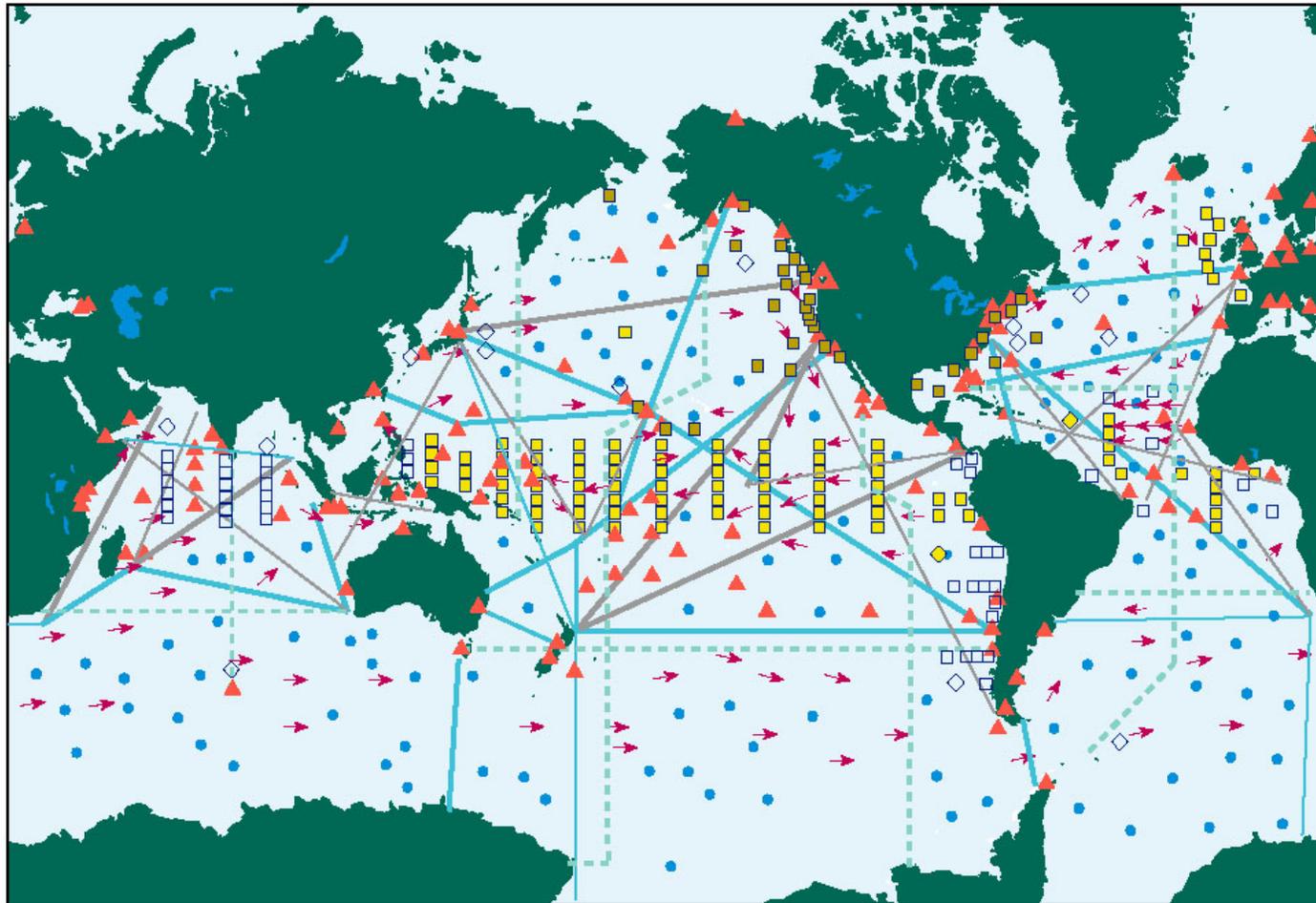


Observing System Monitoring Center (OSMC)

Work in progress in brief
June 2005

Steve Hankin, Kevin O'Brien – PMEL

... a system view of global ocean climate observations



● $3^{\circ} \times 3^{\circ}$ ARGO ARRAY ▲ TIDE GAUGE STATIONS ■ MOORED BUOYS → $5^{\circ} \times 5^{\circ}$ DRIFTER ARRAY — SHIP LINES

"Big fleas have little fleas
upon their backs to bite 'em.
And those fleas have lesser fleas
and so ad infinitum."

Leo Brody, *Starting FORTH*
(I think)

The analogy (lame):

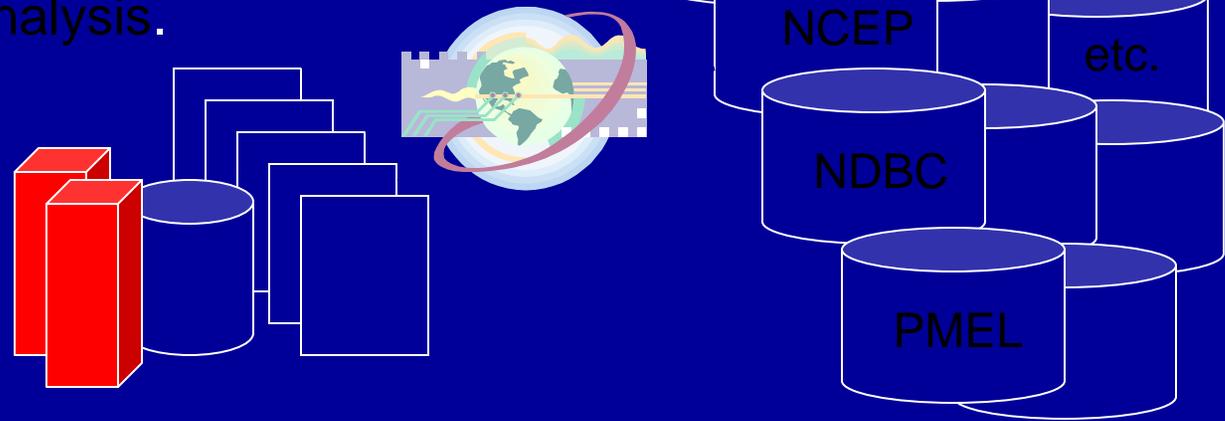
When the metadata is the data,
even metadata has metadata.

Systems View of the OSMC

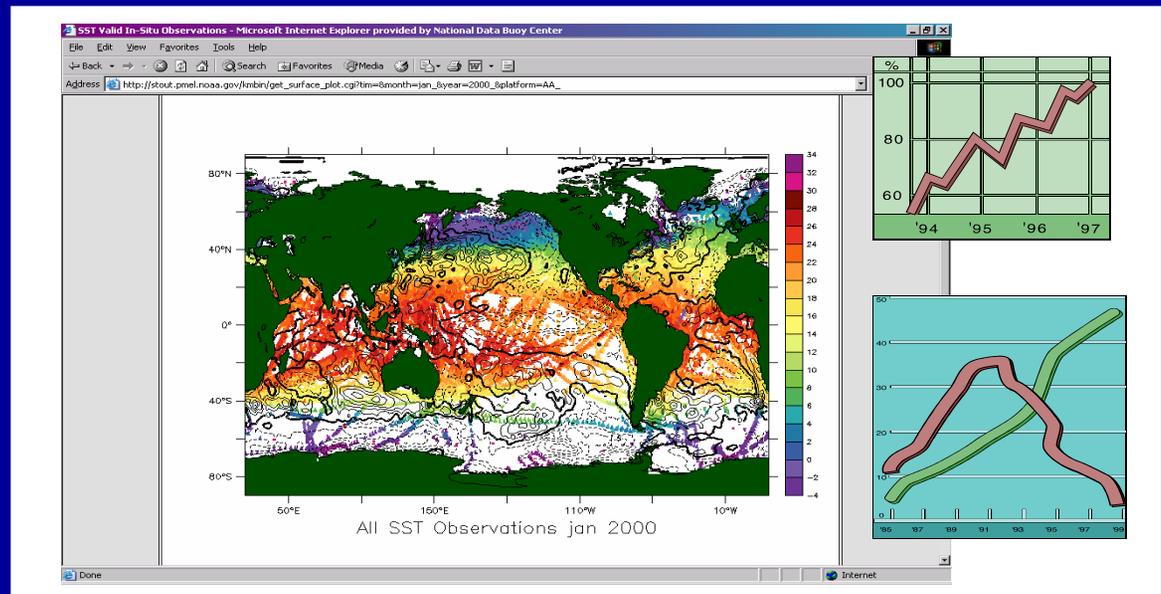
Data and metadata pulled from various sources.

OSMC servers will store metadata for display and analysis.

Live Access Server to provide web browser access & data visualization



Analysts and Researchers



A partnership ...

- PMEL
User interface logic & tools
- NDBC
Metadata assembly & operations
- NGDC (new partner)
GIS and DB technical services

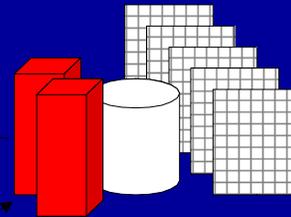
with assistance from

- JCOMM-OBS (platform metadata)
- US GODAE Server (GTS metadata feed)

OSMC Schematic View

Data and metadata is pulled from various sources (mainly GODAE)

OSMC servers store data and metadata
Updated daily



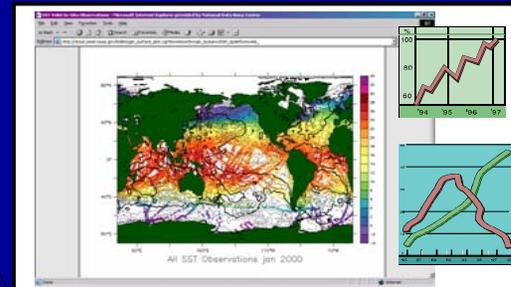
Live Access Server provides Web Browser Access & Data Visualization

NDBC Firewall



OCO Analysts and Researchers

NASA Firewall



Internet



Getting a handle on the "climate data record"

- Current (meta)data *("realtime")*
 - GTS -- primary source
- Historical (meta)data
 - poorly integrated
 - need "DMAC" style of integration
 - (for now ... use a GTS archive
& acknowledge missing data e.g. research cruises)

OSMC (meta)database at NDBC

- Met and Ocean data from GODAE Server
~350 MB of data per day

URL=<http://usgodae2.fnmoc.navy.mil/ftp/outgoing/fnmoc/data/met/2005031706.tar.Z>

- Mooring updates from NDBC-hosted metadata
- Ship call sign info from the WMO Pub 47
- Float updates from JCOMMOPS

URL = <ftp://ftp.jcommops.org/Arqo/Status/status.txt>

- Country information is assigned based on WMO allocation table

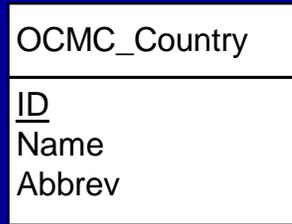
URL = <http://www.wmo.ch/web/aom/marprog/Operational-Information/buoy-ids.htm>

OSMC (meta)database at NDBC

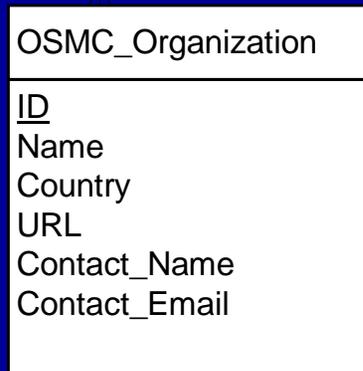
Platform Type	# Observations
ARGO FLOAT	5,4326
CMAN	794,262
DRIFTING BUOY	4,447,127
MOORED BUOY	2,066,686
SHIP	682,757
NOT DEFINED	934,451

- Database back to 2004 (for now)
- Metadata tracking not easy - about 10% undefined

OSMC Database - Entity Diagram



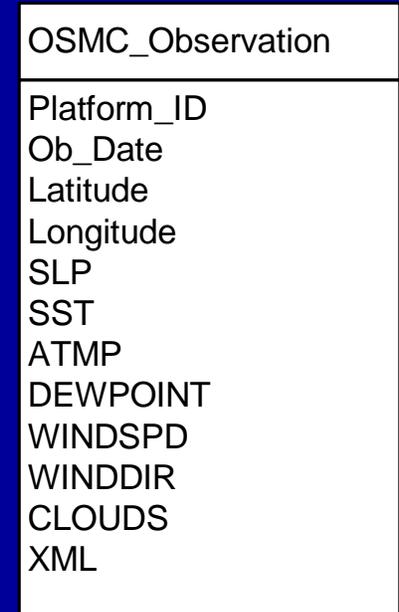
Country is based on ISO 3166, which defines unique 2-character identifiers for each country



Organization identifies an agency, institute, university, or private company that owns or operates a reporting platform



Platform identifies a ship, drifting buoy, moored buoy station, or other platform that reports marine data



Observation records the instance of a marine observation for a reporting date and time.

