# Observing System Monitoring Center: a comprehensive global ocean observing system for climate

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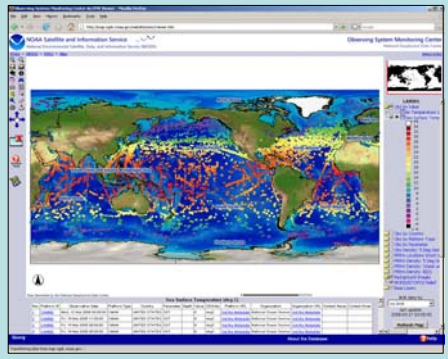
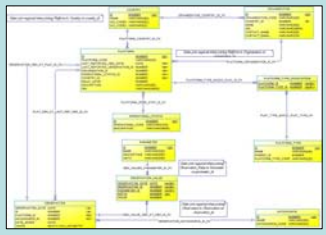
## Overview

Information gleaned from a comprehensive global ocean observing system for climate may enable a clearer understanding of climate variability. The Observing System Monitoring Center (OSMC) project assists managers and scientists in monitoring a real-time, global, in-situ ocean observing system by providing tools to evaluate the adequacy of the system in supporting ocean/climate state estimation, forecasting and research, as well as the means to identify shortcomings in the system more immediately. The OSMC project is charged with the development and maintenance of a centralized management of reports from a variety of global ocean platforms. NGDC contributes guidance in spatial database design and management for the near real-time data of the OSMC project, as well as creation, deployment and maintenance of Web-accessible tools for monitoring and visualization. Tools include interactive maps displaying ocean platform and observation data distribution, summary tables, and quality assessment of the ingested data. Future plans involve utilizing open source and standard protocols in the implementation of "web service" portals to access data and metadata contained in the OSMC database. These protocols may include SWE/SOS (Sensor Web Enablement/Sensor Observation Services), OGC/WFS (Open Geospatial Consortium Web Feature Service) and OPeNDAP (Open-source Project for a Network Data Access Protocol).

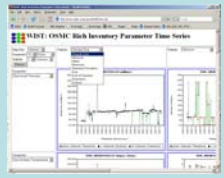


An ArcIMS interface displays observation locations from diverse ocean platforms such as Argo Floats, ships, moored buoys, and drifting buoys. The interface provides access to both metadata about the platforms, as well as parameter data such as measured sea surface temperature, air temperature, salinity and water temperature profiles, among others.

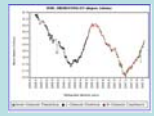
Geospatial database schema representation of the observation parameter/value design. Design considerations included the ability to easily expand the database to include a wide variety of types of platforms and parameters measured. Foreign key constraints help manage data. The observation table is partitioned on the observation date, which is key for optimizing queries to produce quick responses. The platform table includes information on the last report observed by a platform, of interest to platform managers. The datasource table tracks datastream ingest origin.



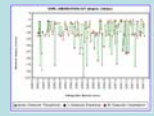
**Spatial Database:** A sound database design enables developers to load data from near real-time data streams and to subsequently query the data effectively and efficiently for use in Web applications that data managers and scientists may access. The use of an Oracle Spatial database provides powerful tools for spatial queries and analysis.




An inventory of sample size for SLP begins in May, 2005 and hovers around ~ 120,000 (for five days of data). Data ingest problems may be manifest in the graphs, e.g., when there are 0 samples in the dataset.

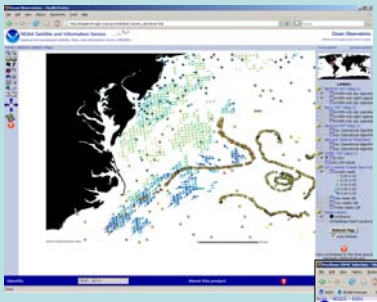


The graph of the mean value of Sea Surface Temperature for the entire dataset shows a trend of colder temperatures in February (month 2) and warmer temperatures in June (month 6), which seems realistic.

