



WCRP EPESC – LEADER Science Meeting

14-18 July 2025 | APEC Climate Center
Busan, Republic of Korea

Joint Science Meeting between the Lighthouse Activity on Explaining and Predicting Earth System Change (**EPESC**) & Large Ensembles for Attribution of Dynamically-driven ExtRemes (**LEADER**), an activity of the Core Project Atmospheric Processes And their Role in Climate (APARC) supported by **G-Impact** in Pusan National University (**PNU**), Institute for Basic Science Center for Climate Physics (**ICCP**), APEC Climate Center (**APCC**), World Climate Research Program (**WCRP**), and International Association of Meteorology and Atmospheric Sciences (**IAMAS**) within the International Union of Geodesy and Geophysics (**IUGG**)
<https://www.wcrp-climate.org/epesc-leader-meeting2025>

AGENDA

MONDAY 14 JULY 2025

14:00 – 18:00 | Preparation

14:10 – 15:40 | Local Organizing Committee Meeting

16:00 – 18:00 | Organizer/Science team Meeting

TUESDAY 15 JULY 2025

08:30 – 09:00 | 2F-Lobby | Registration

09:00 | 2F-Lobby | Check-In

09:15 | 2F-Lotus Hall | Welcome, Workshop Logistics, Framing the Goals of the Meeting
Jin-Ho Yoo, June-Yi Lee, Erich Fischer, Chaim Garfinkel, Jeongeun Yun

09:25 | 2F-Lotus Hall | Session A-1: Setting the stage with model-obs framing: What are models good at, where are they deficient?

Chair: Erich Fischer

09:25 | Erich Fischer: Introduction from the session chair

09:30 | Tiffany Shaw: Confronting Earth system model trends with observations

09:45 | Kirsten Findell (virtual): What do models get right about changes in evapotranspiration? Attribution of mechanisms of ET change

10:00 | Yang Chen: Undetected observation errors as a major cause of the long-

standing observation-model discrepancy on relative humidity trends

10:15 | Andrea Steiner: Tropospheric and stratospheric temperature trends from observations

10:30 | Lijing Cheng: A large-ensemble observational ocean temperature/heat content product and the application

10:45 | Discussion

11:15 | 2F-Lobby | Coffee Break

11:45 | 2F-Lotus Hall | Session A-2: Predictions and predictability of large-scale modes, Part I

Chair: Chaim Garfinkel

11:45 | Chaim Garfinkel: Introduction from the session chair

11:50 | June-Yi Lee: Estimating predictability of tropical trans-basin climate variability using the CESM2-based multi-year prediction system

12:05 | Doug Smith: The need to account for model error in attribution and prediction
Hold discussion until after lunch

12:20 | Jeong-Eun Yun: Exploring ocean-driven multi-year predictability of terrestrial ecosystem components

12:35 | 2F-Lobby | Lunch Break

14:00 | 2F-Lotus Hall | Session A-2 (cont.): Predictions and predictability of large-scale modes, Part II

Chair: Chaim Garfinkel

14:00 | Leonard Borchert: PDO-facilitated seasonal predictions of growing season heat in the central USA

14:15 | Dim Coumou: AI in climate science: mining knowledge and boosting predictability

14:30 | Rashed Mahmood (virtual): Multi-decadal initialized climate predictions using the EC-Earth3 global climate model

14:45 | Markus Donat (virtual): Towards understanding the sources of forecast signals and skill in interannual to decadal climate predictions

15:00 | Stephanie Fiedler (virtual): On CMIP climate forcings TT efforts for prediction and attribution

15:15 | Discussion

15:45 | 2F-Lobby | Coffee Break

16:15 | Introduction of the Breakout Room Topics, followed by Breakout Discussions

Topic 1 | 2F-Lotus Hall | Model errors including the signal-to-noise paradox; what we have learned and ways forward

Discussion leads: Doug Smith and Scott Osprey

- Signal-to-noise issues in the models
- Exploiting model differences
- What are the implications for predictability and long-term signals?
- What have we learned and how can we deal with understanding the S/N paradox?

Topic 2 | 2F-Edelweiss Hall | Attribution methods for extreme events

Discussion leads: James Risbey and Yukiko Imada

- What attribution approaches are available, and what are the strengths and weaknesses of these approaches? What attribution are they addressing (conditional vs. unconditional, risk approach, intensity, storyline approach, all-forcing)
- How can we bring together multiple lines of evidence and methods?
- What are the opportunities and challenges in the next step towards impact attribution?

