G-20
REGIONAL DATA STREAM PLAN: OCEAN ACIDIFICATION MOORINGS, AUGUST 2016

1. DATA AND INFORMATION TYPES

A. Provide a contextual description of the data stream.

Interannual variations in temperature and salinity on the northern Gulf of Alaska (GAK) shelf reflect environmental changes that affect this marine ecosystem. Quantifying and understanding this variability requires long time series such as the 32-year record at hydrographic station GAK 1 near Seward (See REGIONAL DATA STREAM PLAN: OCEANOGRAPHIC STATION: GAK1, AUGUST 2016). The PMEL Ocean Acidification (OA) program has maintained 4 OA moorings in Alaska; GAKOA, which augments the GAK 1 time series with a separate stand alone, near-surface mooring containing a MAPCO2 system and a subsurface CTDs and seawater pH sensors; the M2 in the Bering Sea with similar configuration as GAK 1 OA mooring; and three other moorings that were discontinued in early 2016 in Southeast AK, Kodiak, and station M8 (though historical data available).

Measuring pH in addition to pCO2 allows changes associated with ocean acidification (OA) to be more accurately and precisely assessed and forecasted.

The OA mooring program in Alaska has been developed through a consortium of agencies including the National Science Foundation, NOAA, the North Pacific Research Board, and the Alaska Ocean Observing System (AOOS), and is the centerpiece of the research program within the Ocean Acidification Research Center at UAF.

Website URL: Real-Time Sensor: Source: NOAA PMEL: (1-2 reporting as of 2016): http://portal.aoos.org/#module-metadata/5da59d98-59ad-11e1-a1da-0019b9dae22b/8c5dd704-59ad-11e1-bb67-0019b9dae22b

Website URL: Historical Sensor: Source: NOAA-PMEL: (4 stations 2011-2016): http://portal.aoos.org/#module-metadata/0cbe63ce-87aa-11e3-acbf-00219bfe5678/467dd946-87aa-11e3-9eb2-00219bfe5678

B. How many station locations are there for this data stream?

2 real-time (GAK OA; M2) (temperature, salinity, pressure)
4 historical (GAK OA; M2; SE AK; Kodiak) (temperature, salinity, pressure, dissolved oxygen).

C. What are the specific parameters of the data.

The parameters of this data stream include: date, time, GPS, atmospheric boundary layer and surface ocean CO_2 partial pressure (pCO_2) and pH. temperature (TSG_T) (subsurface and near-bottom), salinity (TSG_S) (subsurface and near-bottom), dissolved oxygen, and pCO2/pH (subsurface and near-bottom from secondary sensors to the surface pCO2).

Currently, the pCO2 and pH data are not being reported on the AOOS data portal.

D. Provide information about the sampling platform or instrumentation.
The typical OA mooring includes a surface buoy equipped with a real-time reporting, MAPCO2 system to measure the atmospheric boundary and surface ocean CO2 partial pressure. The real-time pCO2 data are not reported on the AOOS data portals, as they require post-processing by NOAA. These data, when released, will be served as part of the historical record.

The subsurface mooring consists of internally recording instruments, with subsurface CTDs reporting real-time, whereas near-bottom data are recovered during the annual maintenance of these moorings. The surface instruments can report data real-time to provide temperature, salinity and pressure, and sometimes oxygen. They include two Sea-Bird Electronic's SeaCAT CTDs (SBE 16+) to measure temperature, conductivity and pressure (used for computing salinity), and two autonomously recording combination pCO2 / pH systems (SAMI by SundBurst Sensors). The SAMI uses an in situ spectrophotometric method that can measure pCO2 and pH with a reported accuracy of 0.003 pH units. The M2 mooring is equipped with an SBE 43 Clark Electrode dissolved oxygen sensor on the subsurface CTD.

2. DATA PATHWAY

A. Is a data sharing agreement required?
No, these data are available publically.

B. In which format(s) are data received by AOOS?
Specifically the data are harvested from the originators' website as CSV file with converted engineering units: http://www.pmel.noaa.gov/co2/story/GAKOA; http://www.pmel.noaa.gov/co2/story/M2+OA+Mooring

C. How can the information be accessed?
The data are available through the AOOS data portal, where it can be downloaded or explored through interactive visualizations. Specifically, data are available from two unique access points:
- File downloads (CSV)
- ERDDAP

D. What file formats will be used for sharing data, if different from original?
Data are shared as CSV and through ERDDAP. Data are also available for exploration in the AOOS portals via interactive, graphical visualizations.

E. Describe how the data are ingested (e.g. the flow of data from source to AOOS data portals) and any transformations or modifications made to share data in the AOOS data portal.
Data are downloaded from the source to the AOOS storage. Custom Java, Scala, and Python scripts are used to convert data formats suitable for internal and external interoperability services. Data are made available in the AOOS portals through the access

points and via graphic displays generated through internal JSON-format data requests from these services.

