July 2025

WCRP

ESMO Brief

The newsletter of the ESMO Project

Welcome to the Second Issue of the ESMO Brief

Much has happened since the launch of our first newsletter. Over the past months, ESMO has steadily grown its presence in the global Earth system science community, contributing to key conferences, initiating new collaborations, and supporting innovative projects at the intersection of observations and modelling. As the project evolves, so does its reach, with exciting developments both within working groups and across partner institutions.

This issue brings you a selection of updates and reflections from across the ESMO network. From hackathons and model intercomparison projects to international conferences and capacity-building efforts, the contributions showcase the diverse ways in which ESMO is helping shape the future of climate science. You'll find insights into global-scale modelling, satellite-observation integration, and the development of cutting-edge data products, alongside reflections on equity in Earth science careers.

Looking ahead, ESMO continues to build momentum, with several major events already in the pipeline, including the CMIP Community Workshop in Kyoto, the S2S2D Conference, and upcoming working group activities. We hope this newsletter serves as both a snapshot of what's been achieved and an invitation to stay connected and engaged as ESMO grows.

Thank you to all contributors, and we look forward to highlighting even more of your work in future issues.

The ESMO Editorial Team


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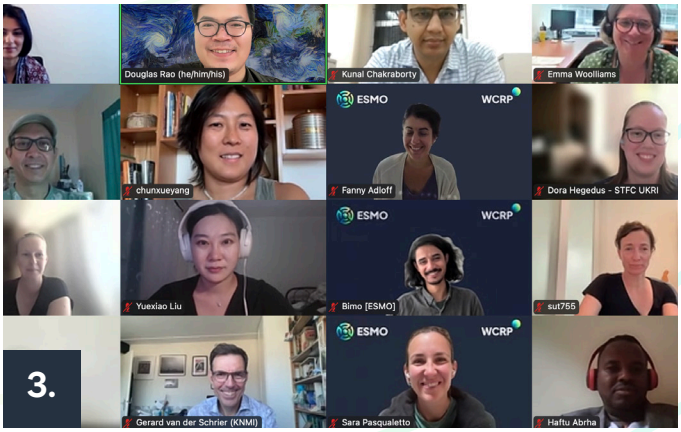

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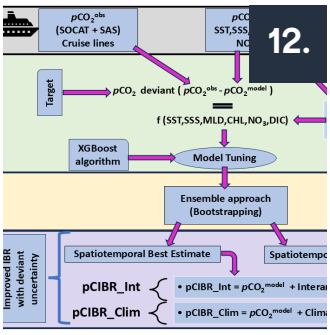

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In this issue:

In the Spotlight

1. Seeing Through the Satellite's Eye: Bridging Models and Observations at the Global km-Scale Hackathon

Interview with Karsten Peters-von Gehlen by Sara Pasqualetto

In May 2025, the international Earth system science community came together for the Global Kilometer-Scale Hackathon, a week-long, distributed event designed to accelerate collaboration around high-resolution Earth system modelling. Hosted across multiple nodes worldwide, the hackathon focused on the analysis of kilometre-scale storm-resolving models and how these can improve our understanding of complex Earth processes. At the ESA node in Frascati, participants worked at the interface between satellite observations and climate model outputs, fostering collaboration between observational scientists and modelling groups to explore how satellite data - particularly from missions like EarthCARE - can inform model evaluation. This approach offers a powerful means of directly comparing model simulations with observations: a key step toward ESMO's vision of tightly integrating Earth system models and satellite data. In this interview, we speak with Karsten Peters-von Gehlen, who participated at the Frascati node, about the work done, its significance for ESMO, and the path forward.

Can you walk us through the specific objectives and activities you were involved in at the ESA Frascati node during the Global km-scale Hackathon?
Absolutely. I was invited to join the ESA Frascati node by Bjorn Stevens, primarily because of my background with model and satellite data, which I've worked extensively with during my PhD and postdoc. The team was looking for someone who could bridge the gap between observational data and state-of-the-art modeling, especially in the context of the new EarthCARE satellite, which became operational July 2024.

When I arrived, the main objective became clear: to explore how EarthCARE's newly released data products could be integrated with high-resolution

The group at the ESA node. From the left: Karsten Peters-von Gehlen, Blanka Piskala, Johanna Mayer, Saskia Brose, Arthur Avenas, and Beniamino Abis

model data in a hackathon setting. The challenge was to see whether our current tools and workflows, designed largely for working with large-scale, centralized model datasets, could be effectively adapted to datasets deriving from satellite-based measurements. Our team in Frascati consisted of six people, including our PI, Saskia Brose, three postdocs who were already working with EarthCARE data, a developer I coincidentally knew from my Max Planck days, and myself. It was a small, focused group, which made collaboration quite fluid.

One of the key contributions I made was helping ESA colleagues better understand model data. At one point, they wanted to directly compare specific features between the model outputs and satellite observations. I explained how coupled simulations work and why e.g. model timestamps (like April 15 or December 2020) don't always align with real-world events. These nuances are critical when interpreting and comparing datasets.

What's so special about Earth Care and its data?
EarthCARE is a remarkably sophisticated satellite: it's the result of more than two decades of planning. In fact, it was already being discussed in concrete terms during my PhD back in the early 2000s. It brings something genuinely unique to Earth observation science.

What makes EarthCARE special is that it was specifically designed to study the complex interactions between clouds and aerosols. It doesn't just take images, it carries a suite of advanced instruments all mounted on a single platform. This includes a radar for cloud profiling and a lidar for aerosol detection. The fact that these instruments are all on the same satellite allows for perfectly co-located measurements.

Another reason EarthCARE is so significant is its direct link with recent airborne campaigns. For instance, the PERCUSION campaign over the tropical Atlantic. It was partly funded by ESA specifically to help evaluate EarthCARE data. Every HALO flight during that campaign was planned to fly directly underneath the satellite's path at some point, enabling near-simultaneous comparisons between in-situ aircraft measurements and satellite observations.