Topic 3 | 4F-Video Conference Room | Confronting models and observations

Discussion leads: Tiffany Shaw and Erich Fischer

- What are the major pitfalls in confronting models and observations (internal variability, forcing uncertainty, model response biases, observational uncertainty)?
- What experiments and methods are suitable for disentangling the differences?
- What are the challenges in observational products and how can we make progress?
- Can we come up with a protocol for good practice guidance?

WEDNESDAY 16 JULY 2025

08:45 | 2F-Lobby | Check-In

08:55 | 2F-Lotus Hall | Session B-1: Tropical circulation variability and trends

Chair: Andrea Dittus

08:55 | Andrea Dittus: Introduction from the session chair

09:00 | Andrea Dittus: Update on tropical circulation activity and LESFMIP sprint

09:15 | Jonathon Wright: The South Pacific Convergence Zone: Reanalysis and LESFMIP Perspectives

09:30 | Suyeon Moon: Climate change-driven evolution of East Asian summer monsoon frontal precipitation

09:45 | Seok-Woo Son: Accelerated Hadley circulation weakening by aerosol mitigation

10:00 | Chaim Garfinkel: Forced changes in the QBO in the LESFMIP simulations

10:15 | Discussion

10:30 | 2F-Lobby | Coffee Break

11:00 | 2F-Lotus Hall | Breakout Room Reports and Discussion

11:00 | 5-minute reports from Breakout Topics 1-3

11:15 | Discussion

11:30 | 2F-Lotus Hall | Session B-2: Response to solar and volcanic forcing

Chair: Scott Osprey

11:30 | Scott Osprey: Introduction from the session chair

11:35 | Basudev Swain (presented by Scott Osprey): Lessons from historical volcanic eruptions for projecting the Tonga event's impact on polar warming

11:50 | Davide Zanchettin: Volcanically-forced climate variability in the historical period: perspectives from LESFMIP (community paper)

12.05 | Wenjuan Huo: A retrospective study of climate response to solar variability with outputs of LESFMIP (community paper)

12:20 | Discussion

12:35 | 2F-Lobby | Lunch Break
Edelweiss

[EPESC WG3 lunch and side meeting] 2F-

14:00 | 2F-Lotus Hall | Session B-3: Tropical circulation variability and trends (cont.)

Chair: Jonathon Wright

14.00 | Jonathon Wright: Introduction from the session chair

14:05 | Melissa Seabrook: Multidecadal Pacific Atmospheric Circulation Trends and their Drivers

14:20 | Rei Chemke (virtual): Historical Hadley circulation strength changes: resolving the model-reanalysis discrepancy

14:35 | Indrani Roy (virtual): Influence of the sun and volcanoes on atmosphere-ocean coupling

14:50 | Shubham Waje (virtual): Understanding the impact of the Quasi-Biennial Oscillation on the subseasonal variability of the Indian monsoon

15:05 | Annalisa Cherchi (virtual): Global and regional monsoons in a changing climate

15:20 | Discussion

15:35 | 2F-Lobby | Extended Coffee Break with Poster Session [posters will be up all week]

1. **David Avisar:** Changes in ENSO teleconnections in response to human activities diagnosed from the LESFMIP simulations
2. **Leandro B. Díaz:** Southern Hemisphere surface climate response to human activities analyzed using LESFMIP simulations
3. **Chaim Garfinkel:** Teleconnections between the African monsoon and extreme summer temperatures in the Eastern Mediterranean
4. **Kourosh Haddadi Moghaddam:** El Nino and its role on the global carbon cycle in the Caspian Sea
5. **Bianca Mezzina:** ENSO teleconnections in eddy-rich climate models: Insights from the EERIE project
6. **Yunju Park:** Soil Moisture–Precipitation feedback over East Asia using radiosonde observations
7. **Amitava Roy:** Volcanoes causing regional weather extremes
8. **Abhinav Rajalakshmi Subrahmanian:** Improving North Atlantic climate predictability on interannual -to- decadal timescales
9. **Sohan Suresan:** Diagnosing Atlantic subtropical jet variability and forcing dependencies in LESFMIP
10. **Wuhan Ning:** The tropospheric response to the zonal asymmetric momentum torques: implications for the downward response to wave reflection and SSW events
11. **Yong-Yub Kim:** Identifying sources for multiyear plankton predictability
12. **Gopi Nadh Konda:** The recent increases in Atmospheric Rivers and the Associated Extreme Rainfall
13. **Fei Luo:** Projected characteristics of extreme rainfall in Southeast Asian Megacities from the V3 study

