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Panel overview

The key roles for the Ocean Model Development Panel in CLIVAR and WCRP are to: (i) Collaborate with and to advise other CLIVAR panels and Research Foci Teams on issues related to ocean modelling; (ii) Coordinate activities aimed at addressing modelling needs (e.g., experimental protocols and analysis methods), especially to identify and address model biases (e.g., eastern boundary upwelling), improve ocean process representation and parameterizations, and (iii) address other issues impeding progress of CLIVAR core activities, research foci, and WCRP Grand Challenges.

This past year, the OMDP has been working on a number of fronts. 1) Continuing analysis of the OMIP simulations in various regions at high and low resolution, particularly Arctic simulations and simulations of mixed layer depth. 2) Writing review papers on the impacts of high-resolution ocean models on climate model fidelity. 3) Continuing work on comparison of parameterizations and numerics across ocean models. 4) Collaborating with WGNE on how to initialize coupled forecast systems. 5) Collaborating with the SWOT science team to prepare for the SWOT-Adopt-a-Crossover calibration and validation experiments, which will offer both high-frequency altimeter and in situ sampling that can be used to evaluate models.

Membership Update in 2021

Two members rotated off: Petteri Uotila (University of Helsinki, Finland), Yoshiki Komuro (Japan Agency for Marine-Earth Science Technology, Japan).

Two new members: Rym Msadek (CNRS, France), Sarah Nicholson (Council for Scientific and Industrial Research, South Africa)

The panel is highly interested in the applicants Shogo Urakawa (whose membership is critical to continue the tradition of collaboration with Japanese scientists, and whose application was solicited in conversation with both the SSG and former panelists Drs. Komuro and Tsujino) and Dr. Julie McClean (who brings gender diversity to the panel, is a US scientist, and has the qualifications and experience to be a potential future co-chair). Ideally, we would like to admit both of these members in January 2022 as Julien Le Sommer rotates off, but we understand that it is up to the SSG to make the choice between these candidates. It would be our plan to bring on whichever of these two candidates is the alternate as soon as possible to ensure the continuity of collaboration and future leadership of the panel.

Request for new members: At the end of this year (Dec. 2021), co-chair Julien Le Sommer will have reached the end of his term (including extensions). At the end of next year (Dec. 2022), co-

chair Baylor Fox-Kemper will have reached the end of his term (including extensions). Dr. Le Sommer requests a transfer from active member and co-chair status to emeritus status in January 2022. The Panel wholeheartedly approves this transfer, given the continuing work with Dr. Le Sommer on both the SWOT AdAC project and the high-resolution simulation comparisons that are ongoing. No replacement co-chair has yet been identified for Dr. Le Sommer, although conversations have begun with the present panelists.

Achievements for 2020-2021

- Workshops

OMDP-5.4 (February, 2021)

This brief virtual meeting planned for later more complete meetings.

OMDP-5.5 (May, 2021)

This virtual meeting followed on the success of earlier virtual panel meetings to have a wide-ranging science discussion and update, as well as greeting the new panelists.

<https://www.clivar.org/news/clivar-ocean-model-development-panel-successfully-organized-virtual-meeting-may>

Future Directions in High-resolution Ocean Modelling, Kiel, Germany (Oct. 2021)

<https://www.clivar.org/news/future-directions-basin-and-global-high-resolution-ocean-modelling-workshop-took-place-online>

OMDP-6 (Oct. 2021)

<https://www.clivar.org/news/sixth-session-ocean-model-development-panel-was-held-virtually>

Various smaller meetings in collaboration with WGNE and SWOT occurred during this period.

- Scientific results from activities

The virtual meetings were convened to check in on progress of ongoing collaborations and to plan the upcoming larger meetings. As Slack channels and email communication are used between meetings, it is really the discussion, brainstorming among panelists, and introductions to new panelists that are most valuable at these short meetings. These check-ins were valuable in these regards.

The Kiel workshop and panel meeting were the major activity for the year. These had originally been planned to be in person events in the tradition of previous OMDP-CLIVAR workshop-plus-panel-meeting events (e.g., Kiel, Exeter, Tallahassee, etc.). Unfortunately, after several delays in the hopes that the pandemic would ease, a virtual alternative was planned.

