Tropical Basin Interaction (TBI)

Ingo Richter. richter@jamstec.go.jp
Noel Keenlyside. noel.keenlyside@gfi.uib.no

RF overview

Start date: March 1, 2020
Planned end date: December 31, 2024

Current status of the RF with regard to the proposed timeline
The RF is clearly behind the original timeline but there are two good reasons for this. First, the original timeline assumed a January starting date but eventually we did not get the green light until March. Second, the developing COVID-19 situation brought with it many challenges for the panel members, including the co-chairs, and also interfered with the planning of the first workshop. Considering these circumstances, we believe that we have made good progress toward the goals of the RF in the first 8 months of the project.

Overview of where the RF is on the proposed timeline
Here we list the four main items in the proposed timeline and explain how we have addressed them.

1) Workshop
Due to the delayed start date and due to the COVID19 situation, the workshop originally planned for 2020 has been moved to February 2021 and will be held in an online format. US CLIVAR has kindly agreed to give financial and technical support for the web-based workshop. Holding this workshop in late 2020 would have been possible but panel members felt this would have been too close to the AGU Fall Meeting. The planning of the workshop is now well under way: a registration website has been set up, all 8 invited speakers have already confirmed, and invitations for virtual poster presentations have been sent to about 40 potential participants.

2) Formation of task teams within the RF
We have decided to start with general meetings in which particular research topics are discussed. Four such online meetings have been held, with the next planned for November.

3) Begin Tier 1 experiments (of the coordinated GCM experiments)
Due to the delay in the workshop the experiment design has not been finalized yet, and we are therefore behind the schedule on this item. However, co-chair Richter and panel member Tokinaga, in collaboration with Yu Kosaka (University of Tokyo) are currently testing several experiment designs using the GFDL CM 2.1 model. These experiment designs will probably not be final but will form a good basis for discussion at the workshop.

4) Foster observational studies
Several panel members have led, or participated in, observational studies of basin interaction (see published articles: Chikamoto et al. 2020; Johnson et al. 2020; Gomara et al.

2020; Roxy et al. 2019; Wang 2019). More activities are planned for the remainder of the first year of the RF.

Background and activities

The interactions among the tropical Pacific, Atlantic, and Indian Ocean basins are increasingly recognized as a key factor in understanding climate variability on interannual to decadal timescales. While recent years have seen progress toward understanding tropical basin interactions, much remains to be learned. This includes a deeper understanding of the mechanisms, the preferred pathways, and the potential benefits for seasonal-to-decadal prediction. The RF TBI aims to make progress in these areas by fostering research activities and holding workshops and summer schools. Two specific outcomes are the coordination of new climate model experiments and the compilation of a paleo proxy archive.
Since the inception of the RF in March 2020, we have held 4 general meetings to discuss the current understanding of TBI and ways to advance it. We will also hold a session on TBI at the upcoming 2020 AGU Fall Meeting (convened by panel members Richter, Taschetto, Stuecker and Keenlyside), and a dedicated WCRP/CLIVAR workshop in February 2021. In addition, many panel members have actively participated in studies on TBI (see references below).

Achievements for 2019-2020

Please note that the RF started from March 2020. Thus, there are no achievements coordinated by the RF in 2019. Individual members have, however, participated in TBI-related research as well.

- Workshops
  A WCRP/CLIVAR workshop on TBI will be held February 24-26, 2021 (see http://www.clivar.org/events/wcrp-clivar-workshop-climate-interactions-among-tropical-basins-online for details). The workshop is receiving financial and technical support from US CLIVAR. The 8 invited speakers have accepted our invitation. About 40 invitations for virtual posters have been sent, and about half of the invitees have accepted. An open call for submissions has also been placed.
- Scientific results from activities
  Several RF members have participated in TBI-related research activities, with a focus on the Atlantic-Pacific connection (see references below).
- Scientific capacity building and career support
  Several RF members advising members of their research groups in the study of TBI. This includes co-chair Ingo Richter, who is partially advising postdoctoral fellow Shoichiro Kido at JAMSTEC.
  Keenlyside organized the Nansen Tutu TRIATLAS Summer School on Ocean, Climate, and Marine Ecosystems, Cape Town, South Africa, 14-21, January, 2020.
  A session on TBI will be held at the 2020 AGU Fall Meeting. We hope that this session will invigorate research activities on TBI, particularly among younger members of the research community.
- Knowledge exchange
  The RF TBI is linked to other CLIVAR activities through co-membership of the following members: Richter and Rodrigues (Atlantic Region Panel), Keenlyside (Climate Dynamics Panel, WCRP GC Near-term prediction), Stuecker (ENSO

Conceptual Model group), and Roxy (Indian Ocean Region Panel). Furthermore, Regina Rodrigues is co-chairing one of the WCRP lighthouse activity (LHA) teams.