OSMC Database Environment

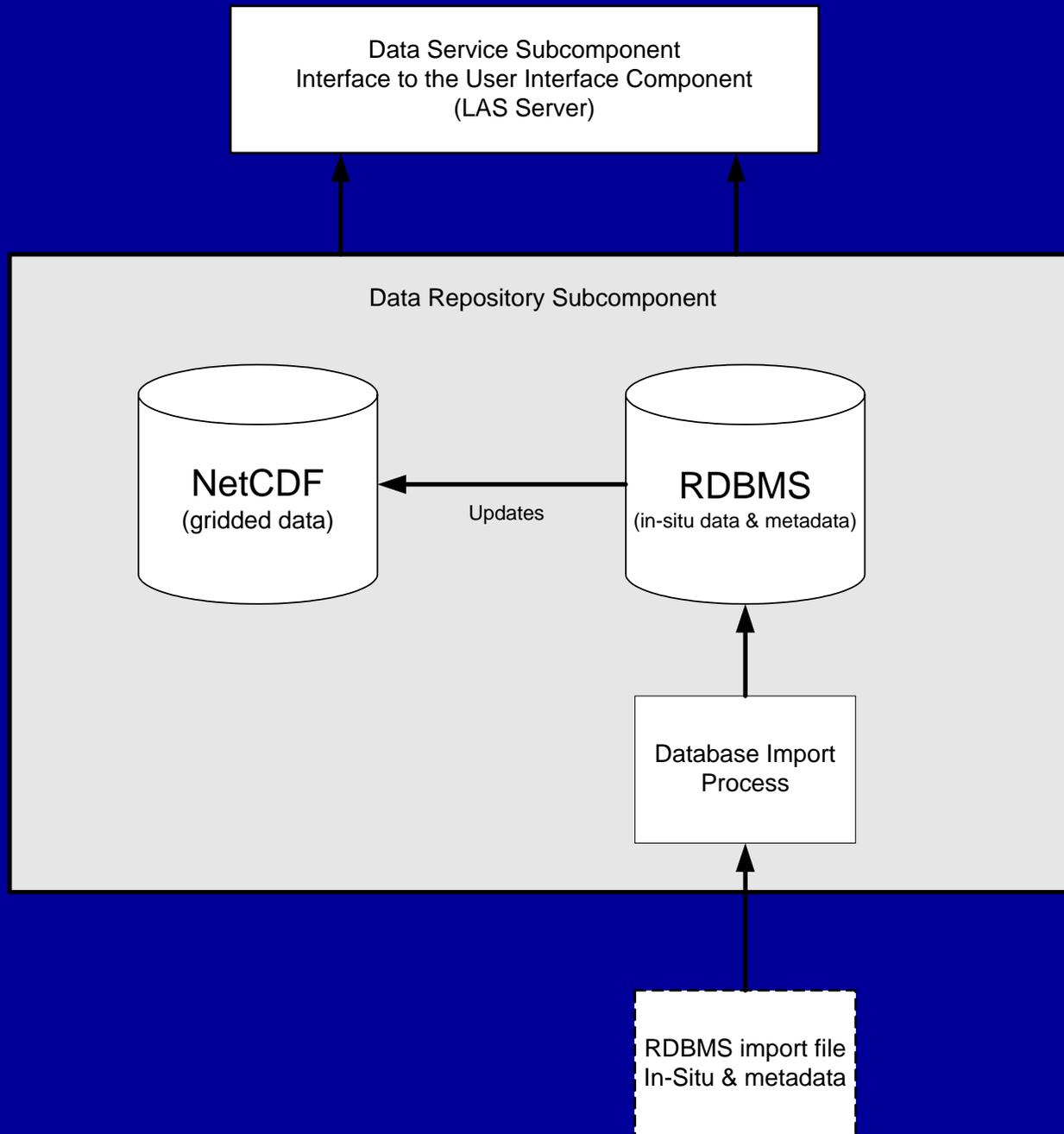
- Dell PowerEdge 2650
 - Dual Processor 3.06 GHz/1MB Cache
 - Five 146 GB Harddrive
 - Red Hat Enterprise Linux ES v3
- Oracle Database

OSMC (meta)database

- Derived gridded files

Observation metadata are summarized into 1X1 degree daily gridded files (netCDF) to support interactive observing evaluation operations

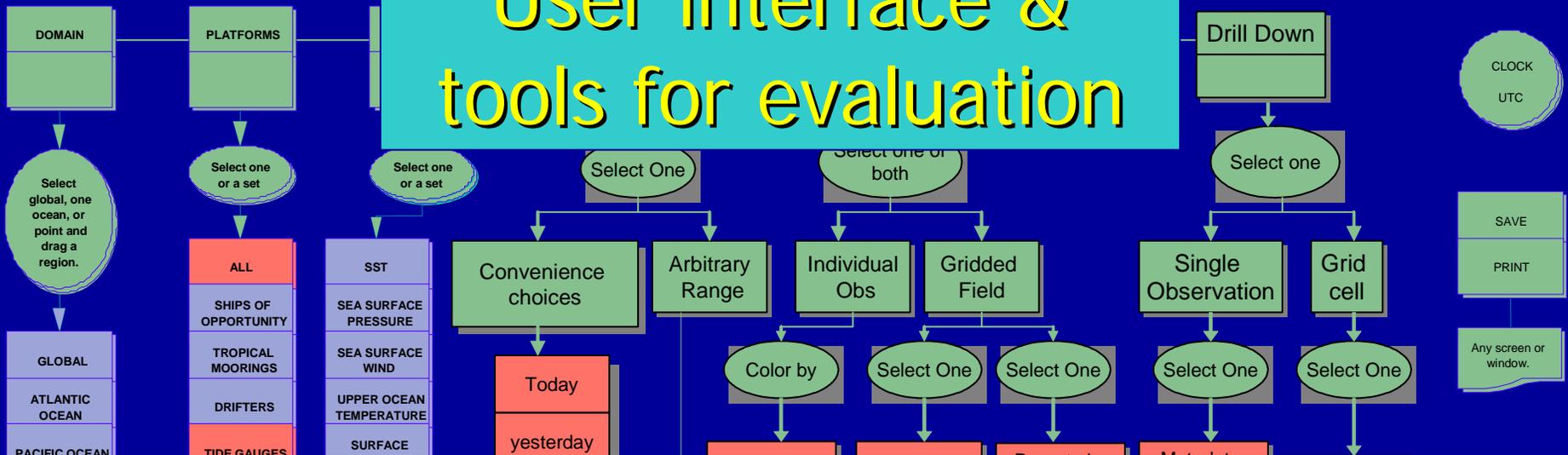
OSMC Database - Architecture



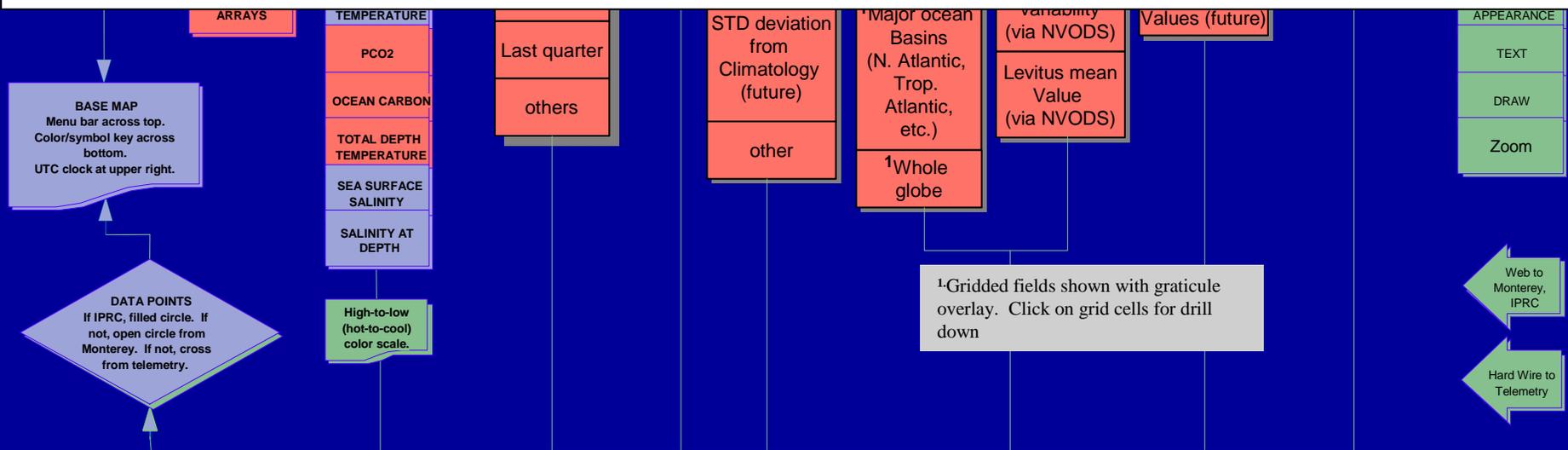
Functionality that OSMC must provide:

- Overview (where are the obs?)
- Drill-down (what are the obs?)
- Evaluation (are the obs adequate?)

User interface & tools for evaluation

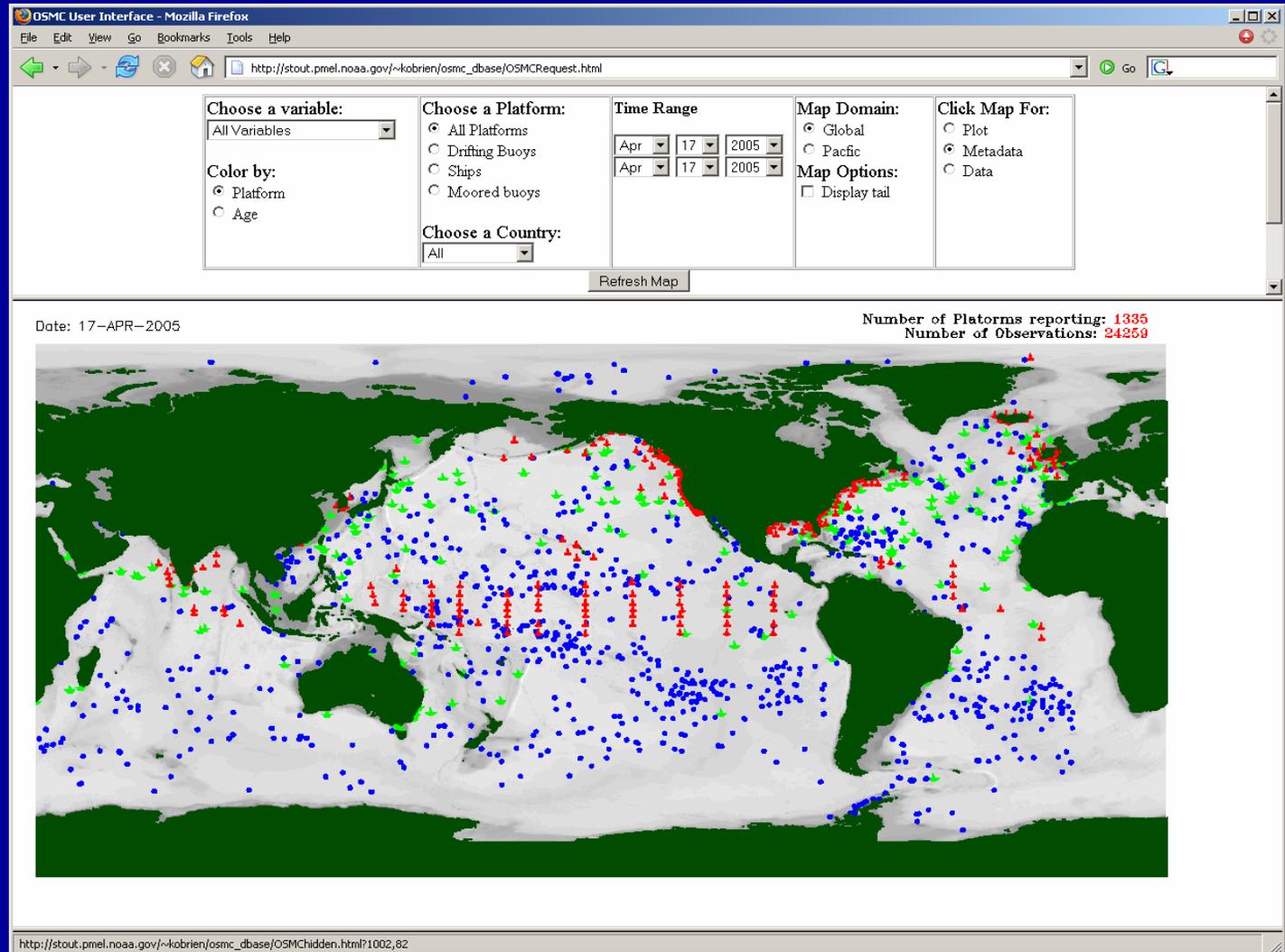


Web-accessible to the community



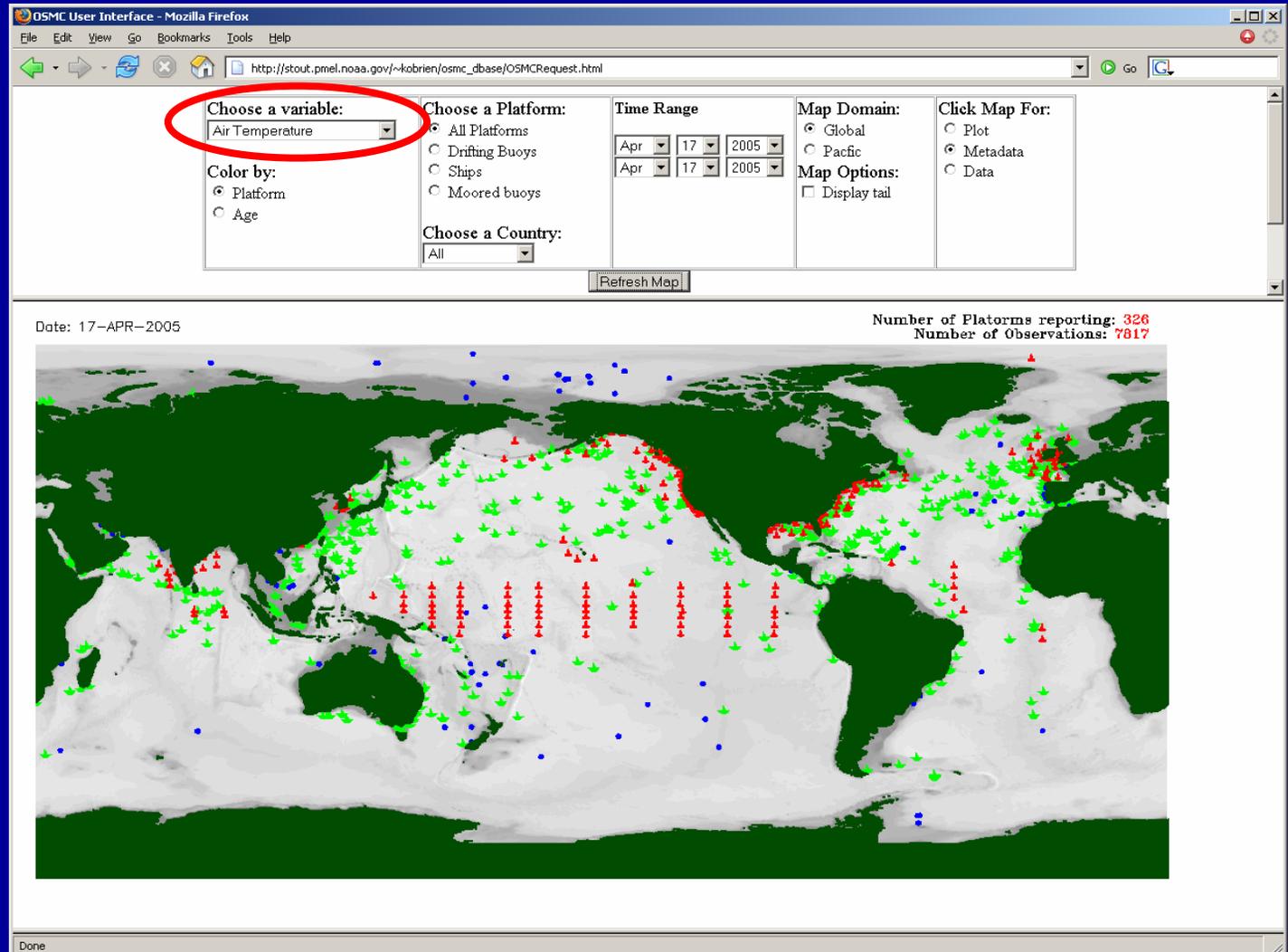
Visualization & evaluation Overview (tour)

