

This document contains the final response to comments from both reviewers on the original manuscript entitled “**The OCEAN ICE mooring compilation: a standardised, pan-Antarctic database of ocean hydrography and current time series**”.

Reviewer’s comments are in **blue**, and our point-by-point responses are in **black**. The changes made in the manuscript is annotated in **red (line number in bold)**.

Reviewer #1:

General Comment.

In this paper Zhou et al. present a large dataset compiling available moored observations of temperature, salinity and current velocities around Antarctica since the 1970s. The dataset is impressive, including close to 500 different datasets, covering a range of key ocean environments across all longitudes around Antarctica. Given the crucial role of Antarctic Ocean and ice processes on climate, extensive re-use of the dataset by the research is warranted and may enable substantial advances in the field. I am sure the community will be very grateful to the authors for their great efforts to put the dataset together. Therefore, I strongly endorse publication of the dataset and associated manuscript in ESSD. However, I have identified a series of potential issues and areas for improvement in the current version of the manuscript and dataset. It would be great if the authors could address my comments and suggestions, or at least respond to them, before I accept the article for final publication.

We thank reviewer’s general comments on our manuscript. Our response to reviewer’s comments below is in black.

Specific Comments

My main concern about the dataset is that it is not very clear how the user would know how much trust they could place on each individual instrument, dataset. Where should the user refer to get information about if and how instruments (e.g. conductivity cells) were calibrated, how was the data treated between acquisition and publication, and about general data quality and flags (and/or whether instrument failure or drift are flagged). I also understand this is a complex task, and it may not be realistic to recover detailed data quality metadata from all deployments, but it would be great if the authors could talk about this a bit more in the manuscript, acknowledge this (important) limitation and say that users should refer to the original datasets, but also give an indication on whether the original files contain some more information.

We agree that this information is not explicitly presented in the published dataset. It is indeed a technically challenging task to harmonise the level of quality control of all the datasets that were acquired with different level of processing. Intercomparison of mooring timeseries has always suffered from a lack of consistency between mooring data types and processing. But hopefully our compilation provides a standardised

product to some degree. The source link provided in both the metadata spreadsheet and each NetCDF file can lead users to the original source of the data or the data owner to better assess the processing level of these data. **We rephrased and added text to describe the data quality, acknowledge the concern raised by reviewer and entice future users to consider those concerns at Line 162-166 in revised manuscript.**

On a different note, it is great that the authors put together such a massive dataset. However, as I was reading the paper and having a look at the data, I have developed the feeling that the dataset can be a bit daunting, from the users' perspective, due to its richness and diversity. I would suggest that the authors do some effort to further digest the dataset to give a clearer overview of it and make it more accessible. Some suggestions I could come up with are:

- In the manuscript, present one or multiple figures and/or tables with general statistics on the dataset: e.g. periods and seasons covered, record lengths, regions sampled, depths sampled, how many records with TS, velocities, both, etc. One good thing to report would be some statistics on the instrument vertical location with respect to local bottom depth / surface, since you mention there is a “bias” toward deep measurements

We thank the reviewer's for their request to add more general statistics and propose an improved overview the dataset. We included a new Figure 2 in the revised manuscript to illustrate the observing period in length and seasonal coverage, the fraction of each combination of variables measured by each mooring deployment, and the averaged instruments depth (normalized) to demonstrate our point about the ‘bottom-biased’ nature of instrument installation in Antarctic shelf seas. The new Figure 2 in the revised manuscript is also attached below.

