The Observing System Monitoring Center (OSMC)

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1. Project Summary

The Observing System Monitoring Center (OSMC) is an information gathering, decision support, and display system for NOAA's Climate Observations and Monitoring (COP) Program. The OSMC helps COM to ensure that NOAA meets the long-term observational requirements of forecast and modeling centers, international research programs, major scientific assessments, and decision-makers. To monitor the full suite of ocean sensors the OSMC ingests real time ocean observations carried on the GTS as well as (increasingly) real time and delayed mode observations available through Internet web services and dedicated data assembly systems.

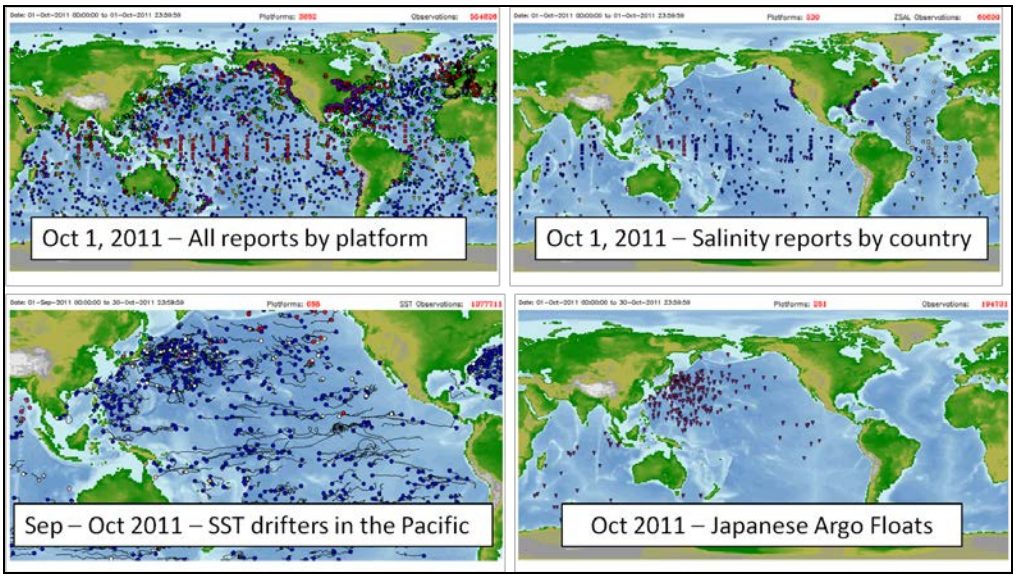

Figure 1. Several illustrations showing the status of the global observing system

The OSMC permits the many "networks" of *in situ* ocean observing platforms -- ships, surface floats, profiling floats, tide gauges, etc. -- to be viewed as a single system. It provides tools to help managers to assess the contributions of different countries and programs, and tools to help scientists track the effectiveness of *in situ* observations for assessing the state of measured parameters – temperature, salinity, etc. The OSMC is also a key component in guiding COM data integration strategies. It provides a single, simple portal for access to the full range of observations from the global ocean observing system, both real-time and delayed mode data. It integrates US coastal (IOOS) and global (GOOS) observations. It provides a project-level liaison with NOAA's data centers to facilitate archival of observations. Increasingly it integrates *in situ* observations with gridded climate products – climatologies, state estimations and model forecasts – and will play a key role in the fusion of observations, products and climate forecast models in support of such activities as IPCC AR5/CMIP5.