This synergy between HALO and EarthCARE provides a uniquely valuable dataset for validating satellite products and for improving model evaluation. It's not just about how realistic a model seems; it's about using observational data like this to challenge and refine what we think we know.

The ESA Frascati team worked closely with modelling teams to align analysis strategies. Can you describe how this collaboration unfolded during the hackathon, and what insights it led to? What kind of comparisons were you able to make between model and satellite data?

The collaboration really kicked off on the first day during the introductory session. Teams were encouraged to reach out to us if they thought satellite data could support their work. Most of the coordination happened through Mattermost channels, with each team explaining what they were working on, what parameters they wanted to analyze, and what they hoped to achieve.

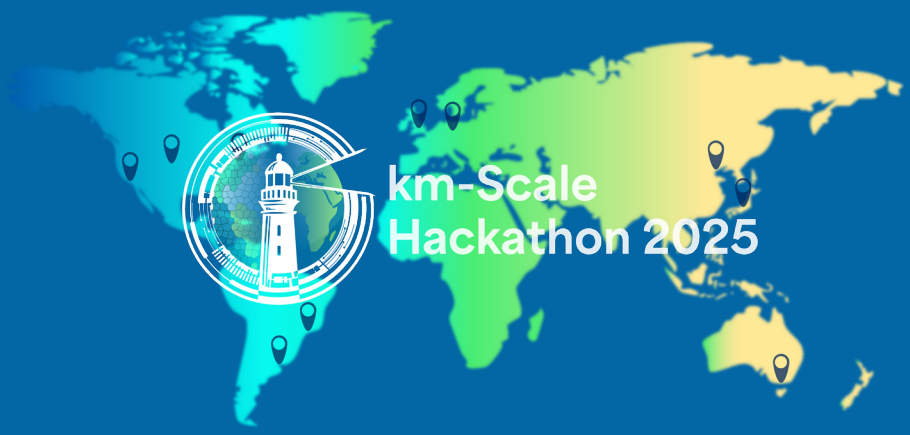
The overall idea was to see if the kinds of analyses that modeling teams were doing with their data could be replicated or complemented using satellite data from EarthCARE. For example, one group focused on stratocumulus clouds off the coast of Namibia. They were looking at parameters like liquid water path and albedo, and our job was to identify what EarthCARE instruments and data products could be used to support or benchmark their analyses. That's where the collaboration got interesting. Satellite and model variables don't always align neatly, so I helped guide the ESA colleagues in identifying the right satellite parameters for comparison. It can be tricky: there are uncertainties, naming inconsistencies, and sometimes it's just not obvious how to match variables. But in the end, it worked out well. We managed to overlay EarthCARE data with model output on the same plot, just a simple line among other lines, but it was striking to see how well they matched. That kind of result, even if small, validates both the observational approach and the modeling work.

The ESA team working hard during the hackathon week. Picture: Karsten Peters-von Gehlen.

Did you know?

The **WCRP Global Km-Scale Hackathon** took place on 12-16 May 2025 across 10 local nodes across the globe, with satellite nodes, including the ESA one, contributing to the overall mission on in-depth analysis of high resolution storm-resolving models.

The hackathon saw the participation of over **650 participants** in Canberra, Tokyo, Beijing, Hamburg, Oxford, Sao Paulo, Buenos Aires, Princeton, Boulder and Berkeley. A truly collaborative effort that brought together for one week climate researchers from all over. Cross-node interactions and multi-disciplinary science teams made this intense week a success story for collaborative initiatives in climate modelling.



To learn more about what happened during the Hackathon week, jump to the ESMO website and read through the Live-Blog.

Another group was looking at dust storms in the Sahara. Finding these in EarthCARE's data was incredibly challenging. We had to manually sift through imagery from a geostationary satellite, frame by frame, to identify potential dust storms. And even when we found one, the next question was: did EarthCARE fly over it? Often the answer was no, the satellite's path would be hundreds of kilometers off. But eventually, we found a good case where EarthCARE's track aligned with a visible dust storm. The vertical profile of both dust and cloud in that event was excellent, and it became a strong example for model comparison.
Overall, the hackathon showed that real synergy is possible between modelers and satellite data users.

From a technical perspective, what specific advantages did the hackathon environment offer that enabled the group to achieve things you wouldn't have been able to do as easily in a regular research setting?
The hackathon environment offered something quite unique, an opportunity to focus intensely on a single topic for several consecutive days, which is a rare luxury in day-to-day academic or research life. That kind of uninterrupted concentration, even just over two or three days, enables a level of deep exploration that often leads to insights you wouldn't arrive at otherwise. It also creates a collaborative dynamic that's hard to replicate in regular settings.

Of course, one week isn't enough to finish a full research paper, and I don't think anyone expects that. But what the hackathon does provide is the spark, the foundation for ideas and collaborations that can be developed further afterward. It's about testing what's possible with the data and tools you have at hand.

For ESA specifically, I think it was an eye-opener in terms of understanding how their data is used by the broader scientific community. They saw firsthand the technical and practical barriers to data access and how those obstacles can limit engagement. That kind of direct feedback loop wouldn't happen as naturally in a more traditional setting.

Want to learn more about Karsten's highlights of the week and future plans for collab-oration? Read the full interview on the ESMO website.

2. Reimagining Weather Prediction: WP-MIP Takes Off

The Weather Prediction Model Intercomparison Project (WP-MIP) is a new international initiative bringing together physical, AI-based, and hybrid models to advance global weather prediction. We recently sat down with project coordinators Ron McTaggart-Cowan (ECCC), Linus Magnusson and Inna Polichtchouk (both ECMWF) to get their thoughts on the WP-MIP goals, scope, and how you can get involved.

I've heard that you're running an AI intercomparison project. Is that true?