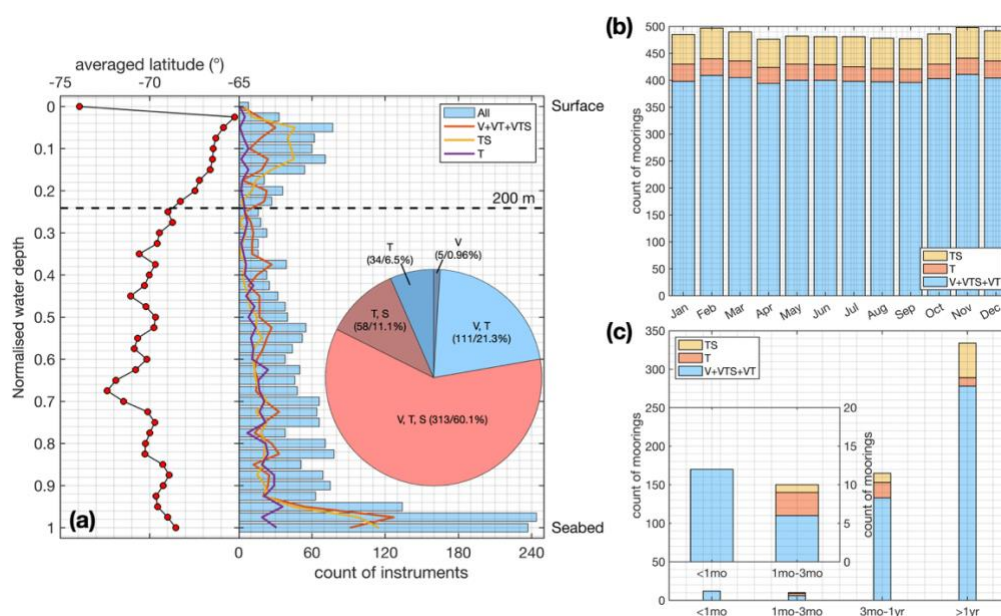


Figure 2 is added to the revised manuscript at **Line 150-155**. Text describing the mooring stats shown in Figure 2 and addressing reviewer's comments here is at **Line 143-149**.

- In the datafiles. For each of the deployment files, you could add an overview in the metadata about the mooring location (not only latitude and longitude, but name of region), types of instruments and sampling depths and period. A link to the original dataset within files themselves could be useful. In general, richer deployment-specific metadata within each netcdf would be great. I am aware that modifying the whole dataset at this point could be a massive task, so please take this only as a suggestion, I leave to the authors' judgement whether this is a sensible thing to do.

We really appreciate the reviewer's comments on including more metadata information. Although we believe that naming each mooring regions can be subjective – in some cases the naming of the region can be very specific/localized and in other cases it would have to be represented by the name of the broader area due to lack of locally recognized feature/name. We found that the longitude and latitude is the most consistent way of marking the mooring location.

- I wonder if the authors could share the code used to produce the figures for the preliminary analysis presented in the manuscript. That would give an example to users on how to bulk-access the data and generate some interesting insights from the ensemble of observations.

We believe that the code we used in producing figures and reading files are very basic MATLAB coding and should be easily replaced by other programming languages and can perhaps even be done better by more proficient MATLAB users. However, there is one fundamental piece of code we used for analysing tidal harmonics that needs a bit of instruction – the UTide toolbox. The UTide toolbox and its full instruction are available at <https://uk.mathworks.com/matlabcentral/fileexchange/46523-utide-unified-tidal-analysis-and-prediction-functions>.

In line comments

Line 98. Maybe provide an early indication of the size of the dataset: e.g. “This compilation includes 521 mooring time series [...]”

We thank reviewer's suggestion, but we feel that the mentioning of data quantity at the beginning of the following section makes a more coherent narrative overall. Considering

it is not too far earlier in the text; we decided to keep the original way of mentioning the data quantity.

Line 109. Could you include some general description of the SOOS mooring dataset and how many more records you are including in your database.

We found that this point is always a tricky one to phrase, but in short, SOOS map does not provide any links to the actual dataset (in data archiving world, this is called landing page), in other words, there are no landing pages behind all the moorings appearing on SOOS mooring map other than some very brief information about the mooring (i.e., name, country, deployment status). In our compilation, we have included all mooring data that we can gathered from colleagues in the author list, excluding those are still in the water or being analysed/QC'ed by individuals and groups. Therefore, in terms of 'how many more', it would be 521 timeseries (OCEAN ICE) versus 0 timeseries (SOOSmap). **We rephrased the text in the revised manuscript to make this point clearer at Line 113-116.**

Line 114. There is a typo here “,.”

Corrected in the revised manuscript at **Line 117**.

