

Ocean Model Development Panel

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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: 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) New review papers on impacts of high-resolution ocean models on climate model fidelity. 3) Completed our cloud-based submesoscale-permitting model comparison paper. 4) Collaborating with WGNE on how to initialize coupled forecast systems. 5) Collaborating with the SWOT science team to carry out the FilaChange meeting planning for the SWOT-Adopt-a-Crossover and calibration and validation experiments. 6) Convened an EGU session on mixed layer depth science (to be repeated in 2023).

The current tasks

High-res and low-res OMIP2 comparison with focus on the Arctic Ocean and mixed layer depth.

JRA55 extension and climate-change ocean-only (prototype evaluated)

North atlantic current

Spin up OMIP and coupled forecasts (collaboration with WGNE & DAO)

SWOT-AdAC (Published cloud-based model comparison, established dataset, held meeting)

Membership Update in 2022

One co-chair be Emeritus: Julien Le Sommer (CNRS, France)

One new co-chair: Sarah Nicholson (Council for Scientific and Industrial Research, South Africa)

One new member: Shogo Urakawa (Meteorological Research Institute, Japan Meteorological Agency, Japan)

Membership renewal plan in 2023

Although some of the members haven't finished their second term or have just finished their first term, to better facilitate future continuity of the membership, the panel has worked with members to stagger between rotating off, extending one year, or extending two years. The specific proposal is: Alistair Croft becomes the co-chair, Baylor Fox-Kemper to become emeritus, Stephen Yeager rotating off, Laure Zanna rotating off, Arne Biastoch rotating off to become emeritus, Julie Deshayes to extend for one year, Dorotea Iovino to extend one year then become emerita, Qiang Wang extend for one year, Adele Morrison to extend for two years, Luke Van Roekel to extend for two years, Jing Zhao to extend for two years.

New member recommendations for immediate appointment: Scott Bachman for immediate appointment to replace Steve Yeager as NCAR contact, Diego Bruciaferri to reconnect to Hadley Centre and bring vertical coordinate and gridding expertise, Manita Chouksey to bring ICON and FESOM expertise back to the group, Julie McClean for her expertise in high-resolution forced ocean simulations and polar shelf work.

Alternate member recommendations: The other four candidates—Song, Samanta, Scilingo, and Behrens are all strong candidates we would like to keep on the prospective list for later appointments, but strategic and scientific needs recommend the list above have priority.

Achievements for 2021-2022

- Workshops

FilaChange, an international conference on ocean processes linking filaments and fine scales (1-100 km) with climate change, A SWOT-AdAC and CLIVAR-OMDP initiative, 29 August – 2 September 2022, PARIS, PROVIDENCE, QINGDAO, HOBART

- Scientific results from activities

There was a small business meeting after the Filachange workshop, discussing progress and membership plans. The panel summarised the main conclusions of the workshop, and touched on key issues such as: How big is the submesoscale? A series of calculations were done with both observations and 1-D models to estimate the scales of mixed-layer instabilities, symmetric instabilities and arrested fronts. These scales inform planned observations and modelling. Takaya Uchida led an OMDP paper which displayed the first multi-model ensemble of submesoscale-permitting models. Many talks on submesoscale physics and biophysics, and opportunities for both observations with SWOT and with analysis of in situ data at the crossover sites were presented and discussed.

- Scientific capacity building and career support

There were travel grants for Early Career Researchers for the FilaChange workshop (both from CLIVAR funding and other funding resources). The ECRs were a key part of the international meeting—they summarised each day's key talks and communicated these summaries through the 1-hour multi-site teleconferences.

The current OMDP co-chair Sarah is a ECS who will improve the capacity building in the future.

The panel is refreshed by recruiting young scientists, so that the ECRs have more opportunity to join in the CLIVAR activities. The use of emeriti memberships facilitates this emphasis on ECRs without losing continuity or focus on the longer term goals of the panel.

- Knowledge exchange

OMDP has long term communication with GSOP, DAO, WGNE. This year, OMDP organized the FilaChange workshop which is a SWOT-AdAC and CLIVAR-OMDP initiative, and has been endorsed by the UN Ocean Decade, which will enhance the knowledge exchange among those communities. All CLIVAR panels were invited to participate in the meeting, and some of the crossover sites involve CLIVAR scientists from other panels. A white paper from the meeting is in preparation.