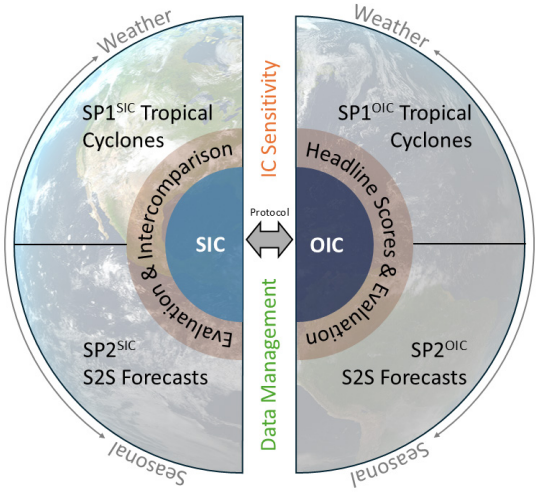
We're planning a project that's broader than just AI intercomparison. The Weather Prediction Model Intercomparison Project (WP-MIP) is designed to include traditional physical models, AI models, and all forms of hybrids between the two.

So is this WP-MIP a bilateral ECMWF-ECCC initiative?

Not at all! One of the essential elements of the project is that we've got broad engagement of the operational weather prediction community. We currently have 17 centres from 6 different continents that plan to contribute forecasts. This project came out of discussions between WGNE and WIPPS, then merged with a planned follow-up to the successful DIMOSIC project that Linus ran a few years ago. In this first phase we're focusing on medium-range guidance from global deterministic prediction systems, but we're hoping to expand that scope in the future to include ensembles, limited area models, and more.

With such broad engagement, what do you hope to achieve?

As a first step, we're hoping to build a centralized archive for distributed diagnostics and development. The important second step focuses on model evaluation, pulling in the expertise of the JWGFVR and PDEF and providing the community. We think that we'll be able to accelerate the development of new evaluation tools and techniques that effectively compare AI, hybrid and physical model predictions.



An important practical outcome of WP-MIP will be guidelines for evaluation best-practices that allow developers and operational centres to fairly assess strengths and weaknesses across the different modelling paradigms.

Are these goals similar to other projects in this domain?

The active involvement of so many national meteorological services and WMO working groups distinguishes WP-MIP from other efforts like WeatherBench and projects within NOAA. Those projects have played the important role of introducing AI techniques to the weather prediction community; however, a broader base of engagement is needed going forward. We believe that the WMO is the right organization to lead such an effort given its global reach and the broad range of expertise contained in its working groups.

What stage is the project at right now, and how would someone join the group?

Our contributors are in the process of setting up their integrations and submitting prototype data to the MARS system at ECMWF where the database will be hosted. We hope that early datasets will be available by the end of the summer. That being said, we'll be more than happy to welcome new groups to the project at any time. Anyone can access the project Whitepaper or get in touch with either of us via email. Remember that you don't have to be running a model to have a place in WP-MIP: diagnostics and evaluation are central to the project. We send out regular status updates to those who have expressed interest in the project, so please let us know and we'll gladly add anyone to our distribution list!

3. Working Group on Observations for Researching Climate: new members and activities underway

The selection process for the **new Working Group on Observations for Researching Climate (WGORC)** has been completed, and the group has now been officially formed. This diverse team of experts will support the development and coordination of observational strategies critical to advancing climate science.

Below, we are pleased to present the profiles of the newly appointed members. They will join the co-chairs **Amy Doherty** and **Yuhan Douglas Rao** in shaping the activities and objectives of this new working group.

Haftu Abrha Mengesha
Institute of Climate and Society (ICS), Mekelle University, Ethiopia
Research interests: Climate modeling, Drought mentoring, Forest Ecology and Carbon Stock Estimation, Remote Sensing and GIS Applications

Kunal Chakraborty
MoES-Indian National Centre for Ocean Information Services (INCOIS), India
Research interests: Ocean Modelling, Physical-Biological Interactions in the Ocean, Biogeochemical Cycling of Carbon, Ocean's Role in Climate Variability, Predictability, and Change

Dora Hegedus
UK Research and Innovation, UK
Research interests: Remote sensing, retrieval algorithms for atmospheric composition, cross-ECV research, observations for climate model evaluation, complex citation and data standards, observation-modelling interface

Yuexiao (Selina) Liu
China Institute of Water Resources and Hydropower Research (IWHR), China
Research interests: Climate change, Landslide, Flash flood, Flood models, Attribution study; transport risk and resilience.

Christina McCluskey
NSF National Center for Atmospheric Research, USA
Research interests: Aerosol-cloud microphysics, earth system modeling, integrating models and field observations

Samar Minallah
NSF National Center for Atmospheric Research, USA
Research interests: Earth system modeling; Atmosphere-Cryosphere-Hydrosphere assessments; Complex terrain hydroclimates; Climate variability and predictability; GIS applications in ESM

Pallav Ray
Florida Institute of Technology (FIT), USA
Research interests: Tropical Meteorology, Madden-Julian Oscillation, Regional Climate Modeling, Land-Air-Sea Interactions

Marc Schröder
Deutscher Wetterdienst (DWD), Germany
Research interests: Observations for climate and process studies, satellite-based remote sensing, data record assessments, support to climate services and analysis

Gerard van der Schrier
Royal Netherlands Meteorological Institute, the Netherlands
Research interests: In situ observations of the ECVs for Europe and the production of gridded datasets based on thee observations. Drought

monitoring. Monitoring extreme climatic events and producing a historical perspective for these events.

particularly for radiometric and radar altimetry satellites.

Emma Woolliams
National Physical Laboratory, UK
Research interests: Application of metrology (measurement science) principles of metrological traceability, uncertainty and comparison to observational datasets,

Chunxue Yang
Institute of Marine Sciences, National Research Council, Italy
Research interests: Ocean and climate dynamics, ocean reanalyses, ocean climate datasets evaluation for marine and climate service

Join us in welcoming the newest members of the ESMO community!

