

CLIVAR/CliC Northern Oceans Region Panel

Co-chairs: Amy Solomon (Amy.Solomon@noaa.gov)
Ruth Mottram (rum@dmi.dk)

Panel overview

NORP serves as an international forum for coordinating and strategizing activities on the role of the Arctic Ocean in the context of the global climate system from a coupled perspective. NORP facilitates progress in the development of tools and methods to monitor and assess climate variability and change, and evaluate climate predictability of the ocean-atmosphere-ice system in the Arctic and Subarctic Ocean. NORP coordinates efforts to enhance the ability to monitor the coupled system, understand the driving mechanisms of the system change from a coupled process perspective, and predict the evolution of the emerging New Arctic climate. NORP plays a central role in coordinating, monitoring, and evaluating the progress of such activities during and beyond the Year of Polar Prediction.

NORP has a number of activities planned (listed below) that had to be postponed due to COVID-19.

Achievements for 2019-2020

- **Workshops and Meetings**
 - ❖ Co-sponsored 2020 EGU Session: Changes in the Arctic Ocean, sea ice and subarctic seas systems: Observations, Models and Perspectives
 - ❖ Co-organized OOPC Workshop on Ocean Heat and Freshwater Storage and Transports in Observations and Climate Models **【POSTPONED】**
 - ❖ Organized 2nd session of CLIVAR/CliC Northern Ocean Region Panel **【POSTPONED】**
 - ❖ Co-sponsored session on Sea ice, ocean and climate connections in the Northern Oceans and the Southern Oceans at IGS 2019
 - ❖ Co-sponsored session on 'Changes in the Arctic Ocean, sea ice and subarctic seas systems: Observations, Models and Perspectives' at EGU 2019
 - ❖ Co-sponsored AGU 2020 sessions on “Sea Ice–Ocean–Atmosphere Interactions in the “New” Arctic and Southern Oceans” and “Extratropical and High-latitude Storms, Teleconnections, Extreme Events, and the Rapidly Changing Polar Climate”
 - ❖ Co-sponsored The Aspen Global Change Institute workshop on “Arctic Climate and Weather Extremes: Detection, Attribution, and Future Projection” in spring 2020 **【POSTPONED】**
 - ❖ Monthly telecons with reports of international Arctic collaborations and campaigns, updates on scientific studies, planning for future activities.

- **Scientific results from activities**
 - ❖ Contributed section on “Observational challenges and needs in the polar oceans” to CLIVAR OceanObs19 Community White Paper
 - ❖ Contributed to OceanObs19 Community White Paper, “A Critical Gap in the Observing System and its effect on Environmental Prediction”
- **Scientific capacity building and career support Summer school (both in-person or online are ok)**
 - ❖ Discussed the NORP 2021 Summer School via SLACK and telecon. This summer school will provide opportunities to early career scientists and students to get access on the frontier knowledge of Arctic science.
- **Knowledge exchange**
 - ❖ FAMOS 2020 Talk on NORP activities and near-term scientific objectives
 - ❖ Presentations on NORP activities at US CLIVAR Summit, IASC Annual Meeting, FAMOS Annual Meeting, CLIVAR SSG, and CliC Annual report-out.

Plans for 2021 and beyond

- ❖ Organize session at ASSW2021 on “Marine ecosystems in the New Arctic”
- ❖ Co-organize OOPC Ocean Heat and Freshwater Storage and Transports in Observations and Climate Models workshop
- ❖ Organize workshop with SORP on “Role of Freshwater in Polar Ocean Climate Change and Global Linkages” (in parallel with OOPC Ocean Heat and Freshwater Storage and Transports in Observations and Climate Models workshop)
- ❖ Work with national representatives to secure support for Arctic ocean-sea ice state estimates
- ❖ Advance studies on Greenland ice sheet – ocean interactions: Advocate for inclusion in CMIP7 and Sea level call in Horizon2020
- ❖ Coordinate archiving/mirroring of past/future campaign/in-situ data for assimilation and analysis with CLIVAR Global Synthesis and Observations Panel
- ❖ Continue monthly telecons
- ❖ Plan NORP 2021 Summer School in coordination with NORP MOSAiC activities to:
 - learn/improve big data management skills; from writing the algorithm to visualizing the results;
 - get an Earth system perspective by working with students from a different topic;
 - improve critical skills: know why models are not perfect and how to detect biases;
 - Provide an introduction to current MIPs and SSPs.

Articles published in 2019/20 as part of RF activities (if any)

NORP made contributions to two OceanObs19 publications:

- 1) Smith, G., and coauthors, 2019: Polar Ocean Observations: A Critical Gap in the Observing System and its effect on Environmental Prediction. *Frontiers*, doi:10.3389/fmars.2019.00429.

