Template for Annual SCOR Working Group Reports to SCOR

Summary:

Over the last 12 months, the ATOMIX working group has met as a full committee in December 2021 and again in June 2022, with subgroups meeting on a more regular basis in order to fulfil our terms of references. Notable advancements in the last 12 months include:

Production of an operational Wiki which includes flow charts for processing epsilon from shear probes, velocity profilers and velocity point measurements. Note that this wiki remains a work in progress as we test the benchmark datasets (see 4 below).

Achieved agreement on the format and key NetCDF variable names for the benchmark datasets that will serve the community by allowing them to test their algorithms and learn about common issues with processing turbulence data

Production of some of the benchmark datasets which are available on the wiki now.

Testing of the benchmark datasets by members of the working groups. Results of this ongoing exercise are guiding refinements in the best practice flow charts and NetCDF benchmark format, which result in modifications to the wiki.

COVID has impacted our ability to meet in person and also placed additional professional burdens on many working group members. Consequently, although the wiki and benchmark datasets are currently live, we have not yet made the big push to engage the community for independent benchmark dataset testing or feedback on the wiki. Nonetheless, we have made presentations on the efforts of ATOMIX with a poster the Asia Oceania Geoscience Society (AOGS) Meeting 2021, a Townhall discussion at AGU Ocean Sciences 2022, and the Gordon Research Conference on Ocean Mixing, 2022. We have also used these opportunities to advertise the mailing list for the ATOMIX newsletter. Planning has also begun for the capacity-building workshop we will host next summer, alongside the 2023 AOGS meeting.

1. Name of group

Analysing turbulence ocean mixing observations (ATOMIX) WG #160

2. Activities since previous report to SCOR (e.g., virtual or in-person meetings, email discussions, special sessions). Limit 1000 words

The working group is split into three subgroups with members overlapping across instrument types. The three subgroups focus on the three main techniques used to derive turbulence estimates, but some overlap exists. The working group now have less organizational items to discuss together, which enables the subgroups to meet more regularly and focus on fulfilling the terms of reference.

Since the last report, the working group met during a two-day virtual meeting centered around the UTC time zone in December 2021 and more recently a two-day hybrid meeting in June 2022 (Boston, USA). A special townhall session was also held during the Ocean Sciences meeting in February 2022, which was attended by 48 members of the ocean mixing community. The working group activities were further advertised during the Gordon Research Conference on Ocean Mixing in June 2022.

In between these larger meetings, the subgroups met together to finalize the benchmark dataset format in addition to discussing the results of algorithm testing. For example, the velocity-meters subgroup does monthly virtual check-ins on the members' progress with collating and testing the benchmark datasets. The two other subgroups meet about every two months.

Organizational decisions are being made through asynchronous discussions via a Microsoft TEAMS group. This platform is provided by Bangor's University, through Lenn's institutional affiliation. The platform enables polling, and sharing of articles and messages relevant to the group's activities. It also holds the working documents, and minutes from our meetings.

3. Documents published since previous report to SCOR (e.g., peer-reviewed journal articles, reports, Web pages) and should be limited to publications that resulted directly from WG activities and which acknowledge SCOR support

- Wiki is online and operational. It still needs some work once some of the best practices are finalized after testing the benchmarks.

Note that in the 2021 report we anticipated having this operational for community consultation by August 2021. Much of the content on processing flow charts was in place by that time, and we did alert the wider community to the presence of the wiki. However, before a really big publicity push on the wiki, we have taken some extra time to standardize the formatting of the wiki pages across the three sub-groups and also allowed for necessary discussions on essential variables (and variable names etc) for the benchmark datasets which are also presented in the wiki. COVID travel restrictions did thwart the efficient resolution of some of these issues as meeting in-person last December as planned was not possible.

- Poster at Gordon Research Conference on Ocean Mixing
- Presentation at Asia Oceania Geoscience Society in 2021
- Townhall at the Ocean Sciences meeting (American Geophysical Union)

4. Progress toward achieving group's terms of reference. List each term of reference separately and describe progress on each one. Limit 1000 words

Our proposal included four terms of reference (in *italics*):

1. *Develop best practices for acquiring and processing turbulence observations collected from conventional and emerging autonomous platforms, which measure velocity or velocity gradients.*

Each subgroup has listed key processing steps, and identifying potential misfit and quality-control criteria. The different subgroups are working at a different pace. The shear probe group has the most established set of data processing steps, although differences exist across users/groups that must be resolved. The other velocity subgroups have more variation in terms of how to execute the processing steps, but also differ more in the order in which the steps are applied to a dataset, or in whether to recommend a choice of methods for specific steps. These groups, in particular the point-velocity meters subgroup, are doing some targeted testing based on reviewing new papers in processing these data-streams from other fields of turbulence. These tests have resolved some open questions about the ordering of certain processing steps. The remaining "contentious" steps should be resolved in the next few months once the testing is complete. The best practices will then be detailed in a peer-reviewed Data descriptor article that will accompany the benchmark datasets. Each subgroup is expected to produce their own Data descriptor paper.