4. Call for New Members: obs4MIPs Steering Panel

obs4MIPs
Observations for Model Intercomparison Projects

We are seeking applications from enthusiastic individuals with a background in observations and/or climate modelling to join the obs4MIPs Steering Panel.
There are three types of membership positions included in this call:

- Co-chair (1 position)
- Member - domain expertise in geospatial, high resolution and regional datasets (up to 5)
- Member - reference dataset preparation e.g. json files, coding, Github repositories (up to 5)

We are particularly interested in candidates that have skills and interests to contribute at a technical level to deliver obs4MIPs datasets.
Deadline for applications: 25 July 2025
Find all information and links to the full call and application portal on our website.

5. CMIP Community Workshop 2026 - Join Us in Kyoto for Advances in Climate Modeling

We're excited to announce the CMIP Community Workshop 2026, to be held **March 9-13, 2026**, at the **Kyoto International Conference Centre in Japan**, with hybrid options for virtual participation. This gathering—hosted by Japan's SENTAN project and AIMEC, and generously supported by the CMIP International Project Office at ESA and Australia's ACCESS NRI—brings together a diverse and growing community of Earth system scientists, partners, and stakeholders

What to Expect:
This workshop is an opportunity to reflect on progress made under CMIP6 and to explore the early results and experimental designs shaping CMIP7. Discussions will emphasize the evolving interface between models and observations, new strategies for generating and disseminating climate information, and efforts to build more inclusive and accessible modeling communities. A highlight of the week will be a hackathon organized by the "Fresh Eyes on CMIP" early-career community, alongside sessions that foster exchange across scientific disciplines and career stages.

Call for side sessions and abstracts
The workshop is currently seeking side-session proposals by 12:00 UTC on 13 August 2025. These 90-minute in-person or hybrid formats can take various shapes (Townhalls, Panel Discussions, World Cafés, or Training/Learning Labs) but creativity is encouraged. Conveners should assemble teams of 2 to 5 co-conveners, include at least one in-person participant, and commit to WCRP's diversity, equity, and Code-of-Conduct principles.

Side-session proposals offer a rich opportunity to explore key themes such as historical climate variability, system feedbacks and thresholds, and the synthesis of model-data insights. Whether facilitating interactive cafés on AI-driven diagnostics, a training lab for new evaluation tools, or a panel on emerging CMIP7 experiment designs, your session can spark vibrant dialogue and collaboration.
Alongside side events, abstract submissions are open from 23 May to 13 August 2025, contributing to the core programme. Notifications on accepted sessions and abstracts will be shared in May and September 2025, respectively.

Key Dates (Side Sessions & Abstracts):
- Side-session proposals submissions by **13 August 2025,** 12:00 UTC (Deadline extended)
- Abstract submissions by **13 August 2025**, 12:00 UTC

Take the lead in shaping CMIP26: submit side-session ideas that inspire community interaction, learning, and impact. For proposal forms and guidelines, visit the side-session page on the workshop website or reach out to the CMIP IPO at cmip-ipo@esa.int.

See you in Kyoto!

Meeting Report

6. Climate Science in the Spotlight: ESMO at EGU Vienna

By Bimochan Niraula

In the last week of April this year, we packed our bags, boarded the train and headed to Vienna to represent the ESMO IPO at the 2025 EGU General Assembly. Over 20,000 scientists from 120 countries came together here for what proved to be a very successful gathering of the global Earth science community. The conference, held from April 27th through May 2nd at the Austria Center Vienna, featured innumerable presentations, posters, panel discussions and other activities and we were happy to be a part of this scientific gathering.

Throughout the week, ESMO was a part of the DKRZ & Universität Hamburg CEN (Center for Earth System Research and Sustainability) booth, displaying informational material, giving introductory presentations, and answering people's inquiries. As one of the displays on the main floor of the convention center, we fielded hundreds of visitors each hour and a lot of new and some familiar faces stopped by the booth to ask questions and pick up some of our little branded goodies. Most famous (or infamous) among these was the ESMO bicycle bell, ensuring that ESMO's presence rang true and well throughout the floor.

Apart from the booth, ESMO also organised a town-hall discussion on "**Innovative Approaches to Observations and Modelling for Improved Climate Information and Services**" in partnership with CORDEX (Coordinated Regional Climate Downscaling Experiment), and the RifS (Regional Information for Society) Global Extremes Platform (GEP). Five scientists working with the different groups came together as a panel to describe the projects and answer questions related to the topic. Alongside this, we were also part of a climate related session with a poster on ESMO's structure and how it is valuable for advancing climate research. On top of these, several events from CMIP and other WCRP initiatives took place, often including members of the ESMO community.

Our panelists at the EGU Town Hall. From the left: Aurélien Ribes (Météo-France), Erika Coppola (ICTP), Jason Evans (UNSW), Brigit Hassler (DLR, obs4MIPs), Roland Séférian (Météo-France, ESMO SSG), Bimochan Niraula (ESMO IPO).

IPO Director Fanny Adloff presenting ESMO at the DKRZ booth

The General Assembly, while overwhelming at times, was a great avenue for both formal presentations and informal networking opportunities. We had the chance to connect with several colleagues in person and discuss new collaboration ideas. The conference was well organised, with scientific sessions interspersed with social events and certain programs tailored for Early Career Researchers as well. Vienna provided an excellent backdrop for the exchange of ideas, with the city's blend of historical significance and modern research infrastructure and we are already looking forward to EGU 2026.

Meeting Report

7. Bridging Space and Climate Science: ESMO's Contributions to LPS25

By Bimochan Niraula

From 23 to 27 June 2025, the European Space Agency's 25th Living Planet Symposium (LPS25) was convened at the Austria Center Vienna in Vienna, Austria. Under the banner "From Observation to Climate Action and Sustainability for Earth," this five-day gathering united scientists, policy-makers and industry leaders to showcase cutting-edge satellite research, unveil the latest Earth-observation missions and translate space-borne insights into tangible climate solutions. With its clear focus on turning planetary-scale observation into real-world impact, LPS25 sets the stage for meaningful collaboration and decisive action on our changing planet.

