

Proposal for a CLIVAR Climate Dynamics Panel

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Motivation:

CLIVAR is a WCRP project focused on the ocean and climate. Its mission is “To improve understanding and prediction of the ocean-atmosphere system and its influence on climate variability and change, to the benefit of society and the environment.” CLIVAR is organized around Panels and Research Foci, through which the core CLIVAR capabilities are facilitated. Jointly, the Panels and Research Foci provide a mechanism for the project to address long-standing challenges and at the same time remain flexible and responsive to new ideas and opportunities. “Research Foci” usually relate to topics requiring cross-panel/project interactions, while the Panels at the same time ensure that core CLIVAR science topics continue to be addressed.

During the 34th WCRP JSC meeting, when all core projects presented their plans, it became apparent that a gap in the WCRP structure exists with regards to the domain of atmospheric/climate dynamics research. CLIVAR responded by proposing a possible way forward by creating a new Climate Dynamics Panel to be finally discussed and decided at JSC 35.

This new panel would focus on the large-scale dynamics of climate variability and change over seasonal, interannual, multidecadal to centennial timescales, for example, addressing annular modes, storm track dynamics, teleconnections, and mid-latitude air-sea interactions. It is envisioned that this panel would have linkages with several other CLIVAR panels, and within WCRP with SPARC DYVAR, GEWEX (GASS), CliC, WGNE, WGCM, WGSIP, WGOMD, and the Monsoons Panel.

A team of experts was asked (named above) to scope brief details on the rationale, potential activities and anticipated impacts of the panel, as well as a proposed panel composition.

Rationale

An important aspect of climate research, concerned with “climate dynamics”, involves the study of large-scale phenomena, processes, and mechanisms of climate variability and change on seasonal to centennial time-scales. Climate dynamics should provide the basic concepts, terminology, and phenomenological explanation that can be used to characterize regional to hemispheric climate variability and change. A common way of studying climate dynamics is to define modes of variability. Interest in climate dynamics is growing as the quantity and quality of new observational datasets and numerical modeling outputs are increasing. Yet, the understanding of climate dynamics has not yet been extensively applied in new research areas such as long-term regional climate change assessment.

To further advance climate research, it is important to have a specific activity devoted to climate dynamics within CLIVAR and WCRP. Climate dynamics can cover a wide range of topics, however it is important to set some focus for a successful launch of this panel. Furthermore, the panel should avoid inefficient overlaps with other activities relating to climate dynamics in CLIVAR and WCRP, but have synergistic linkages with them. Thus, this panel should focus on climate dynamics research related to atmosphere-ocean interactions, while cooperating with GEWEX, CLIC and SPARC on links related to the land, cryosphere and stratosphere-troposphere coupling respectively.

From these considerations, CLIVAR proposes that the Climate Dynamics Panel should address phenomena that span two or more ocean basins, or those phenomena, which are common to multiple basins, in which links between ocean and atmosphere processes are potentially important. There will be a focus on modes of variability and phenomena in which atmospheric dynamics play a leading role, as well as on local-to-basin scale ocean-atmosphere interactions common to multiple basins.

Examples of specific topics could be;

- The role of climate modes of variability in regional climate change.
- The Northern Hemisphere annular mode and its regional imprint (NAM-NAO) and the Southern Annular Mode (SAM)
- Forcing versus internal dynamics of the Atlantic Multidecadal Oscillation (AMO)
- Teleconnections.
- Storm track dynamics.
- Atmospheric and stationary waves.
- Ocean-to-atmosphere feedback in mid-latitudes especially at oceanic fronts.
- Non-ENSO and non monsoon inter annual variability.

In more detail, climate modes, such as NAM-NAO, Southern Annular mode (SAM), AMO, Interdecadal Pacific Oscillation (IPO) or Pacific Decadal Oscillation (PDO) are central topics in climate dynamics. These modes have global impacts spanning multiple basins. The nature, mechanisms, predictability and future changes of these modes must be further studied. In particular, research on the

regional impacts of these modes over land and the ocean is important for the WCRP grand challenge on “Regional Climate Information”.

Other items listed are phenomena that play important roles in those modes or other climate phenomena. Teleconnections have close linkage with atmospheric variability modes, such as NAM-NAO, SAM, PNA, PSA, and are central to global and regional climate variability and change. Storm tracks, and the associated cyclonic and anticyclonic surface circulation, are essential phenomena shaping atmospheric circulation patterns. Atmospheric blocking and stationary waves are closely associated with some mode such as NAO and PDO. Mid-latitude ocean-to-atmosphere feedback may influence to atmospheric modes, and recent high resolution observations and numerical modeling provide new results and insights especially to the feedback from the oceanic fronts, which are action centers of the interactions. Recent studies suggest that ocean-to-atmosphere feedback also influence to the storm tracks and blocking.

Potential activities of the panel

The panel will conduct the following activities

- Coordinate scientific projects and international collaborations for numerical modeling experiments and observational data analysis for advancement of coupled climate dynamics.
- Provide an online resource, via the CLIVAR website, which has links to research tools, such as simple models relevant for understanding of basic dynamics and diagnostics programs, developed by the community.
- Organize international workshops or sessions at conferences.
- Publish synthesis or review papers for appropriate topics.
- Specifically over the next five year:
 - 1) tbd
 - 2) tbd
 - 3) tbd

Cross-Panel Synergies

Clearly there will be multiple opportunities to link with many, if not all, of the regional-ocean panels and research foci. CLIVAR expects such synergies to emerge naturally by targeting panel meetings on specific topics and inviting representatives from other relevant panels to attend. Also, it should be possible to hold joint panel meetings like the recent Pacific and Indian Ocean panels.

For studies on air-sea interactions, the panel will communicate with modeling groups, which utilize AGCMs and CGCMs with much higher resolutions compared with CMIP-resolution models, since these high-resolution models are powerful tools to understand of how the ocean and the atmosphere interact. Also, the panel will encourage activities to examine the air-sea interaction processes in CMIP models, and provide useful information for the use of these models involving air-sea interaction including decadal predictions.

... WCRP friends: please add specific language to GEWEX, SPARC and CLIC panels and others that we might have missed.

Anticipated impacts of the panel

The panel activity will advance our understanding of climate variability and change, and facilitate international collaboration. It is intended that the panel will build a new bridge across the broad collection of basic and applied climate dynamics research.

Panel composition

The panel members would have the following expertise:

- Climate modes and teleconnections
 - NAM-NAO
 - SAM
 - Pacific variability PDO/IPO/PNA, NPO/NPGO
- Storm tracks
- Atmospheric blocking
- Ocean-to-atmosphere feedback
 - High resolution AGCM or CGCM
 - Observational analysis
 - Air-sea interaction in changing climate
- Regional climate variability and change

Any other comments or suggestions

It is anticipated that the panel will meet on approximately on a 18month basis. Partial support from WCRP would facilitate such meetings. It is anticipated 15k USD would be requested from WCRP to support the panel travel. Besides the WCRP travel support, the panel would seek other sources of funding (both local and international) for panel meetings and other activities suggested above. Over the first year the panel will meet to finalize the development terms of reference discuss the initial plan of work and to develop a long range plan targeting specific activities with tangible outputs over a 5-10 year period.