WG 160- Analysing Turbulence Ocean MIXing observations (ATOMIX)

1. Brief summary with the main highlights (200-300 words)

Over the last 12 months, the ATOMIX working group has met virtually on a regular basis to fulfil our terms of references. Notable advancements in the last 12 months include:

1. Producing benchmark datasets which are available on the wiki.
2. 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 quality-control indicators and flags.
3. Drafting of best practices manuscripts to describe benchmarks and processing steps.
4. Brainstorming and collating existing materials for teaching core principles of processing turbulence analysis to develop capacity in estimating mixing.

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 has less organizational items to discuss, which enables the subgroups to meet more regularly and focus on fulfilling the terms of reference.

Since July 2023, the full working group has met once to discuss choice of journals for data descriptor papers, timeline for sharing benchmark datasets with the community at large and how best to incorporate their feedback into the outputs of the working group.

The three subgroups have met online much more frequently given the focus on testing the benchmarks and refining guidelines and quality-control indicators. For example, the point-velocity subgroup has met almost monthly (zoom), while the other two subgroups have met at least every other month. Separate online meetings (2x) have been held to discuss the capacity building activities across all three subgroups. We have elected to prepare online videos to teach certain aspects of turbulence data processing so that we can reach a wider audience than possible through a one-off workshop.

Other 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, 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

No new publications have been created since the last report, as these were planned for the last year of the working group activities. The wiki has been updated according to the discussions associated with benchmark testing. Three publications, one per subgroup, are currently being drafted to summarize the benchmarks and the best practices for processing turbulence observations. We also issued two newsletters to apprise the community of our current and future activities (see links below).

Links
- Newsletters Dec 2022: https://preview.mailerlite.com/x2m0f0r0u1
- Draft newsletter to be sent in Sept 2023 (awaiting more benchmarks): https://preview.mailerlite.com/h3j6d3o0j3
- Benchmark datasets temporary location until testing completed are linked on the wiki for each subgroup (e.g. https://wiki.app.uib.no/atomix/index.php?title=Tentative_benchmarks_for_shear_probes)

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.*

The three subgroups have progressed at different rates, but most have drafted their best practices now that benchmarks have been tested. Some of the subgroups have a few outstanding questions related to testing quality-control measures. None of the subgroups have yet incorporated feedback from the wider community.

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 that is accessible from the wiki. Testing of the benchmarks is currently underway by the SCOR working group, and complete for the shear probe subgroup. A few outstanding issues remain for the point-velocity subgroup (despiking and phase wrapping), which will likely require feedback from the wider community before converging to the final best practices.

All WG members with their own tools have tested the same benchmark to ascertain differences in the implementation of the best practices. Some changes to our best practices document have resulted from his testing exercise. Some WG members also tested the impact of executing certain processing steps differently on the final results. For example, the point-velocity members tested different

techniques for identifying the inertial subrange on synthetic datasets for which the result is known a priori. Some WG members who do not have their own algorithms have been tasked with generating tools for issuing the comparative plots and processing charts, which will be deposited in a public code repository to accompany the Data descriptor papers that are currently being drafted.Overall, each subgroups have a few benchmarks with agreed upon 'best-practices' epsilon estimates, but not all datasets are ready.

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

This item is almost complete. We have identified misfit criteria for theoretical models applied to observations, in addition to listing techniques for deeming data unsuitable for deriving turbulence quantities. Some of the subgroups have additional indicators to evaluate for the final epsilon estimates, namely there are some ongoing discussions about how the quality should be reported in the archived datasets.

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.*

The wiki is continuously being updated, but it was put on the backburner to focus on developing and testing the benchmark datasets since the results of this testing will ultimately influence the content of the wiki.

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

- Release benchmarks with our next newsletter in September 2023. The datasets of the shear probe subgroup are ready, but some outstanding questions remain for the quality-control flags to store in the archived benchmarks of the other subgroups.
- Submit the best practices publications, which are currently in draft form.
- Finalize the wiki, and best practices following the feedback from the community.
- Create more capacity building videos that will be uploaded to the Wiki and Youtube, a few videos have been collated/recorded from existing members' teaching material. The ADCP subgroup is in the final stages of producing their first video.

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

We continue to accumulate delays associated with COVID closures, reduced travel and availability of members (e.g., many have moved/changed jobs). To avoid burning out members, we have elected to focus on developing and testing the benchmarks as all other outputs depend on agreeing on the final epsilon estimates. The workload has been also adjusted such that some members are focusing more on the capacity building activities and wiki drafting rather than testing datasets. Our working group was approved in October 2020, and we expect to finalize our working group outputs by late 2024 depending on the amount of feedback received by the community.

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

We have not met in person at the AOGS meeting in Singapore since many members from Asia were not intending on attending the conference. A survey was used to query which conferences our members intended to attend in the next year. All members who voted (14) selected the Gordon conference, which is where we met in June 2022 for the only in-person meeting held by our working group so far.

Additional information can be submitted and may be posted at the SCOR Annual Meeting webpage at the discretion of the SCOR Executive Committee Reporter for the WG and the SCOR Secretariat.