ESMO was an active participant at the Symposium, and organised a **two part science session**, in collaboration with CMIP, where various presenters shared their work related to "Advances at the observation - modelling interface". This ranged from studies about radiative forcing and cloud properties to observational candidate missions and ESM benchmarking tools. Similarly, ESMO also organised an **agora** session that took place as a panel discussion around the newest part of ESMO - the Working Group on Observations for Researching Climate (WGORC). Alongside brief introductions to WGORC, ESMO, Obs4MIPs and the ESMO Emulators task team, the panelists also fielded various questions and suggestions from the audience related to the observations - modeling interface. Similarly, CMIP also organised an agora session on Delivering Sustained Mode Climate Forcings and the Critical Role of Earth Observations, which was very informative.

Alongside the formal sessions described, several members from the ESMO (and WCRP) community were actively involved in various projects, panels, and presentations in the Symposium, which included our WCRP scientific officer Maureen Wanzala participating in the **LPS Early Career session**, helping to inspire the next generation of Earth system scientists. The IPO gave several mini presentations based out of the ESA CCI booth and engaged in innumerable informal discussions. Suffice to say that the Symposium was quite alive with science and collaboration efforts related to our Planet and its Climate.

The panel discussion organized by ESMO at LPS. From left to right: Axel Lauer (DLR / ESM ValTool), Chris Smith (Vrije Uni, Climate Emulators TT), Jörg Schultz (EUMETSAT / ESMO SSG), Claire Macintosh (ESA / ESMO SSG), Amy Doherty (MetOffice / WGORC), Bimochan Niraula (ESMO IPO)

Science Insights

8. Better Observations, Better Predictions: Tackling Climate Uncertainty and Misuse

By Haftu Abrha Mengesha

Climate predictions are essential for guiding global adaptation, mitigation, and risk management strategies. However, their usefulness is often compromised by two major challenges: the misuse of forecasts and the inherent uncertainties in climate models. A key yet often overlooked solution lies in strengthening observational systems and improving validation methods.

Climate models are powerful tools designed to simulate the Earth's complex systems, but their accuracy depends entirely on the quality of the observational data used to calibrate and test them. Observations from satellites, ground stations, and field campaigns serve as the foundation for refining these models. Traditional validation techniques frequently assume that climate data points are independent and identically distributed, but this assumption breaks down when dealing with spatially correlated variables. In response, scientists are developing innovative methods that account for these spatial relationships, leading to more reliable assessments of model performance and uncertainty, especially at local and regional levels.

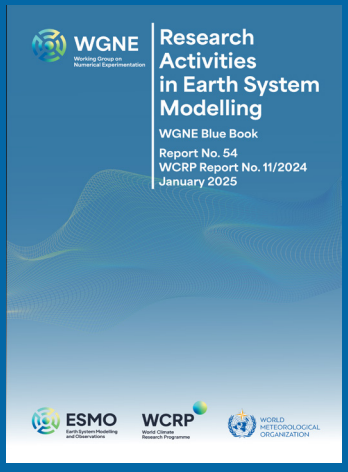
Another critical issue is the misinterpretation of climate forecasts, where probabilistic predictions are treated as fixed outcomes. This can result in misguided decisions, maladaptation, and misplaced confidence. Observational data plays a vital role here as well, helping to identify where models perform well and where they do not, which in turn supports clearer communication of uncertainties. By integrating real-time observational data into models, researchers can continuously refine predictions, enhance scientific accuracy, and build greater trust among decision-makers. This process reduces the risk of misuse and leads to more effective, informed policies. To improve climate forecasting, it is essential to expand and modernize observational networks.

Advanced validation techniques that reflect the spatial complexity of climate systems must also be prioritized. Collaboration between modelers and observational scientists, along with active engagement of users such as farmers, planners, and policymakers, is critical to ensure that climate services address real-world needs. Ultimately, accurate and actionable climate predictions begin with better observations. By reinforcing observational infrastructure and embracing advanced validation approaches, we can reduce uncertainty, avoid misinterpretation, and deliver climate services that genuinely support sustainable and resilient development.

9. Call for Contributions: WGNE Blue Book 2025

The WGNE Blue Book publication is an attempt to foster an early interchange of information among scientists developing numerical models for the purpose of climate simulation and for forecasting on various timescales. The annual call for contributions is now open, and the deadline to submit is **September 15th, 2025**.

Contributions are requested under various topics, including the development and studies of coupled models and ESMs, parameterization of physical processes in ESMs or their components, Reanalysis datasetsand ML and AI in weather prediction.
All info on submissions and formats can be found on our website.



July 2025

ESMO

WCRP

Save the Date

10. WCRP School on Climate Prediction Across Timescales

WCRP School on Climate Prediction Across Timescales

When: 23-27 February 2026

Where: Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina

The World Climate Research Programme (WCRP) is pleased to announce the upcoming edition of its Summer School on Climate Prediction Across Timescales, themed "Prediction Across Timescales: Predictability Assessment and Communication of Uncertainty for Applications in Environment and Society."

This intensive program is designed for early-career researchers and advanced students in atmospheric, climate, and data sciences, as well as junior professionals in climate services or operational prediction. Participants will engage in foundational and advanced lectures during the mornings, followed by interactive, hands-on lab sessions in the afternoons.

Key Objectives:

- Enhance understanding of predictability, forecast skill, and cross-timescale interactions.
- Introduce novel tools for determining predictability and assessing forecast skill.
- Explore emerging applications of machine learning and AI in forecasting.
- Develop practical skills through applied exercises using real-world data.

Target Audience:

Graduate students, postdocs, and junior professionals with a background in climate science, statistics, or related fields. Basic programming experience is expected, proficiency in Python is encouraged.