all
platforms
reporting
today



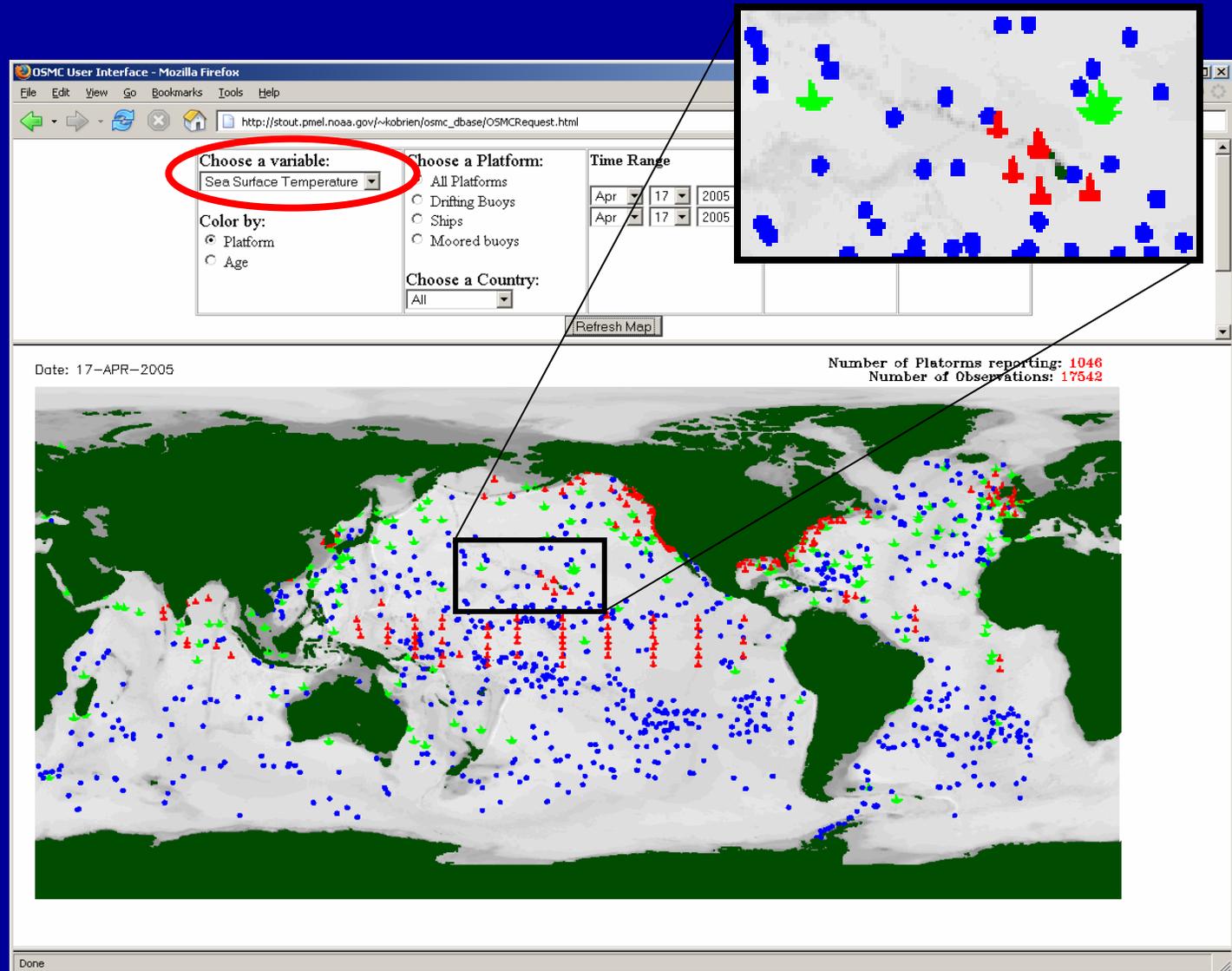
Visualization & evaluation Overview

all
platforms
reporting
air temp.
today



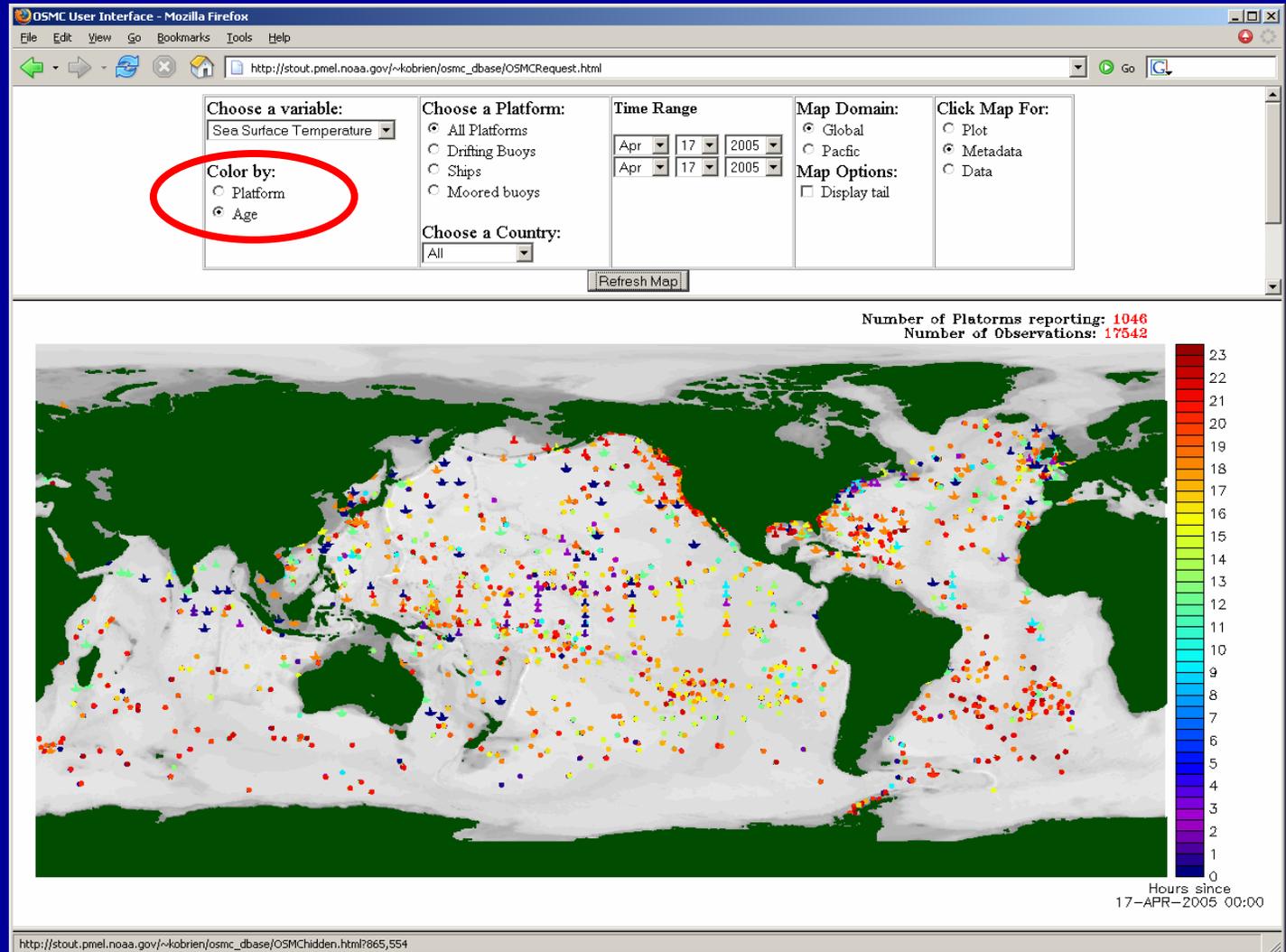
Visualization & evaluation Overview

all
platforms
reporting
SST
today



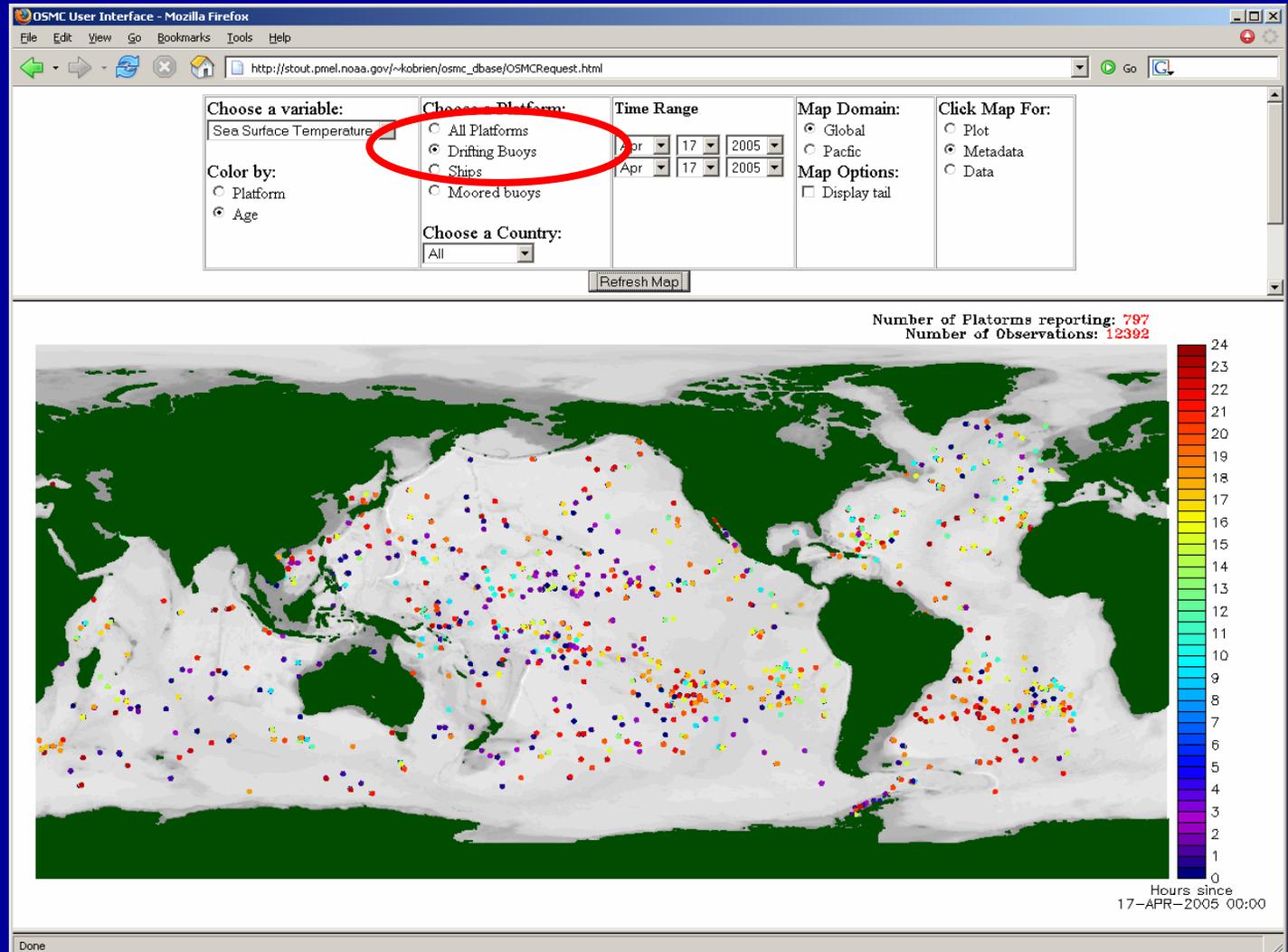
Visualization & evaluation Overview

all
platforms
reporting
SST
today
colored
by age



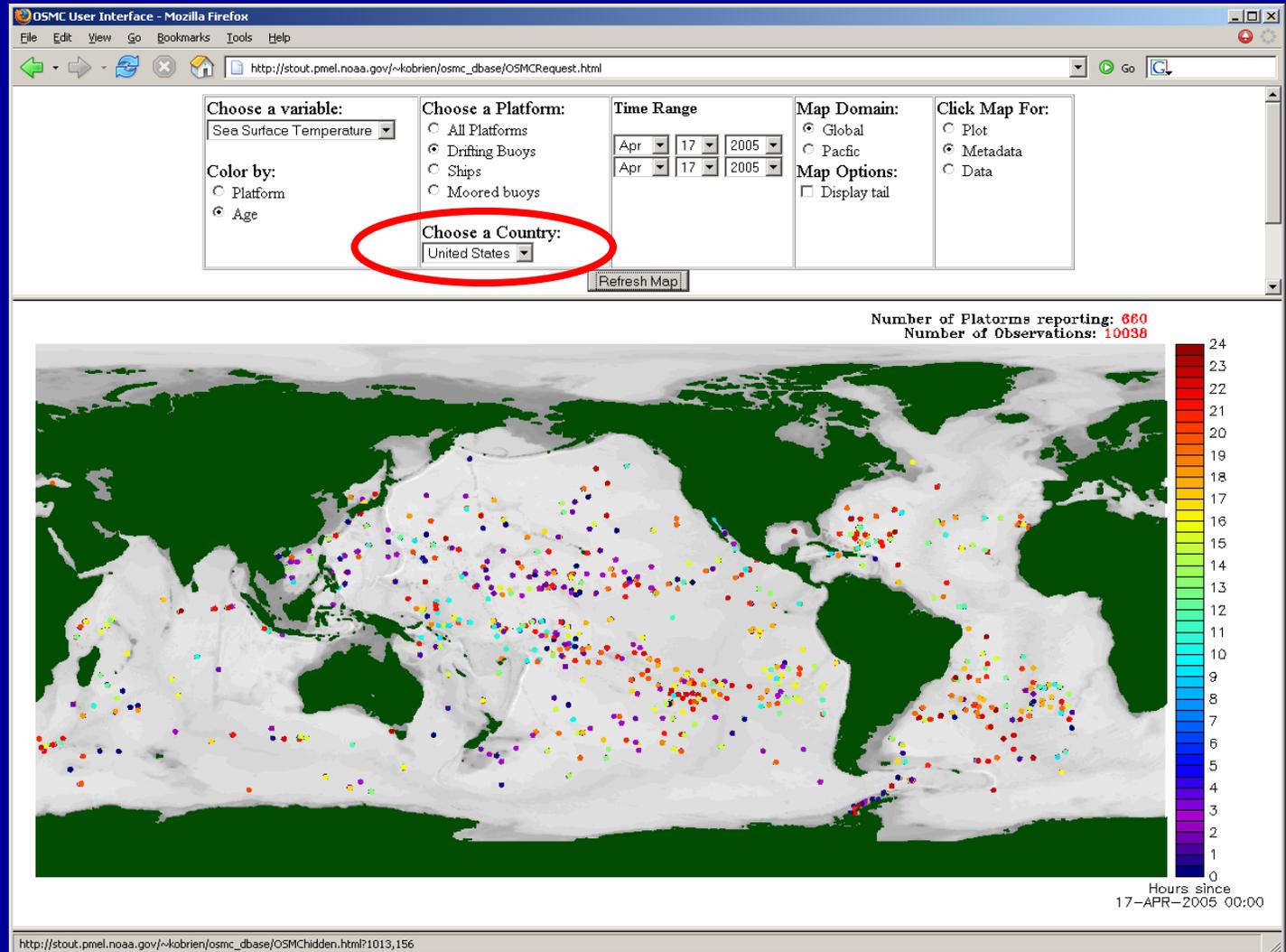
Visualization & evaluation Overview

Drifters
