Data Management Plan: NANOOS Washington Coast Moorings, Northwest Environmental Moorings Lab, University of Washington

I. Type of data and information created

1. What data will you collect or create in the research?

Contextual statement describing what data are collected and relevant URL (IOOS Certification, f 2)

Since 2010 the University of Washington has maintained a pair of moorings 13 nm WNW of La Push, Washington on the Washington continental shelf and within the Olympic Coast National Marine Sanctuary, collectively referred to as the Northwest Enhanced Moored Observatory (NEMO). The moorings consist of a large surface buoy (Cha'Ba or Quileute for "whale tail") and an adjacent (~400 m away) profiling subsurface mooring referred to as NEMO-subsurface. Both moorings collect oceanographic and atmospheric data, with oceanographic observations throughout much of the 100 m water column. Data are stored both locally and transferred to shore hourly to be displayed on the NANOOS Visualization System (NVS) in near real-time.

2. What data types will you be creating or capturing?

The two moorings collect a host of data.

On Cha'Ba the measurements are:

1. air temperature
2. barometric pressure
3. rain rate
4. relative humidity
5. downwelling shortwave radiation
6. wind speed and direction
7. 3-axis magnetometer and accelerometer at 8 Hz averaged over 1 second
8. pCO2 air
9. pCO2 water
10. near-surface T, S, dissolved oxygen, pH, fluorometer (chlorophyll), turbidity, pressure, density
11. water column T, S, dissolved oxygen and pressure at multiple depths

On NEMO-Subsurface the measurements are:

12. profiles of T, S, pressure, dissolved oxygen, chlorophyll, turbidity, and nitrate between 85 and 20 m.
13. ADCP-measured velocity in 1 m bins from 15 m to 2 m.
14. ADCP-measured velocity in 4 m bins from 85 m to 8 m.
15. T, S, and P at 18 m depth.

3. How will you capture or create the data?

Describe how the data are ingested (IOOS Certification, f 2)

The data are collected a number of different instruments. Some record full data sets on internal recorders and transmit a subset of the records to shore for near real-time display,

some do not transmit data and record all data internally, and some both record and transmit all data.
Data are transmitted to shore via cell modem with a back-up Iridium system. Data not transmitted via cell modem are offloaded from instruments during semi-annual mooring servicing cruises.

Describe how data are managed (IOOS Certification, f 2)
The real-time data are managed at the APL/UW "waves" server (http://waves.apl.uw.edu/~mooring/), which both archives real-time data and serves data to NANOOS. Full data sets are maintained on the APL/UW "kipapa" server (http://kipapa.apl.washington.edu/datashare/nemo). Both of these servers currently implement restricted access, for security.
In addition to local backups of data, archived data are also backed up semi-annually on Google Drive on a University of Washington Account. Data are stored in raw unprocessed format, which is either binary or ascii, and also in a processed Matlab format. Real-time data are not QA/QC'd, but if data streams are known to be corrupt, we will turn off the sensor remotely if possible. Processed archived data are QA/QC'd according to the data type. Access to fully archived data can be requested at: http://nwem.ocean.washington.edu/prod_DataReq.shtml

Describe the data quality control procedures that have been applied to the data. (IOOS Certification, f 3)

As there is a wide range of data, we are not able to apply a single technique for quality control, but instead we aim to follow the QARTOD guidelines available for the various types of data. In all cases we archive the raw data in addition to the processed, QA/QC'd data so that a user can refer back to the original data to determine what has been cut or flagged.

As a NANOOS Observing System provider, we follow best practices and manufacturer guidance where applicable, to calibrate, operate, and maintain the equipment used in this effort, and are able to provide documentation of this upon request. NANOOS operators maintain equipment inventories, shipping logs, and instrument maintenance history logs, as appropriate, that are also available upon request.

4. **If you will be using existing data, state that fact and include where you got it. What is the relationship between the data you are collecting and the existing data?**
   N/A

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II. Expected schedule for data sharing

Adheres to the NOAA Data Sharing Procedural Directive. The System is an operational system; therefore the RICE should strive to provide as much data as possible, in real-time or near real-time, to support the operation of the System. (IOOS Certification, f. 4.)

Once data have been acquired, processed, and quality controlled, we will make the complete data set available. This will occur within 6 months of mooring turn around cruises which typically occur in the spring (March-May) and fall (Sept-Nov). Near-real time data are displayed and available on NVS within 2 hours of transmission.

1. **How long will the original data collector/creator/principal investigator retain the right to use the data before opening it up to wider use?**
   N/A

2. **How long do you expect to keep the data private before making it available? Explain if different data products will become available on different schedules (Ex: raw data vs processed data, observations vs models, etc.)**
   N/A

3. **Explain details of any embargo periods for political/commercial/patent reasons? When will you make the data available?**
   N/A

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III. Standards for format and content

1. **Which file formats will you use for your data, and why?**
   How can the information be accessed? (IOOS Certification, f 2)
   We share data in a variety of file formats.
   1. Matlab data format ('mat') files.
   2. ASCII - Text file that are easily read and parsed by people and programs via the web. Matlab files to parse these are often available upon request.
   3. Raw binary instrument files (e.g ADCP current data)
   4. Upon request we are often able to provide both ASCII and Excel files if only binary or .mat files are available.