Graphic displays include a mapping service, customized interactive visualizations, and time-series plots of the unit values wherein each parameter is graphed independently. Back-end scripts handle the conversion of visualized data from CF standards to other, non-CF units that may be requested by the user. Data files may be downloaded by the user from the AOOS data portal. A user request for a CSV file request pulls the data from the server cache. A user request for ERDDAP pulls data from the ERDDAP service using the same cache. For this data, no CF-standard names or units exist, therefore custom names of abundance_of_{scientific_name} were used. Refer to Appendix I for CF standards.

Summary statistics generated within the interactive graphical displays may be requested by the user. Summary statistics may include minimum, maximum and mean values. Seasonal statistics, available on time series longer than 3 years, include mean, and 10th and 90th percentiles. Note: the number of points visually available to interactive users from the source data are limited when necessary using temporal binning, such as daily, weekly, monthly, seasonally and yearly.

F. What metadata or contextual information is provided with the data?
Metadata are shared in the AOOS portals with descriptive narratives describing the data and linking back to the originator's site.

G. Are there ethical restrictions to data sharing?
No

  a. **If so, how will these be resolved?**
  N/A

H. Who holds intellectual property rights (IPR) to the data?
NOAA Pacific Marine Environmental Laboratory (NOAA-PMEL)

I. Describe any effect of IPR on data access.
None

3. DATA SOURCE AND QUALITY CONTROL
A. Indicate the data source type (i.e. Federal, Non-Federal, University, State Agency, Local Municipality, Military Establishment (branch), private industry, NGO, non-Profit, Citizen Science, Private individual)
Federal

  a. **If Federal data source, were changes applied to the data?**
  Yes

b. If Yes, describe any changes to the data that require documentation?

The file format of the original data (CSV) was changed so it is also accessible using the ERDDAP service.

B. Indicate the data reporting type (e.g. real-time, historical).

Real-time and historical records.

C. If real-time, list the QARTOD procedures that are currently applied.

These data are from a Federal source, and therefore, AOOS is not required to provide further QC documentation or QARTOD implementation. However, AOOS currently applies three standard QC procedures to all real-time and historical observation data before they are displayed or stored in the AOOS Data System (see 3G).

D. If real-time, list the QARTOD procedures that are planned for implementation.

N/A

E. What is the status of the reported data? (e.g. raw, some QC, incomplete, delayed mode processed but not QC'd)

All data reported from this source is QC'd by originator.

F. Describe the data control procedures that were applied by the originator.

Contact the data provider for availability of QC information.
http://www.pmel.noaa.gov/co2/story/Coastal+Moorings

a. Provide a link to any documented procedures.

N/A

G. Describe the data control procedures that were applied by AOOS.

AOOS currently applies three standard QC procedures to real-time and historical observation data before they are displayed or stored in the AOOS Data System. These tests include the following:

1. *Syntax Test:* Each regional data source uses unique syntax to transfer data. Some (e.g., Canada Water Office) have standardized data storage protocols and provide files whereas others (e.g., Alyeska Weather stations) are merely html web pages that are scraped for data. Therefore, each regional source requires a custom syntax test, which merely checks for parity errors by testing if data can be extracted from the downloaded or scraped data. If no data can be extracted, the test fails, and no data are accessed, served or stored for that record.

2. *Gross Range Test:* This test checks data values against minimum and maximum values defined for each parameter. In addition to parameters outlined in QARTOD manuals, AOOS performs gross range tests for parameters listed in Appendix H including water temperature, salinity, oxygen saturation values and pH. Values outside of the prescribed parameter ranges are rejected and replaced with missing value flags in data storage connected to access points and the graphic displays.

3. *Time-Gap Check:* AOOS implements a *"time-gap check"* that informs observational assets (e.g., weather stations) displayed on its "Real-Time Sensor Map". If no data are received from an existing observational station for four hours, the icon on the map changes from a scaled color to a small grey-shade dot. If no data are received from an existing observational station for one week, the asset is automatically removed from the map, although assets are still made available on a historical sensor map.

    a. Provide a link to any documented procedures.
    AOOS Data Assembly Center and Data Management Plan (2016)

H. List the procedures taken for data that could not be QC'd as directed.
    N/A

4. STEWARDSHIP AND PRESERVATION POLICIES

A. Who is responsible for long-term data archiving?
    NOAA

    Data are aggregated for visualization and exploration with other layers in the AOOS data portal. AOOS stores the real-time and historical data on the AOOS data servers.

    Data are archived by NOAA with the Carbon Dioxide Information Analysis Center (CDIAC). Full metadata record available there.

B. Which long-term data storage facility will be used for preservation?
    Carbon Dioxide Information Analysis Center (CDIAC)

C. Describe any transformation necessary for data preservation.
    N/A

D. List the metadata or other documentation that will be archived with the data.
    Full metadata record available at the CDIAC.