14. **Fei Luo:** The role of soil moisture on summer atmospheric circulation climatology and persistent heatwaves in the Northern Hemisphere
15. **Mincheol Moon:** Tropical cyclone response to ambitious decarbonization scenarios
16. **Daeun Kwon:** Attribution of heavy precipitation event using pseudo global warming simulations: sensitivity to vertical temperature changes
17. **Gayathri Salila:** Seasonal forecasts of precipitation in the Mediterranean and Southwest Asia

16:20 | 2F-Lotus Hall | Session B-4: Summer northern hemisphere atmospheric circulation trends

Chair: June-Yi Lee

16:20 | June-Yi Lee: Introduction from the session chair

16:25 | Alexia Karwat: Exploring multi-year predictability of terrestrial heatwaves in Global Hotspot Regions

16:40 | Tiffany Shaw: Anthropogenic aerosols have significantly weakened the regional summertime circulation in the Northern Hemisphere during the satellite era

16:55 | Tilda Huntingford: External forcing of European summer heatwaves and circulation

17:10 | Gerard Marcet-Carbonell (virtual): On the Northern Hemisphere summer circulation: Disentangling the contributions of different forcings through LESFMIP experiments

17:25 | Jitendra Singh (virtual): Quantifying the role of externally forced atmospheric circulation change in heat extremes from nudged circulation

17:40 | Discussion

18:00 | Group Dinner Provided by the Local Organizing Committee

THURSDAY 17 JULY 2025

08:45 | 2F-Lobby | Check-In

08:55 | 2F-Lotus Hall | Session C-1: Southern hemisphere circulation trends and extremes

Chair: Doug Smith

08:55 | Doug Smith: Introduction from the session chair

09:00 | Leandro B. Díaz: Response of the Southern Hemisphere atmospheric and oceanic circulation to single forcings (community paper)

09:15 | William Dow: The role of external forcing in Antarctic peninsula temperature extremes in austral summer and the links with large-scale atmospheric circulation patterns

09:30 | Kewei Lyu: Roles of external forcings and tropical teleconnections in the Southern Ocean warming

09:45 | Bianca Mezzina: Exploring the contributions of single atmospheric forcings on Antarctic sea ice trends using large ensembles

10:00 | Sabine Bischof: Contributions of Various Climate Forcings to Historical Southern Hemisphere Stratospheric Vortex Strength and Lifetime

10:15 | Ghyslaine Boschat (virtual): Role of external forcing on the Southern Annular Mode and its impact of Southern Hemisphere climate

10:30 | Discussion

11:00 | 2F-Lobby | Coffee Break

11:30 | 2F-Lotus Hall | Session C-2: North Atlantic atmosphere and ocean circulation, Part I

Chair: Leandro B. Díaz

11:30 | Leandro B. Díaz: Introduction from the session chair

11:35 | Chaim Garfinkel: The response of the North Atlantic atmospheric and oceanic circulation to external forcings: understanding intermodel spread (community paper)

11:50 | Shoshiro Minobe: Spatiotemporal structures of forced response revealed by a novel analysis approach designed for LESFMIP

12:05 | Ales Kuchar: Understanding historical changes in the Northern Hemisphere stratospheric polar vortex: insights from the Large Ensemble Single Forcing Model Intercomparison Project

12:20 | David Avisar: Revisiting the historical Drying of the Mediterranean in the LESFMIP Simulations

Hold discussion until after lunch

**12:35 | 2F-Lobby | Lunch Break
Edelweiss**

[LEADER lunch and side meeting 2F-

14:00 | 2F-Lotus Hall | Session C-2 (cont.): North Atlantic atmosphere and ocean circulation, Part II

Chair: Leandro B. Díaz

14:00 | Rachel Wu: Stratosphere-troposphere coupling in LESFMIP (community paper)

14:15 | Sara Bennie (virtual): Do externally forced atmospheric trends resemble modes of internal variability?

14:30 | Rei Chemke (virtual): Targeted large-ensemble simulations for elucidating model-reanalysis discrepancies in storm track trends

14:45 | Discussion

15:15 | 2F-Lobby | Coffee Break

15:40 | 2F-Lotus Hall | Session C-3: Impact of circulation changes on extreme events

Chair: James Risbey

15:40 | James Risbey: Introduction from the session chair

15:55 | Zhuo Wang: At the weather-climate interface: interactions between large scale circulation and extremes

16:00 | Hamish Ramsay (virtual): Poleward migration of the most damaging tropical cyclones

16:15 | Marlene Kretschmer (virtual): Using machine learning to infer teleconnections of extreme weather events

16:30 | Discussion

16:45 | Introduction of the Breakout Room Topics, followed by Breakout Discussions

Topic 4 | 2F-Lotus Hall | Circulation response to external forcing

Discussion leads: Doug Smith and Scott Osprey

- How can we make progress in isolating the forced response in circulation to external forcing?
- How can we address the potential challenges of the signal-to-noise paradox making it more challenging to isolate the forced response?
- What are the first insights from LESFMIP?
- What are the changes in which we have high/medium/low confidence?
- What are the next steps needed to move forward? Novel model experiments, more targeted analysis? What should LESFMIP phase 2 include?