The Kiel workshop was partly a celebration of the retirement of Claus Boening, who was a founding co-chair of the WGOMD, which is OMDP's predecessor. Claus's career was feted and many of the talks featured links to Claus's research, such as high-resolution ocean modeling, North Atlantic variability, parameterization sensitivity, and multi-model intercomparisons. Many of the talks led directly into topics under study by the OMDP, and a few extensions into new directions, e.g., the use of an ABL instead of applied fixed surface fluxes to capture some aspects of coupled modeling in ocean-only simulations were valuable. Overall, the meeting was highly successful for both the OMDP panelists' edification and for dissemination of the work by OMDP panelists.

- Scientific capacity building and career support

The primary way in which the OMDP is engaged in capacity building and career support is through the recruitment of junior panelists. Many of the present panelists are at a junior career stage (recently promoted from postdoc positions) or from countries new to the OMDP (e.g., S. Africa). This strategy was actively sought out by the present co-chairs to diversify the panel by gender and geography, but has the side benefit of career support. The Kiel workshop featured many early career scientists as speakers, and all of them are potential future OMDP panelists. All OMDP-sponsored activities such as workshops emphasize early career support alongside invited speaker support. The OMDP is eager to participate in the Academy Lighthouse Activity, once the pandemic conditions allow it to fully begin.

- Knowledge exchange

Despite the pandemic, the panel has noted one new paper (<https://doi.org/10.1029/2020JC016886>) emanating from panel activities, and more are likely to be counted as the remainder of the year wanes. A few presentations at the Kiel meeting reported on panel business that was either in preparation or submitted that will be included in the panel work. Obviously, the talks and exchanges throughout the year also constitute panel knowledge exchange.

Plans for 2022 and beyond

Workshop: From filaments to climate change: recent advance and future challenges in finescale ocean dynamics

Articles published in 2020/21 as part of panel activities (if any)

The best way to track panel activities is through our Google Scholar page:
<https://scholar.google.com/citations?hl=en&user=AGbQMyoAAAAJ>

But the recent (2020-2021) publications are:

<https://doi.org/10.1029/2020JC016886>

<https://doi.org/10.1007/s40641-020-00164-w>

<https://doi.org/10.5194/gmd-13-4595-2020>

<https://doi.org/10.5194/gmd-13-3643-2020>

<https://doi.org/10.1016/j.ocemod.2019.101557>

<https://doi.org/10.1016/j.ocemod.2019.101503>

Significant contributions by the panelists to the IPCC AR6 (2021) are also noteworthy. Hewitt and Fox-Kemper were CLAs of Chapter 9 (Ocean, Cryosphere and Sea Level Change), and the panelists' and panel's works were also highly cited in the assessment report.

Budget and other needs for 2022 (in CHF)

Please keep in mind that the overall budget of CLIVAR is limited and this needs to be distributed between all activities and the SSG meeting.

In 2022, the panel is planning an international meeting co-convened with the SWOT science team, entitled "From filaments to climate". This meeting will be in hybrid format, with travel expenses only for early career scientists and invited speakers. The planned date is in late summer/early fall of 2022. The overall conference expenses for the 3 site meeting (USA, France, China) are likely to be in the range of \$75,000. The panel requests **\$10,000 from CLIVAR to support this effort**, or less if that amount is not available. Other support (from funding agencies, from USCLIVAR, from hosting institutions) will be sought as well.

Aim for a total length of ~2 pages, more is fine, but not necessary

Annex A

Proforma for CLIVAR Panel requests for SSG approval for meetings

Note: If your group has approved funds in 2021 that were not used because of Covid19 and other unexpected issues, and you propose to use them in 2022, they should be included again in this request, in addition to any new request.

1. **Panel name:** Ocean Model Development Panel
2. **Title of meeting or workshop:** From filaments to climate change: recent advance and future challenges in finescale ocean dynamics
3. **Proposed venue (Or indicate if online):** There will be two or more sites (one in the US and one in Europe, with an extra possible site in Asia/Australia)
4. **Proposed dates:** End of August (August 22-September 3)
5. **Proposed attendees, including likely number:**

The total number of participants is to be determined. The proposed attendees include invited keynote speakers, students, and early career scientists. Travel funds will be limited to these groups, all other participants will be encouraged to attend local meetings rather than travel internationally.

