

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

Marty Hidas (AODN)

Eduardo Klein Salas, Guillaume Galibert, Sebastien Mancini (AODN)

Craig Steinberg, Simon Spagnol (AIMS)

Bernadette Sloyan, Peter Jansen, Miaoju Chen (CSIRO)

Michael Hemming (UNSW)

Ana Redondo Rodriguez (SARDI)



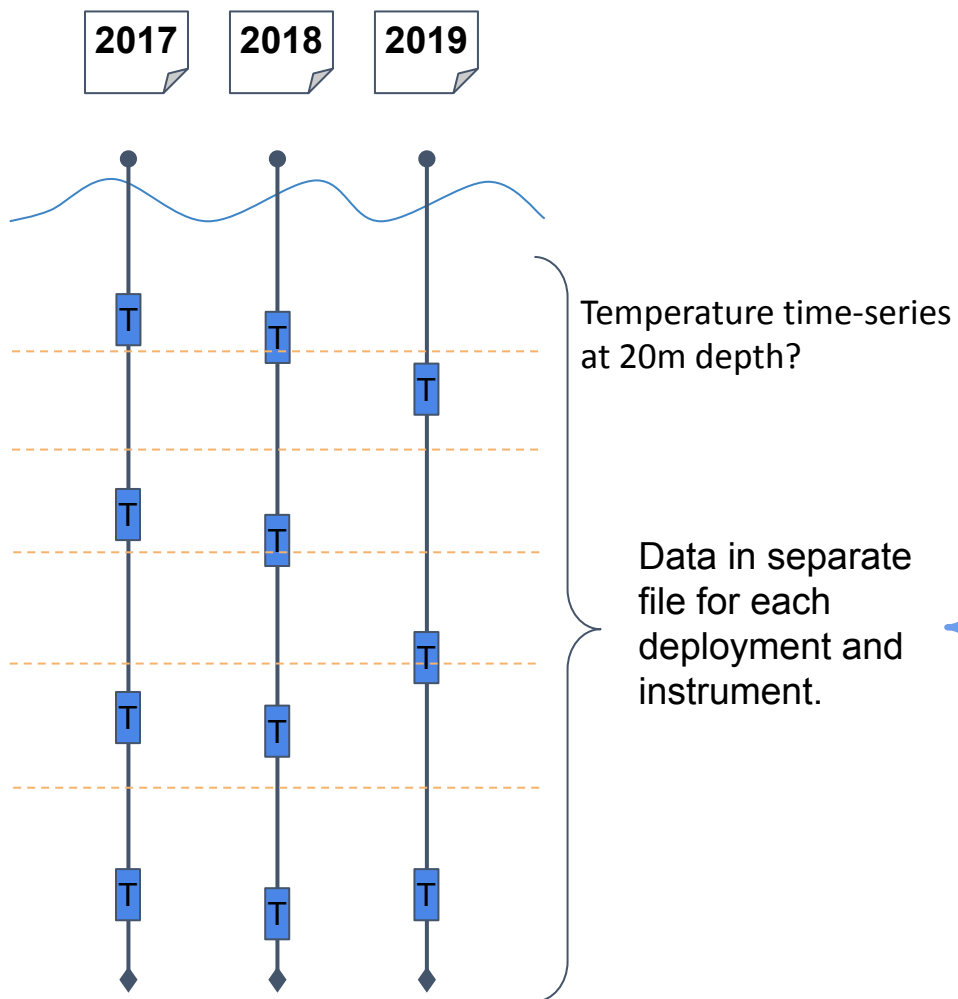
IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe and recognise their unique connection to land and sea. We pay our respects to Aboriginal and Torres Strait Islander peoples past, present and future.

Overview

- Why do we need new data products?
- The development process
- Products developed to date
- How to access
- Future development



Motivation: the trouble with moorings data



Barriers to data uptake and use

- Many files for one time series
- Instruments deployed to varying depths
- Instruments sample at different times
- Significant work and expert knowledge required to view and analyse time series
- Different user groups need different products (gridded density, MLD, data combined from multiple sources, plots, etc...)

