

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.

Membership Update

Simona Masina (CMCC, USA) was rotated off with no replacement since there was no qualified nominee. Petteri Uotila (FMI Finland) and Yoshiki Komuro (JAMSTEC Japan) renewed their membership for another 2-year term (to the end of 2020). A number of recruits and nominations are to be presented to the next meeting of the SSG to prepare for the rotating off of 7 members of the present panel.

Achievements for 2018-19

Workshops and Meetings

- A lunch meeting at the 2018 AGU Ocean Sciences meeting was held to facilitate planning for JRA55-do simulations and the Tallahassee meeting.
- 2018 Pre-AGU Workshop on Greenland Freshwater Fluxes (Baylor Fox-Kemper is on the steering committee). The workshop gathered to develop mutual appreciation of the challenges, identify individual and cross-community needs, highlight potential approaches for improvement, and build cross-community efforts. The workshop report was published in October.
- 2019 OMDP-5/USCLIVAR joint Workshop on Sources and Sinks of Ocean Mesoscale Eddy Energy in March, 2019 at Florida State University, Tallahassee, Florida. The workshop report was published in October (<https://indd.adobe.com/view/a91bedf3-00a2-4ea1-86a9-d79953a89295>).

Scientific results from activities

- A report has been published on the achievements of the 2018 pre-AGU workshop.
- At the Tallahassee panel meeting and workshop, the progress on JRA55-do forced modeling, contributions to the IPCC AR6, high resolution modeling, progress in

numerics, parameterizations, and coupled simulations for CMIP6 were discussed. Main achievements from this are:

- Published a joint CLIVAR and US CLIVAR workshop report; a joint CLIVAR and US CLIVAR Variations/Exchanges special issue will be published in January, 2020.
- Outline of OMIP-1 (CORE) – OMIP-2 (JRA55-do) comparison paper was prepared by Hiroyuki Tsujino on behalf of OMDP. For the implementation, a protocol has been drafted and sent out to the ocean community together with the outline. So far 11 models have contributed data to the comparison. The paper will be submitted by Dec. 31, 2019 so as to be includable in AR6.
- Outline of OMIP-2 high-resolution vs. low-resolution model comparison has been prepared by Eric Chassignet on behalf of OMDP. The protocol has been sent to potential participants. So far, 4 modeling centers have uploaded data. The paper will be submitted by Dec. 31, 2019 so as to be includable in AR6.
- One additional publication (Indian Ocean by Rahaman et al.,) has been accepted for publication in the Virtual Special Issue of Ocean Modelling devoted to CORE-II which can be found at:
<http://www.sciencedirect.com/science/journal/14635003/vsi/10PSR6J3BV4>

Scientific capacity building and career support

The co-chairs have aggressively pursued nominations for consideration by the SSG. The emphasis on early-career, gender and geographic representation, and disciplinary scope has been much higher than in the recent few years during the co-chair transitions. As 7 panelists are scheduled to rotate off this year, this effort was required to maintain the health of the panel. As is the OMDP practice, to maintain expertise to continue ongoing projects (OMIP and JRA55-do simulations) continue, as well as maintaining some of the past efforts (high-resolution, coupling issues, and coastal modeling), a number of requests for panellists to join as emeritus members are being made. These emeriti frequently participate in email exchanges, act to guide the direction of the panel, participate in peer-reviewed publications, and advise the co-chairs, and they are not granted any travel support for meetings. Furthermore, significant gains in gender and geographic diversity without loss of expertise is facilitated by transitioning presently active members to emeritus status rather than requesting subsequent panellist terms.

Plans for 2020 and beyond

- The OMDP panelists who will be at the AGU Ocean Sciences meeting would like to schedule an informal lunch meeting there. OMDP co-chairs will coordinate.
- The next OMDP meeting will probably be in 3rd quarter 2020 at GEOMAR, Kiel, Germany. This meeting has been arranged by Arne Biastoch (a nominee to join the

OMDP) and includes a retirement celebration of Claus Boening (a founding member of OMWG/WGOMD).

- The Climate Process Team (CPT) meeting has just been held in New York City, at New York University. Many of the OMDP panelists are participating in this new project and were present at this meeting. Discussions about synergies between upcoming OMDP and CPT meetings were had.