reporting
SST
today



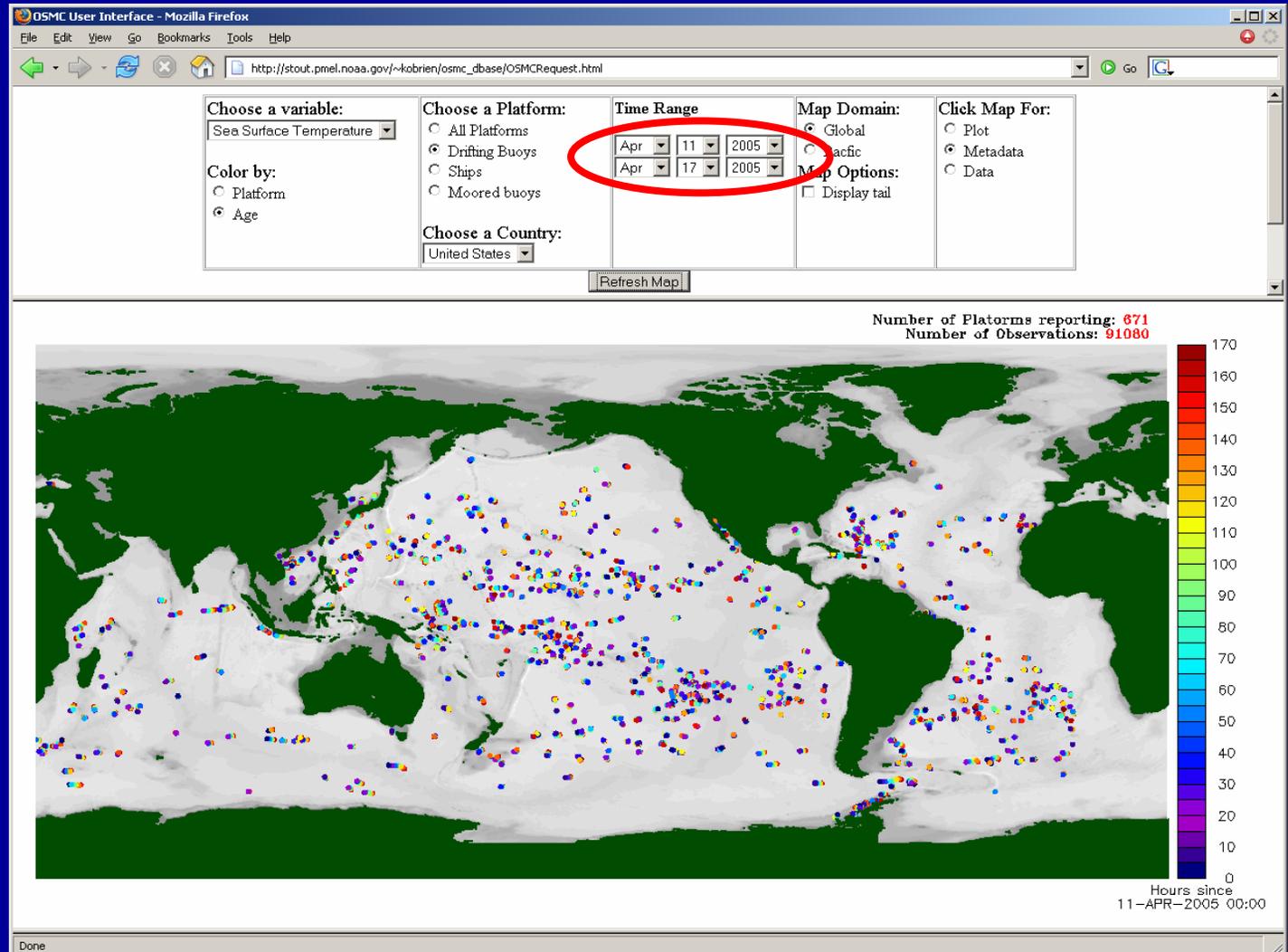
Visualization & evaluation Overview

U.S.
drifters
reporting
SST
today

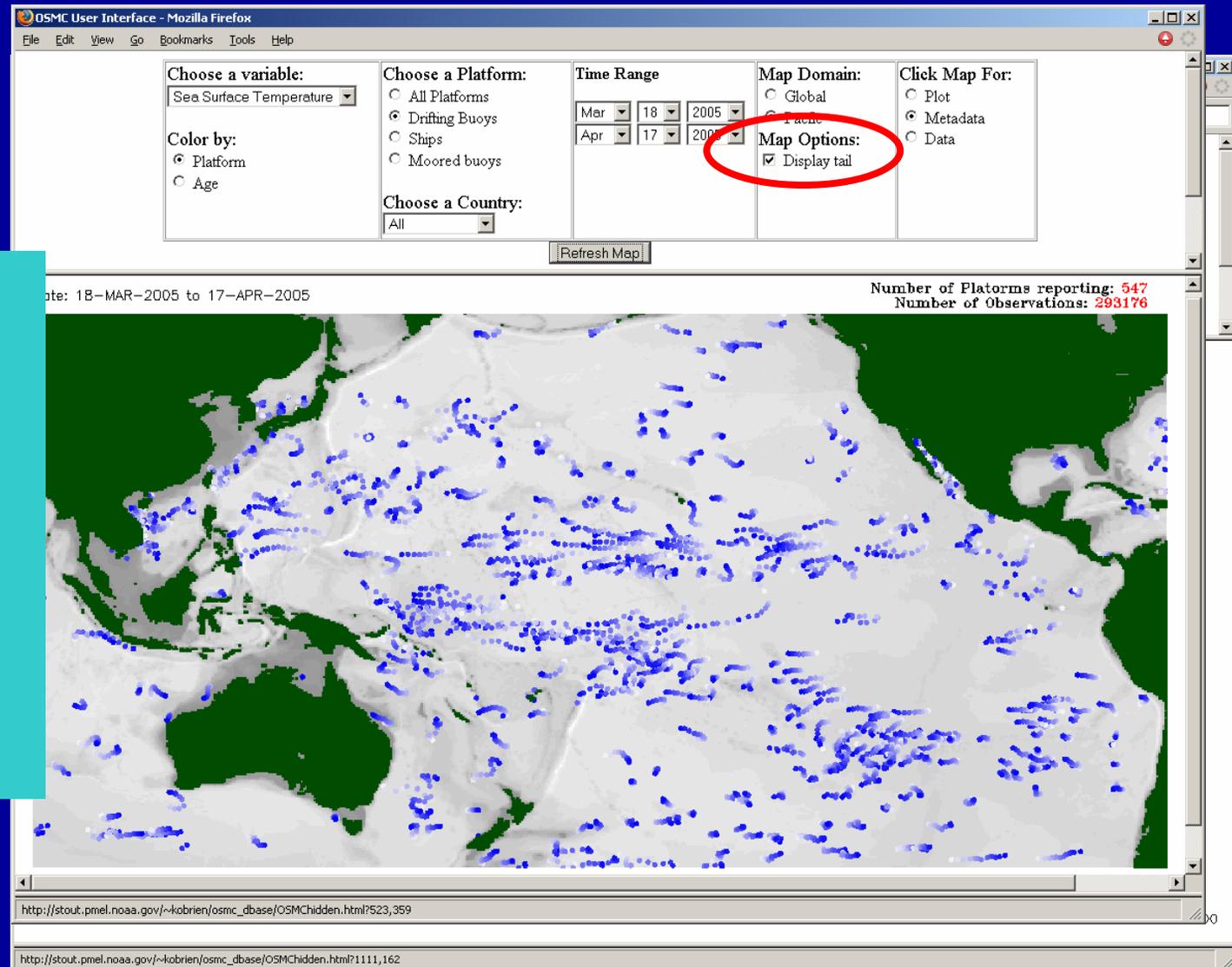


Visualization & evaluation Overview

U.S.
drifters
reporting
SST
this week



Visualization & evaluation Overview

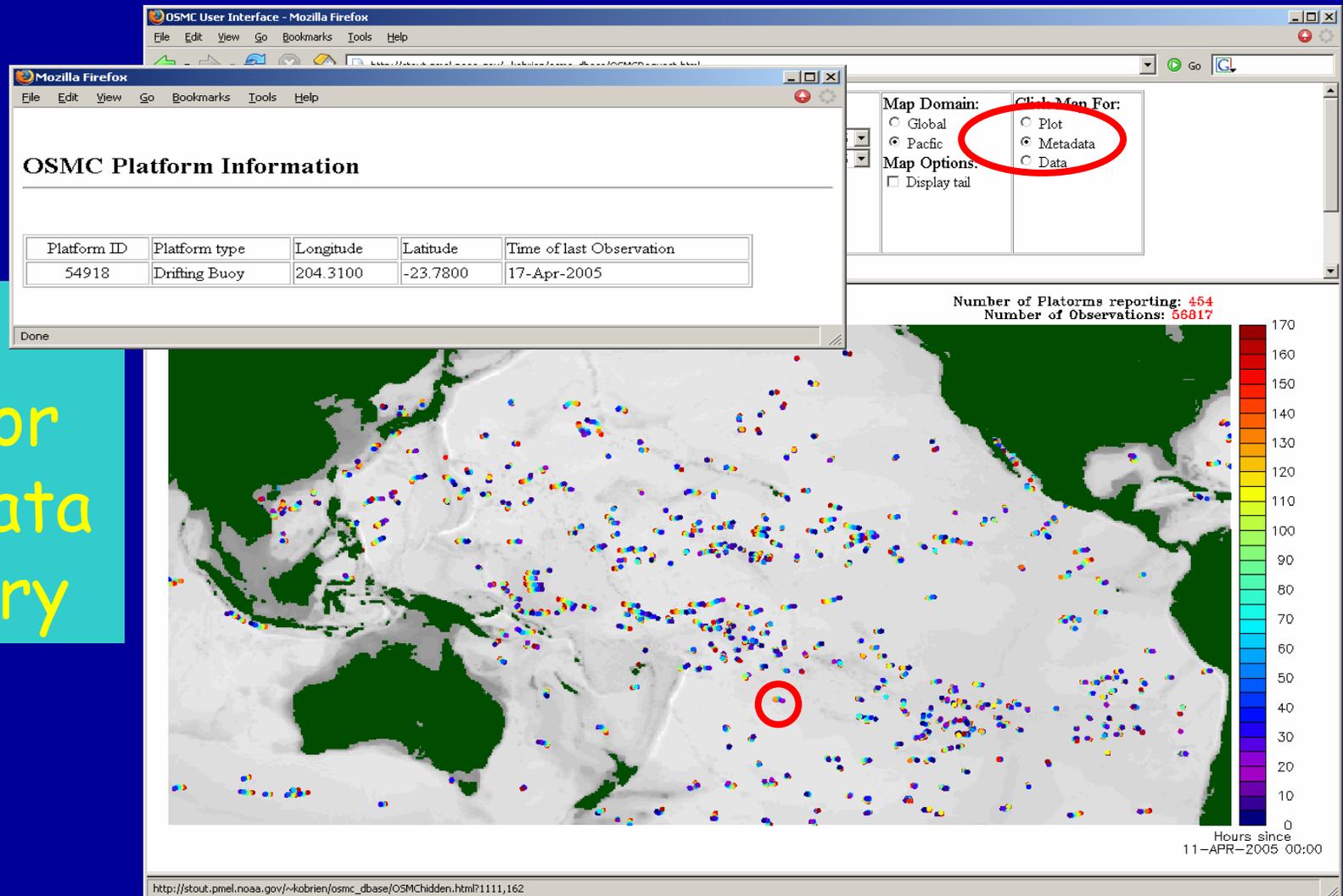


User interface & tools for evaluation

- Overview (where are the obs?)
- → Drill-down (what are the obs?)
- Evaluation (are the obs adequate?)

