

Ocean Data Management at NCDC

From Ingest to Archive, Blended Products and Data Services

Huai-Min Zhang¹, Richard W. Reynolds², Rich Baldwin¹, and Eric Freeman³

¹NOAA National Climatic Data Center, Asheville, NC

²Cooperative Institute for Climate and Satellites, Asheville, NC

³STG, Inc, Contractor at NCDC, Asheville, NC

Project Summary

Summary in Brief: The goal of this project is to ensure that the surface marine observations, most of which are funded and managed by NOAA, are officially archived at the NOAA archive and served to the public. This is important to avoid any potential for permanent data loss or loss of NOAA/OCO investment (Figure 1). This project further carries through an End-to-End process (Figure 2), including ingestion of observing system data, data quality control, production of gridded and blended data sets, and provision of direct data services to the user communities, including scientific research, marine ecosystems (e.g. NOAA's World Coral Reef Watch), renewable energy industries (offshore energy), marine transportation (e.g. ship routing services), and outreach and education among many others.

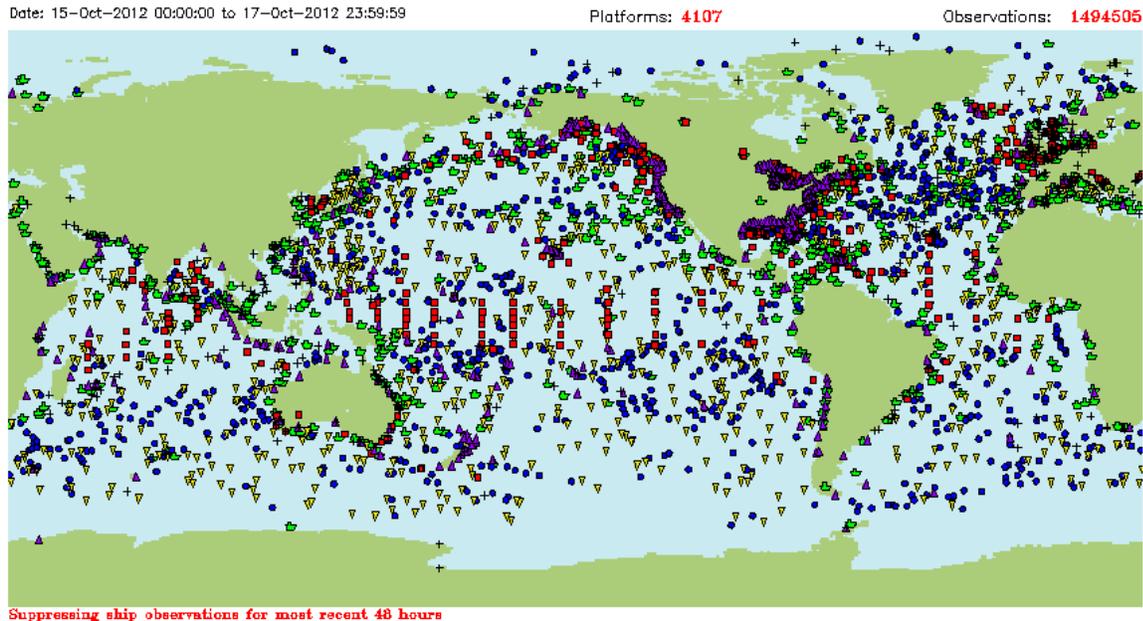


Figure 1: NCDC serves as NOAA's official archive of weather and climate data. The goal of this project is to ensure that the marine surface observations managed by NOAA OCO (this figure, from COD's Observing System Monitoring Center: <http://osmc.noaa.gov/Monitor/OSMC/OSMC.html>), and others such as the international VOSclim (below for details), are included in the NOAA Archive and served to the public online.

Summary of Project Scope:

The data of this project include those from ship and buoy observations invested by NOAA, data collected in ICOADS and VOSCLIM, as well as satellite observed sea surface winds. This project directly supports the NOAA's mission: "To understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs." It directly serves the COMD's Program Deliverables in: 1) To identify climate variability through surface marine observations including SST and sea surface winds; and 2) To identify changes in forcing functions through the air-sea exchange processes. This is accomplished by fulfilling NCDC's mission: "To provide stewardship and access to the Nation's resource of global climate and weather related data and information, and assess and monitor climate variation and change."

This project also supports NOAA's Congressional mandate to preserve the Nation's Weather and Climate Data as a National asset, and the National Climate Assessments required under U.S. Global Change Research Program (USGCRP), which began as a presidential initiative in 1989 and was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606). This mandate provides essential support of the environmental data needs of the Nation's public, private, and academic sectors. Partners and customers who will benefit from these services include federal, state and local agencies, scientists, researchers, resource managers, businesses, communities, and decision makers that can use the data and information for their strategic planning, actions, and decisions (e.g., coastal communities, building code, and planning of power plant, transportation infrastructure, to name just a few). A well-known example is the El Niño events that affect multiple billions of dollars worldwide. To map out the trends and to identify the frequencies of these extreme events require long term records of the climate (including the ocean) data. Long-term data records provide the foundation to advance the understanding and unlock the mysteries of the Earth's weather and climate system.