Products created

Three levels of product:

1. Aggregate many files into one per site
2. Bin to common hourly time interval
3. Interpolate vertically to fixed depths

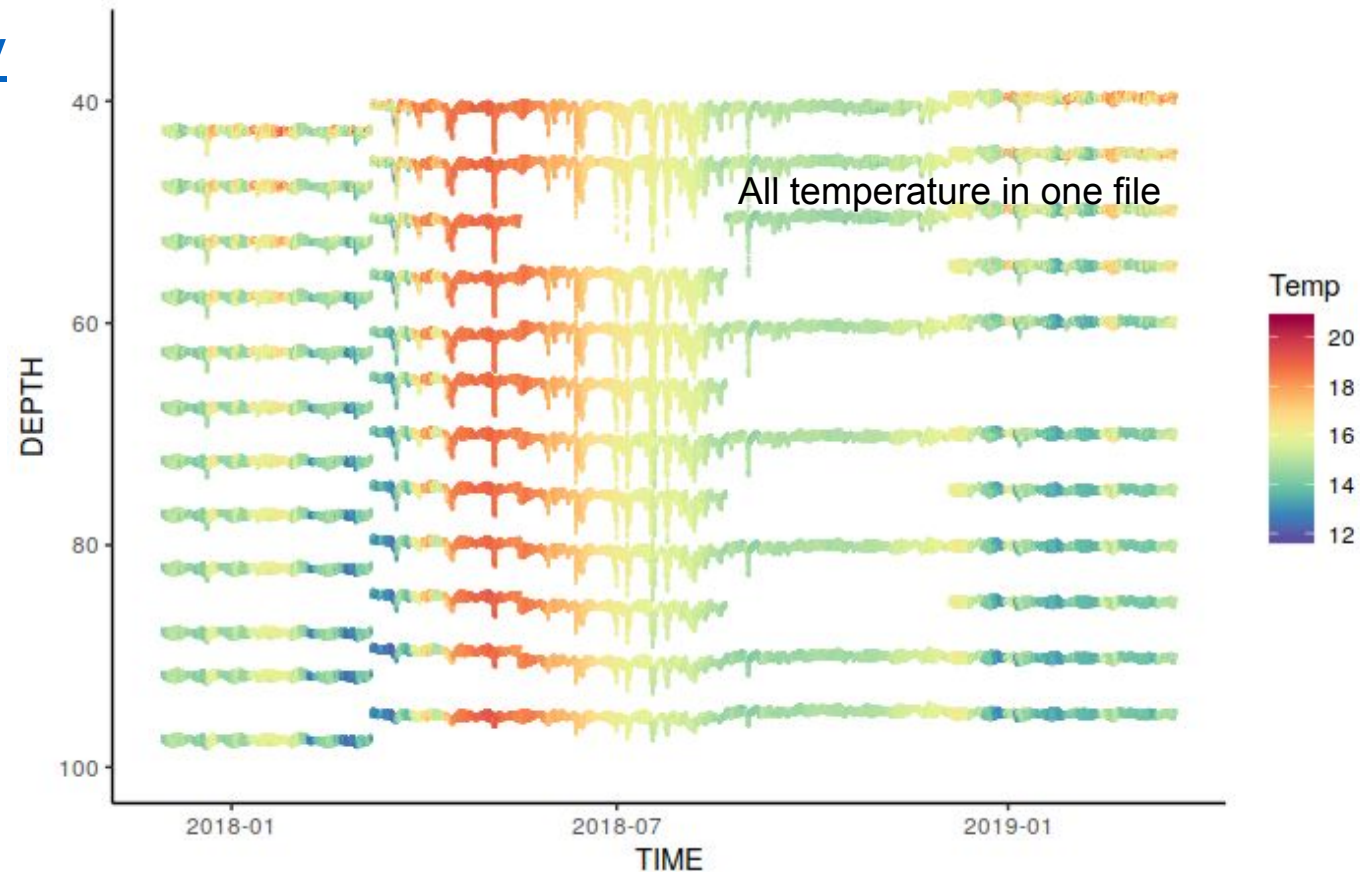
Inputs: Single instrument netCDF files, including quality control flags (auto QC)

Outputs: Aggregated netCDF file per site (and variable)

	Point time series (except current meters)	Profile time series for velocity (+ current meters)
Aggregated	✓	✓
Hourly	✓	✓
Gridded (time-depth)	✓	(TBD)...