Figures 3-5. I felt the scatterplots may look better on log-colour scale, to highlight overall patterns rather than some particularly high values in some locations? Not sure... Also, I suggest annotating the maps with key locations mentioned in the text, e.g. on line 227 and others.

We thank the reviewer for their comments on colour scale. We agree that the logarithmic colour scale can highlight more detailed regional distribution, but these elevated small differences do not change the overall broad picture of the contrasting in non-tidal motion condition between cold and warm shelves, and the fact that tidal motion dominates the semi-diurnal, diurnal and fortnightly periodicities. Therefore, we decided to keep the linear colour scale in Figure 3-5, but we annotated all the first panel with locations as suggested. Here, and to assuage the reviewer's curiosity, we show the Figure 3-5 with logarithmic colour scale to demonstrate our point. **In the revised manuscripts we changed figures at Line 241, Line 273, Line 299.**

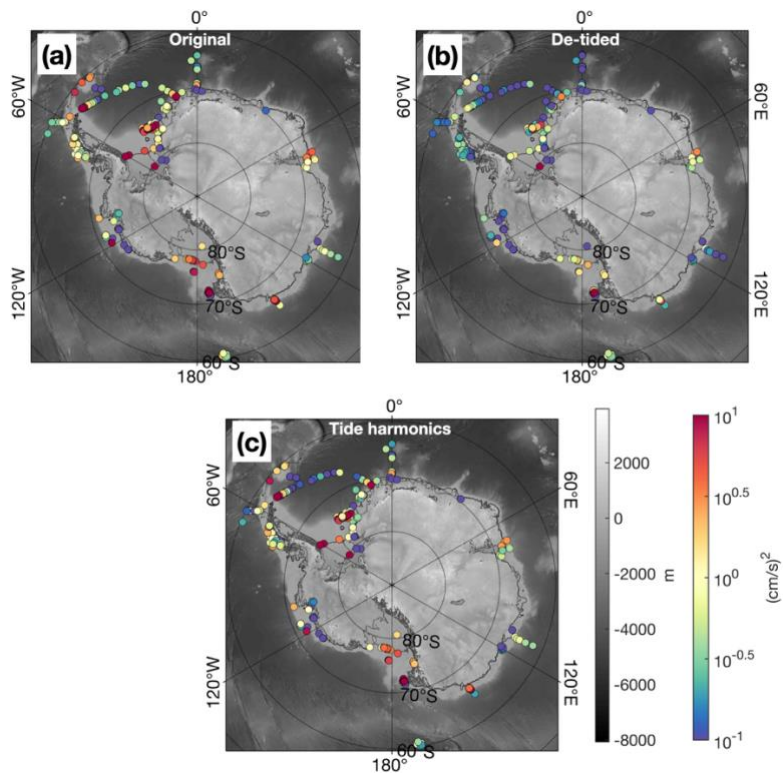


Figure 3

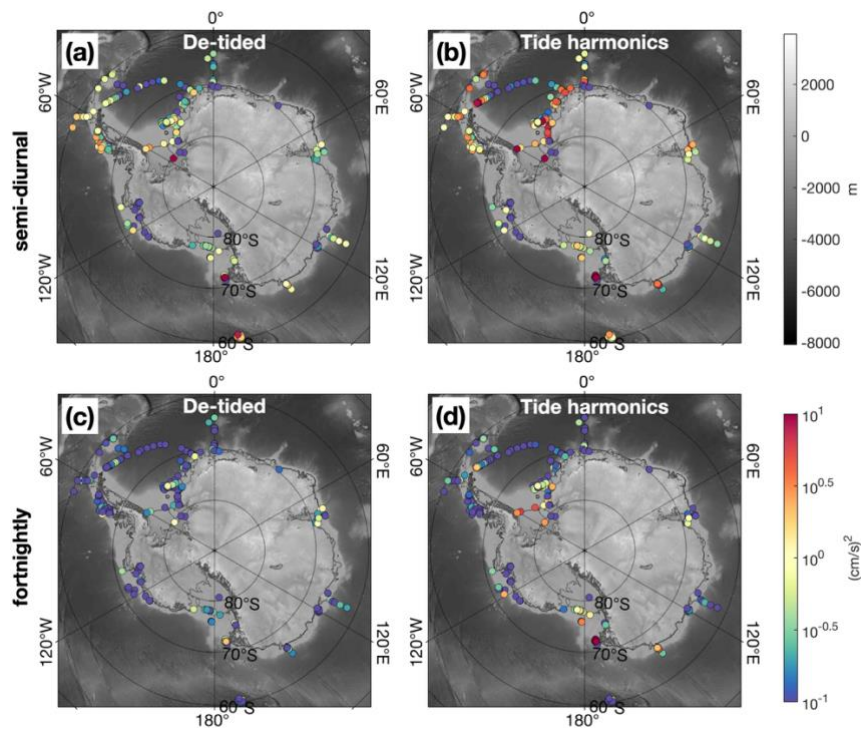


Figure 4

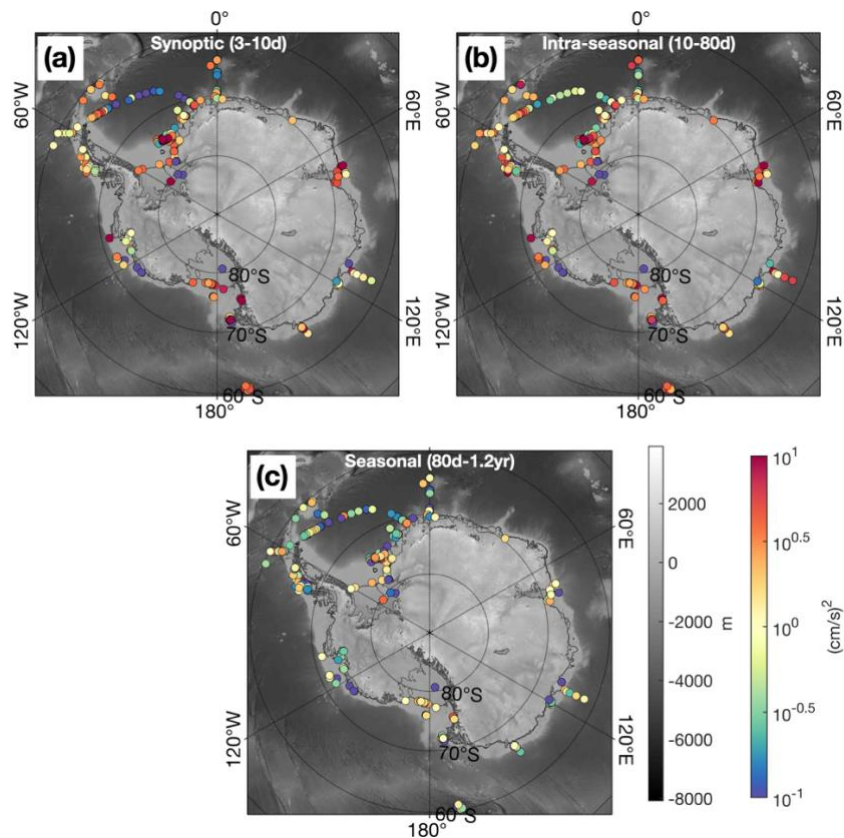


Figure 5

Lines 201-214, Lines 222-232. I think these paragraphs would benefit from more support from citations.

Line 201-214 are now supported with additional citations (**Line 259-260**). Line 222-232 is mainly our speculation, and we don't have direct supporting evidence from the existing literatures, in turn we propose that this speculation requires a more in-depth analysis and can be potentially a future research avenue, we added references relating to the different ice shelves here to support of our claim of cold/warm ice shelves (**Line 283-293**).

Line 212. "... mixing ..." Turbulence may be a more appropriate term here

Corrected in the original manuscript. (**Line 268**)

Figure 6. In the caption, can you add a bit more information about the different features presented in the TS plots here?