In addition, OMDP members have become engaged with other WCRP activities. The OMIP for CMIP ocean diagnostics specification project successfully led by OMDP for CMIP6 (Griffies et al. 2016, Dutay et al. 2017) is planned to be repeated for CMIP7 (this was just discussed at the joint WCRP/WGNE meeting in Boulder). OMDP members (Fox-Kemper, Danabasoglu, Marsland) have been participants in the ESMO transition team. OMDP members have participated in some of the Lighthouse Activities, and as noted in preceding reports, most OMDP activities neatly align with the goals of the Lighthouse Activities. Finally, Helene Hewitt, OMDP emerita, will serve as the CMIP7 chair.

Plans for 2023 and beyond

In 2023, the OMDP plans to continue work on its ongoing projects: completing the mixed layer papers, water mass papers, coupled model forecast spinup papers, OMIP for CMIP7, and continued OMIP2 and SWOT-AdAC analyses. The OMDP plans a significant presence at the WCRP Open Science meeting, with the potential for an in person informal panel gathering.

No formal in person meetings are planned for 2023 and no funding is requested, as the FilaChange meeting just completed recently. Virtual meetings will be held on a regular basis during 2023 by both the whole panel and project teams.

Articles published in 2021/22 as part of panel activities (if any)

Fox-Kemper B, Johnson L, Qiao F. Ocean near-surface layers[M]//Ocean Mixing. Elsevier, 2022: 65-94.

Wang S, Wang Q, Wang M, et al. Arctic Ocean freshwater in CMIP6 coupled models[J]. Earth's Future, e2022EF002878. <http://dx.doi.org/10.1029/2022EF002878>

Biaostoch A, Schwarzkopf F U, Getzlaff K, et al. Regional imprints of changes in the Atlantic Meridional Overturning Circulation in the eddy-rich ocean model VIKING20X[J]. Ocean Science, 2021, 17(5): 1177-1211.

Drenkard E J, Stock C, Ross A C, et al. Next-generation regional ocean projections for living marine resource management in a changing climate[J]. ICES Journal of Marine Science, 2021, 78(6): 1969-1987.

Wang S, Wang Q, Shu Q, et al. Nonmonotonic change of the Arctic Ocean freshwater storage capability in a warming climate[J]. Geophysical Research Letters, 2021, 48(10): e2020GL090951.

Tebaldi C, Debeire K, Eyring V, et al. Climate model projections from the scenario model intercomparison project (ScenarioMIP) of CMIP6[J]. *Earth System Dynamics*, 2021, 12(1): 253-293.

Uchida, T., Le Sommer, J., Stern, C., Abernathy, R. P., Holdgraf, C., Albert, A., Brodeau, L., Chassignet, E. P., Xu, X., Gula, J., Roullet, G., Koldunov, N., Danilov, S., Wang, Q., Menemenlis, D., Bricaud, C., Arbic, B. K., Shriver, J. F., Qiao, F., Xiao, B., Biastoch, A., Schubert, R., Fox-Kemper, B., Dewar, W. K., and Wallcraft, A.: Cloud-based framework for inter-comparing submesoscale-permitting realistic ocean models, *Geosci. Model Dev.*, 15, 5829–5856, <https://doi.org/10.5194/gmd-15-5829-2022>, 2022

Wang Q. Stronger variability in the Arctic Ocean induced by sea ice decline in a warming climate: Freshwater storage, dynamic sea level and surface circulation[J]. *Journal of Geophysical Research: Oceans*, 2021, 126(3): e2020JC016886.

Durgadoo J V, Biastoch A, New A L, et al. Strategies for simulating the drift of marine debris[J]. *Journal of operational Oceanography*, 2021, 14(1): 1-12.

Couldrey M P, Gregory J M, Boeira Dias F, et al. What causes the spread of model projections of ocean dynamic sea-level change in response to greenhouse gas forcing?[J]. *Climate Dynamics*, 2021, 56(1): 155-187.

Feedback to SSG's comments during SSG-27

Panel co-chairs should continue to build connections with other panels/LHAs/partner projects where strong links exist, or where stronger connections would be beneficial. Panels are encouraged to develop specific actions (e.g., joint activities, workshops) to build on these connections.

- Within WCRP, OMDP has regular discussions with DAO and WGNE, and has built connections with ESMO. The co-chairs have invited the GSOP co-chairs to join in the OMDP/DAO/WGNE discussion. The ongoing meetings with other panels and activities are quite regular, nearly one per month in 2022.

