

World Ocean Database in 3D: Development, Dissemination, Deliverables

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The World Ocean Database (WOD) is a collection of scientifically quality-controlled ocean profile and plankton data that includes measurements of temperature, salinity, oxygen, phosphate, nitrate, silicate, chlorophyll, alkalinity, pH, pCO₂, TCO₂, Tritium, Δ¹³Carbon, Δ¹⁴Carbon, Δ¹⁸Oxygen, Freon, Helium, Δ³Helium, Neon, and plankton. WOD - the world's most extensive collection of ocean profile data, which is updated four times per year and available without restriction.

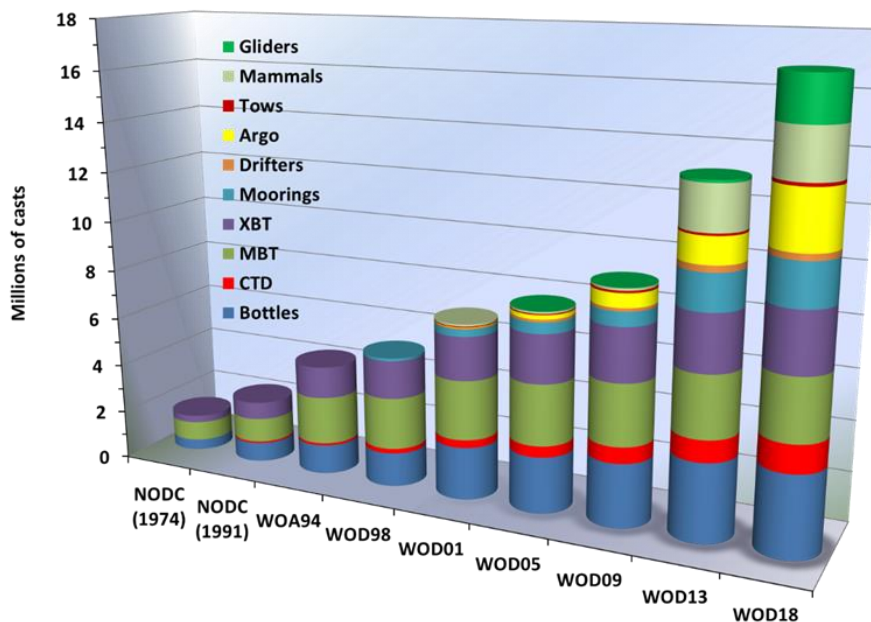


Figure 1: WOD development: in situ seawater Temperature data holding growth

Development. The work on the WOD began in 1992 by Sydney Levitus. Six major versions of WOD has been released since then in 1998, 2001, 2005, 2009, 2013, and 2018. The WOD team at NOAA has been ingesting data from multiple countries, many institution, and various platforms and instruments. The

WOD can be considered as the final step in gathering oceanographic profile data and preparing them for public dissemination. The inventors, oceanographers, and engineers who conceived, designed, and tested the oceanographic instrumentation and measurement techniques are responsible for the plethora and variety of oceanographic data. The primary investigators, marine technicians, ship's crew, and volunteers who made and continue to make many of the oceanographic measurements, often under harsh conditions, are responsible for the quality and quantity of the oceanographic data. The institutions, which maintain the platforms and the projects, which plan, fund, and execute the field campaigns and operational ocean monitoring are responsible for the spatial and temporal coverage of the oceanographic profile data. Finally, the data managers are responsible for the preservation and reusability of the data. This is a vast network, maintained and updated over time, which should receive the credit for the aggregated WOD. Every cast, which in essence is a central granule of WOD, contains (when supplied) information on the instrumentation, platform, project, institution, and data management entity. The archive at NCEI and those who populate and maintain it also deserve credit for the continual availability of historical oceanographic data. Finally, international organizations such as the Intergovernmental Oceanographic Commission's (IOC) International Oceanographic Data and Information Exchange (IODE) and the World Data System (WDS) for Oceanography should be credited for creating and facilitating a global culture of data exchange and preservation. Over 40+ years of development more than 17 million casts of oceanographic parameters has been collected, quality controlled and uniformly formatted. The WOD makes these data available for all to work with confidence and convenience. Figure 1 illustrates the WOD seawater temperature data holding grows over the time.

Dissemination. The WOD and the products based on it go through different stages of preparation and dissemination techniques, which reflects the technological evolution in oceanographic observations and processing. It started from 8-tracks mainframe tapes to HD-floppy disks to CDs, to DVDs, and, now completely moved to the web and preparing to be finally transferred to the cloud for being accessible in real time. Currently, the entire collection of data in the WOD is accessible via WODSelect web-portal (<https://www.nodc.noaa.gov/OC5/SELECT/dbsearch/dbsearch.html>) where data selection can be made based in different user-defined criteria. The data selected by a user request are prepared automatically and can be downloaded from a NOAA server.

Deliverables. Aside from quality controlled and uniformly formatted oceanographic data, WOD is the foundation for several stand-alone products. The major product is the World Ocean Atlas – a set of global climatological fields of major oceanographic variables – temperature, salinity, etc., calculated on two spatial grids at the 33 (before 2013) and 102 (after 2013) standard depth levels with one- (before and after 2013) and quarter-degree (after 2013) spatial resolutions. These climatologies calculated based on entire data collection as well as on decadal sub-sets. The top product based on WOD and WOA is Global Ocean Heat and Salt Content anomalies accompanied by Sea level changes data. These assessments are updated quarterly. For several regions of the world ocean where data density is sufficient for data analyses on one-tenth-degree grid, the high regional climatologies created. As for now, there are seven regional climatologies has been prepared for Southwest North Atlantic, Greenland-Iceland-Norwegian Seas; Northeast Pacific; Northern North Pacific; Northwest Atlantic; Arctic; East Asian Seas; and Gulf of Mexico.