AOOS-Funded Projects:

Submitting Data and Metadata Using the Research Workspace

Data Management Timeline for AOOS-Funded PIs

This timeline is intended to help you stay organized and meet the AOOS data management requirements. Items marked with an asterisk are required. The remaining items are guidelines to help you stay on track. If you have any questions, contact the AOOS Director of Operations and Development, Carol Janzen, janzen@aoos.org (907) 644-6752.

Upon award
- Review AOOS Data Management and Information
- Log in to the AOOS Research Workspace and complete your profile information (tutorial here)
- Start AOOS Funded Project Data Sharing Plan form

Within 3 months of award
- Submit final AOOS Funded Project Data Sharing Plan to AOOS
- Review data management best practices for planning, organizing, and updating data

Within 1 year of award*
- Load final, QC'd data into the AOOS Research Workspace (tutorial here)
- Create metadata record using metadata best practices (tutorial here)
- Review and finalize metadata with Axiom Data Science staff

Annually, final 30 days of award
- AOOS to approve final data and metadata in the AOOS Research Workspace
- Submit semi-annual report to AOOS via email to kent@aoos.org

Final 60 days of 5 year award
- AOOS to approve any outstanding final data and metadata in the AOOS Research Workspace
- Submit final 2021 report to AOOS via email to kent@aoos.org

* or date otherwise agreed upon by AOOS

Table of Contents

1.   PURPOSE

The Alaska Ocean Observing System (AOOS) was established in 2004 by a consortium of partner agencies and research institutions and serves as the regional association for integrating coastal and ocean observing activities in Alaska's three regions: Arctic, Bering Sea/Aleutians

and Gulf of Alaska. AOOS formally serves as the Alaska regional component of the U.S. Integrated Ocean Observing System (IOOS) and is considered to be a Regional Information Coordination Entity (RICE) under the authority of the Integrated Coastal and Ocean Observation System Act of 2009 (ICOOS Act).

As a member of IOOS, AOOS has a mandate to collect, organize, and provide access to Alaska oceanographic data. These data need to be easily understandable, electronically accessible and well organized to allow policy makers, industry and the general public to make well-informed decisions. To satisfy this mandate, AOOS supports a regional Data Assembly Center (DAC) and web-based data portal (called the Ocean Data Explorer) for the entire state of Alaska providing ocean, coastal and relevant watershed environmental data and information products.

To ensure data collected by AOOS and other regional entities and distributed through the AOOS DAC and on the AOOS web portal are managed according to best practices identified by NOAA, and that the data are of a known quality to the end user, AOOS is implementing recommended and standard practices as defined by the U.S. Integrated Ocean Observing System (IOOS) Data Management and Communications (DMAC) committee. These practices apply to data standards, metadata and data transport. This document provides a framework of data management policies and procedures with defined roles and responsibilities, and processes for the collection, quality control, storage, maintenance, and dissemination of AOOS data assets. The intent is more effectively carry out data management activities between AOOS and its technical partner, Axiom Data Science, to improve the accessibility and long-term usability of AOOS funded data.

2.   AOOS DATA POLICY

The Recipient agrees to report their data to the AOOS, in accordance with specifications in a data management and information transfer plan, to be developed in consultation with AOOS staff, and submitted within 30 days of the full execution of this award. The plan should specify, among other requirements, the storage media and format(s), schedule, and location for reporting, and other relevant information, such as metadata, that may be required by the circumstances of the project. When possible, data are to be served in real-time, with a method for AOOS to access these data in real-time to be identified. On projects that do not produce real-time data, the project investigators are responsible for making sure data become accessible by AOOS within an agreed upon timeframe. Investigators are required to use the "Research Workspace," a web-based project-level data management system used by AOOS data management contractor Axiom Data Science, to develop metadata and manage and ingest specified project data streams. When data submission is completed, AOOS will make the data searchable and accessible for download to the public through the AOOS Regional Data Assembly Center. In addition, as a federally funded program, AOOS is required to submit data it generates to a national archive center, in most cases the National Centers for Environmental Information (NCEI). Therefore, all data must be formatted and appropriate metadata generated to ensure ease of archiving

3.   DEFINITIONS

For the purposes of this document, the following definitions apply:

Data: Data are distinct units of information, such as numbers, model code base, sensor or research outputs, usually formatted in a specific way stored within a database or file and suitable for processing by a computer.

Data storage: Data files uploaded and stored in the Research Workspace, a secure, web-based scientific collaboration and data management tool used to centralize and share information from AOOS AOOS Funded Projects. Data files are stored for long-term access exclusively by AOOS and its collaborators.

Data transfer: Data files that are submitted to AOOS either by direct access or harvest from the originator website (e.g. real-time sensors), by upload to the Research Workspace, or by other means, such as email or physical copy (e.g. hard drive).

Data shared with the public: Final project data and data products made available publicly through the AOOS Regional Data Assembly Center's web-based data portal.

Archived: Final data and data products are stored in a data repository for long-term preservation. At the time of writing, the Research Workspace supports an automated pathway to submit data to the Research Workspace Member Node in the DataONE network where it is discoverable and accessible through the [DataONE Search](#) catalog. The final data package is assigned a digital object identifier (DOI) to facilitate the citation of project data.