Additional information is added in the caption. (**Line 320-326**)

Reviewer #2:

Summary

This study presents the first standardized, pan-Antarctic compilation of moored hydrography and current time series, developed through a systematic analysis of historical mooring data from the marginal seas and contributions from international data centers, research institutes, and individual data providers. Spanning over five decades (1970s–2020s), the compilation enables detailed analysis of water mass transport and shelf connectivity across the Antarctic margin. The authors demonstrate the utility of the compilation through spectral analysis, removing dominant tidal signals via multi-linear regression. The detided records, though limited in duration, capture synoptic to seasonal variability, with regional patterns of kinetic energy offering insights for future study.

This dataset is a timely and valuable resource for research along the Antarctic margin, addressing an urgent need for sustained observations in the Southern Ocean. I appreciate the international effort by the group of observational scientists in assembling and standardizing this compilation. I have one major comment regarding Technical Quality, along with several minor comments detailed below. Overall, the manuscript is well written and provides a clear and well-structured contribution to the oceanographic community.

We thank reviewer's kind words on the manuscript, and we respond to the comments point-by-point below.

Technical Quality

While the compilation brings together an impressive range of historical mooring records, it remains unclear how the authors address uncertainty and error analysis across the dataset.

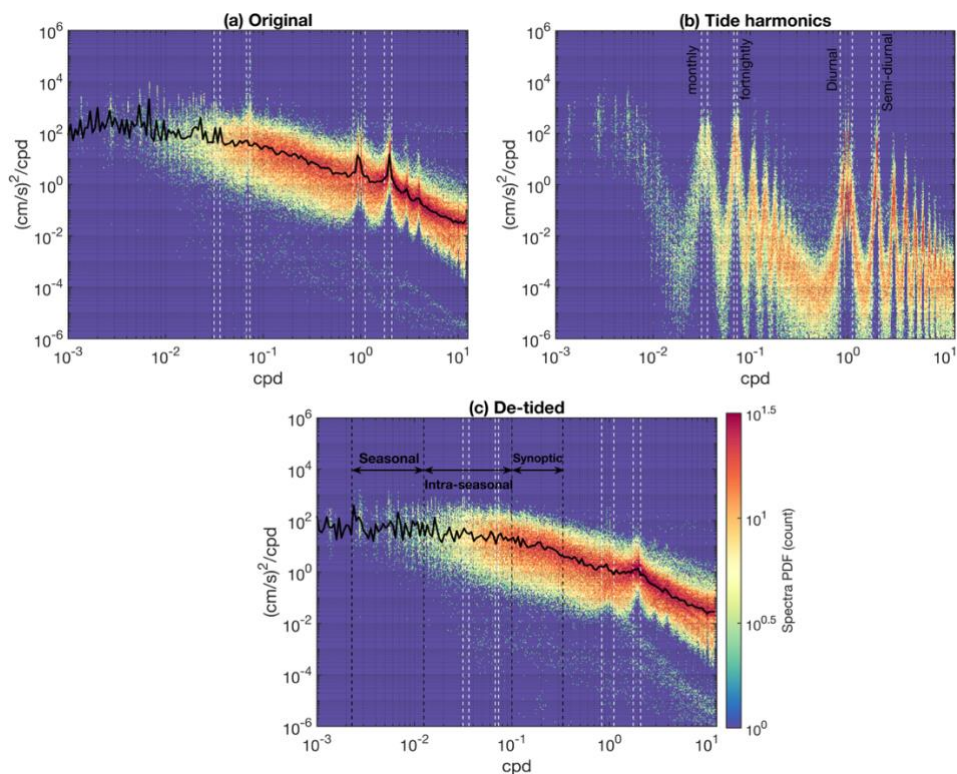
The manuscript notes that only minimal data cleaning was performed, with bad data identified by flags or unrealistic values replaced by NaNs, and no further interpolation or extrapolation applied. However, individual mooring datasets often include important quality control information, such as standard errors, instrument uncertainties, or confidence flags. A more detailed explanation of whether and how such uncertainty metrics were retained, harmonized, or reassessed would enhance the transparency of the compilation and support its appropriate scientific use, particularly given the analyses of detided variability presented in the study.

