

Climate Dynamics Panel

Mat Collins, Shoshiro Minobe, M.Collins@exeter.ac.uk, minobe@sci.hokudai.ac.jp

Panel/RF overview

The main aim of the Climate Dynamics Panel is to advance our basic understanding of atmosphere-ocean climate dynamics using observations and models and to determine the role of climate dynamics in shaping climate variability and change on seasonal to centennial time scales. Specific activities will, in the first instance, be organized around three areas; (i) the organisation of storms, blocks and jet streams on seasonal and longer time scales, (ii) ocean basin to ocean basin and tropical-extratropical teleconnections and (iii) the development of predictive theories of climate dynamics involving non-linear interactions between the dynamics and physics of the atmosphere and ocean.

Key methodological approaches employed to address these objectives are (i) high-resolution atmosphere-only and coupled models, (ii) the use of stripped-down or simplified dynamical models of the atmosphere and ocean e.g. aqua-planet configurations with mixed-layer oceans, and (iii) 'pacemaker' type experiments where e.g. SSTs in an ocean basin are relaxed towards observed values and the response of the coupled climate system outside that region is assessed.

Achievements for 2016-17

The main highlight of the Panel for this year is the preparation of a number of sub-projects aimed at exploiting forthcoming high-resolution climate model experiments that are being run as part of the CMIP HighResMIP project in collaboration with the EU PRIMAVERA project. Eighteen proposals have been received from the community on dynamical topics as diverse as ocean fronts and extra-tropical cyclones. High resolution has the potential to 'unlock' dynamical processes and physics-dynamics processes that represent feedbacks between the ocean and atmosphere. These feedbacks may then influence large-scale climate phenomena and the response to greenhouse gas increases. These projects will be discussed at the forthcoming joint PRIMAVERA-Panel meeting in Bologna in Nov. This effort is a joint coordination between the Climate Dynamics, Atlantic and Indian Ocean panels.

In addition, the Panel 'position paper', highlighting its vision, has been favourably reviewed by Nature Climate Change and a revised manuscript will be submitted in the near future.

Meetings

- 3rd Meeting of the Climate Dynamics Panel, 20-24th Nov 2017, Bologna, Italy. This is a joint meeting between the panel and the PRIMAVERA high-resolution modelling project

- NCAS climate modelling summer school <https://www.ncas.ac.uk/en/climate-modelling-summer-school>
- A session at the IAMAS-IAPSO-IAGA General Assembly on the “Role of Ocean-Atmosphere Interactions in Climate Variability, Change and Predictability” was jointly convened by Noel Keenlyside with panel co-conveners, Mat Collins, Shoshiro Minobe and Shang-Ping Xie. Noel Keenlyside gave a talk outlining the work of the panel.

Projects

- See Achievements section.

Plans for 2017 and beyond

- Meeting on storm tracks, August 2018, Stockholm. Yohai Kaspi (panel) and Roger Caballero are organising.
- Proposal for an Aspen workshop on ‘Constraining Regional Climate Change’. Noel Keenlyside, Shang-Ping Xie (panel) and John Fyfe are leading this.
- The Panel co-chair, Collins, has been selected as a Coordinating Lead Author for the IPCC special report on ‘Oceans and Cryosphere in a Changing Climate’.
- A new working group of North Pacific Marine Science Organization (PICES) for “Climate and Ecosystem Predictability” has recently been established in July 2017 with three CLIVAR scientists participating as CLIVAR co-chairs; Shoshiro Minobe from Climate Dynamics Panel, Antonietta Capotondi from the Pacific Regional Panel, and Ryan Rykaczewski from the upwelling research focus.

Articles published in 2016/17 as part of panel/RF activities (if any)

Collins, M., Minobe, S., Barreiro, M., Bordoni, S., Kaspi, Y., Kumano-Yoshida, A., Keenlyside, N., Manzini, E., O’Reilly, C., Sutton, R., Xie, S.-P. and Zolina, O. Climate Dynamics and Regional Climate Change. In review in Nature Climate Change.

Roberts M. J., P. L. Vidale, C. Senior, H.T. Hewitt, C. Bates, S. Berthou, P. Chang, H. M. Christensen, S. Danilov, M.-E. Demory, S. M. Griffies, R. Haarsma, T. Jung, G. Martin, S. Minobe, T. Ringler, M. Satoh, R. Schiemann, E. Scoccimarro, G. Stephens, M. F. Wehner. The benefits of global high-resolution for climate simulation: process-understanding and the enabling of stakeholder decisions at the regional scale. submitted to Bull. Am. Meteorol. Soc.