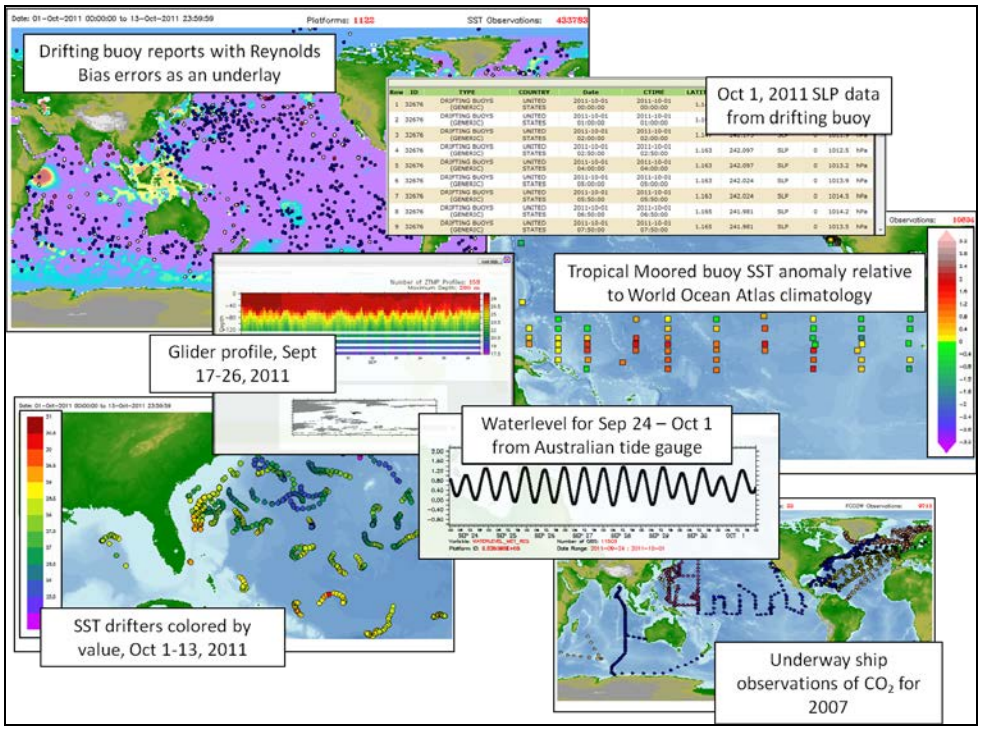

Figure 2. A sample of the drill down products available from the OSMC

Through the OSMC, a scientist or manager can "drill down" to obtain a detailed look at a particular platform and the measurements that the sensors it carries have made as shown in Figure 2, or can assess the long term trends in observing system coverage with analyses such as Figure 3.

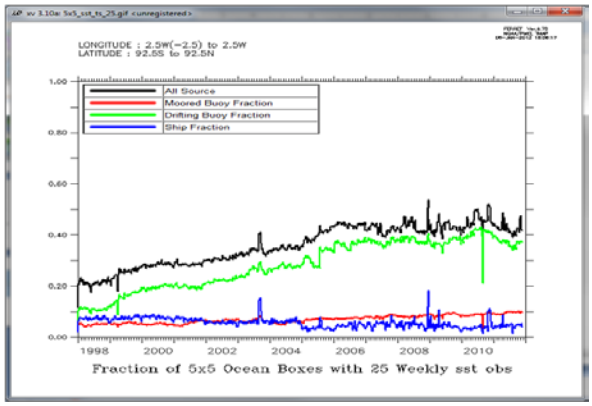

Figure 3. Time series showing progress implementing the ocean observing system

2. Scientific and Observing System Accomplishments

The following milestones track the progress made by the OSMC project during fiscal year 2011. For clarity the accomplishments are broken out by collaborating institution (PMEL, NDBC, NGDC).

PMEL Accomplishments

- **OSMC project leadership**
  - PMEL provides project leadership for the OSMC collaboration: organized the OSMC annual planning meeting in Seattle during July of 2011; hosted regular weekly technical telcons; oversaw the tracking of bug fixes, milestones, and deliverables; coordinated plans of high level strategy; ensured that group-wide communications continued to flow smoothly.
- **Guiding COM-wide data integration**
  - Provided leadership and technical guidance that contributed significantly to the modernizing of the University of Hawaii Sea Level Center services to the use of standardized netCDF-CF data formats and OPeNDAP/THREDDS web services.
  - Similar integration efforts were significantly advanced in FY11 towards converting SAMOS and SOCAT data services into the use of standardized formats and protocols. (We expect these efforts to be completed in FY12.)
  - Continued to provide similar guidance for the OceanSites data management team and its resulting data integration successes.
  - OSMC as a public data source: see outreach section of this report