We appreciate the reviewer's comments on the data quality control harmonisation. Similar feedback is raised by Reviewer #1. We acknowledge that the standardisation that we applied on the mooring timeseries is minimal. And this is mainly because that the dataset we received generally lack specific QC flags and are often inconsistent in terms of data processing level. Mooring timeseries are unique types of dataset – data processing is often *ad hoc* and depending on individual/group. We therefore did not

attempt to harmonise the QC flag but only provide minimum manipulation on the dataset and meanwhile provide the original source links. We now further advise to determine on if further processing is needed depending on their needs. **Additional texts addressing reviewer's concerns are at Line 162-166 in the revised manuscript.**

Minor comments

- Figure 2: What causes the sharp drop in the black line at low frequencies in Figure 2a? Since this feature is not present in the detided spectra (Figure 2c), it may be related to tidal energy. A brief explanation would help clarify its origin. We agree that the dip of the black line was odd. There was an error in the code, and we corrected it. We corrected black line in figure 2 has no dip anymore. See revised version below. The revised figure is used in the revised manuscript at **Line 212.**

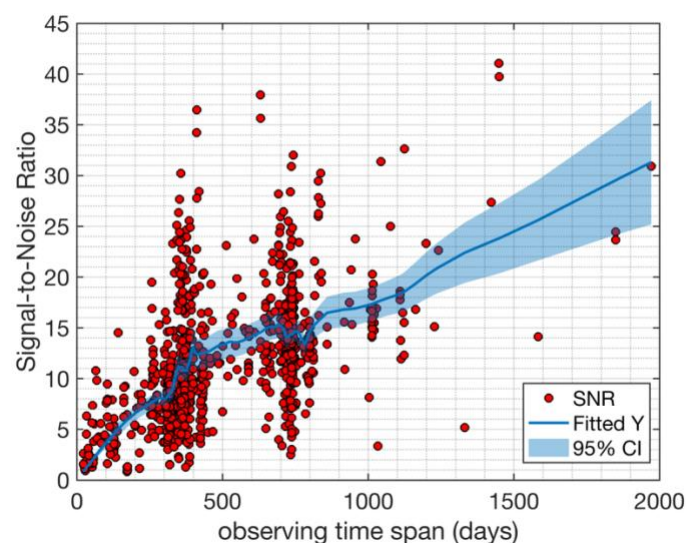


- Given the importance of the detided analysis, will the detided time series be made publicly available alongside the original data? We thank reviewer's comments on the de-tided timeseries. The implementation of UTide toolbox is straightforward, and there are a few user-defined options in the toolbox that can lead to slightly different results. We specify the user-defined parameters that we used in our study for reference in the revised manuscript, but we are reluctant to publish the de-tided timeseries that we generated as we believe that (1) users of these datasets should be entitled to generate their own version of de-tided timeseries and (2) this would unnecessarily increase the size of the dataset. We further acknowledge in the revised manuscript that the generated tidal

harmonics and de-tided timeseries are only used here for a first glance at the kinetic energy partition.

It would also be helpful to clarify the sensitivity of the UTide method to record length, particularly in the case of shorter mooring records.

This is a good point. Below we show the signal-to-noise ratio computed using UTide-estimated K1 magnitude divided by the UTide-estimate K1 uncertainty as a function of their timespan of each mooring timeseries. There is a natural/expected tendency for shorter records to bear smaller signal-to-noise ratio. Although the scatter plot tendency is skewed by the number of available moorings timeseries at different time span - most of the moorings have time span of 1-to-2 years which is the typical timescales of mooring turnaround. To account for the uneven data distribution over the time span axis, the fitted line considers the data density using a locally weighted linear regression method and the spread of the filled patch expands as less data become available at longer time span. The fitted line still shows an overall increase in signal-to-noise ratio with the observing time span, suggesting that the length of the record is a key factor in the robustness of estimated tidal signal using UTide toolbox.



- Lines 189 & 223: The authors define the seasonal band as spanning 80 days to 1.2 years. Would it be more appropriate to refer to this range as “seasonal-to-annual” to better reflect the upper bound?

We thank the reviewer’s suggestion on the choice of naming the timescales. It is now rephrased throughout the revised manuscript.

