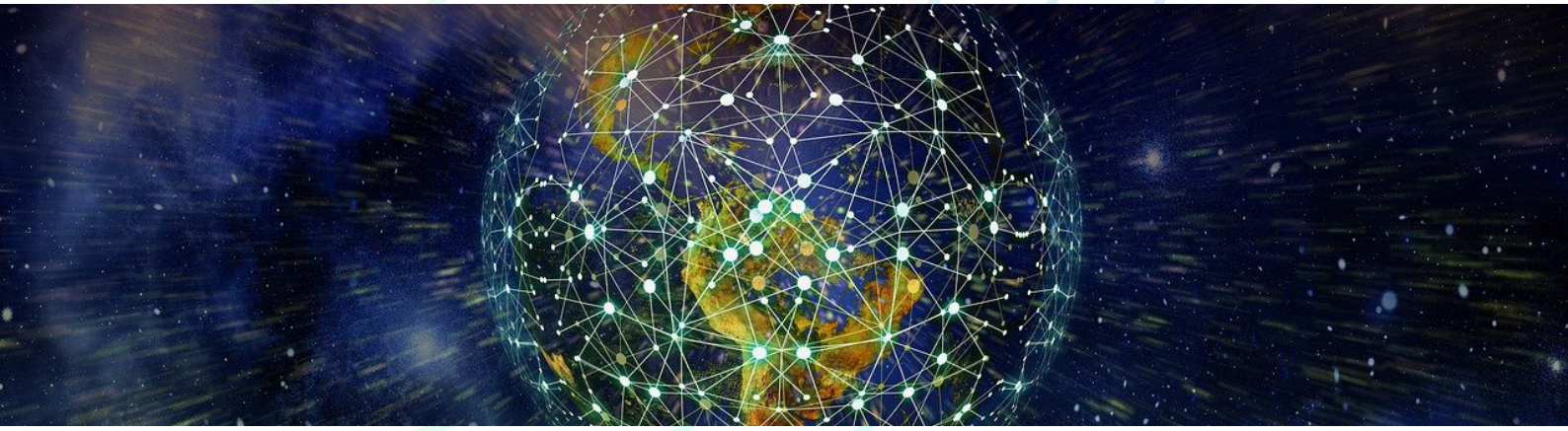
January 2025

WCRP

ESMO Brief

The newsletter of the ESMO Project



Welcome from the Co-Chairs

Dear ESMO Community,

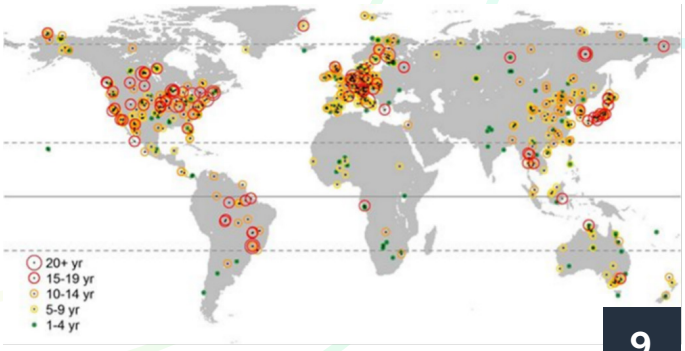
We are happy to welcome you to the inaugural edition of the Earth System Modelling and Observations (ESMO) Project Newsletter. As the ESMO Co-Chairs, it is our privilege to coordinate a vibrant global community dedicated to advancing the integration of Earth system modelling, observations, and data assimilation within the framework of the World Climate Research Programme (WCRP).

At the heart of ESMO is a shared commitment to addressing the most pressing challenges in climate science. We seek to improve predictions and projections of the Earth system, enhance our understanding of climate system changes and their impacts, and embrace emerging technologies to support innovation. By bridging gaps across scales, disciplines, and data systems, ESMO aims to develop robust, science-based climate information that supports decision-making and policy at all levels, from local to global.

In this first edition of our newsletter, we take a first pass at celebrating the collective efforts of our working groups, sharing progress toward future goals, and highlighting opportunities for collaboration. We thank all of the contributors to the newsletter and especially the ESMO International Project Office staff who make it and ESMO possible. We invite you to engage with us as we forge a path toward impactful and equitable climate science.

With warm regards,

Baylor Fox-Kemper and Susann Tegtmeier
Co-Chairs, ESMO



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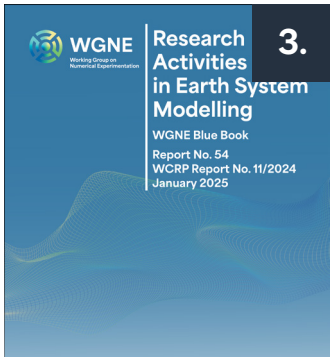

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In this issue:

1. Integrating observations and Earth system modelling: the new Working Group on Observations for Researching Climate (WGORC)

By Amy Doherty and Yuhan Douglas Rao

One of ESMO's central missions is to strengthen connections between the climate modelling and observation research communities and to foster collaboration to advance Earth system modelling. In line with this goal, a new working group has been established: the **Working Group on Observations for Researching Climate (WGORC).**

WGORC is a new ESMO working group focusing on **improving communication and collaboration between the climate modelling and observation research communities** to facilitate an easier and more beneficial use of observations in climate modelling. The group will serve as a platform to address challenges, identify opportunities, and ensure observations are optimally leveraged to enhance Earth system model predictability and utility.

WGORC will consider gaps and opportunities in the provision of observations for climate research and make recommendations to the wider community. Areas of interest include **Earth system model verification and intercomparison with observations, reanalysis, emerging technologies, standards for data policy, and engagement with all players** across the international climate research and observation landscape.