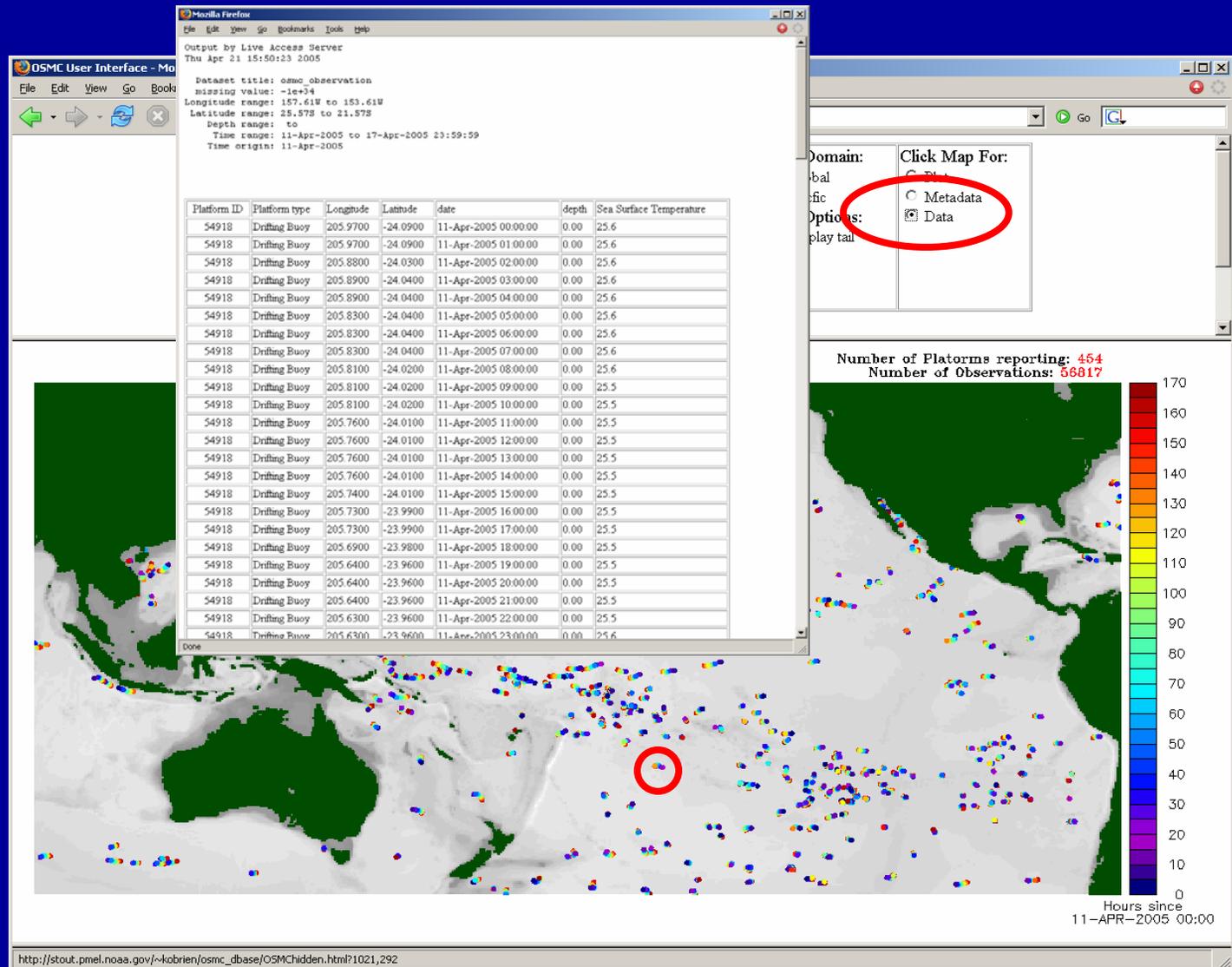
Visualization & evaluation Drill Down

mouse
click for
metadata
summary



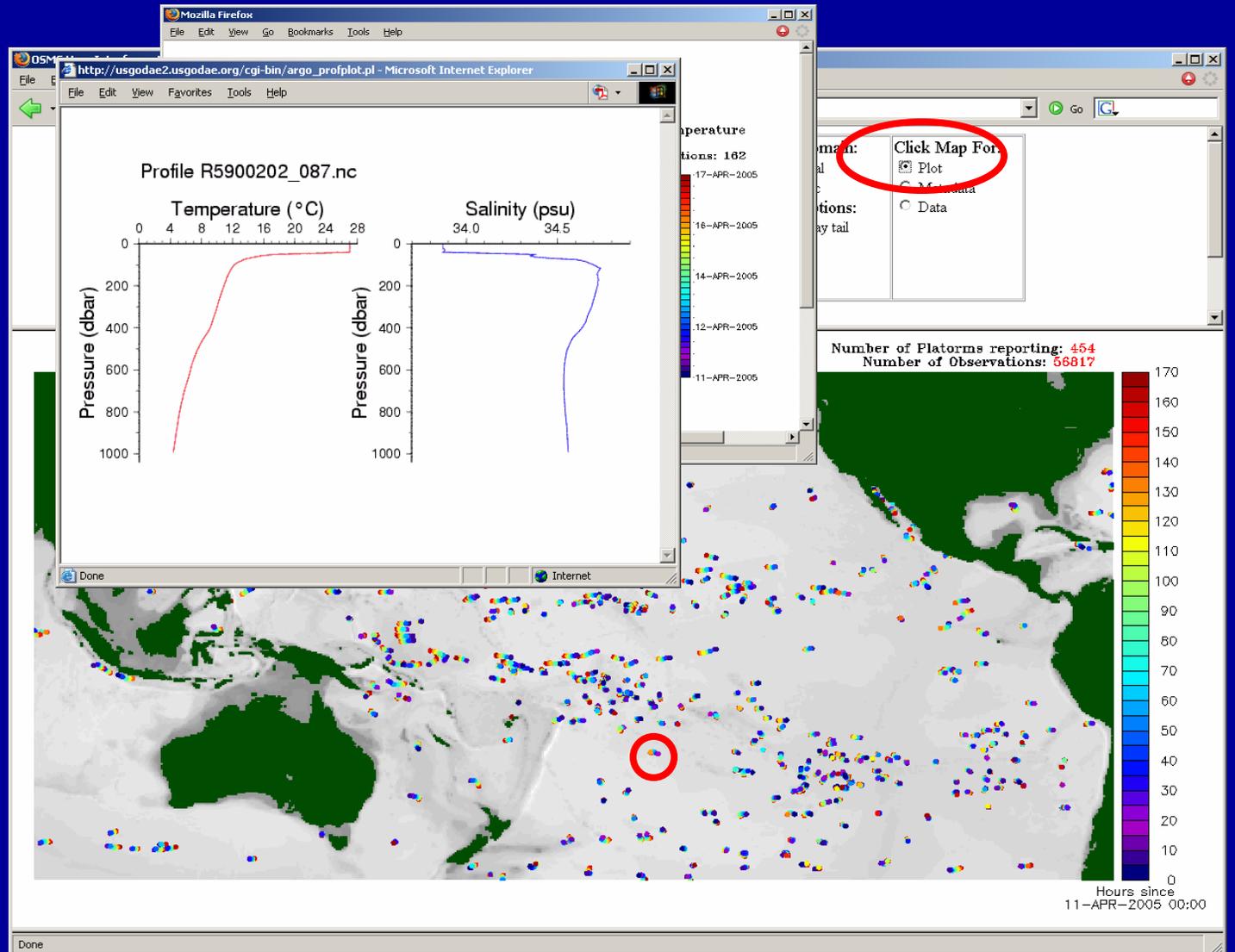
Visualization & evaluation Drill Down

mouse
click to
view data



Visualization & evaluation Drill Down

mouse
click to
view plot

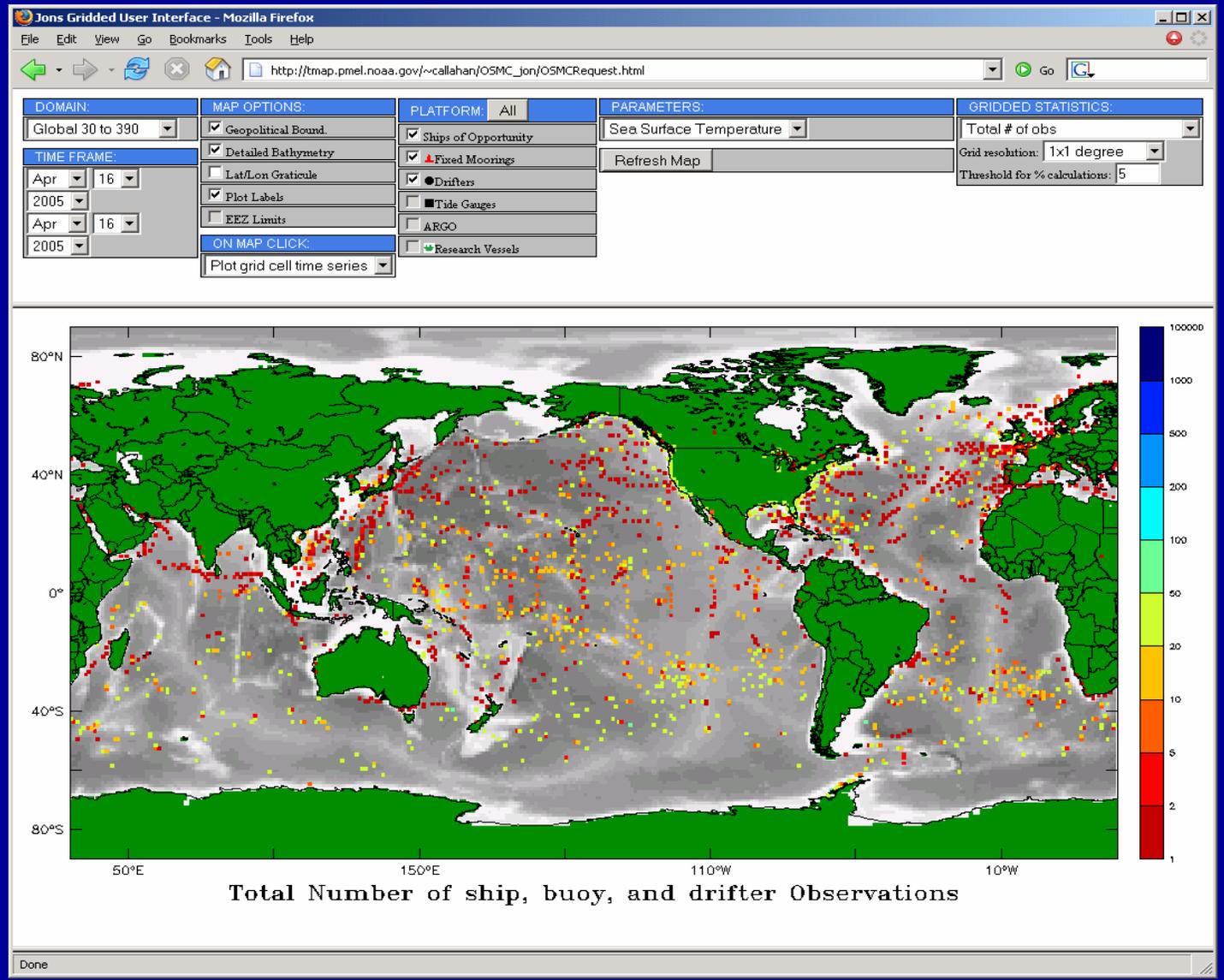


User interface & tools for evaluation

- Overview (where are the obs?)
- Drill-down (what are the obs?)
- → Evaluation (are the obs adequate?)