Prospective Lecturers

- Constantin Ardilouze, CNRM (Université de Toulouse, Météo-France, CNRS), France
- Leandro Diaz, DCAO-CIMA-IFAECI (UBA-CONICET-CNRS-IRD), Argentina
- Leon Hermanson, MetOffice, UK
- Debbie Hudson, Bureau of Meteorology, Australia
- Kirsten Mayer, NSF NCAR, USA
- William Merryfield, ECCC, Canada
- Andrea Molod, NASA, USA
- Ángel Muñoz, Barcelona Supercomputing Center (BSC), Spain
- Marisol Osman, DCAO-CIMA-IFAECI (UBA-CONICET-CNRS-IRD), Argentina
- Yuhei Takaya, Meteorological Research Institute, Japan
- Bimochan Niraula, ESMO IPO
- Sara Pasqualetto, ESMO IPO

The applications will open soon! For more information and updates, please visit the official event page.

The school is supported by the Abdus Salam International Centre for Theoretical Physics

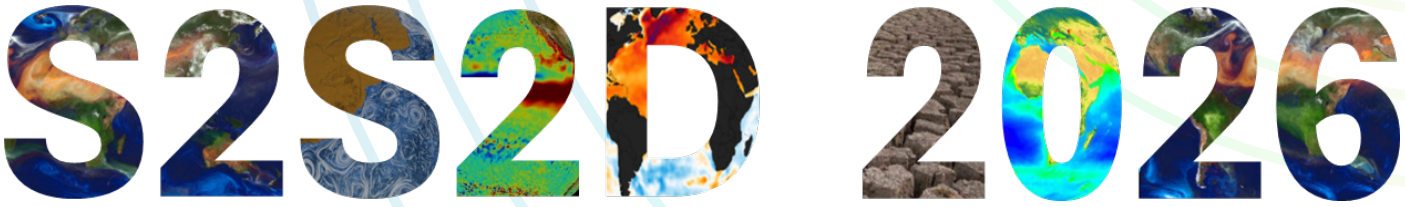
ICTP The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

unesco United Nations Educational, Scientific and Cultural Organization

Save the Date

11. S2S2D Conference 2026: Advancing climate predictions from weeks to decades to benefit society



When: 7-11 September 2026
Where: Reading, UK

The science and practice of subseasonal to decadal prediction are at a crossroads. In recent years subseasonal and decadal prediction have matured from exploratory research areas into multi-system operational services, while multi-annual and multi-decadal timescales have emerged as further temporal realms for initialized prediction. However, inherent sources of predictability remain to be fully understood and exploited as predictions aim to address a widening array of Earth system components and to support early warnings of extreme events. Meanwhile, artificial intelligence/machine learning are propelling rapid and revolutionary developments, the outcomes of which are not yet clear.

This event will provide a forum for the current state of Earth system prediction science to be shared and discussed. It will consist of two parallel sub-conferences, respectively focusing on the subseasonal-to-seasonal and seasonal-to-decadal prediction horizons, together with plenary sessions addressing cross-cutting themes.

Overall objectives include :

- Facilitating coordination and integration of global research on subseasonal to decadal Earth system prediction and its applications
- Highlighting scientific advances and emerging methodologies in subseasonal to decadal prediction
- Sharing approaches for development of products and services from subseasonal to decadal predictions
- Providing opportunities for Global South and early career professionals to share their work and network with the international research community.
- Informing the development of operational systems to provide Early Warnings for All (EW4A)

This meeting is open to all scientists, producers, and users involved in subseasonal to decadal climate predictions and related topics, at all stages of their careers.

For more information and updates visit the event page on the ESMO Website.

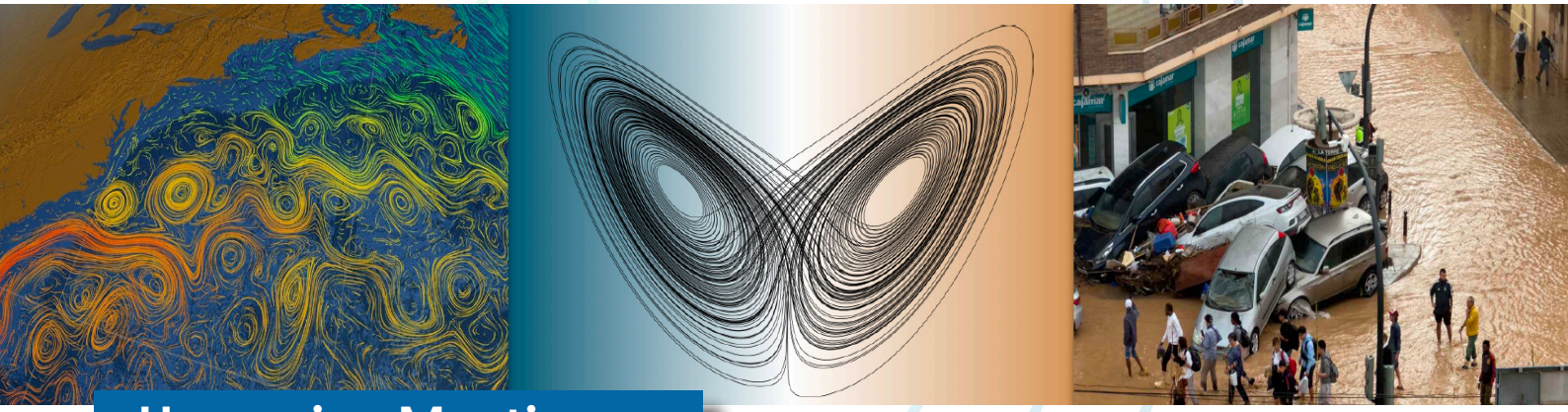
The event is supported by WCRP and has been endorsed by the World Weather Research Programme (WWRP) of the World Meteorological Organization (WMO)

WCRP World Climate Research Programme

WWRP WORLD WEATHER RESEARCH PROGRAMME

WORLD METEOROLOGICAL ORGANIZATION

1950-2025 SCIENCE for ACTION



Upcoming Meeting

12. Open Workshop on Understanding and Predicting Annual to Multi-Decadal Climate Variations

Bologna, Italy & online
18-20 November, 2025

In a world stricken by unprecedented climate anomalies and impactful weather extremes, there is an increasing need for reliable climate predictions on multiple forecast horizons. Even though large-ensemble predictions exhibiting statistically significant skill in various aspects have been developed, and are produced operationally by several centers globally, there are still important gaps in understanding the origins and the limits of the associated predictability. In particular, the fundamental drivers of historical and future climate variations are still, in part, poorly understood and often mis-represented in the climate models, limiting our confidence in predictions and projections. Hence, an integrated attribution and prediction is needed, in which the drivers of forecast signals are understood and model fidelity is assessed regarding the representation of relevant processes, to improve confidence in predictions of regional climate extremes.

