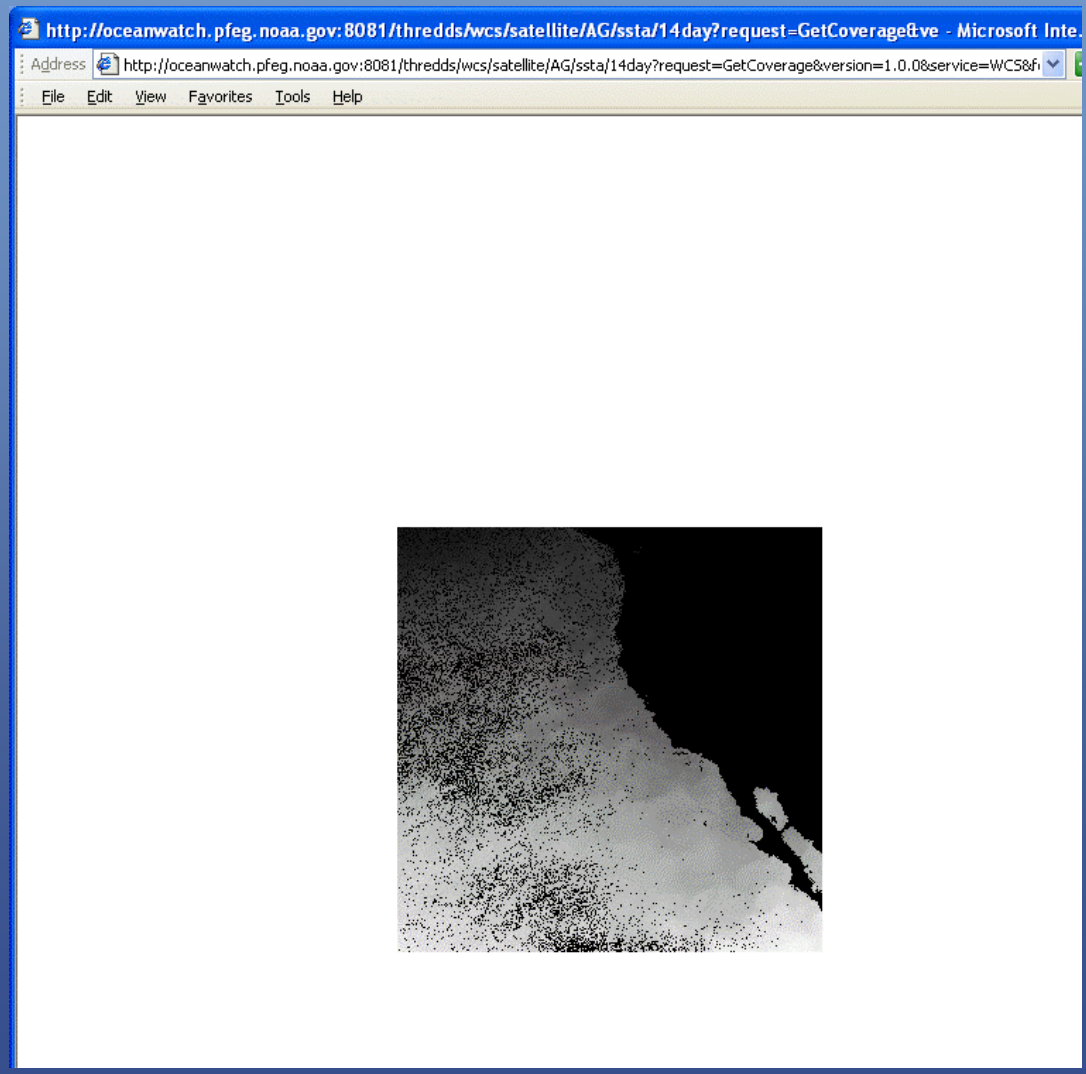
Access with single URL

Updates automatically when file added to directory

http://www.unidata.ucar.edu/projects/THREDDS/

WCS - Web Coverage Services

http://oceanwatch.pfeg.noaa.gov:8081/thredds/wcs/satellite/AG/ssta/14day?request=GetCoverage&version=1.0.0&service=WCS&format=GeoTIFF&coverage=AGssta&Vertical=.0&time=2006-01-09T23:59:59Z&bbox=220,20,250,50



Summary

A small amount of time spent setting up a standardized, efficient data transport layer can greatly reduce the time spent on serving data.

An OPeNDAP Server immediately provides (without any further work) access to the data for :

- desktop applications (Matlab, IDV, ArcGIS, R, Ferret, others?)
- developers in Java, Python, others?
- basic web access with OPeNDAP form

Installation of an open-source application such as DChart or Live Access Server further provides:

- powerful web-based access to the data with a community-familiar interface
- customization of display (open-source software)

Remote users and web interfaces can have standardized access to the data, facilitating interoperability of data systems and integration of data from varying sources.

Once basic access has been supplied, researchers can get the data they need, web developers can focus on web pages rather than data format issues.