4.   ROLES AND RESPONSIBILITIES

Alaska Ocean Observing System: AOOS is responsible for managing, gathering, and serving data important to the AOOS region to end-users via standard services as recommended by the Integrated Ocean Observing Committee (IOOC) and the IOOS Program Office. AOOS is also responsible for making policies related to project data. They oversee the submission and maintenance of data, and the dissemination of final data and data products through the AOOS web-based data portal and long-term data repositories.

Axiom Data Science: Axiom is the technical partner to AOOS and acts to design and deploys a data management subsystem to meet the needs of the AOOS user base. The AOOS data management system provides access to and use of data by all user groups and allows data management staff to rapidly develop new capabilities and tools to meet emerging user needs. Axiom also provides data management and informatics support for AOOS and development capacity for map-based data portals, spatial planning tools and data management frameworks, which transfer and ingest data from external systems via interoperability protocols. The team ensures transparency and communication between client and contractor about design requirements and development progress, and remains

current with, researches and employs new technologies to extend the capabilities of digital information and computer analysis systems..

Project Principal Investigators (PIs): The project PIs are responsible for data collection, analysis, metadata generation, and the delivery of final data, data products, and metadata to AOOS according to the project agreements. The PIs are also responsible for ensuring data quality, completeness, and integrity relative to the scientific standard within the respective project discipline throughout data creation and maintenance. This includes: i) documenting data quality practices (QA/QC) for the project (e.g., Standard Operating Protocols), including best practices followed during the project, instrumentation service records/calibration and data processing protocols (e.g., data corrections to raw data using water samples or pre and post calibration data, and parameter conversion formula for derived parameters); ii) providing a AOOS Project Data Sharing Plan within 3 months of project onset; and iii) submitting final data to the AOOS Research Workspace annually or otherwise the agreed-to time schedule.

Data Management Procedures for Projects

All projects shall follow the procedures listed below for managing and submitting final data and data products. Further, it is recommended to follow the common data management guidelines for the Research Workspace. The rationale for these procedures is to save PIs time at project close-out by ensuring data is well-organized and documented and, ultimately, to increase access by the broader community to research outputs.

Data management and information transfer plans are the best way to ensure that your data are well-organized, managed, and prepared for preservation into the future. Prior to sending data to AOOS, Project PIs are required to complete a AOOS Funded Project Data Sharing Plan at the beginning of the project to document the planned research effort, the expected outputs, and the plan for documenting and archiving your data. This form will be reviewed by Axiom Data Science to identify any potential problems that could be obstacles to long-term preservation and sharing. Axiom will communicate with the PI about any highlighted issues allowing for consideration of solutions.

For projects involving model or analytical workflows, at the request of AOOS, Axiom may contact the PIs early in the project to understand the nature of the data and recommend an appropriate data management structure. This information would be formalized into a data sharing plan by Axiom and shared with the project PI to help define the final data, data products, and documentation that should be generated.

1. Data Storage & Security

The Research Workspace is a web-based scientific collaboration and data management tool used to secure and centralize project information, generate metadata, and ultimately select final data

files to be published openly in the AOOS data portal and national data repositories. The Workspace enables PIs to capture and retain the entire legacy of their project, while providing AOOS with a real-time and transparent view of project status.

All final project data and metadata shall be submitted using the Research Workspace: https://workspace.aoos.org/login. PIs are required to log into the Workspace and create a user account. User accounts are associated with a secure project within the Workspace that is maintained behind a password-protected firewall and is accessible only to your project collaborators. Project information is automatically populated into the Workspace from the AOOS proposal, including name and contact information, project title, project abstract, purpose, and keywords. The PIs and co-PIs listed in the project proposal are given access to the project, though additional collaborators can be added to your project in the Workspace upon request to the AOOS Director of Operations.

2. Data Submission

Under the project agreement, the PI(s) agree to transfer all data and metadata to AOOS at the completion of the project using the Research Workspace. Final data and metadata shall be submitted prior to the final report.

While the minimum requirement is for final data to be stored in the Workspace, PIs are encouraged to use the Workspace throughout the life of the project. The Workspace is an effective tool to help PIs centralize project information, securely store data files, and share project data with collaborators.

Detailed information on how to use the Workspace can be found in the help documentation.

2.1 Data Organization

Project information stored in the AOOS Research Workspace shall adhere to the below data guidelines. Refer to Axiom's documentation for more detailed recommendations about best practices for managing your data.

Folder Structure

Folders are important for breaking down project files into smaller, easier-to-manage and identifiable units. PIs are encouraged to build upon the default 'Files' folder structure to help you stay organized and easily retrieve your data files. Refer to the best practices documentation for guidance on creating and naming new folders.

Finalized files shall be stored in separate and clearly-marked folder(s) from intermediary or raw data files. This will expedite the final review for your project.