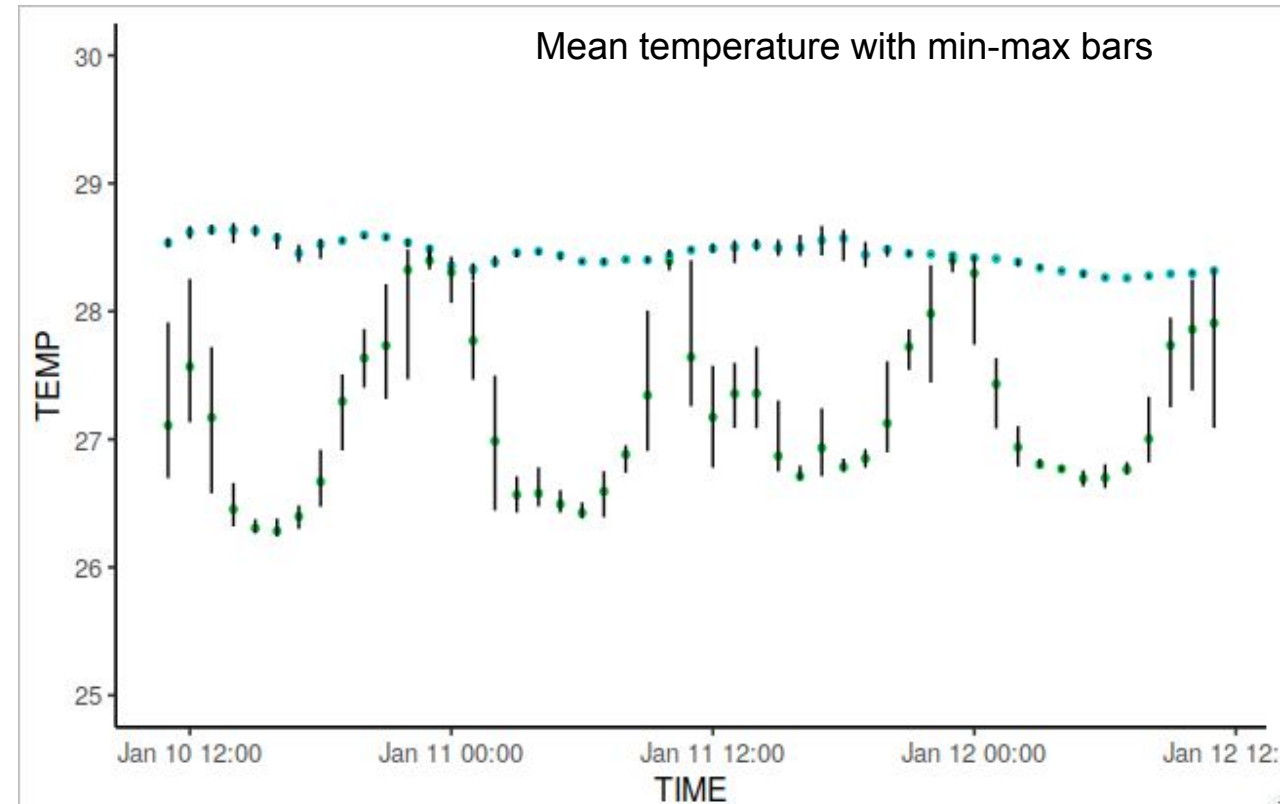
Aggregated time series

- All measurements of *one parameter at one site* in a single netCDF file
- + pressure, depth
- Includes *all original data* + QC flags
- Original measurements at full sampling rate => large files!
- For expert users
- File structure: [Indexed ragged array](#)
- Access: THREDDS server