Budget and other needs for 2017

(Please keep in mind the overall budget of CLIVAR is ~60,000 CHF for 2017 and this needs to be distributed between all activities and cover the SSG meeting.)

We have already received some support for the forthcoming Panel meeting in Nov 2017.

Annex A

Proforma for CLIVAR panels requests for SSG approval for meetings

1. **Panel:** Climate Dynamics
2. **Title of meeting or workshop:** Stormtracks 2018: Coming to grips with alternative perspectives on storm tracks in a changing climate.
<http://climdyn.misu.su.se/stormtracks2018>
3. **Proposed venue:** Stockholm, Sweden
4. **Proposed dates:** August 27-31
5. **Proposed attendees, including likely number:** 60-80
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:**

One of the four WCRP Grand Challenges is devoted to better understanding of mid-latitude storm tracks. A variety of perspectives and approaches coexist in the study of storm tracks, their governing mechanisms and their response to climate change. The climate/general circulation perspective views the storm tracks as a statistical ensemble of waves and eddies interacting with the mean flow, while the weather/synoptic perspective focuses on the behavior of individual storms and sub-storm structures. The former perspective typically identifies storm tracks using Eulerian diagnostics, while the latter naturally uses feature-tracking methods, resulting in different pictures of the storm tracks. Numerical approaches involve a broad hierarchy of model complexities and initial-value or statistically steady-state simulations.

The aim of this meeting is to bring together scientists representing these two communities to: (i) explore how insights from their different perspectives may be integrated, and (ii) identify opportunities for testing different mechanistic storylines quantitatively.

This workshop is therefore directly related to CLIVAR science, the WCRP Grand Challenges and within the goals of the newly formed CLIVAR Climate Dynamics Panel.

7. **Specific objectives and key agenda items:**

The meeting will be organized around two broad topics:

Storm track position and spatial structure. What controls the latitudinal position and spatial structure of the climatological storm tracks, and how will it change in response to global warming? A poleward shift of the storm tracks is a robust prediction of climate model simulations, but there are currently several different mechanisms to explain this response. How unique are each of these mechanisms and can several of them work simultaneously? What is the relative importance of each mechanism to the real atmosphere? How does the

climatological response relate to storm track variability, for example through blocking or wave-mean flow interaction?

Storm track intensity. What controls the overall number of cyclones and the distribution of cyclone intensities and lifetimes, and how will these change under global warming? Climate models give ambiguous predictions about these changes; can we develop storylines to explain these varying responses? What are the relative roles of dry dynamics and diabatic heating by moist processes and cloud-radiative feedbacks? What light does the seasonal evolution of storm tracks throw on these questions — for example the midwinter minimum of the Pacific storm track?

8. Anticipated outcomes (deliverables):

The lead organizers will write a meeting summary to be published in a community bulletin (EOS or BAMS). We will propose the writing of a review or perspective paper by key participants for peer-reviewed publication.

9. Format:

The conference will take place 27-31 August 2018 (5 days). A detailed program is under development. The plan is to devote the first 3 days to short talks from a large subset of the participants to review the current state of play. This will be followed by 2 days each dedicated to one of the questions posed in Section 6, with ample time dedicated to discussion anchored by a smaller number of longer keynote talks.

Program outline:

Days 1-3:

60 short talks (12 mins + questions)

Day 4:

Morning: Location of the storm tracks – 4 keynote talks (30 mins each) and discussion.

Afternoon: Eulerian diagnostics vs. feature tracking – 2 keynote talks (45 mins) and discussion

Day 5:

Morning: Intensity of storm tracks – 2 keynotes (30 mins each) and discussion

Afternoon: The midwinter minimum – 2 keynotes (30 mins) and discussion

10. Science Organizing Committee

Yohai Kaspi, Weizmann Institute – CLIVAR Climate Dynamics Panel member

Rodrigo Caballero, Stockholm University

11. Scientific Advisory Committee

Isaac Held, GFDL

John Methven, University of Reading

Gwendal Riviere, ENS/LMD

Tiffany Shaw, University of Chicago

Heini Wernli, ETH Zürich

12. Proposed funding sources and anticipated funding requested from WCRP: We applied for funding from local sources at the University of Stockholm. Our request from CLICAR is 10,000 USD.