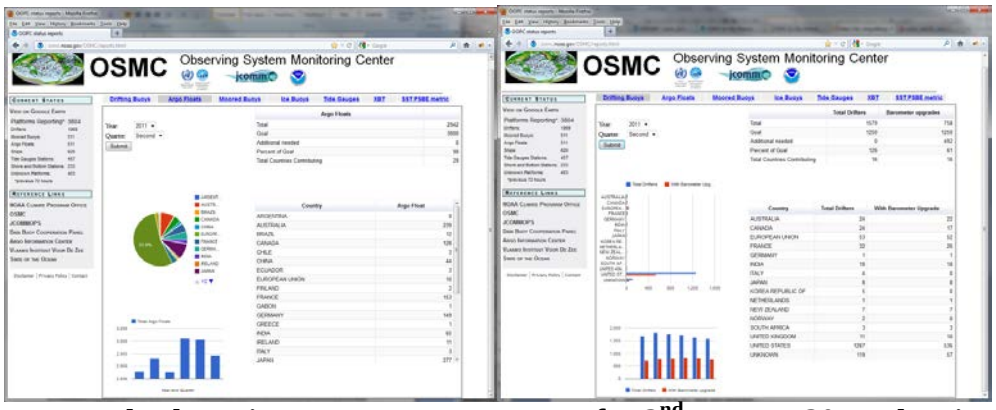

Figure 4. Example observing system status reports for 2nd quarter 2011, showing metrics for Argo floats (left panel) and for drifting buoys, both for the second quarter of 2011

- **Automated generation of observing system summary reports for COM**
  - For a number of years a manually-maintained spreadsheet has served as the basis for generating observing COM system status reports. In the past year PMEL has made major progress replacing this labor intensive strategy with an automated process drawing on data within the OSMC and JCOMMOPS data bases. PMEL is using a new Google capability called "Fusion Tables" for this purpose. PMEL and JCOMMOPS are jointly developing the web services to permit remote database queries. The resultant reports are not only automated, but also highly customizable by the COM users, as illustrated by Figure 4.

  - Following the annual OSMC meeting in July 2011, PMEL drafted a document proposing the metrics that should be tracked from ocean observing subsystems. This document has been distributed to OSMC partners (JCOMMOPS, IOC) for review.

- **UNESCO/NOAA State of the Ocean indices**
  - OSMC has assumed responsibility for maintaining and enhancing the international State of the Ocean index site as a contribution to UNESCO. Figure 5 shows an example output plot. This site is maintained with the understanding that further significant ocean/climate indices will be cooperatively added as they are identified.

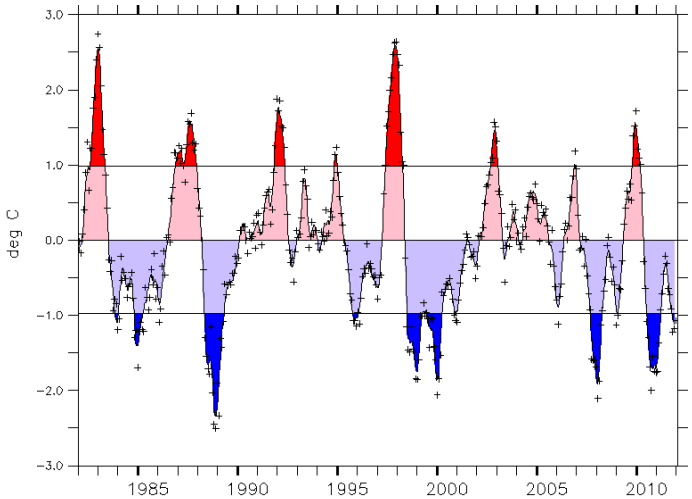

Figure 5. Niño3.4 SST anomaly index of El Niño conditions

- **OSMC analysis capabilities**
  - Added ability to display OCEANSITES deployments as a new category.
  - With significant contributions from all partners, OSMC added the ability track progress of drops along named XBT lines (figure 6). (Note that we have delayed migrating this capability to the operational OSMC server pending reconciling differences between this analysis and JCOMMOPS manual surveys.)

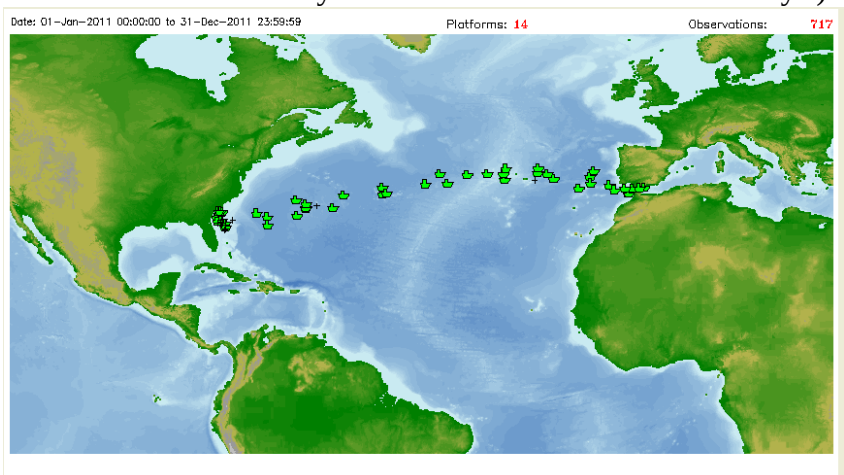

Figure 6. XBT drops along line AX07 (Gulf of Mexico – Gibraltar) for 2011

  - Implemented a new and more efficient strategy for creating the OSMC gridded summary files (3°x3°xWeekly) that are used to provide high-performance, long time-duration summaries of observing system growth.