Hourly time series

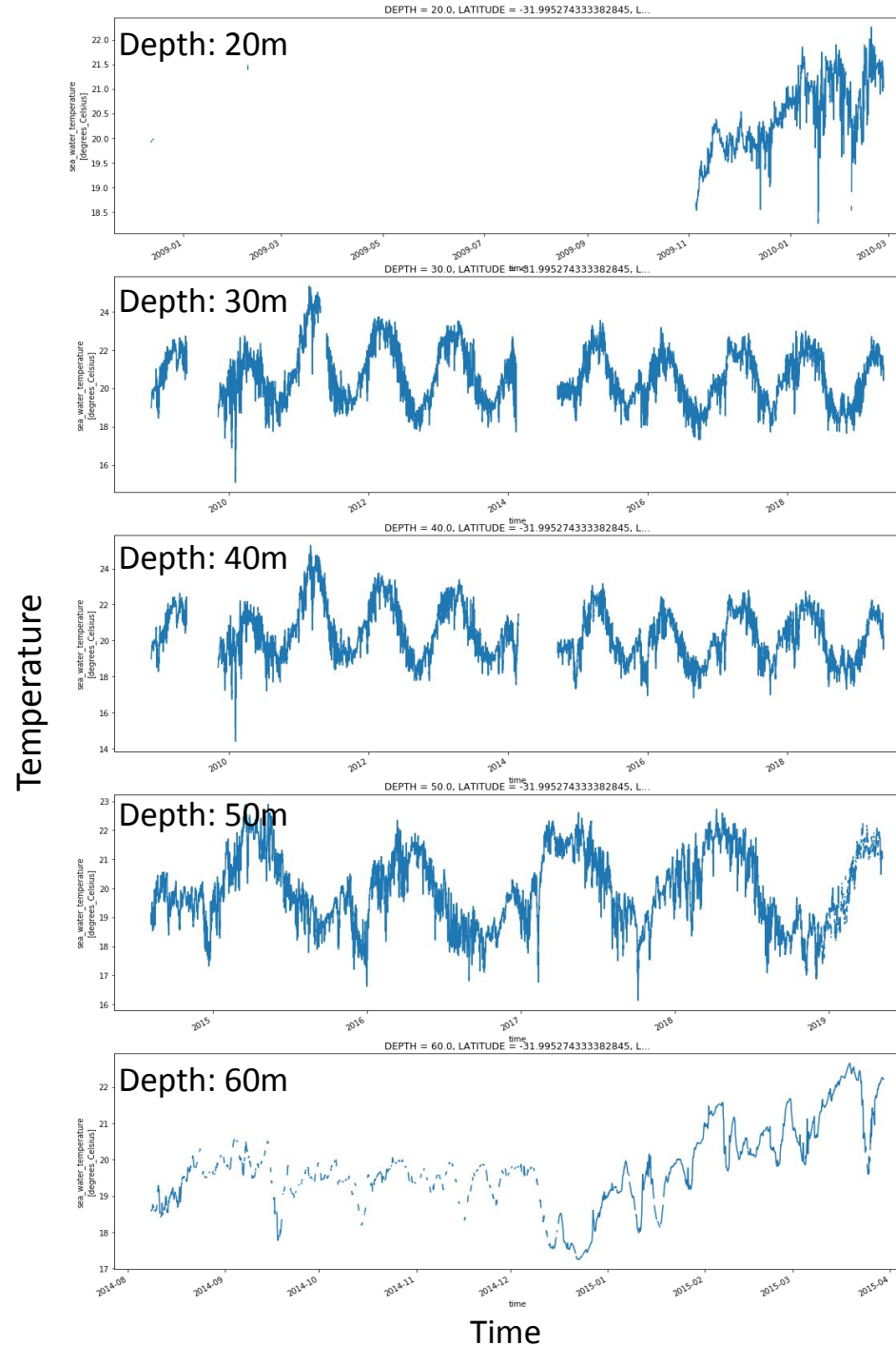
- *All parameters at one site* in two files (1 velocity, 1 everything else)
- Only “good” data (according to QC flags)
- Binned into 1-hour time intervals
- Stats on each bin (min/max, stddev, # obs)
- Smaller files, more user friendly
- File structure: [Indexed ragged array](#)
- Access: AODN Portal & THREDDS