This workshop focuses on climate variations on annual to multi-decadal timescales (1-30 years) and invites contributions on a wide range of topics, including: skill assessments of predictions; studies on the role of external forcings and climate variability; investigations on the mechanisms underlying specific aspects of predictability; prediction and predictability of climate extremes; evaluations of novel post-processing methods and new modelling techniques; studies on integrated attribution and prediction of climate and extremes. Around these themes, we also welcome studies employing explainable artificial intelligence and machine learning approaches.

This workshop is jointly organized by three Horizon Europe projects (ASPECT, EXPECT, I4C) together with the World Climate Research Programme's DCPP and EPESC groups working on integrated attribution, prediction and projection. Given a degree of overlap between the aims and the scope of the individual entities involved, this workshop also aims at providing new opportunities for closer collaboration.

Deadline for abstract submission: **31 July, 2025 (deadline extended)**

Sessions:

- Understanding and attributing historical climate variations and extremes
- Forecast evaluation (extremes, anomalies, trends, windows of opportunity)
- New methods in prediction (modelling, initialization, AI/ML, post-processing)
- Mechanisms underlying predictability and their representation in forecast systems

Scientific Organizing Committee:

• Panos Athanasiadis • Roberto Bilbao • Remy Bonnet • Annalisa Cherchi • Markus Donat • Kirsten Findell • Noel Keenlyside • Wolfgang Müller • Dario Nicolì • Pablo Ortega • Scott Osprey • James Risbey • Jon Robson • Doug Smith • Lara Wallberg • Antje Weisheimer • Stephen Yeager

Paper Highlights

13. Development of a High-Resolution Indian Ocean Surface pCO2 Data Product Using Advanced Machine Learning Techniques

By Kunal Chakraborty

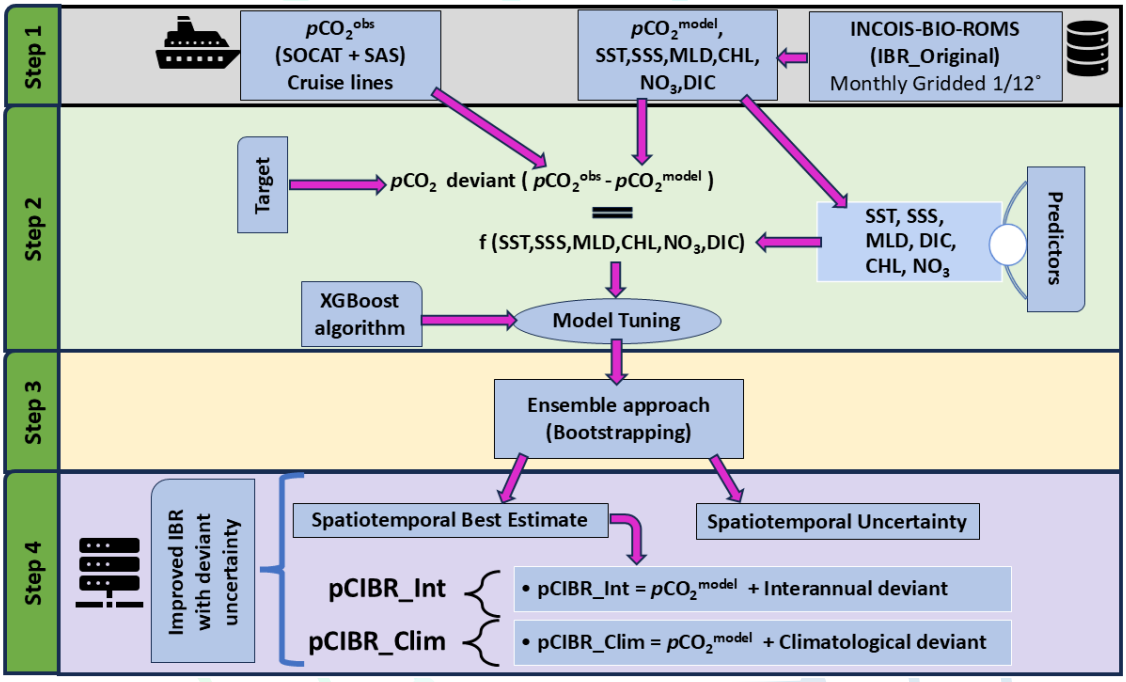
Accurate estimation of surface ocean partial pressure of carbon dioxide (pCO2) is essential for understanding the ocean's contribution to the global carbon cycle and its response to climate change. Regional ocean models offer valuable insights into pCO2 variability and long-term trends; however, they often exhibit systematic biases due to challenges in representing small-scale processes and uncertainties in model parameterizations. Observational data are critical for assessing surface pCO2, but their spatial and temporal coverage remains limited particularly in the Indian Ocean (IO).

In this study, we use a machine learning (ML) approach to correct the biases in high-resolution (1/12°) surface pCO2simulations from the INCOIS-BIO-ROMS model (pCO2model) over the period 1980-2019. We train the ML model using the differences between observed (pCO2obs) and modeled pCO2 to generate the spatio-temporal pCO2 deviants (pCO2obs- pCO2model). These deviations (interannually and climatologically varying) are then added back to the original model output which results in two improved data products, pCIBR_Int and pCIBR_Clim, respectively.