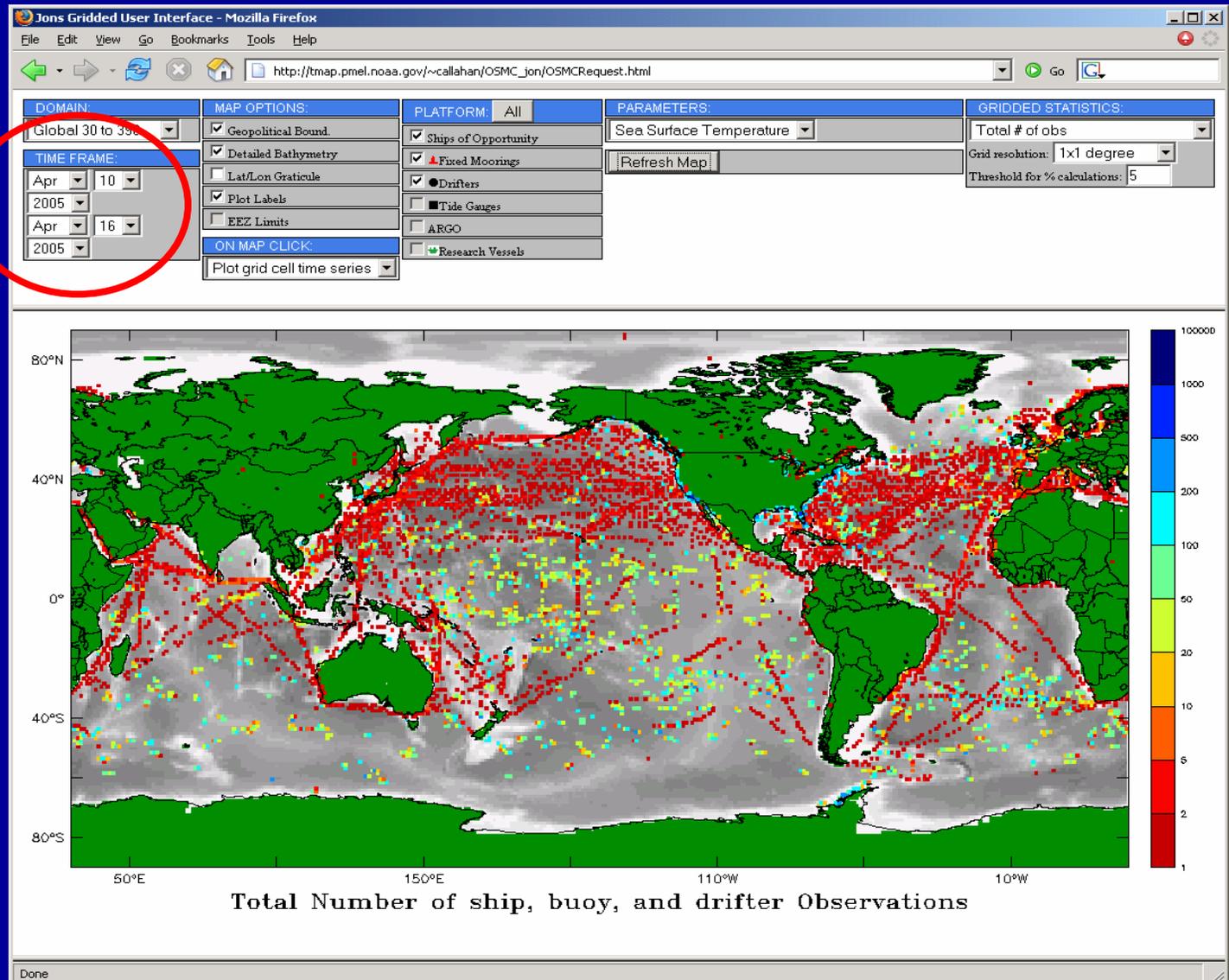
Visualization & evaluation

Number of platforms per 1x1 degree box reporting SST today



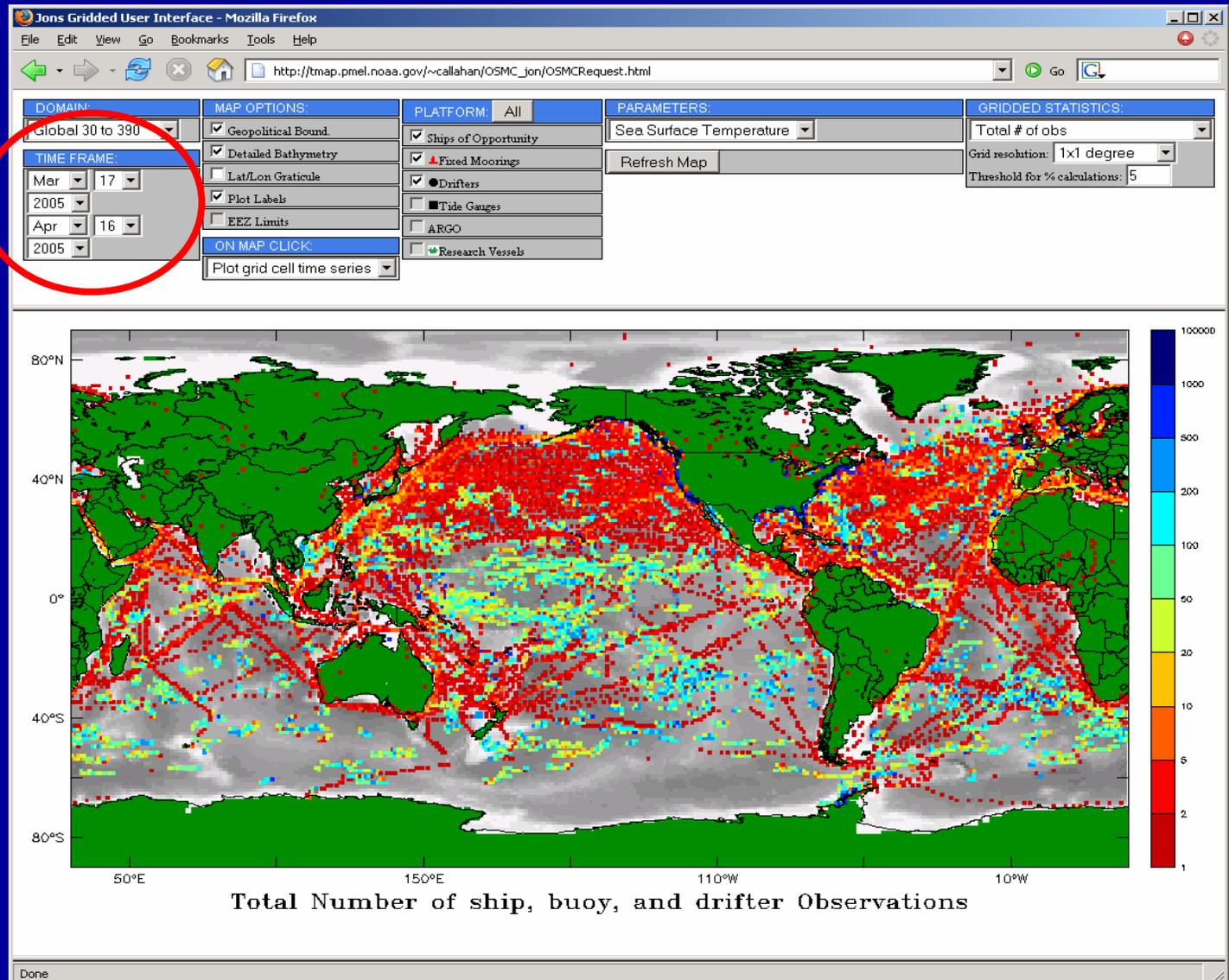
Visualization & evaluation

Number of platforms per 1x1 degree box reporting SST this week



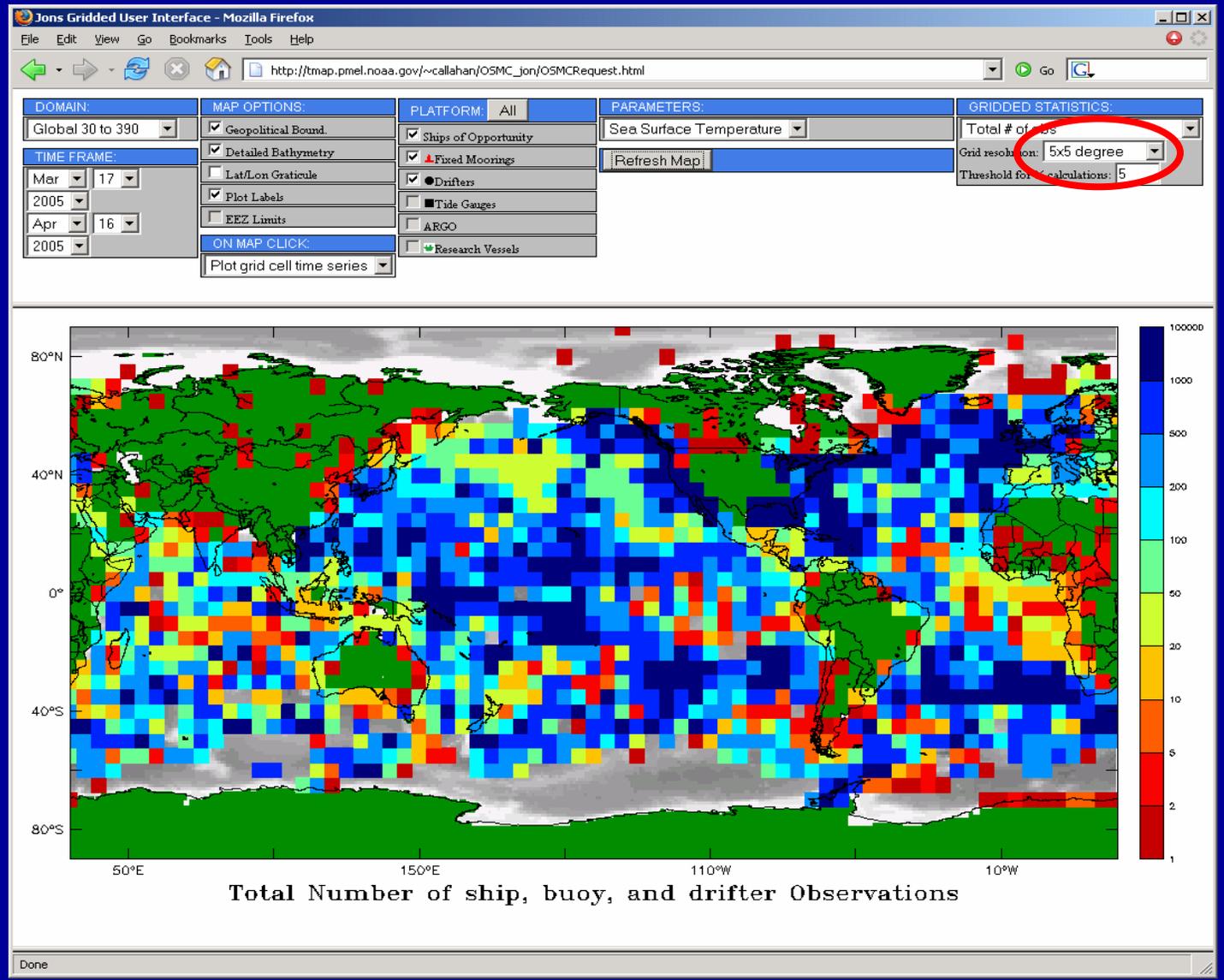
Visualization & evaluation

Number of platforms per 1x1 degree box reporting SST this month



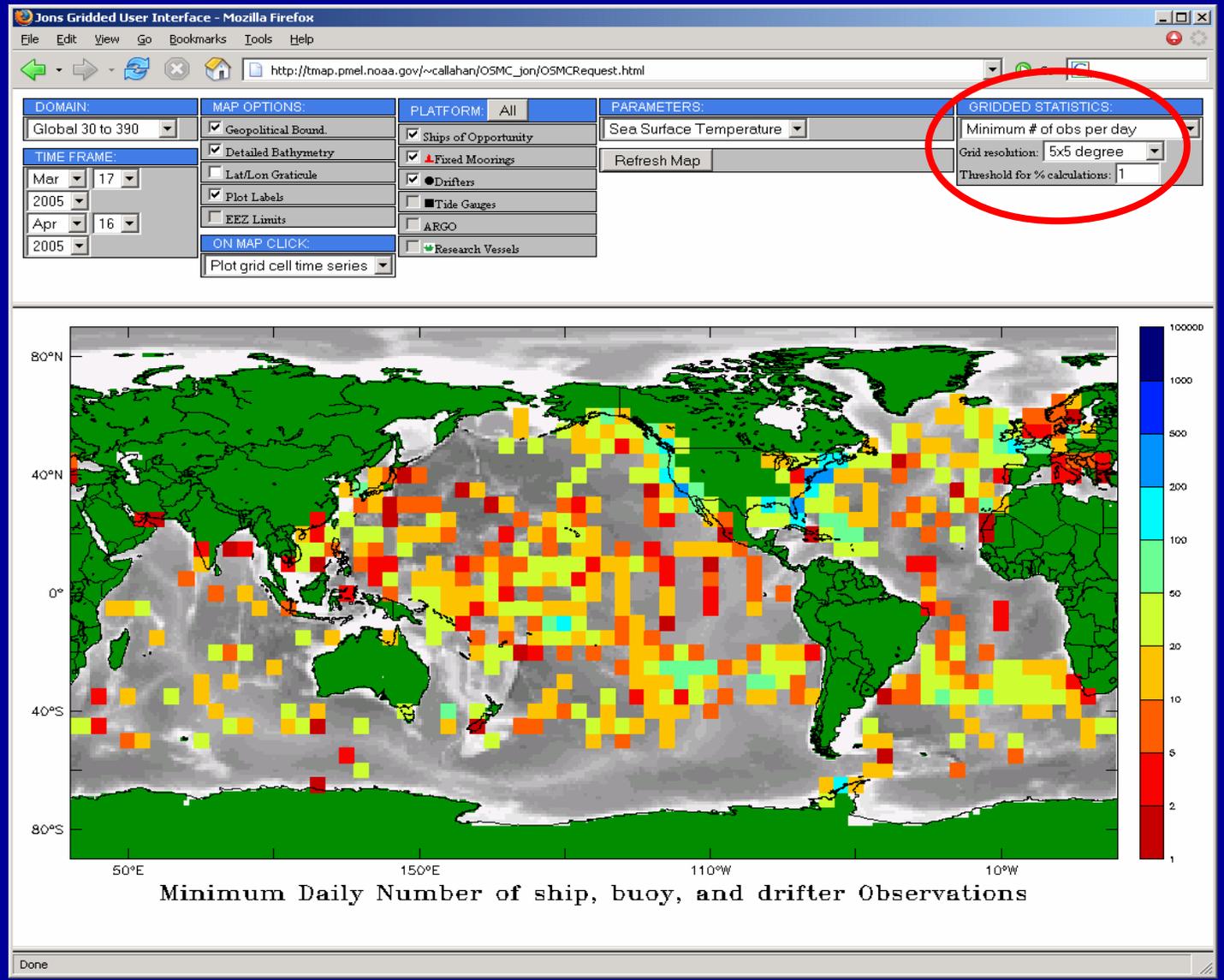
Visualization & evaluation

Number of platforms per 5x5 degree box reporting SST this month



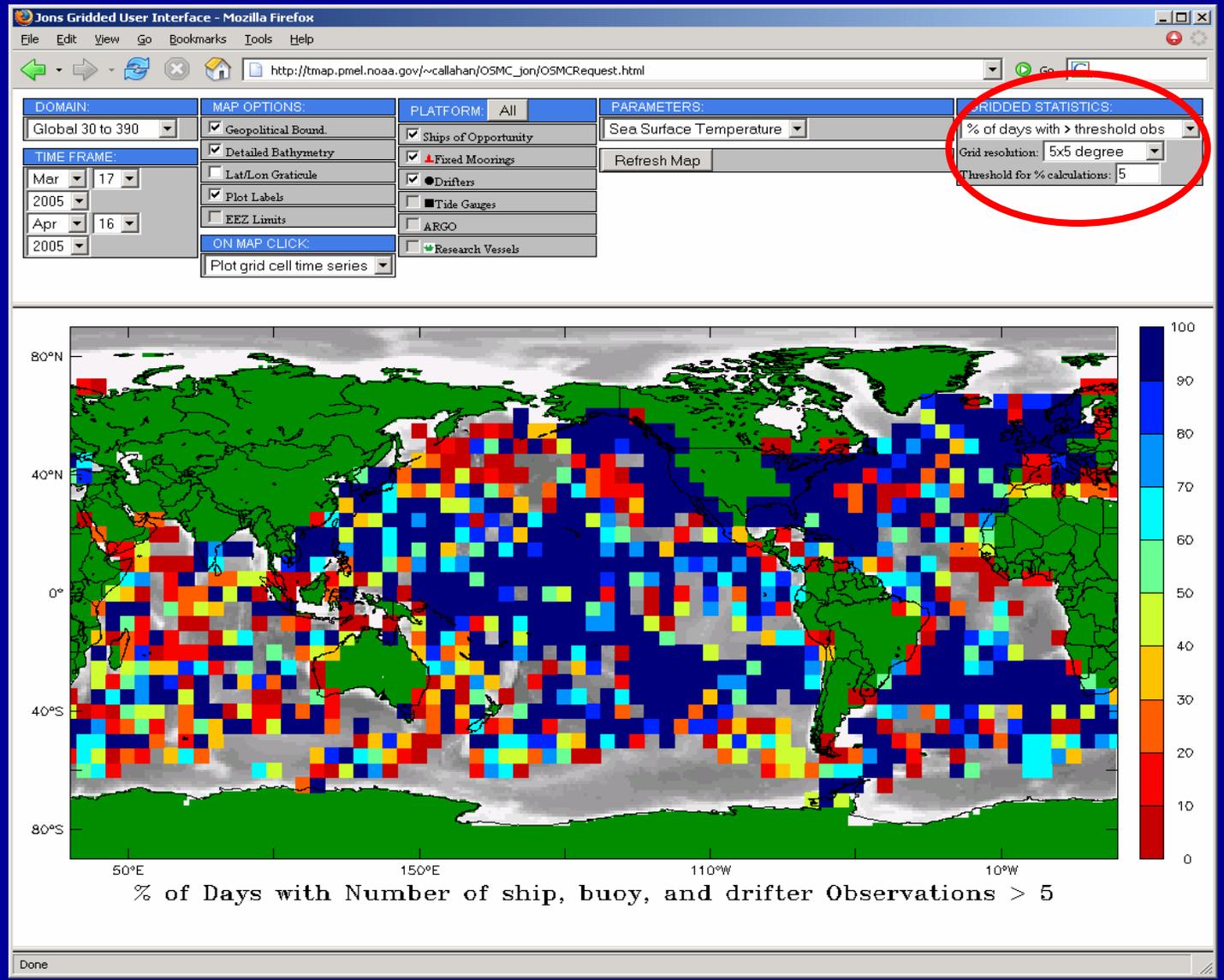
Visualization & evaluation

5x5
degree
boxes this
month that
had one or
more SST
obs every
day



