

The CoralHydro2k Seawater $\delta^{18}\text{O}$ Database



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The PAGES Data Stewardship Scholarship contributed to the development of an updated metadata-rich database of seawater $\delta^{18}\text{O}$ data by the CoralHydro2k Network.

The oxygen isotopic composition ($\delta^{18}\text{O}$) of seawater is a powerful tracer of the global water cycle, providing valuable information on the exchange of water between the ocean, atmosphere and cryosphere, as well as on ocean-mixing processes (LeGrande and Schmidt 2006). As such, these data provide an additional degree of freedom for understanding the complex hydroclimate system, beyond what standard oceanographic variables like temperature and salinity can offer. The integration of water isotopes into climate models has also made them an important diagnostic for assessing model performance and skill. Furthermore, because seawater isotopes form the basis of paleoclimate proxies based on the $\delta^{18}\text{O}$ of marine carbonates, they provide a "common currency" that links paleoclimate reconstructions, modern climate observations and isotope-enabled model simulations, allowing hydrological processes to be evaluated on a wide range of time and spatial scales (Dee et al. 2023).

In recognition of the broad value of seawater $\delta^{18}\text{O}$ data, and the growing number of seawater $\delta^{18}\text{O}$ datasets that have been generated over the last decade, the CoralHydro2k Seawater $\delta^{18}\text{O}$ Database project (pastglobalchanges.org/science/wg/2k-network/projects/coral-hydro/intro) was launched in 2020 to recover "hidden" seawater oxygen-isotope data that were not easily findable. Over the past three years, we have integrated these records with data from public databases and repositories to create a new, centralized, machine-readable, and metadata-rich database that aligns with findability, accessibility, interoperability, and reusability (FAIR) standards.

Database overview

The new database consists of 18,615 seawater $\delta^{18}\text{O}$ observations from 107 datasets. Of these data, 53% were not previously available in public databases or data repositories. These "hidden" data were recovered via direct author submission (39%), scientific papers (12%) and theses/dissertations (2%). The other 47% of the data were gathered from public databases and repositories, with the largest contributions from the GEOTRACES 2021 Intermediate Data Product (13%; Schlitzer et al. 2021), the NASA GISS Global Seawater Oxygen-18 Database (10%; Schmidt et al. 1999), PANGAEA (7%), CISE-LOCEAN Seawater Isotopic Database (7%; Reverdin et al. 2022), and GLODAPv2 (3%; Key et al. 2015; Olsen

et al. 2016). When recovering "hidden" data, we collected data from all regions and all depths of the global ocean. Our public data curation efforts were focused on the upper 50 m from 35°N to 35°S to align with the goals of CoralHydro2k (Fig. 1).

The extensive metadata is a unique aspect of the database. Only eight metadata fields are required, but an additional 44 optional metadata fields provide important supporting information, including isotope-analysis technique, sample collection and storage notes, site information, paired salinity, temperature, and seawater $\delta^2\text{H}$ values. This template provides a set of best practices for reporting seawater isotope data.

EarthChem community for dataset DOIs

A second achievement of the project was the development of a Seawater Oxygen Isotopes Community within the EarthChem Library, an open-access repository for geochemical datasets (earthchem.org/communities/seawater-oxygen-isotopes), where researchers can submit their seawater isotope data and obtain a dataset DOI. We hope that the creation of this site helps researchers publish their seawater isotope datasets, minimizing the number of "hidden" datasets. The template provided on the EarthChem Seawater Oxygen Isotopes community webpage is aligned with the CoralHydro2k Seawater $\delta^{18}\text{O}$ Database to facilitate future updates to the database.

Current and future plans

We are currently preparing a database description paper. Once published

(expected in 2024), the CoralHydro2k Seawater $\delta^{18}\text{O}$ Database will be available in the NOAA/World Data Service for Paleoclimatology archives: ncei.noaa.gov/access/paleo-search/study/35453, with additional data visualization features provided through waterisotopes.org.

This database represents an important step towards increasing the availability and usability of seawater isotope data. As future investments in water isotope observation networks become available, this data will be well-suited to tackle 21st-century research questions related to ocean changes in the past, present and future.

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