- **Scientific coverage metrics**
  - It has long been a management goal for the OSMC to provide scientifically vetted metrics that communicate the effectiveness of the observing system in the

assessment of surface ocean climate variables (SST, CO_2 flux, etc.). Figure 7 shows a new display option for the potential satellite bias error (PSBE) metric using Google fusion tables. To make progress on other metrics requires the development of further metrics by the COM science community.

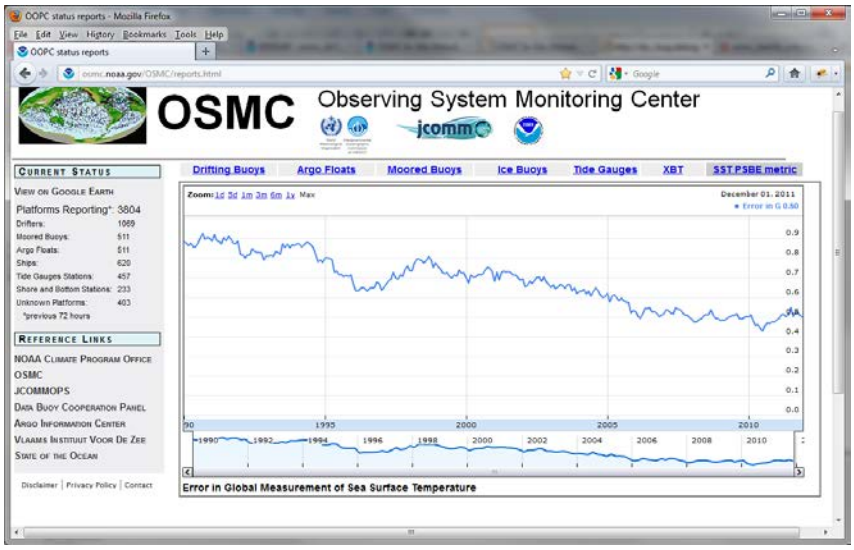

Figure 7. – The SST PSBE metric: error in global sea surface temperature

NDBC Accomplishments

NDBC carries the bulk of the day-to-day data management responsibilities to keep the OSMC database operational -- ingesting data, updating observing metadata resources, resolving ambiguities over platform IDs, etc. Specific tasks and accomplishments include:

Managed the OSMC database environment:

- Managed the daily ingest of data from GTS, GODAE and the metadata sources.
- Upgraded OSMC Version 4 test database to Version 4.5
  - Upgraded the data and metadata load programs
  - Prepared document explaining platform selection
  - Implemented rules for platform selection
  - Upgraded daily summary load scripts
  - Shut down and removed database Versions 1 and 3 from the production server
- Created scripts to add 2011 partitions to target tables
- Implemented GLOSS tide stations database views
- Developed scripts to rebuild summary tables on a quarterly basis

Increased data/metadata available via OSMC:

- Resolved issues with data and metadata loads as they arose
- Corrected identified metadata issues
- Developed routines to read the following metadata sources – JCOMMOPS argo_active, AOML station list, IABP monthly report

- Archiving other metadata sources for future use - JCOMMOPS dbcp_daily.kmz
- Continued effort to identify unknown platforms
- Identified OceanSITES platforms
- Identified gliders
- Added additional GTS headers to the NDBC queue
- Ingesting additional BUFR messages
- Implemented latest version of VLIZ web scraper
- Corrected country names in the VLIZ web scraper configuration file
- Investigated platforms reporting on GODAE but not GTS. Identified missing GTS headers and added to NDBC queue

Miscellaneous Support:

- Analyzed OceanSITES parameters for CF compliancy
- Implemented XBT transect lines
- Updated OSMC SOP document
- Assisted with queries for metrics reports
- Hosted the OSMC IT environment, provided system administration and DBA support
- Managed the security environment for OSMC as a part of the NDBC Certification and Accreditation process.