Evaluation against independent datasets including moored observations (BOBOA), gridded SOCAT, and other ML-based pCO2 products (CMEMS-LSCE-FFNN and OceanSODA) shows an improvement of approximately 40% ± 3.31% in RMSE compared to the original model. These corrected pCO2 products are expected to enhance the accuracy of air-sea CO2 flux estimates over the Indian Ocean from 1980 to 2019, helping to better identify key source and sink regions and advancing our understanding of the Indian Ocean's role in the global carbon budget.

Reference of this published article:

Ghoshal, P. K., Joshi, A. P., & Chakraborty, K. (2025). An improved long-term high-resolution surface pCO2 data product for the Indian Ocean using machine learning. Scientific Data, 12(1), 577.



Schematic representation of the complete methodology adopted in this study to improve pCO2model.

Paper Highlights

14. Balancing Earth science careers in an unequal world

By Sara Pasqualetto

Early-career Earth scientists around the world face vastly different professional landscapes. While some benefit from robust funding, strong mentorship, and institutional support, many others, especially those in low- and middle-income countries, struggle to access even the most basic resources. A recent global study published in Nature Reviews Earth & Environment based on survey data and conducted in-depth interviews with early-career Earth scientists from across the globe, sheds light on these disparities and proposes concrete steps toward a more inclusive and equitable scientific community. This work stems from a side event organized by the Young Earth System Scientists (YESS) community during the 2nd Open Science Conference of the World Climate Research Programme, held in Kigali, Rwanda in October 2023.

One of the clearest findings was the significant **disparity in access to funding and infrastructure**. Researchers from the Global South face significant barriers in publishing their work, including financial constraints, perceived biases in peer review, limited access to data, and personal discrimination, challenges that less affect their Global North counterparts. Similarly, Global South scientists struggle to access leadership roles in international organizations due to fewer institutional connections, inadequate funding, and limited time, often feeling excluded from what they describe as a "private club."

Mobility and international training opportunities also play a crucial role in career development, yet many early-career researchers face major barriers in accessing them. Visa restrictions, high travel costs, and lack of institutional support often prevent scientists, particularly those from the Global South, from participating in short-term visits, workshops, and international collaborations. These experiences are often seen as essential to building a global profile and forming research partnerships.

*The seesaw graphic contrasts favorable (right side) and unfavorable (left side) experiences. Pie charts show the distribution of Global South, Global North, and mixed experiences by color (green, violet, orange), with quotes illustrating each side. A bar plot summarizes total reports by region and sentiment, using the same color code. *Country names are anonymized as "In my country."*

The disparities highlighted during the workshop on Global South–North inequalities underscore the urgent need for systemic change within the Earth science community. Persistent structural barriers are limiting the ability of Global South researchers to contribute fully to scientific knowledge and climate solutions, reinforcing global inequities and deepening climate injustice. Achieving a more just and sustainable future requires intentional action—from fairer publishing practices to more inclusive institutional support and collaboration. As a global scientific community, we must recognize our shared responsibility to dismantle these barriers and foster equity in knowledge creation and impact.

The paper was published in *Nature Communications Earth and Environment*: Testani, N., Cappelletti, L.M., Díaz, L.B. et al. Balancing Earth science careers in an unequal world. *Commun Earth Environ* 6, 22 (2025). https://doi.org/10.1038/s43247-024-01964-w

15. Upcoming meetings and conferences

As part of our commitment to keeping the Earth system modelling and observations community informed, we've compiled a list of key meetings and conferences scheduled in the coming months. Whether your focus is on numerical modelling, data assimilation, observational techniques, or interdisciplinary approaches, these gatherings provide platforms to engage with peers, discuss emerging challenges, and contribute to shaping the future of our field.

Explore the list below to identify the events that align with your interests and mark your calendars for a productive and inspiring year ahead!

August 2025

25-27 August 2025: Machine Learning for Earth System Modelling - Bonn, Germany

September 2025

07-12 September 2026: EMS Annual Meeting 2025 - Ljubljana, Slovenia

15-19 September 2025: EUMETSAT Meteorological Satellite Conference 2025 - Lyon, France

22-26 September 2025: Pan-CLIVAR Meeting 2025 & CLIVAR Symposium: Bridging Science and Society in Southeast Asia and beyond - Bali, Indonesia

October 2025

28-30 October 2025: EUMETSAT Climate Symposium 2025 - Darmstadt, Germany

November 2025

03-07 November 2025: WGNE40 Annual Meeting - Beijing, China

18-20 November 2025: Open Workshop on Understanding and Predicting Annual to Multi-Decadal Climate Variations - Bologna, Italy

December 2025

December 2025/Beginning 2026: Annual ESMO SSG Meeting + WGORC Kick Off (in preparation)

15-19 December 2025: AGU Annual Meeting 2025 - New Orleans, USA

February 2026

09-12 February 2026: Climate and Cryosphere Open Science Conference - Wellington, New Zealand

23-27 February 2026: WCRP School on Climate Prediction Across Timescales - Buenos Aires, Argentina

March 2026

09-13 March 2025: CMIP Community Workshop 2026 - Kyoto, Japan

September 2026

07-11 September 2026: S2S2D Conference 2026: Advancing Climate Predictions from Weeks to Decades to Benefit Society - Reading, UK

= ESMO session planned or event (co-)organized by ESMO

About ESMO
The Earth System Modelling and Observations (ESMO) core project coordinates, advances, and facilitates all modelling, data assimilation and observational activities within WCRP. Website: **wcrp-esmo.org**

Editing and design
Sara Pasqualetto (ESMO IPO).

Cover image credits: Gerd Altmann from Pixabay

Publication policy
The ESMO Newsletter is published twice a year and features updates and contributions from members of the ESMO panels and projects. Articles are also welcome from external people, as long as pertinent and of interest to the ESMO project and its objectives. For questions on editing, distribution and subscription to the newsletter, please contact Sara Pasqualetto at pasqualetto@dkrz.de.
The ESMO Newsletter is not peer-reviewed.

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