Outside WCRP, OMDP initiated the FilaChange 2022 conference, a *SWOT-AdAC and CLIVAR-OMDP initiative*. This meeting convened four sites—Providence, Paris, Hobart, and Qingdao—with daily exchanges led by early career participants. A white paper of outcomes is forthcoming, which will detail scientific outcomes and an estimate of carbon emissions avoided by this hybrid international format.

Panel should devise specific plans for capacity building, by involving early career scientists (ECS) and researchers from the Global South.

The new co-chair, Sarah Nicholson is the first female co-chair of OMDP and she is also an ECS from the Global South, who can help to recruit the global south members in the future. The multi-site format of the OMDP-SWOT workshop gave opportunities to ECS to engage in and lead those convened sessions, and many participants from outside of Europe and North America attended. The inter-site communication was focused on the ECR's interests and experiences, and this offered new insights into the same topics that were originally planned for SWOT and the accompanying in situ experiments. Third, OMDP continues the efforts to diversify the panel through early- and mid-career panelists (e.g., Bachman, Bruciaferri, Chouksey). The idea of 4 hubs with travel funding for ECRs prioritized proved excellent for the capability and recognition building of the ECSs.

Panel co-chairs should communicate their capacity-building activities to the WCRP Academy (if there is).

This is planned for all future activities.

Panel co-chairs are encouraged to develop ideas/proposals for cross-panel interactions and communicate them to the ICPO.

There are many ongoing cross-projects, as mentioned above.

The SSG and panels will look at all the proposed activities and identify appropriate ones to seek the endorsement of the UN Ocean Decade.

The FilaChange workshop has been endorsed as an Ocean Decade Activity.

In addition to reporting capacity building activities within your own panel, sharing information with other panels on your successful activities for capability building will be valuable. CLIVAR *Exchanges* can be used as a venue to communicate best practices.

- Yes. The workshop on Sources and Sinks of Ocean Mesoscale Eddy Energy gave us a good experience after when we organized a special of CLIVAR *Exchanges*/US CLIVAR Variations. We will continue to do this when convenient. The FilaChange meeting did not coordinate a special issue, but plans a white paper presently in preparation.

The SSG is delighted to see that virtual meetings were able to be held.

- Thank you. This format is becoming a regular basis for our work.

The SSG commends the appointment of a female co-chair from the Global South, noting that care is needed not to always identify the same people serving in different groups, as not to overburden them by community work, or to negatively affect their career advancement.

- We will seek to avoid this, ensuring that there are always two effective co-chairs at all times.

The SSG regards the “four-nodes” workshop as a good idea, avoiding international travel while at the same time still allowing face-to-face interactions. Please report to the SSG the experience and lessons gained after the workshop.

- Our initial impression was that the meeting at each node was highly successful, with slightly different emphases based on local projects and participants. The virtual exchanges were entertaining and informative, but there were significant pressures on timing of these exchanges and some connection issues. Despite our best efforts, some countries’ COVID policies still affected the meeting plans (reduced the number of meeting days, leading to long days when allowed). Carbon footprint calculations have not been completed yet, but it is sure to be less than if all participants gathered in one place.

The SSG suggests that the panel increases interaction with other panels by inviting representatives of relevant panels to join particular OMDP discussion/activities. For example, invite GSOP to the SWOT discussion, invite ARP people when working on analysis of the model bias of the Atlantic.

- We did invite participants from the other panels as directed. We will continue to do so in the coming year.

The SSG encourages interaction with GSOP to see if they would be interested in joining with the discussion among OMDP, DAO and WGNE.

- We will seek GSOP participation in the next joint meeting.

Budget and other needs for 2023 (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.

Given the generous CLIVAR funding of the FilaChange meeting, we do not anticipate funding needed in 2023.

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 2022 that were not used because of Covid19 and other unexpected issues, and you propose to use them in 2023, they should be included again in this request, in addition to any new request.

- 1. Panel name:**
- 2. Title of meeting or workshop:**
- 3. Proposed venue (Or indicate if online):**
- 4. Proposed dates:**
- 5. Proposed attendees, including likely number:**
- 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:**
- 7. Specific objectives and key agenda items:**
- 8. Anticipated outcomes (deliverables):**
- 9. Format:**
- 10. Science Organizing Committee (if relevant)**
- 11. Local Organizing Committee (if relevant)**
- 12. Proposed funding sources and anticipated funding requested from WCRP:**