- 2) Stammer, D., and coauthors, 2019: Ocean climate observing requirements in support of Climate Research and Climate Information. *Frontiers*, doi:10.3389/fmars.2019.00444.

In addition, NORP completed a publication entitled, “**Freshwater in the Arctic Ocean 2010-2019**”. This paper assesses to what extent observations during the 2010-2019 period are sufficient to estimate the Arctic freshwater budget with greater certainty than previous assessments and how this budget has changed relative to the 2000-2010 period. The paper includes discussions of processes not included in previous assessments, such as redistribution between basins, run off from the Greenland Ice Sheet, the role of snow on sea ice, and vertical redistribution. It is shown that the trend in Arctic freshwater in the 2010s has stabilized relative to the 2000s due to an increased compensation between a freshening of the Beaufort Gyre and a reduction in freshwater in the Amerasian and Eurasian basins. Notably, the Arctic system has shifted to an increasingly seasonal and mobile sea ice cover, a shift in mass loss from the western to the eastern Greenland ice sheet, and an increased import of subpolar waters into the Arctic. A proposal was submitted to Nature Geoscience and further information about the paper was requested by the journal before a decision about whether the paper would be reviewed was made. We are currently waiting to hear back from Nature Geoscience.

Budget and other needs for 2021

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.

NORP requests 11K CHF to support member travel to the panel meeting and the workshop. NORP requests 1.5K CHF to pay for the publication of the freshwater review paper.

NORP will co-organize the OOPC Workshop on heat and freshwater transport and storage in 2021 in Exeter, UK. In addition, NORP will organize and participate in a parallel workshop with SORP on “Role of Freshwater in Polar Ocean Climate Change and Global Linkages” We request 6000 CHF to support travel to/from the workshops.

NORP requests support for members to participate in the second face-to-face panel meeting to be held in Exeter, UK in conjunction with the OOPC workshop. We request 5000 CHF to support members attend the meeting.

The NORP freshwater review paper is under review in the journal *Ocean Sciences*. It will cost approximately 1500 CHF to publish this paper.

Annex A

Proforma for CLIVAR Panel requests for SSG approval for meetings

1. **Panel name: Northern Oceans Region Panel**
2. **Title of meeting or workshop:** OOPC Workshop on heat and freshwater transport and storage in models and observations
3. **Proposed venue:** Exeter, UK
4. **Proposed dates:** Fall 2021
5. **Proposed attendees, including likely number:** 14 NORP panel members and some possible invited speaker
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:** The OOPC workshop will be co-organized by NORP, which will spread the NORP influence. This workshop is designed to identify observational and modeling gaps and opportunities to advance the understanding of heat and freshwater storage and transports in the global ocean. This workshop will support the WCRP Grand Challenges “Melting Ice and Global Consequences”, “Weather and Climate Extremes”, “Regional Sea-Level Change and Coastal Impacts”, and “Near-term Climate Prediction”.
7. **Specific objectives and key agenda items:** This workshop will bring together experts across the many disciplines involved in freshwater and heat storage and transport in observations and climate models, as well as graduate students and post-doctoral scholars working in this research area, to assess the current state-of-knowledge, identify research gaps and observational uncertainty and needs, and map out a strategy for progress on both regional and global scales.
8. **Anticipated outcomes (deliverables):** A review paper on “Arctic Ocean heat and freshwater transport and storage in models and observations”.
9. **Format:** Workshop.
10. **Science Organizing Committee (if relevant):** Amy is on the organizing committee of the GCOS/GOOS workshop.
11. **Local Organizing Committee (if relevant)**
12. **Proposed funding sources and anticipated funding requested from WCRP:** NORP requests 6000 CHF to support member travel to the panel meeting and the workshop.

Annex B

Proforma for CLIVAR Panel requests for SSG approval for meetings

1. **Panel name: Northern Oceans Region Panel**
2. **Title of meeting or workshop:** The second session of NORP (NORP-2)
3. **Proposed venue:** Exeter, UK
4. **Proposed dates:** Fall 2021
5. **Proposed attendees, including likely number:** 14 NORP panel members
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:** This will be the second NORP in-person meeting since its establishment. The meeting will discuss the NORP future plans, and the membership.
7. **Specific objectives and key agenda items:** The panel meeting will assess the current state-of-knowledge, identify research gaps and observational uncertainty and needs, and map out a strategy for progress on both regional and global scales among the panel. This panel meeting will include interactions with the SORP panel and members of the OOPC global ocean community.
8. **Anticipated outcomes (deliverables):** NORP-2 report
9. **Format:** the NORP-2 will be a side meeting of the OOPC Workshop on heat and freshwater transport and storage in models and observations
10. **Science Organizing Committee (if relevant)**
11. **Local Organizing Committee (if relevant)**
12. **Proposed funding sources and anticipated funding requested from WCRP:** NORP requests 5000 CHF to support member travel to the panel meeting and the workshop.