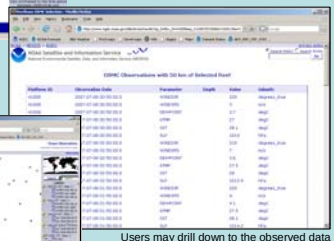


However, where the minimum value for Sea surface temperature is -101, there may be some data quality issues

**Quality Assessment:** The Rich Inventory parameter time series monitors basic statistics for attributes in the OSMC database which may serve to demonstrate either expected or unexpected outcomes. This assists data managers in Quality Control, as well as data discovery and trend spotting.

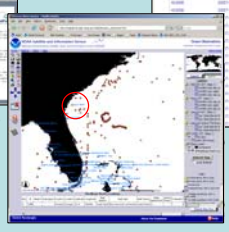


1) The location of Drifting buoys in the OSMC database are mapped over a period of 10 days. Satellite-measured SST and the direction and flow of ocean currents are also included, combining data from diverse sources over a common period of time. One of the drifting buoy paths can be seen to follow the ocean current flow, and the SST measurements from the satellite (boxes without black outlines) and the in-situ OSMC measurements (boxes with black outlines) can be seen to be similar, as color values are coded for the same temperature ranges for both datasets.



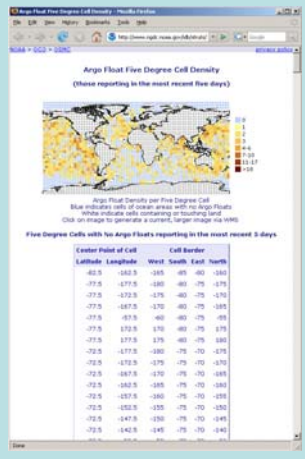
Users may drill down to the observed data near a particular coral reef.

Reefbase mission: To improve sharing and use of data, information, and knowledge in support of research and management of coral reef resources.



2) The location of reefs such as Gray's Reef are rendered in blue triangles alongside the location of OSMC in-situ SST measurements that are rendered as squares.

**Visualization:** The OSMC data may be referenced in combination with other data sets in "mash-ups" of data from diverse sources. 1) OSMC platform locations are displayed along with ocean currents data and satellite SST measurements. 2) Coral reefs from the Reefbase data set are mapped together with the OSMC ocean platform locations. A spatial query enables users to find platforms within 50 km of a coral reef of interest, and then to view associated observation measurements.




**Monitoring:** Summaries of platform distribution, in both visual as well as tabular form, may assist managers in assessment of coverage by ocean platforms

Five degree cells are mapped by color, according to how many Argo Floats have reported observations in the most recent 5 days. A table lists which purely ocean cells have had no reports, assisting managers in deciding where platforms may need to be deployed to achieve more uniform coverage of ocean measurements.

**Future plans:** the use of open source and standard protocols (e.g. Climate Science Modeling Language or CSML) in the implementation of web service portals will broaden access to data and metadata contained in the OSMC database

```
<CSMLFeatureCollection
xmlns:xsi="http://www.w3.org/2001/XMLSchema"
xsi:schemaLocation="http://ndg.nerc.ac.uk/csml csmlMain.xsd"
xmlns="http://ndg.nerc.ac.uk/csml"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
xmlns:csml="http://www.opengis.net/csml"
xmlns:swe="http://www.opengis.net/swe"
xmlns:cf="http://cf-pcmdi.llnl.gov/documents/cf-standard-names/"
gml:id="OSMC.SST6HR_TSQP:2008-03-20T11:53:38">
```

CSML is a standards-based (ISO) data model and GML application schema for atmospheric and oceanographic data. CSML provides a standards-based semantic model and encoding for representing a range of conceptual information classes of relevance to climate science. These classes may be leveraged to build intelligent services for data subsetting, aggregation, processing, etc. CSML also provides a 'wrapper' mechanism to encapsulate legacy file-based data, exposing them instead through a conceptual view.