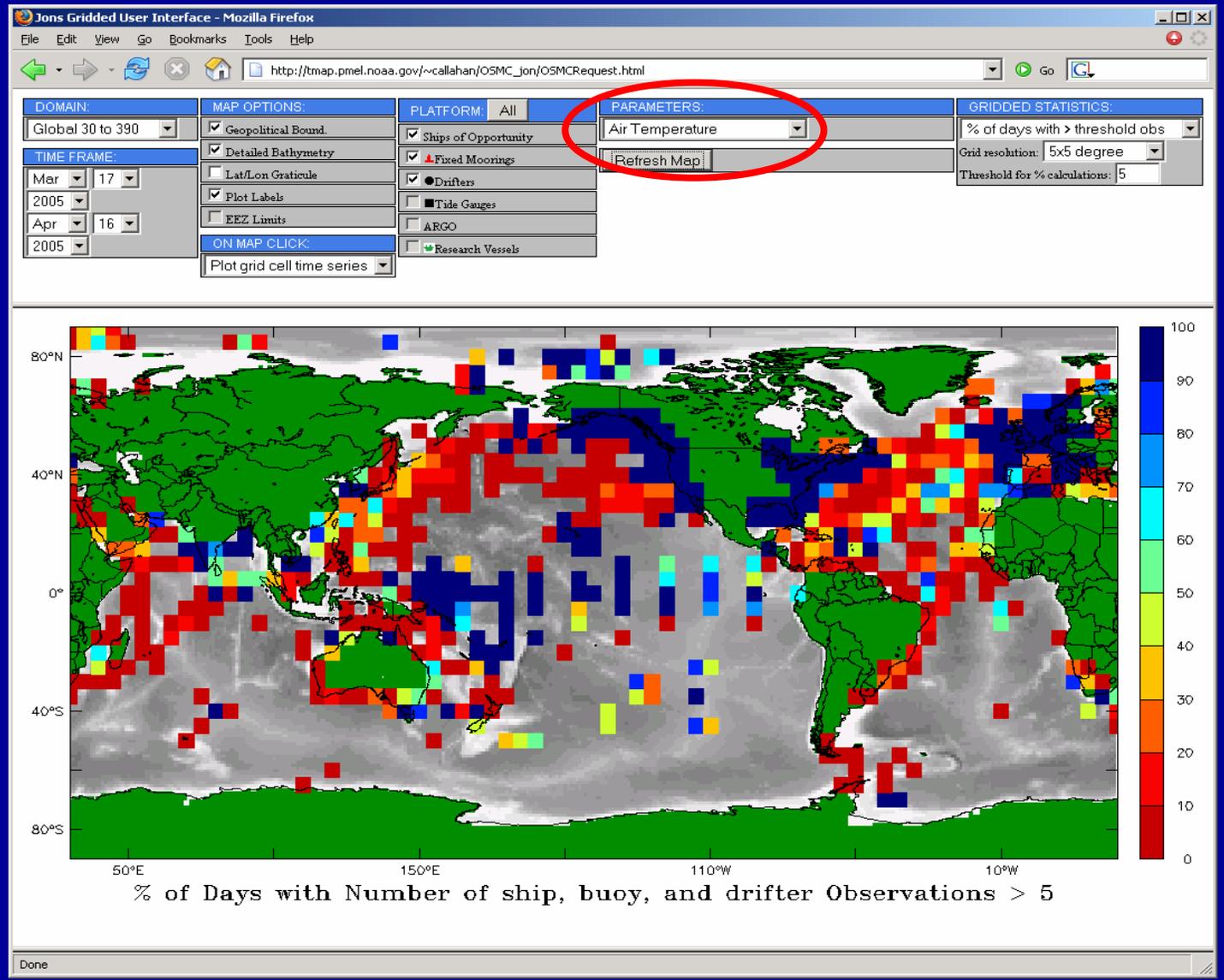
Visualization & evaluation

Percentage of days when a 5x5 degree box had at least 5 SST obs



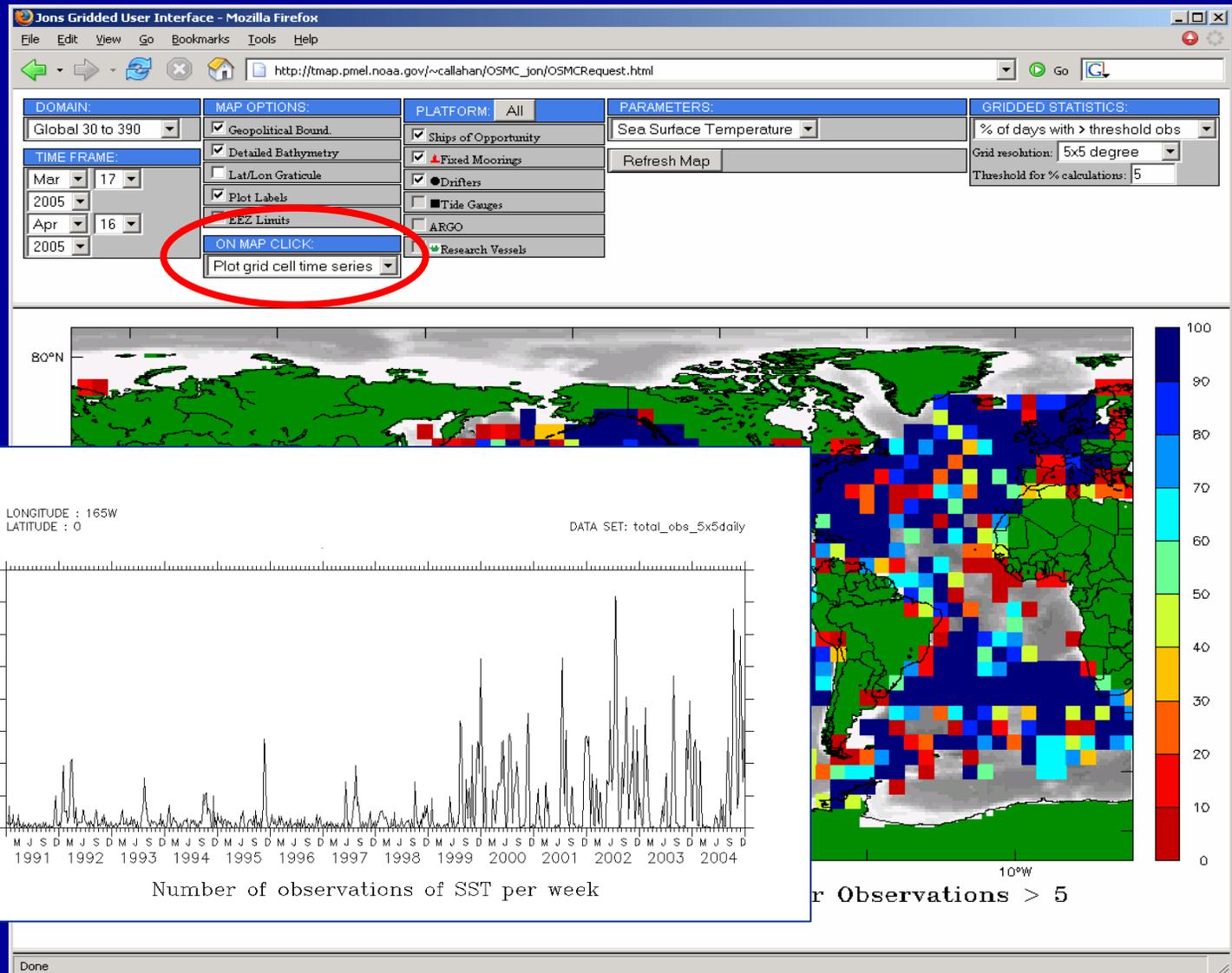
Visualization & evaluation Evaluation

Percentage
of days
when a 5x5
degree box
had at
least 5 air
temp obs



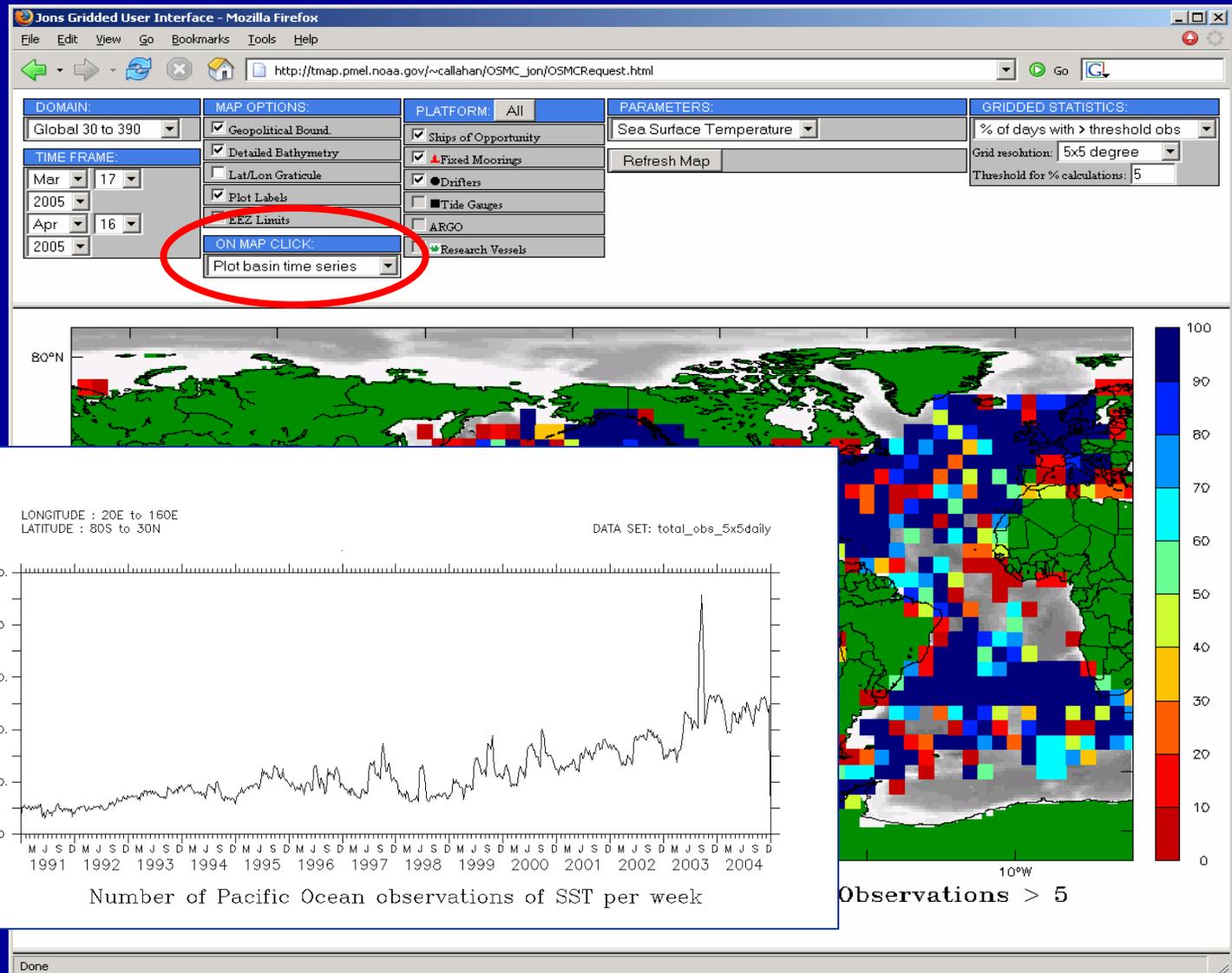
Visualization & evaluation

Click for
time series
record of
SST obs in
a single
5x5 grid
cell



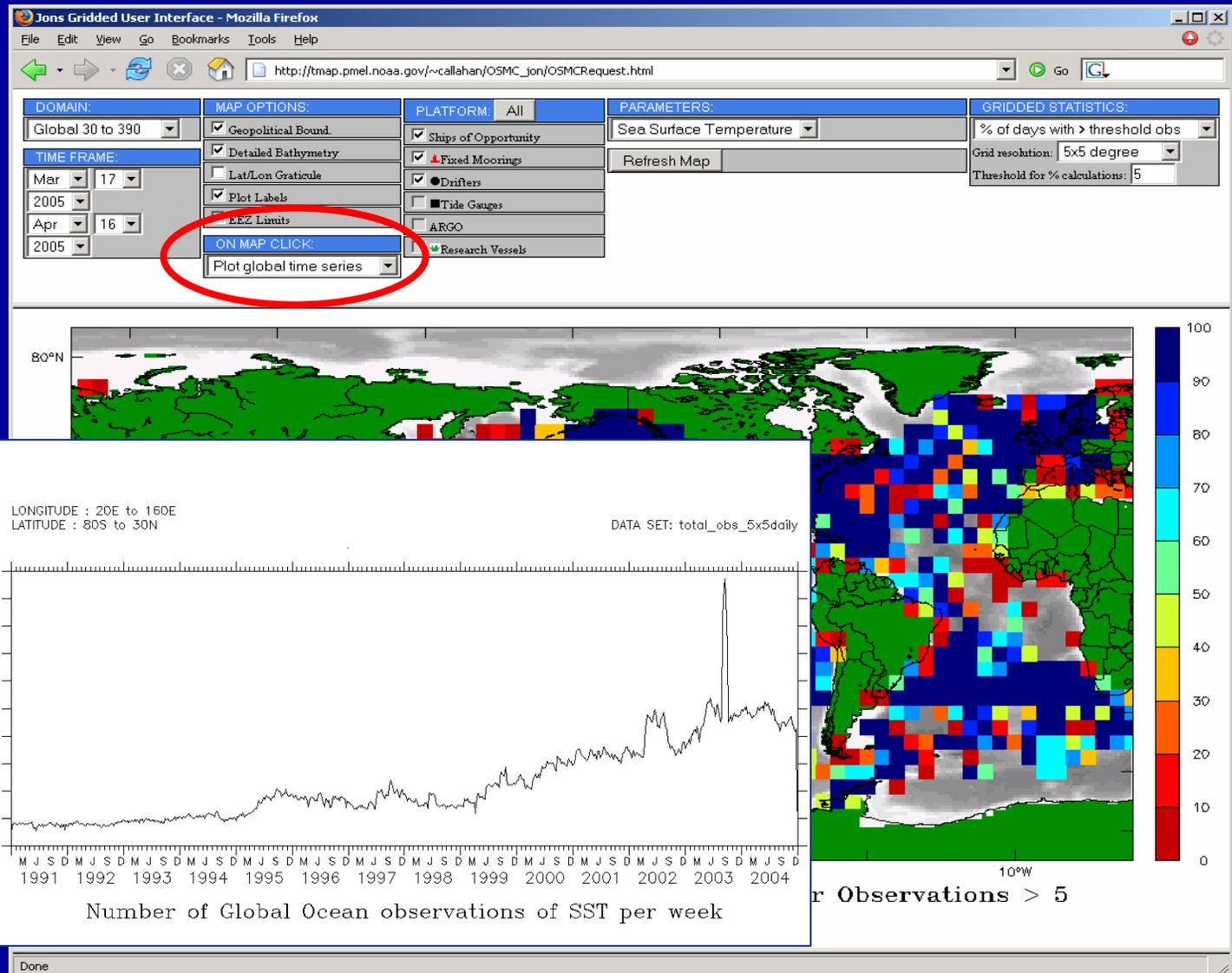
Visualization & evaluation

Click for
time series
record of
SST obs in
of an
ocean
basin



Visualization & evaluation

Click for
global time
series of
SST obs



The OSMC
doesn't look
like a Live
Access
Server ...

