

## Annual SCOR Working Group Reports to SCOR

### 1. Name of group

Analysing Turbulence Ocean MIXing observations (ATOMIX)

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

The current WG meets as a full committee virtually every two months for ~1.5h to discuss the dissemination of the group's activities via a newsletter, organization and lay-out of the wiki (e.g., how to capture peer-review comments), and more recently the benchmark datasets format. These meetings have focused on organizing the overall activities across the three subgroups: 'Shear probes' led by co-chair Fer, the 'Velocity profilers' led by co-chair Lenn, and the 'Point-velocity measurements' led by co-chair Bluteau. A rolling roster of three different set times is used to ensure 2/3 of the WG can attend owing to time zone differences. One of the three chairs leads each meeting, while detailed minutes are collected for members in incompatible time zones to comment/address after the meeting.

In addition to these full committee meetings, the three subgroups meet every 2 months as well for 1-2h to debate the processing steps for analyzing these unique data streams. We have fewer timezones to contend with in each subgroup, which allows for recurring time slots. The three subgroups focus on the three main techniques used to derive turbulence estimates, but some overlap exists. This overlap is identified by having some members work across multiple subgroups and by reading the working documents for best-practices. We now have fewer organizational items to discuss "in person", so we expect the full committee to meet less frequently to enable more time for the subgroups to meet and focus on fulfilling the WG's terms of reference.

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, <https://wiki.uib.no/atomix> which is still work in progress.

A conference abstract was submitted and accepted for the AOGS. This poster will advertise the WG's activities in the Asian-Oceania region as this is where we intend to do capacity building and training for our last planned WG meeting in 2023 (Singapore).

The ATOMIX mailing list is now open for new subscribers: <https://www.subscribepage.com/r7g7r6>

This mailing list is the main tool by which we intend to keep our wider community updated on our activities and solicit their future participation in the wiki. The first ATOMIX newsletter was distributed via this mailing list in February 2021.

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 begun listing 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. They have identified the main differences amongst the types of platforms, and also the similarities. For instance, the gliders are an emerging autonomous platform, and there exists different ways in deriving the speed past the sensor that can lead to erroneous estimates of mixing. 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. These groups, in particular the point-velocity meters subgroup, are reviewing new papers in processing these data-streams from other fields of turbulence (e.g., atmospheric fluxes) so they can determine additional testing for specific steps. For example, the river, coastal and ocean turbulence community rely on a specific routine developed in 1998 for de-spiking velocity measurements. Recent papers in 2018 have accessed other simpler methods, which were more robust and accurate, in determining spikes. All subgroups have working documents to detail the processing steps, so that those which need dedicated testing can be identified. The intention is to post a final version on the wiki in the next few months.

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 location of the database is currently being discussed within the WG. We want to be able to access the raw data soon, but also store the final agreed upon estimates that won't be final until late 2022. The subgroups have commenced detailing the desired characteristics of the datasets (e.g., low energy, brand/make of instrument) and their format. We have agreed to using the NetCDF format, in particular climate-compliant format whenever feasible. Turbulence observations do not currently have a standard naming of channels, so we are creating them. The NetCDF format will adhere to the format used by [OceanSites](#).

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

This item is work in progress. We have started identifying misfit criteria for theoretical models applied to observations, in addition to listing techniques for deeming data unsuitable for deriving turbulence

quantities. Another discussion item is the data channels that should be stored with final epsilon estimates, so that others can verify the quality if required. We have now opted in making the spectra (velocity and shear probes) and structure functions (velocity profilers) available, not just the final epsilon estimates. This term of reference will require the most amount of effort from the WG.

- 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. The advantages of using this platform are the discussion pages to critique page content, and the creation of forms (GUIs) to simplify entry of information. The wiki forms and templates have been created, and the group has reached a consensus on how information should be categorized for ease of searching information. We are now in the process of setting rules and general philosophy for the wiki such that specialized information can be found by the experts, while enabling newcomers to find information about concepts/theories on which the methods are based on.

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

The following activities are planned from mid-July 2021 to mid-June 2022. The group's main goal is to have the systems and datasets in place to begin testing of algorithms before the 1st WG meeting planned for December 2021 in Germany. This meeting will focus on discussing discrepancies amongst how key processing steps are carried out by different groups, and approve a work plan for testing key processing steps and quality control measures. Thus, we are currently identifying conventions for naming the data channels within benchmark data files (NetCDF format), and determining where to store the data for testing purposes. Another work item is providing access to routines for converting raw data from different manufacturers into NetCDF "ATOMIX" format. This will facilitate testing numerous datasets against individual's routines.

A list of key processing steps, that can be converted into a flow chart, will be completed before the end of 2021. These processing steps will be shared through the wiki and our current mailing list (~100 members) who have already registered when we were identifying WG members.

We plan to unveil the wiki by early August i.e., before the planned virtual presentation at the AOGS Asia Oceania Geosciences Society in August 2021. The wiki will describe how members of the ocean mixing community at large can contribute to the WG's goals (e.g., data storage and format). The type of contributions includes testing their own routines against benchmark datasets, or peer-review/editing of wiki content on how to execute various processing steps. WG members have begun uploading content, such as core concepts for processing turbulence data-streams and standard nomenclature.

In early 2022, members of the ocean mixing community at large will be invited to run their routines against the datasets before the 2<sup>nd</sup> WG meeting. This meeting is planned for June 2022 and coincides with the Gordon Ocean Mixing Conference in the USA. The intention is to debate the final epsilon

estimates, revise the algorithms and identify further testing of quality control measures such that the benchmark datasets can be deposited by the end of 2022.

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

None are anticipated at the moment. We have brought forward some tasks earlier i.e., having datasets available for testing before the end of 2021 instead of early 2022. The point-velocity subgroup is progressing more slowly on identifying key processing steps, which is explained by the time spent looking for additional associate members with the expertise and within the Asia/Oceania region. We expect this subgroup to catch up gradually.

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

We would like to request access to a small budget for virtual meeting resources given some full members from Australia and New Zealand for example are restricted from traveling in person until mid-2022 (e.g., <https://remo.co/conference-pricing/>).

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.