6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Strategic Plan and Lighthouse Activities, and any cross-panel/research foci links and interactions involved:**

This is a SWOT-AdAC and CLIVAR-OMDP initiative. This workshop will enhance the knowledge between CLIVAR and SWOT about high-resolution observations and modeling. The meeting is timed to best take advantage of the early days of the SWOT mission, where high-frequency sampling and in situ calibration experiments have the potential to provide high-quality data globally.

The Earth system has complex dynamics, characterized by feedbacks among biophysical processes occurring at a wide range of spatiotemporal scales. Disentangling these complex feedbacks is at the core of our capacity to predict climate change scenarios at high accuracy. This knowledge forms also the base for planning effective adaptation and mitigation strategies, as well as sustainable environmental policies, in particular over the decadal timescale.

Due to their size, the fine scales (i.e. mesoscale and smaller, spatial scales of 1–100 km) are not resolved in most Earth System Models and provide a major challenge for global observing systems. Nevertheless, they play a pivotal role in climate dynamics, by storing

and directing the flow of energy across the ocean scales, and by strongly modulating the ocean biogeochemical cycles as well as air-sea and ice-sea interactions.

The fine scales affect the distribution and behavior of marine biota, forming the skeleton of the open ocean seascape where major conservation programs are planned in the future under international initiatives like “Biodiversity Beyond National Jurisdiction” and “High Ambition Coalition”. Understanding these dynamics is also critically important in the early phase of marine pollution accidents, during which the fate of the pollutants is controlled by horizontal stirring.

This workshop aims at identifying recent advancements and future challenges in all these facets of fine scale ocean dynamics, bringing together scientists from different disciplines in oceanography – GFD, biophysical interactions, model parameterization, observational oceanography, climate modeling – and societal applications. This workshop appeals to all of the Lighthouse Activities in its scope.

Special emphasis will be given to the synergies between models and observations, with a focus on emerging inversion/assimilation techniques, Lagrangian methods, and on the opportunities opened by next-generation in situ and remote sensing finescale platforms, like the incoming SWOT satellite mission.

7. Specific objectives and key agenda items:

There will be five sessions:

- The energy cascade in Earth System Models
- Biodiversity and biogeochemistry in the global ocean
- Emerging finescale observing systems, inversion methods, data assimilation
- Air sea fluxes
- Societal applications: the role of finescale science in conservation and managing of the open ocean: contaminant dispersion (oil, plastic), fishery management, spatial planning of marine protected areas.

8. Anticipated outcomes (deliverables):

Two-page short article by each keynote speaker/discussion group for CLIVAR/USCLIVAR - Exchanges/Variations Joint Issue (not peer reviewed)

A review paper (peer reviewed) led all early career scientists who receive travel funding

9. Format:

The workshop will last 1 week (5 days). There will be two or more sites (one in the US and one in Europe, with an extra possible site in Asia/Australia), with parallel sessions, and each day a short summary session (1-2 hours maximum) in videoconference. We recommend intercontinental flights only for keynote speakers, students, and early career

postdocs. This recommendation (that should not be an obligation) is meant to sharply reduce the carbon footprint of the conference. The reduction in carbon footprint will be estimated quantitatively. This organization will be also effective in maintaining the workshop in case travel restriction due to Covid will be in place, by only canceling oversea trips.

10. Science Organizing Committee (if relevant)

Organizing Committee: F. d'Ovidio, Mara Freilich, B. Fox-Kemper

Scientific Committee: S.Swart, others

11. Proposed funding sources and anticipated funding requested from WCRP:

The total budget is 60-70 Euros for each site. We hope to apply for some funding from the UN Ocean Decade. In addition, we hope WCRP, CLIVAR, USCLIVAR, and funding agencies can allocate funding to support travel costs for some panel members and young researchers. We anticipate requesting ICPO support on logistics and advertising.