Plans for 2021 and beyond

We expect to generally follow the original timeline in our proposal. The workshop in early 2021 will certainly be one of the highlights. We hope that we will be able to finalize the GCM experiment design shortly after the workshop, so that participating groups can start with the experiments in the second half of 2021.

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

Abid, M. A.; M. Ashfaq; F. Kucharski; K. J. Evans; and M. Almazroui, 2020: Tropical Indian Ocean mediates ENSO influence over Central Southwest Asia during the wet season. Geophys. Res. Lett, 47: e2020GL089308, https://doi.org/10.1029/2020GL089308.

Cai, W., McPhaden, M.J., Grimm, A.M., Rodrigues, R.R., Taschetto, A.S., *et al.,* 2020: Climate impacts of the El Niño–Southern Oscillation on South America. *Nat. Rev. Earth Environ.,* **1,** 215–231. https://doi.org/10.1038/s43017-020-0040-3.

Chikamoto, Y., Z.F. Johnson, S.-Y. Simon Wang, M.J. McPhaden, and T. Mochizuki, 2020: El Niño Southern Oscillation evolution modulated by Atlantic forcing. *J. Geophys. Res., 125*, e2020JC016318. https://doi.org/10.1029/2020JC016318.

Dhame, S., A. S. Taschetto, A. Santoso, and K. J. Meissner, 2020: Indian Ocean Warming Modulates Global Atmospheric Circulation Trends. *Clim. Dyn.,* 55, 7, 2053–73. https://doi.org/10.1007/s00382-020-05369-1.

Johnson, Z.F., Y. Chikamoto, S.S. Wang, M.J. McPhaden, and T. Mochizuki, 2020: Pacific decadal oscillation remotely forced by the equatorial Pacific and the Atlantic Oceans. *Clim.Dyn*. *55*, 789-811 https://doi.org/10.1007/s00382-020-05295-2.

Keenlyside, N., Y. Kosaka, N. Vigaud, A. Robertson, Y. Wang, D. Dommenget, J.-J. Luo, and D. Matei, 2020, Basin Interactions and Predictability, in Interacting Climates of Ocean Basins: Observations, Mechanisms, Predictability, and Impacts, edited by C. R. Mechoso, Cambridge University Press. Rodríguez-Fonseca, B., Y. Ham, S.K. Lee, M. Martín-Rey, I. Polo Sánchez and R. Rodrigues, 2020. Interannual variability of the Pacific and Atlantic Oceans , in Interacting Climates of Ocean Basins: Observations, Mechanisms, Predictability, and Impacts, edited by C. R. Mechoso, Cambridge University Press.

Okumura, Y. M., 2019: ENSO diversity from an atmospheric perspective. *Current Climate Change Report*, **5,** 245-257, doi: 10.1007/s40641-019-00138-7.

Roxy M. K., Panini Dasgupta, Michael J. McPhaden, Tamaki Suematsu, Chidong Zhang and Daehyun Kim, 2019, Twofold expansion of the Indo-Pacific warm pool warps the MJO lifecycle, *Nature*, 575, 647–651. doi: 10.1038/s41586-019-1764-4.

Wang, C., 2019: Three-ocean interactions and climate variability: A review and perspective. *Clim. Dyn*., **53**, 5119–5136.

Wu, X., Y. M. Okumura, and P. DiNezio, 2020: Predictability of El Niño duration based on the onset timing. *J. Climate,* doi**:** 10.1175/JCLI-D-19-0963.1.

Articles submitted

Abid, M. A., F. Kucharski; F. Molteni; Kang, I.-S.; A. M. Tompkins, and M. Almazroui, 2020: Separating the Indian and Pacific Ocean impacts on the Euro-Atlantic response to ENSO and its transition from early to late winter. Submitted to J. Climate
Exarchou E., P. Ortega, B. Rodríguez-Fonseca, T. Losada,I. Polo, and C. Prodhomme, 2020: Impact of Equatorial Atlantic Variability on ENSO Predictive Skill (under revision in Nature Communications)

Joshi, M. K; Abid, M. A.; Kucharski, F. 2020: The role of an Indian Ocean heating dipole in the ENSO teleconnection to the North Atlantic European region in early winter during 20th century in Reanalysis and CMIP5 simulations, Submitted to J. Climate

Gómara, I., Rodríguez-Fonseca B.; E.Mohino; T. Losada; I. Polo; M. Coll, 2020: Skillful prediction of tropical Pacific fisheries provided by Atlantic Niños. Submitted to Environmental Research Letters.

Wu, X., Y. M. Okumura, C. Deser, and P. DiNezio, 2020: Two-year dynamical predictions of ENSO event duration during 1954-2015. J. Climate, in revision.

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.

Aim for a total length of ~2 pages, more is fine, but not necessary