Time-Series Data Products from the Australian Integrated Marine Observing System

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Australia's National Mooring Network, a facility of the Integrated Marine Observing System (IMOS), has been operating moored instruments at over 60 coastal sites for up to 13 years. At the seven National Reference Stations, water-column profiles and water samples are also obtained with up to a monthly frequency. From these, a wide range of biogeochemical analyses are made.

All the IMOS observations are available to the public via the Australian Ocean Data Network (AODN) Portal (https://portal.aodn.org.au). However, as the data are served in separate files per instrument and deployment, visualising and analysing the complete time series from a single mooring site requires the downloading hundreds of files, and significant technical expertise to combine them. This is limiting the use and impact of the data in the broader user community.

To address this problem, a Working Group has been set up, comprising technical experts from the IMOS moorings facilities, members of the user community, and AODN data scientists and managers. The group has identified a range of data products required by distinct user groups and use cases. While there are numerous possibilities for high-level products (e.g. mixed-layer depth), the group has been focusing on developing foundational aggregations of oceanographic parameters (e.g. temperature, salinity, currents) to serve broader use cases. The higher-level products will then be easier to build from these.

An initial year-long project was run in 2019-20 to design and implement these foundational products. The scope of the project was defined in an overall business case document, reviewed and accepted by the key stakeholders. For each individual product, the development process began with a more detailed, product-specific business case document, followed by an implementation plan. After the business case was accepted, the implementation plan, along with initial code and prototype files, were reviewed by a small team of technical experts from each regional moorings group. Where feasible, feedback from the review was implemented immediately. However, in order to keep the overall project on track, more significant changes were instead noted for future development. Finally, the first version of the product was created, published, and advertised to the user community.

This project delivered five products, addressing the initial challenges of combining many data sets from individual moored instruments, deployed at varying depths and using different sampling regimes. The products were built up in three levels:

1. Aggregating all the original single-instrument files from a mooring site, without modification;
2. Binning the aggregated time series into a common hourly time interval; and
3. Interpolating onto a site-specific set of depths (where there are enough measurements through the water column), resulting in a time-depth gridded product.

In order to simplify the initial code design, we split the input data into two categories: 1) "non-velocity" parameters, which are always single-point time series; and 2) water velocity observations, measured on most IMOS moorings using Acoustic Doppler Current Profilers (ADCPs), and thus inherently two-dimensional. In combination with the above levels, this results in a total of six possible products. However, the last of these (velocity gridded) did not fit into the scope of the initial project.

The five products have been published on the AODN THREDDS Catalogue (http://thredds.aodn.org.au/thredds/catalog/catalog.html). The hourly binned and gridded products are also available via the AODN Portal. The Python code to generate the products is open source (https://github.com/aodn/python-aodntools). All the products will be updated regularly to incorporate new data.

We present an overview of these products, demonstrate how they can be accessed and used, and describe plans for future work.
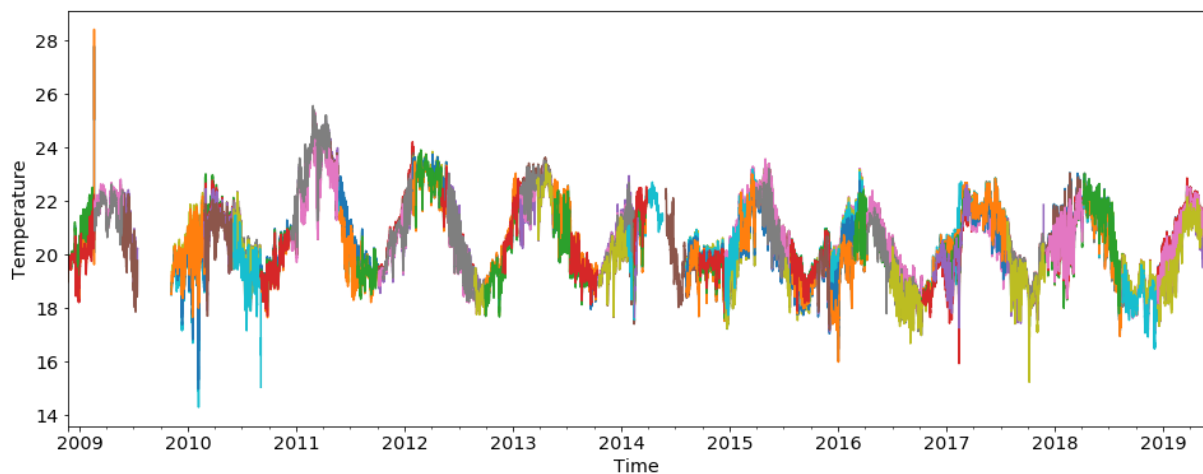

Figure 1: Aggregated time series of water temperature observations at Rottnest Island (Western Australia). Distinct colours indicate each ~4-month long deployment of an instrument, originally stored in a separate file. Up to 7 instruments are deployed simultaneously at various depths.