

45th Session of the WCRP Joint Scientific Committee (JSC)

27-30 May 2024

Report to the WCRP Joint Scientific Committee

Explaining and Predicting Earth System Change (EPESC)

1. Highlights for Joint Scientific Committee (including high-level publications, new achievements/products, and capacity building activities – in particular anything you feel should go into a WCRP annual achievement report or brochure)

- Many EPESC members attended and spoke at the WCRP Open Science Conference in Kigali, Rwanda, October 2023.
- Growing out of discussions at the Open Science Conference, EPESC has launched a new cross-cutting group on **Explaining and Predicting Changes in African Climate**. This group is co-chaired by Caroline Wainwright (Cardiff University) and Linda Hiron (Reading University), working closely with many colleagues in Africa and elsewhere. The initial focus of research is on East African climate, but this is expected to broaden going forwards, and will include coordinated analyses of the EPESC Large Ensemble Single Forcing MIP (LESFMIP) simulations.
- A major research project closely aligned with EPESC was recently funded by the EU Horizon programme, led by Markus Donat at the Barcelona Supercomputing Centre (BSC): *EXPECT - Towards an Integrated Capability to Explain and Predict Regional Climate Changes*. EXPECT is a four year project, commencing 1 April 2024, with substantial participation from all three of the EPESC Working Groups.
- Linked to and immediately following the kick off meeting for the EU EXPECT project, we are holding an EPESC hybrid science workshop on 16 & 17 May in Barcelona. We are grateful to BSC for hosting this.
- EPESC continued our successful webinar series in 2023-24 with webinars on the following topics:
 - Marine heatwaves (May 2023)
 - Earth's Energy Imbalance (July 2023)
 - Trends in northern hemisphere summer circulation and relation to climate extremes (April 2024).
- EPESC co-chair Rowan Sutton gave a short presentation on the science outcomes of the Kigali Open Science conference at COP28.
- Shoshiro Minobe is leading a new EPESC-initiated paper in preparation: Exceptional climate in 2023-24: Beyond the new Normal.

2. Planned science initiatives and major events (over next 1- 5 years)

- **WG1: Observing and modelling Earth System Change** (Co-leads: Anca Brookshaw and Paul Kushner)
- The EPESC WG1 activity on understanding the trend in Earth's Energy Imbalance has completed a clear science plan for 2-3 years of work. They submitted a proposal to the ISSI/ISSI-BJ 2024 Joint Call for Proposals for International Teams in Space & Earth Sciences. *Meysingnac et al.: Causes and consequences of the current trend in Earth energy imbalance*.

- **WG2: Integrated Attribution, Prediction and Projection** (Co-leads: Doug Smith and Scott Osprey)
- EPESC WG2 is progressing work under four regionally-based workstreams:
 - North Atlantic atmosphere and ocean circulation: co-leads Chaim Garfinkel, Isla Simpson
 - SAM circulation trends and extremes: co-leads Leandro Diaz, Amy Butler
 - Summer northern hemisphere atmospheric circulation trends: co-leads June-Yi Lee, Markus Donat - *this topic has cross-cutting links to WG3 on heatwaves and WG1.*
 - Tropical circulation variability and trends: co-leads Andrea Dittus, Annalisa Cherchi
- **WG3: Assessment of Current and Future Hazards** (Co-leads: Zhuo Wang & James Risbey)
- EPESC WG3 is progressing work under the following themes and leads:
 - Variability, predictability, and prediction: Antje Weisheimer
 - Extreme precipitation and droughts: Wenxia Zhang (Priority topics are: 1. Detection, attribution and understanding; 2. High-resolution convection-permitting modelling)
 - Tropical cyclones: Zhuo, Hamish (Priority topics: 1. impacts of individual anthropogenic forcings on TC activity; 2. ENSO-TC relationship).
 - Attribution methodology: Yukiko Imada (Yukiko and others are also participating in the new IDAG WCRP activity to provide coordination with EPESC)
 - Compound extremes: Gabriele Messori (held EGU session on “Compound weather and climate events”)
- We are considering a hackathon (or similar event) on focused analysis of LESFMIP results.
- We plan to hold a 3-day science meeting open to the full EPESC community in 2025. Details to come.