2. **What file formats will be used for data sharing?**
   All of the Above.

3. **What metadata/ documentation will be submitted alongside the data or created on deposit/ transformation in order to make the data reusable?**
   The primary metadata/documentation provided alongside the archived data are an "orientation read-me" document that describes the organization of the data, and a mooring diagram for each deployment. The mooring diagram provides information about the placement (in height or depth) of various instrument serial numbers on each mooring as well as the latitude and longitude coordinates of the deployments. Header information and "info" fields in Matlab structure files provide needed information about variable names and units, instrument serial numbers, and for Matlab files the mooring ID. We are working to include calibration information for all instruments where applicable. An example of a CTD file is included here:

```
SBE =
        DO: [12919x1 double]
        temp: [12919x1 double]
        cond: [12919x1 double]
        pr: [12919x1 double]
        dtnum: [12919x1 double]
        sal: [12919x1 double]
        yday: [12919x1 double]
        start_year: 2015
        info: [1x1 struct]
    NOMdepth: 84.200000000000003
>> SBE.info
       deployID: 'nemo15'
       serial_no: 'SBE37  11202'
       mooringID: 'ChaBa'
```

```
        var: {1x4 cell}
        units: {1x4 cell}
        HDR: {68x1 cell}
>> SBE.info.HDR
  '* Sea-Bird SBE37 Data File:'
   [1x62 char]
   '* Software Version 1.59'
   '* Temperature SN = 11202'
   '* Conductivity SN = 11202'
   '* System UpLoad Time = Dec 21 2015 21:02:17'
   '* ds'
   [1x61 char]
   '* vMain = 13.65, vLith =  3.18'
   '* samplenumber = 14331, free = 385126'
   '* not logging, stop command'
   '* sample interval = 1200 seconds'
   '* data format = converted engineering'
   '* do not transmit sample number'
   '* minimum conductivity frequency = 3145.1'
   '* adaptive pump control enabled'
   ''
   ''
   '* S>'
   '* SBE37IMP-ODO v1.1.0  11202'
   '* temperature:  02-oct-13'
   '*     TA0 = -6.674492e-05'
   '*     TA1 = 2.987007e-04'
   '*     TA2 = -3.883924e-06'
   '*     TA3 = 1.881121e-07'
   '* conductivity:  02-oct-13'
   '*     G = -9.835356e-01'
   '*     H = 1.410123e-01'
   '*     I = -2.534789e-04'
   '*     J = 3.714289e-05'
   '*     CPCOR = -9.570000e-08'
   '*     CTCOR = 3.250000e-06'
   '*     WBOTC = 3.465604e-07'
   '* pressure S/N 3874640, range = 160 psia  30-sep-13'
   '*     PA0 = 2.991138e-02'
   '*     PA1 = 5.049745e-04'
   '*     PA2 = -7.758791e-12'
   '*     PTCA0 = 5.244720e+05'
```

```
'*     PTCA1 = 9.705472e+00'
'*     PTCA2 = -3.204899e-01'
'*     PTCB0 = 2.508488e+01'
'*     PTCB1 = 1.750000e-04'
'*     PTCB2 = 0.000000e+00'
'*     PTEMPA0 = -6.653198e+01'
'*     PTEMPA1 = 5.172678e-02'
'*     PTEMPA2 = -5.370632e-07'
'*     POFFSET = 0.000000e+00'
'* oxygen SBE63 S/N 0514 19-sep-13'
'*     TAU_20 = 5.000000e+00'
'*     OXA0 = 1.051300e+00'
'*     OXA1 = -1.500000e-03'
'*     OXA2 = 3.763000e-01'
'*     OXB0 = -2.417300e-01'
'*     OXB1 = 1.604000e+00'
'*     OXC0 = 1.072200e-01'
'*     OXC1 = 4.516600e-03'
'*     OXC2 = 6.343799e-05'
'*     OXTA0 = 6.918398e-04'
'*     OXTA1 = 2.562684e-04'
'*     OXTA2 = 1.155918e-07'
'*     OXTA3 = 1.167900e-07'
'*     OXE = 1.100000e-02'
''
''
'* S> '
'*END*'
'start time = 23 May 2015 00:00:18'
'start sample number = 1'
```

Real-time data on NVS also provide the depth/height, coordinates of the measurements, and units.

4. **What contextual details (metadata) are needed to make the data you capture or collect meaningful?**
   As mentioned, the mooring diagram in PDF format is important to obtaining spatial information for the measurements. This included at the top level of a folder for each deployment. In addition to the data file this is the only information needed to make the data meaningful. It is worth noting that for some data files (e.g. ADCP processed data), the latitude and longitude coordinates of the observations are included as a field in the Matlab data structure.