2. *Establish an open-access database of benchmark datasets collected in diverse ocean environments via different measurement techniques. These raw datasets will be accompanied by agreed-upon ``best'' processed epsilon estimates to enable validating data processing algorithms irrespective of programming language.*

The benchmark datasets have been collated and converted into NetCDF format. They are currently residing on a temporary repository as the working group work with them (and find errors in the format). Testing of the benchmarks is currently underway by the SCOR working group. We have convened on the expected accuracy so that we can evaluate whether two testers obtain the same results. All WG members with their own tools are testing one file at the moment to ascertain differences in the implementation of the best practices. Some changes to our best practices document may ensue depending on the results of this testing exercise. Some WG who do not have their own algorithms have been tasked with generating tools for issuing the comparative plots, which will eventually be deposited in a public code repository to accompany the Data descriptor papers.

3. *Develop quality control measures and guidelines for publishing and archiving turbulence quantities computed from velocity or velocity gradients.*

This item is still work in progress. We have identified misfit criteria for theoretical models applied to observations, in addition to listing techniques for deeming data unsuitable for deriving turbulence quantities. As we test the benchmarks, additional indicators are added to the test files for accessing data quality. The final guidelines that detail what should accompany turbulence estimates should be completed in the next year.

> 4. *Build capacity by creating a collaborative, living wiki-platform that consolidates knowledge on processing of turbulence observations, both from existing and future technologies, as they become available.*

We identified the wiki-platform and server in early 2021. The information will be stored as plain text files within [MediaWiki](#), a free and open-source software. The wiki is currently publicly hosted on a server at Fer's institution i.e., the University of Bergen (https://wiki.uib.no/atomix/index.php). The entire working group has read/write access. Some pages still need to be created. We are waiting to finalize the testing of benchmarks to complete these wiki pages.

At the last hybrid meeting (June 2022), the working group discussed the format of a short master class on turbulence data analysis to be held after the Asia Oceania Geoscience Society (AOGS) conference, which is being held mid-2023 in Singapore. We convened that a 2d workshop could be held after the conference depending on how much external funding can be obtained. The working group discussed the format of the workshop, and a list of possible tutorials (modules) is currently being drafted.

5. WG activities planned for the coming year. Limit 500 words

Next year's activities include preparing the Data descriptor papers for submission to Earth System Science Data (EGU Copernicus open-access journal). The intent is to document the best practices and explain how the benchmarks should be used for assessing turbulence analysis routines. Guidelines for suitable tolerance (errors) will also be provided in these articles.

Another core activity planned for next year is the preparation of online tutorials (modules) for processing turbulence observations. The modules will work directly with the benchmark datasets. In a first instance, we will convene which topics should require their own online module and identify possible funding sources for a dedicated workshop following the AOGS.

6. Is the group having difficulties expected in achieving terms of reference or meeting original time schedule? If so, why, and what is being done to address the difficulties Limit 200 words

Some challenges in testing files, largely related to getting the benchmark datasets organized in the correct format. Tutorial sessions were organized last Jan-Feb to help some members generate their files, while a subgroup elected to tentatively work in a format that they are most familiar with until the datasets are ready for submission with the data descriptor paper. Delays have occurred largely because of various closures during the Omicron wave of Covid-19 cases. A number of WG members were affected by the closures or being sick for extended time. We originally planned for the benchmarks to be accessible to the ocean mixing community at large before June 2022, but this aim is delayed until late 2022. Some subgroups are on track to finalize their internal tests by September, thus allowing for three months for external users from the community to test these datasets prior to submitting the datasets (as originally proposed) by January 2023 to an online repository. The British Oceanography Data Center have agreed to host these datasets and will provide DOIs for the benchmark data.

7. Any special comments or requests to SCOR. Limit 100 words.

None. Thank you for the zoom license!

Additional information can be submitted and will be included in the background book for the SCOR meeting at the discretion of the SCOR Executive Committee Reporter for the WG and the SCOR Secretariat.