Topic 5 | 2F-Edelweiss Hall | What are the strengths and limitations of data-driven (AI) ensemble forecasting systems and can they play a role in EPESC?

Discussion leads: Dim Coumou and Erich Fischer

- AIFS has become operational at ECMWF
- AI-driven ensemble forecasting systems such as GenCast have been released. If they are becoming better at representing longer time scales (<https://arxiv.org/abs/2503.23953>) and large-scale atmospheric fields, can they also inform EPESC-relevant activities?
- What are the risks and limitations vs. opportunities?

Topic 6 | 4F-Video Conference Room | *Not yet decided: Something around updated recent forcings?*

Discussion leads: TBD

- Are we about to lose crucial satellites which provide key information needed for updated forcings? are we losing key satellites that help constrain EEI? Do we have a Plan-B?
- In the absence of blended historical and future forcings, can we discuss an intermediate staging, perhaps including something like a hindcast of the most recent decade, or a short (up to 5 years) forecast from present day with simple extrapolated future forcings? Depends on the outcome of discussion of updated forcings. Or the forecast impact of degraded future observations of forcings following defunding of observational networks?

18:00 | Early Career Scientist Networking Dinner

FRIDAY 18 JULY 2025

08:45 | 2F-Lobby | Check-In

08:55 | 2F-Lotus Hall | Session D-1: The role of external forcings and internal variability on atmospheric temperature trends

Chair: Andrea Steiner

08:55 | Andrea Steiner: Introduction from the session chair

09:00 | Benjamin Santer (virtual): On Human fingerprints of climate change (atmospheric temperature, models and observations)

09:15 | Matthias Stocker (virtual): Evaluating atmospheric temperature trends from LESFMIP simulations and observations

09:30 | Sebastian Sippel (virtual): Early-twentieth-century cold bias in ocean surface temperature observations & implications for constraints on future temperature projections

09:45 | Erich Fischer: On how the continued upward trend in temperature impacts

hazard likelihoods (the increased likelihood of 5-sigma events)

10:00 | Satyajit Singh Saini (virtual): Aerosol transport and Polar Climate Extremes: Heatwave amplification, Snow-albedo feedback, and Cryosphere vulnerability

10:15 | Discussion

10:45 | 2F-Lobby | Coffee Break

11:15 | 2F-Lotus Hall | Breakout Room Reports and Discussion

11:15 | 5-minute reports from Breakout Topics 4-6

11:30 | Discussion

11:45 | 2F-Lotus Hall | Session D-2: Extreme event attribution, Part I

Chair: Zhuo Wang

11:45 | Zhuo Wang: Introduction from the session chair

11:50 | Yukiko Imada: Event attribution methods and approaches

12:05 | Wenxia Zhang: Anthropogenic amplification of precipitation variability over the past century

12:20 | James Risbey: The role of model bias in model assessment of extreme events
Hold discussion until after lunch

12:35 | 2F-Lobby | Lunch Break

13:30 | 2F-Lotus Hall | Session D-2 (cont.): Extreme event attribution, Part II

Chair: Zhuo Wang

13:30 | Nick Leach: Forecast based weather and impact attribution

13:45 | Seung-Ki Min: Global warming-induced warmer surface water over the East China Sea can intensify super typhoons like Hinnamnor

14:00 | Yang Chen: Human-caused increases in humidity-related compound extremes constrained by homogenized observations

14:15 | Christian Franzke: The first emergence of unprecedented compound extremes in the Anthropocene

14:30 | Discussion

15:00 | 2F-Lobby | Coffee Break

15:25 | 2F-Lotus Hall | Session D-3: The challenges and opportunities of taking research activities into operational mode

15:25 | Chair TBD: Introduction from the session chair

15:30 | Anca Brookshaw (virtual): On the different needs of research vs operational activities from the seasonal perspective; added challenges posed by the decadal time scales

15:45 | OkYeon Kim: Advancing Annual-to-Decadal prediction of Extreme Climate Events in the Asia-Pacific Region

16:00 | Doug Smith: On the operational Annual-to-Decadal updates

16:15 | Erich Fischer: The Future of EPESC and LEADER: where are we going?
Framing the long-term vision of EPESC: Where will the science of annual to decadal attribution and prediction be in 2050?

16:30 | Final Discussion