5. **How will you create or capture these details?**
   Again, these details (position information) are entered manually into a mooring diagram with the position retrieved from the ship's GPS upon mooring deployment.

6. **What form will the metadata describing/documenting your data take?**
   - PDF (mooring diagram)
   - Text (orientation read-me document for folder structure)
   - Data file header information (MAT or ASCII file)

7. **Which metadata standards will you use and why have you chosen them? (e.g. accepted domain-local standards, widespread usage)**
   FGDC and ISO 19115 metadata are both accepted standards and mandated by the US Federal Government.

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IV. Polices for stewardship and preservation

1. **What is the long-term strategy for maintaining, curating and archiving the data?**
   Points of contact- Individuals responsible for the data management and coordination across the region (CV's attached); (IOOS Certification f 1.i)
   John Mickett - Employee 17 years, Principal Investigator/Program Manager
   (206) 897 1795
   jmickett@apl.uw.edu

   Wendi Ruef - Employee 15 years, Oceanographer/Analyst
   (206) 221-6760
   wruef@u.washington.edu

   Identify the procedures used to evaluate the capability of the individual (s) identified in subsection 997.23(f)(1) to conduct the assigned duties responsibly. (IOOS Certification, f 1.iii)
   Both individuals have led data archiving and operations for high-level mooring programs for at least 7 years, and both have advanced degrees in Oceanography, with an emphasis on observations, giving them an appropriate background to take on this role.

2. **Which archive/repository/database have you identified as a place to deposit data?**
   Documents of the RICE's data archiving process or describes how the RICE intends to archive data at the national archive center (e.g., NODC, NGDC, NCDC) in a manner that follows guidelines outlined by that center. Documentation shall be in the form of a Submission Agreement, Submission Information Form (SIF) or other, similar data producer-archive agreement (IOOS Certification, f 6).
   Plans are being developed to archive with NCEI historical data from NWEM moorings annually or after each deployment, to be guided by the procedures laid out by the NANOOS SATURN archiving project and corresponding NCEI Submission Agreement.

3. **What procedures does your intended long-term data storage facility have in place for preservation and backup?**
   Local redundant HDD storage at APL, the UW Google Drive Account, and NCEI.

4. **How long will/should data be kept beyond the life of the project?**
   Data are indefinitely stored.

5. **What data will be preserved for the long-term?**
   All data are publicly available and preserved.

6. **What transformations will be necessary to prepare data for preservation / data sharing?**

Raw data are decoded and formatted, analyzed and quality controlled.

7. **What metadata/ documentation will be submitted alongside the data or created on deposit/ transformation in order to make the data reusable?**
   FGDC standard metadata are available per deposit and transformation.

8. **What related information will be deposited?**
   Master Mooring Diagrams.

V. Procedures for providing access

1. **What are your plans for providing access to your data? (on your website, available via ftp download, via e-mail, or another way)**
   Describe how data are distributed including a description of the flow of data through the RICE data assembly center from the source to the public dissemination/access mechanism. (IOOS Certification, f 2 and 4)

   Real time data are uploaded hourly via cell or Iridium modem to a UW-only access APL server (http://waves.apl.uw.edu/~mooring/). NANOOS servers at APL get data from this server hourly to display data on NVS. Other data products and plots that are not available on NANOOS are presented on the NWEM website. For archived data access we provide password-protected data access via an Apache Web Server maintained at APL/UW (kipapa.apl.washington.edu/DataShare/NEMO). Data requests can be made via our program website at http://nwem.ocean.washington.edu/prod_DataReq.shtml.

2. **Will any permission restrictions need to be placed on the data?**
   NWEM data and products are freely available for public use. When referenced, please provide a link to the CDIP homepage.
   Examples:
   1) Standard html:

   Data courtesy of CDIP

   2) Offline references, choose the appropriate form from the recommended acknowledgements below.

- Short form (figure captions, etc.)
  "... data from NWEM, University of Washington."
- Longer form (in text)
  "...data were furnished by the Northwest Environmental Moorings (NWEM) Laboratory, Applied Physics Laboratory, University of Washington."
- Full form (acknowledgements at conclusion of papers, etc.)
  "...data were furnished by the Northwest Environmental Moorings (NWEM) Laboratory, Applied Physics Laboratory and School of Oceanography, University of Washington."

3. **With whom will you share the data, and under what conditions?**
   Data are publicly available.

4. **Will a data sharing agreement be required?**
   In general, a data sharing agreement will not be required. However, data should be properly acknowledged.

5. **Are there ethical and privacy issues? If so, how will these be resolved?**
   N/A

6. **Who will hold the intellectual property rights to the data and how might this affect data access?**
   The funding agency & the University of Washington through a contractual agreement.

VI. Previous published data

http://nwem.ocean.washington.edu/publications.shtml