NOAA and NCDC play an active and important role in the national and international climate change monitoring and assessment programs (e.g., IPCC and USGCRP). Climate change monitoring and assessment require meteorological and marine data over both land and ocean. Changes of environmental variables at and near the marine surface are important since they occur over approximately 70% of the Earth's surface and contain important climate change signals. Due to the drastic property differences between water and air (e.g., density and heat capacity), huge amount of water, energy, momentum and gases (e.g., carbon dioxide) are constantly exchanged at the turbulent air-sea interface. These exchanges regulate the weather in the short term and the climate change in long term. Thus, NCDC has been actively archiving, serving and utilizing the world's surface marine data, and it will need to continue to do so.

Modern day Global Ocean Observing System (GOOS) consists of multiple platforms and instruments (both in-situ and remote sensing). Each of these observations contributes to the understanding and assessment of climate change signals. However, individual instrument observations have limitations in coverage (in both time and space) and limitations on accuracy (e.g. Zhang et al 2004). To maximize benefits and integrally use all the available observations, it is necessary to blend them together to produce higher resolution and higher accuracy products for the needs of both researches and societal applications (e.g. Zhang et al 2006; Reynolds et al 2007). For example, research on global water and energy budgets and numerical weather and ocean forecasts demand increasingly higher resolution forcing data (better than daily and 50 km;

e.g., WMO/TD-No. 1036, 2000; Curry et al. 2004). The recent international Global Earth Observation System of Systems (GEOSS) and Global Climate Observing System (GCOS) also called for optimal combinations of the above platforms for integrated global observing system and service (reviewed in Zhang et al 2009). The high quality in-situ observations will be used to input directly into air-sea flux computations, as part of coupled atmosphere-ocean climate models, and to provide ground truth for calibrating satellite observations, evaluating and validating NWP model and reanalysis results.

The overall objectives of this project are:

- 1) to ingest the world's surface marine observations into the NOAA archive;
- 2) to quality control the data for various applications;
- 3) to produce blended products for optimal use of all the observations; and
- 4) to improve services for a wide variety of user communities.

A conceptual program summary and flowchart for this Ocean Data Management are shown in Figure 2.

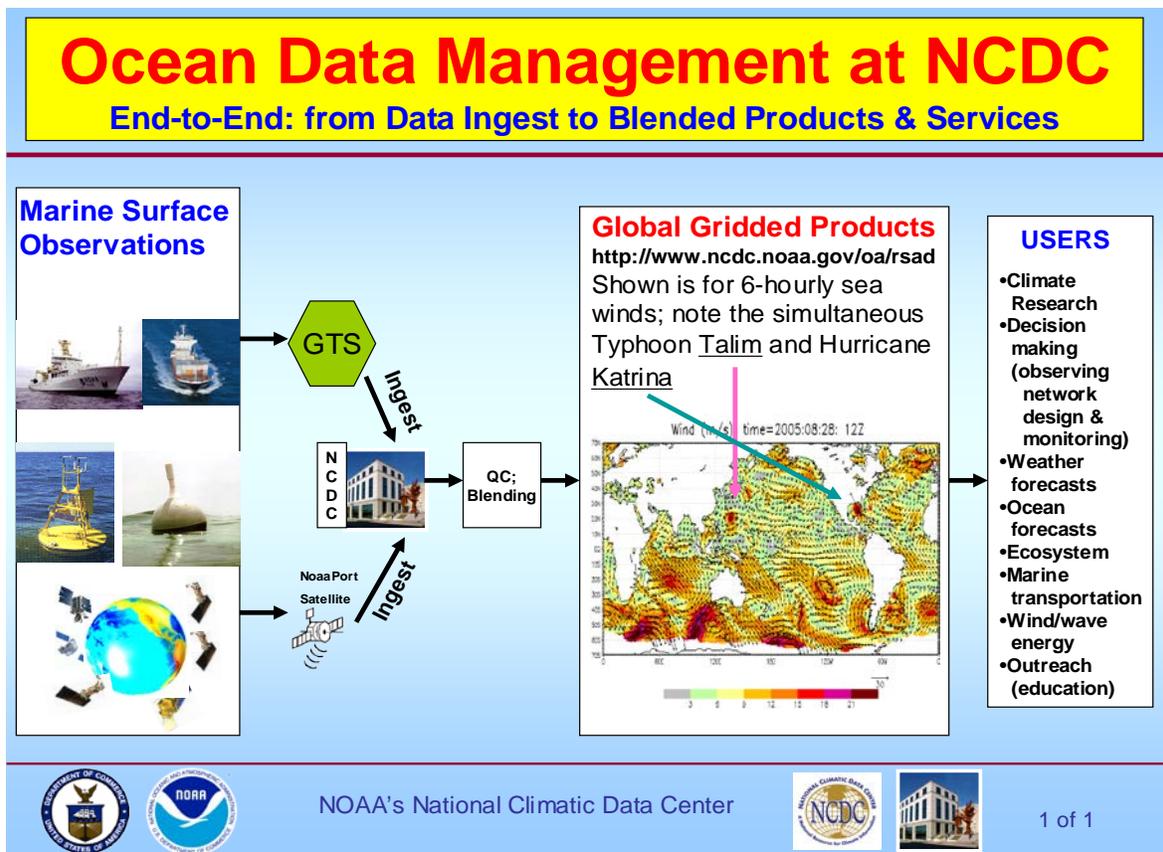


Figure 2: Conceptual diagram of the project's End-to-End data process, from ingest to archive, quality control and product development and services for societal benefits.