- I reviewed the dataset and the provided spreadsheet, which includes useful information such as mooring file names, locations, time ranges, and DOI links to the original data sources. To improve usability, I suggest adding a summary document with more detailed metadata, including instrument type, depth ranges, variable definitions and units, quality control flags, and processing

history for each record. This additional information would significantly enhance the dataset's clarity and completeness. I also recommend sharing the analysis code used in the study to further support understanding and facilitate broader use of the dataset.

We have now appended a new spreadsheet to the provided spreadsheet, which contains the instrument type, instrument depth, observed variables and observational period. See below the sample table from the additional spreadsheet. **The updated spreadsheet information is described in the Data availability session at Line 394-400.**

FileNames	Instrument	Velocity?	Temperature?	Salinity?	Measuring Depth	Start Date	End Date	Bottom Depth	Latitude
A.nc	Aanderaa_RCM5_01	no	yes	yes	175.1523493	724664.541	724693.9993	685	-77.207
A.nc	Aanderaa_RCM5_02	yes	yes	yes	353.6172251	724664.541	724997.791	685	-77.207
ADP1.nc	sbe37_01	no	yes	yes	786.067083	731646.8542	732004.0417	890	-71.981
ADP1.nc	sbe37_02	no	yes	yes	850.9389079	731646.8542	732004.0417	890	-71.981
ADP1.nc	sbe37_03	no	yes	yes	897.2067621	731646.8542	732004.0417	890	-71.981
ADP1.nc	Sontek_ADCP_C63	yes	yes	no	190.4785779	731646.875	732004.0417	890	-71.981
ADP2.nc	sbe37_01	no	yes	yes	511.7852621	732015.0208	732345.875	527	-72.066
ADP2.nc	sbe37_02	no	yes	yes	517.1765049	732015.0208	732345.875	527	-72.066
ADP2.nc	Sontek_ADCP_C180	yes	yes	no	499.799054	732015.0417	732221.1667	527	-72.066
AM01.nc	SBE37_1969	no	yes	yes	436.1832451	731231.7708	733780.2899	783	-69.44203
AM01.nc	SBE37_1970	no	yes	yes	574.8240797	731231.875	733414.5396	783	-69.44203
AM01.nc	SBE37_1971	no	yes	yes	734.1854552	731231.875	733355.9146	783	-69.44203
AM02.nc	SBE37_1174	no	yes	yes	762.3541379	730857.7917	733042.9987	790	-69.7133
AM02.nc	SBE37_1623	no	yes	yes	333.7359762	730857.7917	733042.9988	790	-69.7133
AM02.nc	SBE37_1624	no	yes	yes	555.5287787	730857.7917	733042.997	790	-69.7133
AM03.nc	SBE37_3883	no	yes	yes	1209.935669	732673	734494.9784	1254	-70.561
AM03.nc	SBE37_4054	no	yes	yes	860.5047205	732673	734494.9779	1254	-70.561
AM03.nc	SBE37_4055	no	yes	yes	652.7372946	732673	734494.9775	1254	-70.561
AM04.nc	SBE37_1972	no	yes	yes	535.109399	732688	734494.9792	931	-69.9
AM04.nc	SBE37_1973	no	yes	yes	674.6977769	732688	734494.9792	931	-69.9
AM04.nc	SBE37_1974	no	yes	yes	795.0922499	732688	734494.9792	931	-69.9

The unit and definition of the variables are available in each individual NetCDF file which we decided not to repeatedly include in the spreadsheet. The updated spreadsheet is now available at SEANOE. We also included a summary diagram Figure 2 in the revised manuscript to break down the measuring period, seasonal coverage and overall numbers of moorings for different type of measured variable combinations, and the abundance of instruments at different depth range. Concerning the reviewer's comments on sharing the analysing code used in this study, the scripts are mainly reading and extracting file information, which are not necessarily unique and can be easily replicated. The only code that is not generated by us and is more involved while important for producing the present results is the UTide toolbox that is publicly available at

<https://uk.mathworks.com/matlabcentral/fileexchange/46523-utide-unified-tidal-analysis-and-prediction-functions>.