NGDC Accomplishments

NGDC contributes database design, programming support, and metadata training, tools and services to the OSMC project effort. Specific NGDC accomplishments in FY11 included:

- **Metadata Assessment**

  COM metadata includes descriptions of individual deployments embedded into NetCDF files and station, network and collection metadata using ISO metadata standards. NGDC provides tools that translate between NetCDF and ISO dialects and facilitates assessment of metadata quality using a rubric (Figure 8).

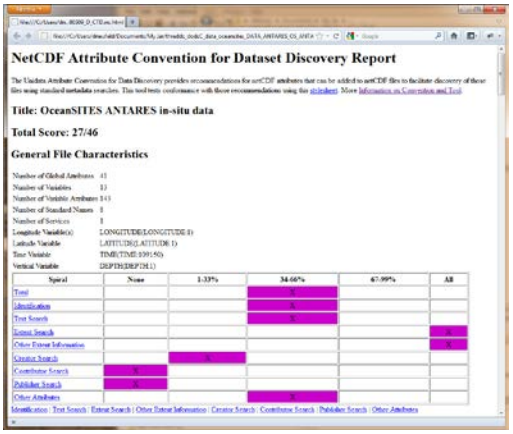

Figure 8. – Metadata assessment for an OceanSites dataset.

- **ISO-Compliant COM Metadata**

  The OceanSITES project involves a number of international partners that share a commitment to uniform data management across a variety of *in-situ* ocean platforms using agreed netCDF conventions. OSMC i) assists the OceanSites community in the developing of these conventions; and ii) automatically generates ISO-standardized metadata from the resulting files, allowing datasets to be discovered and used by a much broader community.

  OSMC contributions to OceanSITES this year included:

  - Recommendations accepted for incorporating the Unidata Attribute Convention for Data Discovery (ACDD).
  - Creation of a tutorial on how to improve metadata ACDD compliance through THREDDS and collaboration with NBDC on implementation strategies.
  - Contributed discussion leadership, metadata examples and Wiki pages to improve OceanSITES user manual content on metadata generation.
  - Researched best practices for emerging areas such as sensor metadata and provenance.
  - Developed configuration files for 19115-2 and DS_Series support in Geoportal.

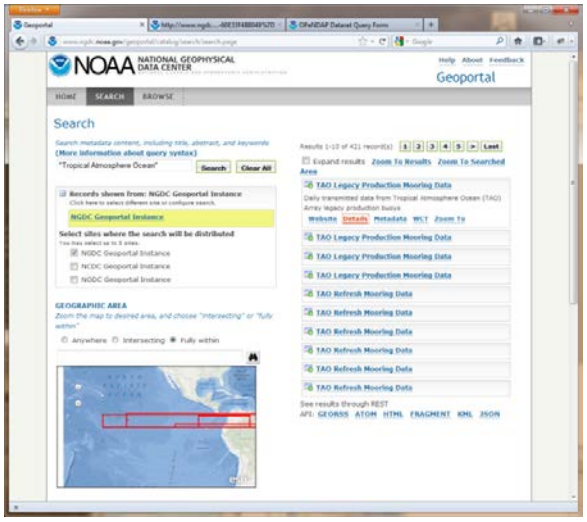

Figure 9. – Metadata supports data discovery in Geoportal.

The NGDC-contributed 'ncISO' tool was enhanced in FY11 (version 2.0) to:

- Resolve conflicts between metadata from alternative sources (based upon a precedence model in XLST 2.0).
- Improve recognition of spatial/temporal metadata using CF-Conventions.
- Automate metadata generation to improve compatibility with data discovery portals at NOAA's Data Centers (now all using 'Geoportal' technology).

- **Database Design and Consulting**
  - Developed spatial queries to support XBT transect analysis.
  - Database views created to facilitate improved query access for ERDAPP.
  - Ongoing collaboration with IOOS Catalog project team and review of Google Fusion tables as used in OSMC.
  - Improved ingestion of OceanSITES data.

  Programming Support
  - Updated OSMC tide gauge loader to reflect new data access implementation from the European 'VLIZ' Sea Level Monitoring Facility.
  - Ongoing GIS support for OSMC QA/QC analysis.
  - GIS web services support for JCOMMOPS.

