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A decade-long cruise time-series (2008–2018) of physical and biogeochemical conditions in the southern Salish Sea, North America

The manuscript presents a valuable and consistent physical and biogeochemical data product covering the time period 2008–2018 in the coastal and estuarine waters of the southern Salish Sea. Such data on waters in complex estuarine systems are particularly important considering that these areas are sensitive to ocean acidification, and play an important ecological and economic role for fishing and shellfish resources.

The data product is compilation relative to 35 cruises, including 715 oceanographic profiles, with >7490 sensor measurements of temperature, salinity, and oxygen, as well as ≥6070 measurements of discrete oxygen and nutrient samples, and ≥4462 measurements of inorganic carbon variables (DIC and TA).

Description and synthesis of CTD and bottle data are reported in the following tables:

Table 1 details each cruise included in the 2008–2018 Salish cruise data product and includes cruise identification (ID), dates, contributing research programs, geographic scope of observations, ship, and funding sources.

Table 2 reports final data variable names, descriptions, units, and measurement temperature (T) and pressure (P) conditions for observations in the Salish cruise data product. World Ocean Circulation Experiment (WOCE) water sample quality flag definitions are also reported.

Table 3 reports oxygen correction coefficients and statistics for each cruise including the total number of paired CTD-bottle O₂ measurements, and number of pairs that were excluded from regression.

Table 4 reports Numbers of profiles and years sampled in each basin by season and months sampled in each season.

Table 5 reports numbers of high-quality measurements (QC flags of 2 or 6) in the Salish cruise data product for temperature (T, ITS-90), salinity (S, PSS-78), adjusted CTD oxygen (O₂), discrete (“Winkler”) O₂, dissolved inorganic carbon (DIC), total alkalinity (TA), and nutrients grouped by basin. Numbers of measurements classified as of “questionable” quality (QC flags of 3) that are included in the data product and may be useful for some applications are also reported and indicated in parentheses.

Table 6 reports a summary of statistics (minimum–maximum, median ± standard deviation) for temperature (T, ITS-90), salinity (S, PSS-78), adjusted CTD oxygen (O₂), dissolved inorganic carbon (DIC), total alkalinity (TA), phosphate, silicate, and nitrate grouped by basin.

All 2008–2018 cruise time-series measurements used in this publication are accessible and downloadable through a DOI <https://doi.org/10.25921/zgk5-ep63> (Alin et al., 2022) with the following instructions:

- HTTPS (download): Navigate directly to the URL for data access and direct download.
- FTP (download): These data are available through the File Transfer Protocol (FTP). FTP is no longer supported by most internet browsers. You may copy and paste the FTP link to the data into an FTP client (e.g., FileZilla or WinSCP).
- HTTPS (download): Navigate directly to the URL for data access and direct download.

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This is a compiled data product of profile, discrete biogeochemical measurements from 35 individual cruise data sets collected from a variety of ships in the southern Salish Sea and northern California Current System (Washington state marine waters) from 2008-02-04 to 2018-10-19 (NCEI Accession 0238424) and includes a series of files reporting:

- SalishCruise_Original_Cruise_Information_Table.xlsx 2021-07-06
- SalishCruise_dataProduct_2008to2018_09202023_CO2calcs.csv 2023-09-26
- SalishCruise_dataProduct_2008to2018_09202023_allData.csv 2023-09-26 17:27
- SalishCruise_dataProduct_2008to2018_09202023_questNut.csv 2023-09-26
- SalishCruise_dataProduct_2008to2018_metadata_09202023.xlsx 2023-09-26
- SalishSea_ver15_w_station_labels_plus38_illustrator_optimized.pdf

The data set is unique, useful, accessible and of high quality. Each measured is associated with a quality flag assigned according to the World Ocean Circulation Experiment (WOCE). Analytical methods are reported in details along with strict quality control procedures and error calculation in line with Best Practice Data Standards for Discrete Chemical Oceanographic Observations, and Standard Operating Procedures (SOPs) for ocean CO₂ measurements.

Details for assigning quality flags are described thoroughly, and criteria for selection/rejection of data are fully explained and justified.

Extended quality control has been carried out and consisted of preparation of property-property plots according to Jiang et al. (2021) for CODAP-NA data sets.

A series of figures are reported in the main manuscript and in the supplementary information, and contribute to the understanding of spatial and seasonal trends in the Salish Sea, and serve as a synthesis of the features during the period covered during the 35 sampling cruises:

- Figure 2: Property-property plots of oceanographic parameters used to detect data with potential sampling or analytical problems
- Figure 3: Property-property plots of oceanographic parameters used to delineate spatial and seasonal variability
- Figure 4: Depth transect plots from Sound-to-Sea cruises for CTD temperature, salinity, adjusted CTD oxygen, dissolved inorganic carbon, and total alkalinity in respective columns.
- Figure 5: Depth transect plots from all Puget Sound cruises by sub-basin for CTD temperature measurements
- Figure 6: Depth transect plots from all Puget Sound cruises for salinity.
- Figure 7: Depth transect plots from all Puget Sound cruises for total alkalinity content (TA, $\mu\text{mol kg}^{-1}$).
- Figure 8: Depth transect plots from all Puget Sound cruises for dissolved inorganic carbon content (DIC, $\mu\text{mol kg}^{-1}$).
- Figure 9: Depth transect plots from all Puget Sound cruises for adjusted CTD 580 oxygen content (O₂, $\mu\text{mol kg}^{-1}$).
- Figure S1: Depth transect plots from Sound-to-Sea cruises for phosphate, silicate, and nitrate content ($\mu\text{mol kg}^{-1}$).

- Figure S2-S3-S4: Depth transect plots from all Puget Sound cruises for phosphate content ($\mu\text{mol kg}^{-1}$), silicate content ($\mu\text{mol kg}^{-1}$), and nitrate content ($\mu\text{mol kg}^{-1}$).

In summary, the manuscript and compiled data sets and product meet the requirements for quality data and accessibility, the time-series data and the data product on the Salish Sea are of high quality data and contribute to increase spatial and seasonal resolution on ocean acidification trends in complex estuarine and coastal areas. Such data are critically important to initialize and validate 3-D models on ocean biogeochemistry.