Gridded time series

- Based on the hourly product
 - At each timestamp, interpolate vertically
 - Linear interpolation between adjacent measurements (if separation is $<$ preset limit)
 - Target depths and max separation configurable by site
- => Long time series at each predefined depth
(with some missing values)
- Only temperature (velocity TBD)
 - File structure: 2-dimensional time-depth grid
 - Access: AODN Portal & THREDDS

	TIME								
	0	1	2	3	4	5	6	7	
DEPTH	0								
	1								
	2		TEMPERATURE						
	3								
	4								



Accessing the products



<https://portal.aodn.org.au>

[IMOS - Moorings - Hourly time-series product](#)

[IMOS - Moorings - Gridded time-series product](#)

The screenshot shows the "Step 2: Create a Subset" interface. It includes a map of Australia with various mooring locations marked by red and blue triangles. On the left, there are input fields for "Spatial" coordinates (N: -12.39, W: 143.92, E: 149.72, S: -21.36) and a "Bounding Box" dropdown. Below that, a "Reset" button and a "Layer" dropdown menu are visible. The "Layer" dropdown is currently set to "IMOS - Moorings - Hourly time-series product". There are also "Subset", "Info", and "Layer" buttons, and a "Clear Subsets" link at the bottom.

AODN THREDDS server

- <https://thredds.aodn.org.au/thredds/catalog/IMOS/ANMN/catalog.html>
- Sub-folders for each site
 - “aggregated_timeseries”
 - “hourly_timeseries”
 - “gridded_timeseries”
- Remote access via OPeNDAP protocol

Catalog http://thredds.aodn.org.au/thredds/catalog/IMOS/ANMN/NRS/NRSROT/aggregated_timeseries

Dataset	Size
aggregated_timeseries	
IMOS_ANMN-NRS_BZ_20081120_NRSROT_FV01_CHLF-aggregated-timeseries_END-20170724_C-20200520.nc	62.19 Mbytes
IMOS_ANMN-NRS_BZ_20100603_NRSROT_FV01_CPHL-aggregated-timeseries_END-20200214_C-20200520.nc	153.6 Mbytes
IMOS_ANMN-NRS_OZ_20090220_NRSROT_FV01_DOX1-aggregated-timeseries_END-20190517_C-20200520.nc	47.81 Mbytes
IMOS_ANMN-NRS_OZ_20090220_NRSROT_FV01_DOX2-aggregated-timeseries_END-20200214_C-20200520.nc	49.62 Mbytes
IMOS_ANMN-NRS_OZ_20090220_NRSROT_FV01_DOXS-aggregated-timeseries_END-20191016_C-20200520.nc	53.39 Mbytes
IMOS_ANMN-NRS_SZ_20081120_NRSROT_FV01_PSal-aggregated-timeseries_END-20200214_C-20200520.nc	140.8 Mbytes
IMOS_ANMN-NRS_TZ_20081120_NRSROT_FV01_TEMP-aggregated-timeseries_END-20200214_C-20200520.nc	210.2 Mbytes
IMOS_ANMN-NRS_UZ_20081120_NRSROT_FV01_TURB-aggregated-timeseries_END-20190517_C-20200520.nc	203.1 Mbytes
IMOS_ANMN-NRS_UZ_20170325_NRSROT_FV01_TURBF-aggregated-timeseries_END-20190523_C-20190822.nc	4.447 Mbytes
IMOS_ANMN-NRS_VZ_20110725_NRSROT_FV01_velocity-aggregated-timeseries_END-20200214_C-20200528.nc	65.00 Mbytes

IMOS Thredds Server at IMOS see [info](#)
THREDDS Data Server [Version 4.42.16 - 2020-05-21T02:51:00+0000] [Documentation](#)

Current & future work

We are now integrating these five products into the AODN infrastructure

- Automating the process of (re-)generating the products to
 - Include new data
 - Apply changes made in the code
- Improving the metadata in the product files
- Open to feedback ([issue tracker](#))
- Future project?
 - Gridded velocity product
 - Aggregated products from CTD profiles, etc...

For more info...