Articles published in 2018/19 as part of panel activities (if any)

A Google Scholar page has been created for the panel, which includes all panel-related, peer-reviewed publications. (<https://scholar.google.com/citations?user=AGbQMyoAAAAJ>)

- Fox-Kemper B, Adcroft A, Böning CW, Chassignet EP, Curchitser E, Danabasoglu G, Eden C, England MH, Gerdes R, Greatbatch RJ, Griffies SM, Hallberg RW, Hanert E, Heimbach P, Hewitt HT, Hill CN, Komuro Y, Legg S, Le Sommer J, Masina S, Marsland SJ, Penny SG, Qiao F, Ringler TD, Treguier AM, Tsujino H, Uotila P and Yeager SG (2019) Challenges and Prospects in Ocean Circulation Models. *Front. Mar. Sci.* 6:65. doi: 10.3389/fmars.2019.00065
- Stammer D, Bracco A, AchutaRao K, Beal L, Bindoff NL, Braconnot P, Cai W, Chen D, Collins M, Danabasoglu G, Dewitte B, Farneti R, Fox-Kemper B, Fyfe J, Griffies SM, Jayne SR, Lazar A, Lengaigne M, Lin X, Marsland S, Minobe S, Monteiro PMS, Robinson W, Roxy MK, Rykaczewski RR, Speich S, Smith IJ, Solomon A, Storto A, Takahashi K, Toniazzo T and Vialard J (2019) Ocean Climate Observing Requirements in Support of Climate Research and Climate Information. *Front. Mar. Sci.* 6:444. doi: 10.3389/fmars.2019.00444
- Rahaman, U. Srinivasu, S. Panickal et al., An assessment of the Indian Ocean mean state and seasonal cycle in a suite of interannual CORE-II simulations. *Ocean Modelling* (2019), doi: <https://doi.org/10.1016/j.ocemod.2019.101503>.
- David Sutherland, Fiamma Straneo, Twila Moon, Isabela Le Bras, Eleanor Frajka-Williams, et al. Estimating the Freshwater Flux from the Greenland Ice Sheet Workshop Report, American Geophysical Union, 2018. Arctic Data Center, 2019. doi:10.18739/A24M9198B.
- Fox-Kemper, B., and Coauthors, 2019: Sources and Sinks of Ocean Mesoscale Eddy Energy. A Joint US CLIVAR and CLIVAR Workshop Report, 2019-5, doi: 10.55065/CHSR-5034
- A joint USCLIVAR and CLIVAR Variations/Exchanges will be published in January, 2020, as one of the achievements of the Tallahassee meeting.

Budget and other needs for 2020

- 1) A small gathering at AGU Ocean Sciences will be organized, providing lunch for the panel members. \$100 would cover this gathering or panelists can contribute.
- 2) The 6th panel meeting and workshop in October in Kiel Germany. OMDP requests \$5000 to support the panel members and potential invited and/or early career speakers to attend the panel meeting and workshop.

Annex A

Proforma for CLIVAR Panel requests

for SSG approval for meetings

1. **Panel or Working Group:** Ocean Model Development Panel
2. **Title of meeting or workshop:** The 6th session of OMDP
3. **Proposed venue:** Kiel Germany (GEOMAR hosting)
4. **Proposed dates:** October 7-9, 2020.
5. **Proposed attendees, including likely number**
Attendees will be part of the panel members (around 10) and some invited and/or early career speakers. It is expected that 50-100 other participants will join with their own funds for the concurrent workshop.
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved**
Ocean Model development panel will have the 6th panel meeting in 2020, discussing membership issues, the ongoing papers about the OMIP-1 (CORE) – OMIP-2 (JRA55-do) comparison, especially focusing on high-resolution vs. low-resolution issues. This workshop will have direct relevance to
7. **Specific objectives and key agenda items**
The aim of this workshop is to address such questions and to provoke further research and collaborations. The focus will be on the realistic representation of the eddying ocean and its interannual to decadal variability in forced basin and/or global ocean-sea ice models as well as in coupled climate models, with the ocean models utilizing spatial resolutions sufficient to admit a vigorous transient mesoscale eddy field. We particularly invite contributions linking observations and reanalysis products with models. Studies furthering the understanding of ocean physics as a driver of biogeochemical processes are also welcome.

A draft workshop description is attached to this annual report.

