Ocean Data Management at NCDC

From Ingest to Archive, Blended Products and Data Services

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Project Summary

This project carries through an End-to-End process, from data ingest from the observing systems, to data quality control, gridded and blended data production, and to direct data services to the user communities, including scientific researches, marine ecosystems (e.g. NOAA's World Coral Reef Watch), renewable energy industries, marine transportation (e.g. ship routing services), outreach and education, among many others (detailed later at the Outreach and Education section). The data include those from ICOADS, VOSClim as well as satellite 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." 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."

NCDC plays 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).

There are typically three types of errors in observations and blended products: 1) random error; 2) sampling error; and 3) bias error. The bias error is the systematic difference between one instrument (or a set of instruments, e.g., in-situ observations) and another (e.g., remote sensing/satellite observations). The combined error for all terms should be reduced to a required accuracy for meaningful climate change diagnostics. In the satellite era, satellite observations provide dense data coverage, thus in-situ data play a minor role in the reduction of random and sampling errors and in increasing resolutions in blended products. However, in-situ observations provide the "ground-truth", thus play an essential role in correcting the systematic biases of indirect measurements (e.g., remote sensing/satellite observations that are calibrated to in-situ observations, e.g. Zhang et al 2009).

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. Highlighted accomplishments are described in the next section.