- [News story](#) about the products
- Code & documentation on [GitHub](#)



Australia's Integrated Marine Observing System (IMOS) is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS). It is operated by a consortium of institutions as an unincorporated joint venture, with the University of Tasmania as Lead Agent. www.imos.org.au

PRINCIPAL PARTICIPANTS



(Lead Agent)



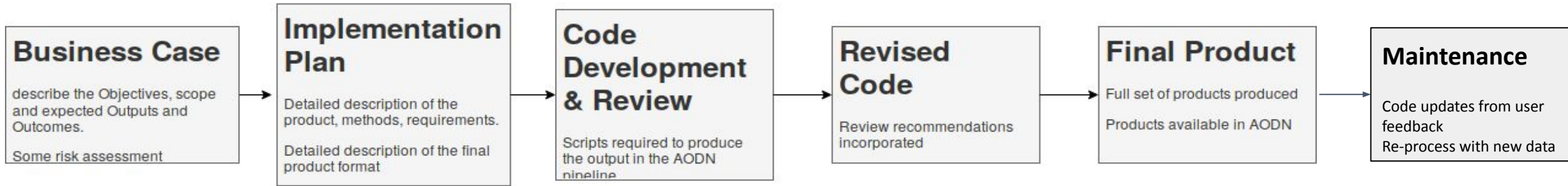
SIMS is a partnership involving four universities.

ASSOCIATE PARTICIPANTS



IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe and recognise their unique connection to land and sea. We pay our respects to Aboriginal and Torres Strait Islander peoples past, present and future.

The development process



Integrated Marine Observing System (IMOS) - National Moorings Network - Long Time Series Products (LTSP)

AGGREGATED TIME-SERIES (NON-VELOCITY)

Project Business Case

Version: 1.2 Date: 22-08-2019

IMOS - ANMN - LTSP AGGREGATED TIME SERIES (NON-VELOCITY) IMPLEMENTATION PLAN

Inputs

The aggregation function will accept a list of input files, and the name of the variable of interest (VoI).

The code will be able to aggregate variables and files that meet the following requirements:

- File contains data from only one deployment of one instrument;
- File is a delayed-mode, quality-controlled product (file version label "FV01");
- File is compliant with CF-1.6 and IMOS-1.4 conventions;
- File contains, at the minimum, the VoI, and variables TIME, LATITUDE, LONGITUDE, and either variable NOMINAL_DEPTH or global attribute instrument_nominal_depth;
- All files to be aggregated are from the same site, and have the same site_code attribute;
- Variables to be aggregated have TIME as their only dimension (or if LATITUDE and LONGITUDE are included as dimensions, they have size 1);
- Variables to be aggregated do not represent current velocity (these will be included in another product);
- The in-water data are bounded by the global attributes time_deployment_start and time_deployment_end.

Output

The output from a single run of the code will be an aggregated file of all available measurements of a single non-velocity variable at one mooring site.

Output Format

The product will be delivered, in netCDF4 format, compliant with the CF-1.6 and IMOS-1.4 conventions, and structured according to the [indexed ragged array representation](#). An example of the structure and metadata content is shown at the end of this document ([Sample structure of the aggregated product](#)).

Method

aodn / python-aodntools

Velocity aggregated time series product #92

Merged mhidias merged 41 commits into master from velocity_aggregated on 25 Feb

Conversation 110 Commits 41 Checks 0 Files changed 4

diodon commented on 3 Feb

This product flattens UCUR, VCUR, WCUR and reference the values to its TIME and absolute DEPTH. The values are aggregated from all deployments at one site in an indexed ragged array structure with OBSERVATION and INSTRUMENT as the sole dimensions

oceanhugo reviewed on 4 Feb

```
aodntools/timeseries_products/velocity_aggregated_timeseries.py
```

```
26 + with nc4.Dataset(file, 'r') as ds:
27 +     time_start.append(np.datetime64(ds.time_deployment_start))
28 +     tuples = sorted(zip(time_start, files_to_agg))
29 +     return [t[1] for t in tuples]
```

oceanhugo on 4 Feb Member

1. change files_to_agg to files or file_list or file_str_list -> there is no agg here and put the type intention.
2. Change file to filestr in the loop -> again type intention.
3. return [file for _, file in tuples] is clearer

diodon on 5 Feb Author Contributor changed