8. **Anticipated outcomes (deliverables)**
A meeting report and collaborative papers for peer-reviewed literature are the intended outcomes. Breakout sessions will be included and consensus documents from those sessions will inform these documents.
9. **Format:** One day panel meeting plus one to three day workshop.
10. **Science Organizing Committee (if relevant):** Arne Biastoch and Torge Martin (GEOMAR), Helene Hewitt (UK MetOffice), Anne-Marie Treguier (CNRS), Stephen Griffies (NOAA-GFDL), Gokhan Danabasoglu (NCAR), Baylor Fox-Kemper (Brown University)
11. **Local Organizing Committee (if relevant):** Arne Biastoch, Markus Scheinert, Torge Martin, Nikole Lorenz
12. **Proposed funding sources and anticipated funding requested from WCRP:** ~\$5000 to support travel costs for some panel members and attendees.

Annex B

Proforma for CLIVAR Panel requests

for SSG approval for meetings

1. **Panel or Working Group:** Ocean Model Development Panel
2. **Title of meeting or workshop:** A small gathering of part of OMDP members at AGU Ocean Sciences
3. **Proposed venue:** San Diego, USA
4. **Proposed dates:** someday during 16-21 February , 2020.
5. **Proposed attendees, including likely number**
Attendees will be part of the panel members (around 10) and some invited speakers.
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved**
Ocean Model development panel will have a small gathering at the AGU Ocean Sciences Meeting. This small face to face meeting will integrate the panel, and panel and project related issues will be discussed.
7. **Specific objectives and key agenda items**
The aim of this gather is to discuss the ongoing papers of the panel.
8. **Anticipated outcomes (deliverables)**
A meeting minutes will be furnished for the gathering.
9. **Format:** A lunch meeting
10. **Science Organizing Committee (if relevant):** Baylor Fox-Kemper, Simon Marsland
11. **Local Organizing Committee (if relevant):** n/a

12. **Proposed funding sources and anticipated funding requested from WCRP:**
~\$100 to support lunch for the participants.

Annex C Description of the Kiel workshop

Future Directions in Basin and Global Mesoscale-Eddying Ocean Modeling

Ocean models are an integral part of today's ocean and climate research. Over the past decade, there has been increasing use of mesoscale-eddy ocean models for studies of ocean variability on seasonal to decadal timescales, based on the success of forcing products like CORE, DRAKKAR, and JRA55-do. These eddy simulations provide a direct link to observations and serve as a basis for biogeochemical studies. While forced ocean-only models are used for such hindcasts and state estimates, coupled climate models are used to separate internal (natural) variability from external variability and anthropogenic warming trends. To merge the benefits of these different approaches, there is a need for joint evaluation of recent advances in physical processes and numerical methods.

Advances in high-resolution ocean modelling provide opportunities but also challenges for simulating the ocean climate system, particularly with the growing availability of observational measures. A selection of related questions are:

- How robust is the decadal variability among hindcasts as compared to observational measures?
- How do modelling strategies regarding spinup, grid resolution (mesoscale to submesoscale), physical parameterizations, and numerical methods affect model drift and robustness of results?
- Are there additional processes critical to explicitly resolve, such as the submesoscale, internal and surface gravity waves, and tides, along with their feedbacks with the atmosphere and the cryosphere?
- Is it critical to make the step from ocean-only hindcasts to coupled simulations to separate internal variability from external variability and anthropogenic climate warming?

A workshop addressing challenges and future directions in high-resolution ocean modeling will be held in Kiel, Germany, on October 7-9, 2020 hosted by GEOMAR.

The aim of this workshop is to address such questions and to provoke further research and collaborations. The focus will be on the realistic representation of the eddy ocean and its interannual to decadal variability in forced basin and/or global ocean-sea ice models as well as in coupled climate models, with the ocean models utilizing spatial resolutions sufficient to admit a vigorous transient mesoscale eddy field. We particularly invite contributions linking observations and reanalysis products with models. Studies furthering the understanding of ocean physics as a driver of biogeochemical processes are also welcome.

During the workshop, we will celebrate the achievements and contributions of Prof. Claus Böning to ocean science and numerical ocean modelling. Claus will retire in autumn 2020.

Scientific steering committee: Arne Biastoch and Torge Martin (GEOMAR), Helene Hewitt (UK MetOffice), Stephen Griffies (NOAA-GFDL), Gokhan Danabasoglu (NCAR), ?Baylor Fox-Kemper (Brown University), ?Anne-Marie Treguier (IFREMER)

Local organizing committee: Arne Biastoch, Markus Scheinert, Torge Martin, Nikole Lorenz (all GEOMAR),