2.1. Outreach and Education

- **Adopt-a-Drifter**

OSMC modernized NOAA's Adopt a Drifter science education web interface in response to demands by teachers and students. The updated service is better integrated into the operational workflow of the OSMC and offers new capabilities such as data downloads as spreadsheets and the ability to view drifter tracks on Google Earth.

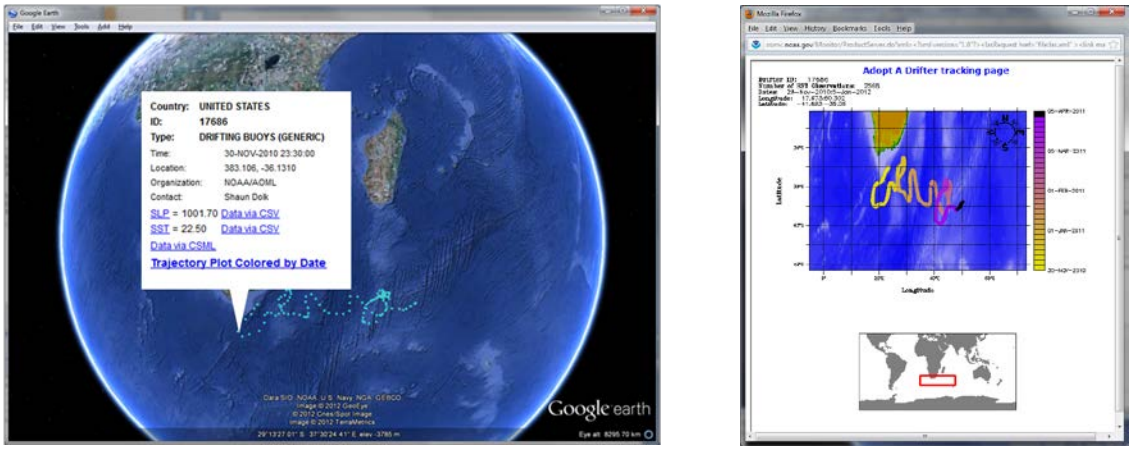

Figure 10. Example Adopt-a-Drifter outputs: WMO ID 17686 track on Google Earth (left panel); and updated graphics for same drifter (right panel)

- **OSMC as a data resource for the community**

  At the July, 2011 annual OSMC meeting in Seattle, there was unanimous agreement that OSMC data should be made available as a public resource. In 2011 steps to integrate OSMC with the NOAA/NMFS-developed Environmental Research Divisions Data Access Program (ERDDAP) were begun. Thus far, ocean profile data (Argo, XBT, etc.) has been made available through this technique. Other "feature types" (time series, ship tracks, etc.) are under development.

- **Connections to community data integration activities**
  The OSMC project is the outreach arm of COM to community data integration activities that include
  - NOAA's Integrated Ocean Observing System (IOOS) program
  - NOAA's Global Earth Observations Integrated Data Environment (GEO-IDE) and the Unified Access Framework (UAF)
  - NOAA's Environmental Data Management Committee (EDMC)
  - DoE's Earth Systems Grid (ESG), supporting WCRP CMIP5
  - NASA's Earth Systems Information Partners (ESIP)
  - Climate and Forecast Conventions standard for netCDF (CF)

3. Publications and Reports

3.1. Publications by Principal Investigators

3.2. Relevant Publications and Presentations

- Kevin O'Brien, Steve Hankin, Kevin Kern, Michelle Little, Ted Habermann, David Neufeld, Derrick Snowden, "OSMC: the COM's Entry Point in an End-to-end View of Ocean Observations," COM Annual meeting, Silver Spring, MD, 27-29 October 2010.
- Kevin O'Brien "The Observing System Monitoring Center: A lightning introduction", NOAA Environmental Data Management Conference, Silver Spring, MD, 20-22 June, 2011
- Kevin O'Brien, Steve Hankin, Ted Habermann, Michelle Little, Kevin Kern, David Neufeld, Derrick Snowden, "Observations for Climate: Using the Observing System Monitoring Center (OSMC) as an entry point in an End-to-end View of Ocean Observations", World Climate Research Programme Open Science Conference, Denver, CO, 24-28 October, 2011
- Richard Bouchard, NDBC, "The Observing System Monitoring Center (OSMC)", Oral presentation at IUGG, July 1 2011 Melbourne, Australia
- David Neufeld, Ted Habermann, "Documentation, UDDC, and OceanSITES", OceanSITES Data Management meeting, La Jolla, CA, November, 2011.