(Shown is the
more traditional
LAS user
interface)

Jons Test Server - Microsoft Internet Explorer

OSMC LAS [OPeNDAP \(FDS\)](#) | [THREDDS](#) | [Index](#) Search:

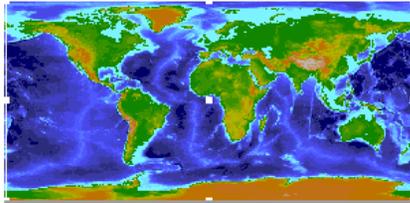
single data set | compare two

Datasets
Variables
Constraints
Output
Previous Output
Define variable
About
LAS UI Version 6.5

Datasets > [Number of valid NCEP drifting buoy obs](#)
Variable(s): **Number of valid NCEP drifting buoy SST observations**

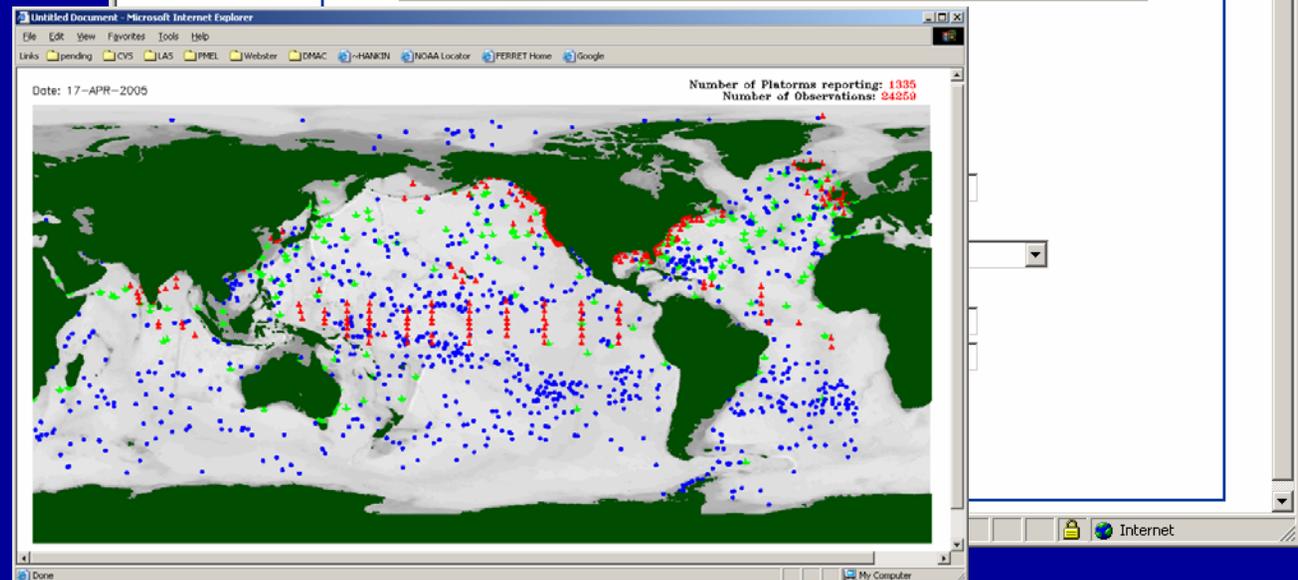
Select your desired view (geometry of output) and output (type of product).
Then set the 4-D region (lon-lat-depth-time) and any additional constraints. [Help](#)

Select view: Longitude-Latitude map (xy)
Select output: Color plot
Select region: Full Region [Use the two-click map](#) [Help](#)



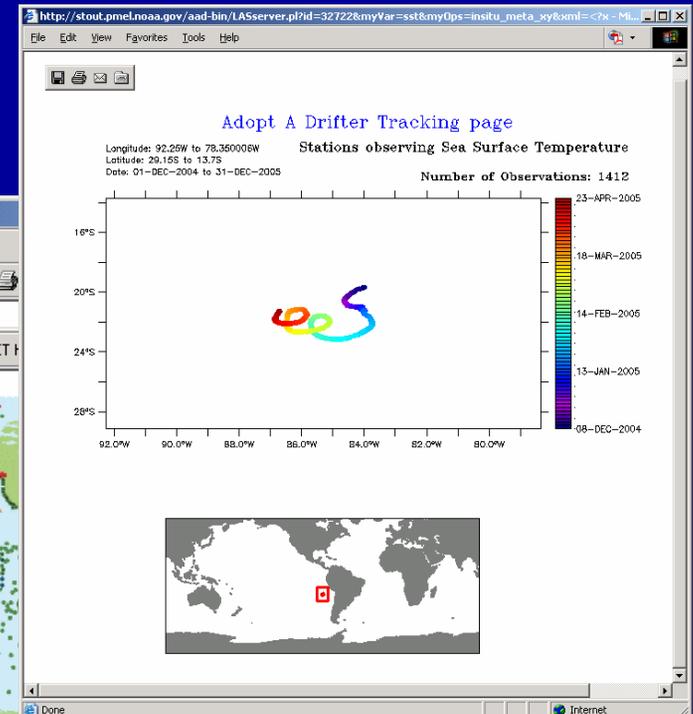
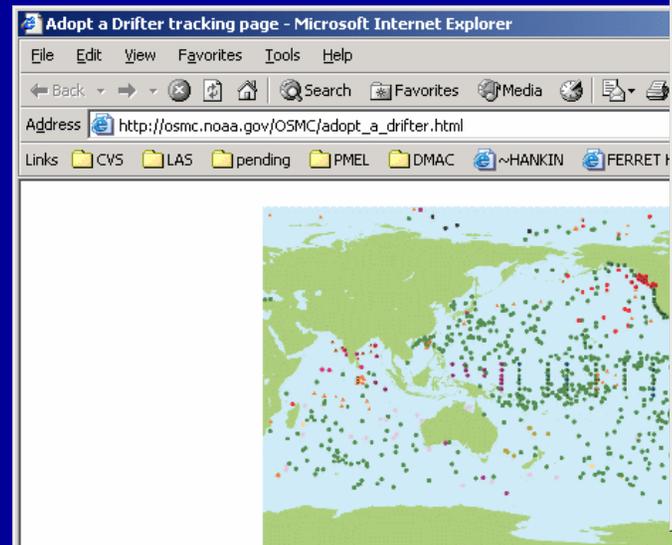
89.5 N
180.0 W 180.0 E
89.5 S

Select time: 01 Jan 1998 01-Jan-1998



"Adopt-a-Drifter"

is another
specialized
user
interface
to the
same
OSMC
server



Select WMO ID of Drifter	Select Variable:	Select Product:
Example Drifters: <input type="radio"/> 41540 <input type="radio"/> 41939 <input type="radio"/> 44030	<input checked="" type="radio"/> Sea Surface Temperature <input type="radio"/> Sea Level Pressure	<input type="radio"/> Map showing measurements <input checked="" type="radio"/> Map showing drifter track dates <input type="radio"/> Table of measurements
Adopted Drifters(WMO ID): <input checked="" type="radio"/> 32722 <i>Debra Brice's Drifter</i> <input type="radio"/> 32724 <i>Mary Cook's Drifter</i> <input type="radio"/> 32727 <i>Viviana Zamorano's Drifter</i> <input type="radio"/> 32723 <input type="radio"/> 32725 <input type="radio"/> 32726 <input type="radio"/> 32728 <input type="radio"/> 32729 <input type="radio"/> 32730 <input type="radio"/> 32731 <input type="radio"/> 32732 <input type="radio"/> 32733 <input type="radio"/> 32734 <input type="radio"/> 32735 <input type="radio"/> 32736		

Fetch!

Ready for
integration
into NVODS,
DMAC,
IOOS and
GOOS

Live Access to the National Virtual Ocean Data System (NVODS) - Microsoft Internet Explorer

OPeNDAP (FDS) | THREDDS | Index | Search: [] Go

single data set compare two

Datasets
Variables
Constraints
Output
Previous Output
Define variable
About

Click on a dataset to continue or an **i** for information about a dataset.

Select dataset:

- America topography at 1/120 degree
- CAC monthly observed SST, anomalies and climatology
- Cayan Analysis of COADS
- CDIAC MSU Precipitation
- CDIAC ndp043a Coastal Hazards Database US East Coast(1992)
- CDIAC tr051 Seasonal precipitation anomalies (1851-1989)
- ECHAM surface stresses
- GEDEX: ISCCP-C2 Monthly Mean Cloud Product
- Global Ocean Heat Flux and Wind Stress from Oregon State University Climate
- Hulme global precipitation
- Oberhuber heat flux climatology
- OORT - Geophysical Fluid Dynamics Laboratory (GFDL) Global Atmospheric Circulation
- SOC Heat Flux Climatology
- World Ocean Atlas 1998 Annual
- World Ocean Atlas 1998 Monthly
- World Ocean Atlas 100R Seasonal

LAS UI Version 6.5

http://ferret.pmel.noaa.gov/NVODS/services/dataset?callback=2495

Live Access to the National Virtual Ocean Data System (NVODS) - Microsoft Internet Explorer

OPeNDAP (FDS) | THREDDS | Index | Search: [] Go

single data set compare two

Datasets
Variables
Constraints
Output
Previous Output
Define variable

Click on a dataset to continue or an **i** for information about a dataset.

Select dataset:

Jet Propulsion Laboratory
California Institute of Technology

Live Access to the National Virtual Ocean Data System (NVODS) - Microsoft Internet Explorer

OPeNDAP (FDS) | THREDDS | Index | Search: [] Go

single data set compare two

Datasets
Variables
Constraints
Output
Previous Output
Define variable

Click on a dataset to continue or an **i** for information about a dataset.

Select dataset:

COLA
GODDARD OCEANIC LABORATORY

Live Access to the National Virtual Ocean Data System (NVODS) - Microsoft Internet Explorer

OPeNDAP (FDS) | THREDDS | Index | Search: [] Go

single data set compare two

Datasets
Variables
Constraints
Output
Previous Output
Define variable

Click on a dataset to continue or an **i** for information about a dataset.

Select dataset:

Climate Diagnostics Center
NOAA-COADS

Live Access to the National Virtual Ocean Data System (NVODS) - Microsoft Internet Explorer

OPeNDAP (FDS) | THREDDS | Index | Search: [] Go

single data set compare two

Datasets
Variables
Constraints
Output
Previous Output
Define variable

Click on a dataset to continue or an **i** for information about a dataset.

Select dataset:

Pacific Marine Environmental Laboratory
A leader in developing ocean observational systems to address NOAA's mission

Live Access to the National Virtual Ocean Data System (NVODS) - Microsoft Internet Explorer

OPeNDAP (FDS) | THREDDS | Index | Search: [] Go

single data set compare two

Datasets
Variables
Constraints
Output
Previous Output
Define variable

Click on a dataset to continue or an **i** for information about a dataset.

Select dataset:

- Sea Level (daily)
- Sea Level (hourly)
- Sea Level (monthly)

University of Hawai'i
Sea Level Center

Ocean CO₂ data access with LAS

Live Access to CDIAAC GLODAP Data - Microsoft Internet Explorer

Address <http://cdiac3.ornl.gov/las/servlets/constrain?var=24>

Ocean CO₂ CDIAAC Carbon Dioxide Information Analysis Center
Environmental Sciences Division Oak Ridge National Laboratory U.S. Department of Energy

Live Access to CDIAAC GLODAP Data

single data set | compare two

Datasets > Bottle Data > Indian Ocean Bottle Data

Variable(s): Temperature:

Select your desired variables
Then set the 4-D region

select view: Longitude-Latitude
select output: Profile Location
select region: Full Region

Don't use map applet

18.0 N
56.0 E 94.0 E
18.0 S

select time range: 01 Jan 1977 to 31 Dec 1996
select depth range: 0 to 100

Live Access to CDIAAC GLODAP Data -- output - Microsoft Internet Explorer

Indian Ocean Bottle Data

Longitude: 56E to 94E
Latitude: 18S to 18N
Date: 01-JAN-1977 to 31-DEC-1996
Number of Profiles: 448

Live Access to CDIAAC GLODAP Data -- output - Microsoft Internet Explorer

Indian Ocean Bottle Data

Longitude: 56E to 94E
Latitude: 18S to 18N
Date: 01-JAN-1977 to 31-DEC-1996
1042 points

Depth (meters)

Temperature: (umol/kg)

Next steps

- Wire it together robustly
(It is not as mature as it appears)
- Tune for performance
(caching schemes)
- Bring NGDC GIS and RDBMS expertise into the partnership

Next steps (database)

- Improve Meta-data quantity and quality
 - Eliminate "Not Defined" platforms
 - Further coordinate with JCOMM OPS
 - Add organization URLs
- Expand data sources
 - Carbon Data
 - NOAA High Resolution Ship Data (FSU)
 - Repeat Lines, Ocean Reference Stations, ...

and after that ...

- Other types of data
(biochem, fisheries, ...)
- IOOS/DMAC integration
(satellites, models, GIS, ...)
- Quality control metadata
- Expanded evaluation metrics
guided by research community input ...

Suggestions? Questions?