3. Planned Products, high-level assessments or other key outputs/publications

- The Large Ensemble Single Forcings Model Intercomparison Project (LESFMIP) dataset (Smith et al. 2022; doi.org/10.3389/fclim.2022.955414) has continued to expand with more models and simulations added. Currently, 12 modeling groups have agreed to participate; half have already completed simulations and begun uploading data to ESGF. Many centres are now contributing to the analysis of these simulations. See latest status [here](#).
- An important objective for EPESC as a whole, and especially WG2, is to add value to the [WMO annual-to-decadal climate updates](#). This will also involve collaboration with APARC - see section 4.

4. Linkages with other lighthouse Activities, Core Projects, Academy etc.

- EPESC continues to make the case for **regular updates to CMIP forcings**, which are required for operational attribution. There have been some positive discussions with the CMIP forcings task team and DAMIP, but (at the time of writing) the current status of plans is not known.
- Synergistic alignment of the new APARC Large Ensembles for Attribution of Dynamically-driven ExtRemes (LEADER) initiative and the EPESC WG2 activities. These activities will focus on the Large Ensemble Single Forcing Model Intercomparison Project (LESFMIP) simulations for their work. We anticipate the work leading to publications examining the scientific feasibility of using the LESFMIP output to provide attribution statements to WMO State of Climate and Global Annual to Decadal Climate Updates.
Two of the four WG2 workstreams have significant overlap in membership and leadership with associated LEADER activities:
 - North Atlantic atmosphere and ocean circulation
 - Summer northern hemisphere atmospheric circulation trends
- Dialogue between EPESC membership and many other WCRP activities continues, often through the form of updates at SSG meetings. There are overlapping interests, so communication will

continue with the hope of coordinated activities happening in the future. A few areas of common interest are noted below, with some details of our efforts to interact.

- Common objectives of RfS and our WG3 with its focus on hazards and extremes.
 - Markus Donat spoke at the RfS SSG meeting in Barcelona in October 2023.
 - Yukiko Imada attended the RfS workshop on "The Robustness of Climate Change Information for Decisions" in Brussels, April 2024.
- Common objectives between ESMO and our WG1 with its focus on tighter integration between observations and models.
 - Paul Kushner presented at the WCRP Workshop on Improving Climate Models and Projections using Observations at MIT, 12 June 2023.
 - Kirsten Findell spoke virtually at the WGNE SSG meeting, November 2023.
 - Paul Kushner spoke at the ESMO SSG meeting in March 2024.
- Common interests between GEWEX's GDAP project assessing Earth's Energy Imbalance and our WG1 activity focused on understanding the trend in EEI.
 - Some overlapping membership between these groups, particularly our EEI trend project leader Benoit Meyssignac.

5. Partnerships with entities outside of WCRP

- Shoshiro Minobe is an EPESC liaison to the PICES WG on Climate Extremes and Coastal Impacts in the Pacific. PICES is the North Pacific Marine Science Organization, an intergovernmental organization of six countries around the North Pacific (USA, Canada, Japan, China, Korea, and Russia) with a history of more than 30 years. He attended the PICES meeting in Seattle in October 2023.
- Scott Osprey will give a presentation at the 8th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction and Earth System Prediction, Norrköping, Sweden, 27-30 May 2024, on "Explaining and Predicting Earth System Change - Charting a course for whole atmosphere observation and operational attribution".

6. Suggestions, issues or challenges, for example:

- We greatly welcome a recent offer of WCRP support for collaborative research platforms. We are currently discussing with our working groups which platform(s) offer the best capabilities. There is a question about whether WCRP should adopt one platform across all activities.