Folder and File Naming

How you name folders and files added to your projects will have an impact on you and your collaborator's ability to find and understand the project's data. Naming consistently and descriptively will help users identify records at a glance, and will help to facilitate the storage and retrieval of data. Final data files shall follow these naming guidelines to ensure they are consistently formatted and informative.

2.2 Data Formats

For data-based projects, final data files shall be stored in non-proprietary formats to help ensure they are useable, open, and readable into the future. Refer to the best practices documentation for data formats appropriate for long-term preservation.

2.3 Data Quality

Beyond scientific quality assurance, basic quality reviews shall be performed to your data throughout its lifecycle, from collection through submission of final data files in the Research Workspace. The data quality procedures used during your project should be described in the metadata documentation to indicate to future users the quality and accuracy of your data. Refer to the best practices documentation for the data quality guidelines.

2.4 Prepare Metadata and Data Documentation

Metadata

Metadata are required for all final data files or data products submitted to AOOS. Metadata must be in a standards-compliant format suitable for long-term archive. The Research Workspace includes an integrated metadata editor to generate FGDC-endorsed ISO 19110 and 19115-2 standards metadata. Use of this editor is highly encouraged to ease the publication and archive of data through the AOOS data portal.

A new metadata record should be created using the AOOS Funded Projects template available through Workspace metadata editor. Follow these steps for how to copy a whole record from a metadata template. The name of the existing template record to be used in step 2 is the *"AOOS Funded Project template"*. New content about your project data can be added to your metadata record after the template is copied.

Depending on the project, more than one metadata record may be required to sufficiently describe the data. Metadata should be created at the final data folder to describe the file or files contained within the folder. The intent of folder metadata is to reduce the burden upon the creator for constructing the metadata and resource archive.

- Depending on the nature of the data, groups of files of the same format or sharing similar

characteristics or methods can be documented by a single metadata record. Examples that require one metadata record include: single data collection methods resulting in one data file; a single instrument or sensor type (e.g. a glider); or single data collection methods repeated at more than one location resulting in one or more data files.

- If there are project datasets that contain distinct characteristics or were generated using different methods, then more than one metadata record should be created to describe each unique dataset. Examples that require more than one metadata record are projects organized by chapters; projects using more than one instrument or sensor type (e.g. moorings, gliders, etc); or projects having generated more than one distinct model or data product.

Refer to the [Best Practices for Scientific Metadata](#) document for guidance in assembling the final data package and creating scientific metadata using the metadata editor. This document provides field-by-field guidance on how to write high-quality metadata.

If you have questions about how to structure your metadata record(s) relative to your project data, please contact Axiom Data Science at metadata@axiomdatascience.com.

Data Documentation

Beyond standardized metadata, additional documentation about your dataset may be useful to further describe the actions taken to the data. Examples of data documentation include standard operations procedures, field notes, QA/QC manuals, and model readme files. AOOS maintains a series of Data Stream Plans to document non-federal observation data served by the AOOS DAC.

2.5 Progress and Final Reports

All semi-annual progress and final reports shall be submitted to AOOS via email. Refer to your AOOS Funded Projects contract for report submission specifications.

2.6 Final Data and Metadata Quality Review

Once submitted, Axiom Data Science will perform reviews of the metadata record(s) to help ensure accuracy, consistency, and completeness of the metadata content. Any recommended edits or additions to the metadata will be communicated directly from Axiom Data Science to the PI. After which, Axiom will perform the final review of any modified metadata prior to approving the final data and metadata for project close-out.

2.7 AOOS Data Portal and Archive

At the end of the project or following its embargo period, final project data may be archived by AOOS into a preservation-oriented data center. At the time of writing, the Research Workspace

supports an automated pathway to submit data to DataONE through its member node. In the future, data archive and/or replication from DataONE to NCEI may be supported.

At the end of the agreed-to embargo period, submission of final data to the repository will be made by AOOS with technical assistance from Axiom Data Science. Prior to submission, the project PI would be notified about the pending submission.

2.8   Maintenance and Updates to Project Data and Metadata

Publicly-available and archived metadata are living documents that need regular review and maintenance. Routine reviews to the technical metadata structure will be made by Axiom Data Science. It is the responsibility of the PI to notify AOOS of any substantial changes to the dataset or metadata to ensure currency, accuracy, and completeness. Changes may include updating of the data contents, contact information, or publications. Axiom Data Science will work with AOOS to reflect these changes within the published or archived metadata records.

5   TECHNICAL SUPPORT

Project PIs are responsible for reading and adhering to the principles and guidelines written or referenced in this document. For additional questions on using the Research Workspace or creating metadata for your project, contact Axiom Data Science at metadata@axiomdatascience.com. Questions asked early in the project can save time and frustration when preparing your final dataset and metadata documentation!

3.1 Resolving Data Issues

Any user of publicly-available or archived data may question the accuracy of any data element. The user is responsible for helping to correct the problem by supplying as much detailed information as possible about the nature of the problem to the AOOS Director of Operations and Development, Carol Janzen (janzen@aoos.org). AOOS will respond to questions about the accuracy of data, and work with the project PI and/or Axiom Data Science, as necessary, to correct inconsistencies in the published or archived resource.