Co-chairs have been appointed and a call for working group members will go out in the coming months. The inaugural WGORC meeting will be held in the autumn in the US. Curious about the new working group and how to get involved? There are several opportunities to engage with ESMO and WGORC in the coming months:

- ESMO will be convening a townhall meeting at the **2025 European Geophysical Union General Assembly** to discuss "Innovative Approaches to Observations and Modelling for Improved Climate Information and Services"
- ESMO sessions will be convened at the **ESA Living Planet Symposium** focusing on emerging Earth Observations capabilities with potential implications for the work of WGORC
- ESMO proposed a session topic for the **American Meteorological Society's 27th Conference on Satellite Meteorology and Oceanography** titled "Advancing Earth System Modelling with Long-Term Earth Observation". Communities are invited to submit an abstract and contribute to the discussions by March 13th, 2025.

The work of WGORC will be pivotal to the entire ESMO community - we look forward to initiating this new endeavour and supporting this new working group in achieving its goals.

Meet the co-chairs:

Amy Doherty is Science Manager of the National Climate Information Centre (NCIC) at the UK Met Office. Her research focuses on observations for climate and meteorology, remote sensing, and co-development of climate services.

Yuhan (Douglas) Rao is a research scientist at the North Carolina Institute for Climate Studies. His research interests include Statistical modelling for data fusion, climate data records, machine learning for climate monitoring and modelling.

Meeting Report

2. Advancing Earth system modelling: WGNE and WGSIP annual meeting

By Sara Pasqualetto, Debbie Hudson, Ariane Frassoni

The Working Group on Numerical Experimentation (WGNE) and the Working Group on Subseasonal to Interdecadal Prediction (WGSIP) convened their annual meetings jointly from November 4th to 8th, 2024, in Toulouse, France. This event brought together leading scientists and researchers participating in ESMO activities to advance the science of Earth system modelling and prediction. It was also the first annual meeting of these working groups organised since the ESMO IPO became fully operational.

As a cornerstone of collaboration, this gathering has provided a platform for members to discuss ongoing projects, share recent developments, and shape collaborative initiatives for the year ahead.

This year's agenda was rich with opportunities for interdisciplinary exchange. The groups held joint sessions to address critical challenges and opportunities, focusing on:

- **Initialization Techniques**: Enhancing such methods to improve Earth system predictions.
- **Bias Reduction Strategies**: Tackling systematic errors for more accurate simulations and forecasts.
- **Model Process Improvements**: Innovating parameterizations to better capture key physical and dynamic processes.
- **Scale-Aware Parameterizations and Seamless Prediction**: Developing methods to bridge scales from local weather phenomena to global climate patterns.

"Having a joint meeting with WGNE was extremely valuable for enhancing the synergy between our working groups, as we address several overlapping ESMO science challenges," remarked Bill Merryfield, former co-chair, WGSIP. "It has set the stage for ongoing, enhanced collaboration between our two groups."

WGSIP's goal is to facilitate collaborative research and information exchange to advance sub-seasonal to inter-decadal climate prediction science and services. A significant aspect of the WGSIP meeting was to identify and start formulating the group's research priorities for its next five-year cycle. Key discussion areas included machine learning and artificial intelligence (ML/AI) for forecasting, sources of predictability, ensemble information across timescales, and consideration of a project or sub-panel specifically focussed on the sub-seasonal timescale. Concept notes and initial plans are currently being drafted.

WGNE promotes and coordinates the development of coupled Earth System Models (ESMs) for research and operational use. WGNE's goals include identifying common systematic errors in models, sharing solutions, exploring new technologies, and providing guidance on computing scalability. WGNE also advises WMO programs and supports

model assessment jointly with the JWGFVR for accurate weather and climate services.

Key discussion topics were around the role of WGNE for the **EW4All initiative.** WGNE plays a crucial role in shaping the development of ESMs, a fundamental activity to enable better multi-hazards forecasting. WGNE, together with the WMO Integrated Processing and Prediction System (WIPPS), proposed an **AI-inclusive MIP as a pilot project** with strong community support. In addition, WGNE also discussed the continuity of the WGNE systematic errors survey by exploring the current capabilities of modelling centres in forecasting the six hazards identified by the WMO as most frequently reported in 30 countries, like flash floods, droughts, riverine floods, tropical cyclones, thunderstorms, and heatwaves. Forecasting timescales range from hours (e.g., for thunderstorms) to seasonal scales (e.g., for droughts). The survey preliminary results show disparities in hazard modelling approaches, with significant efforts focused on improving thunderstorms/squall lines and heatwaves, while few centres make efforts to forecast riverine floods.

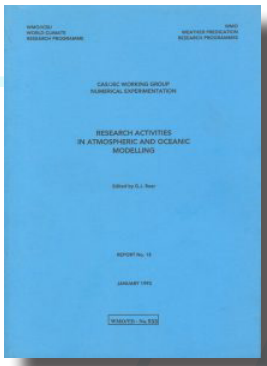
Nils Wedi, WGNE co-chair also stated: "We had a successful joint meeting with WGSIP that brought out very well shared challenges on addressing simulation errors while discussing different perspectives on seamless prediction across scales."

ML/AI was a prominent theme throughout the joint meeting, and featured in future plans of both WGNE and WGSIP, particularly regarding data-driven models for forecasting and prediction. Causality-based methods were also discussed in the joint meetings to support the identification of sources of predictability, model diagnostics and merging forecasts across timescales.

The meeting also featured collaborative reviews of joint experiments, evaluations of current methodologies, and forward-looking discussions to refine strategies for future work. These exchanges reflect the shared commitment to advancing predictive capabilities and deepening our understanding of the Earth system.

WGNE, WGSIP members and invited speakers enjoying dinner on Wednesday

3. Announcing the 2024 WGNE Blue Book: advancing numerical modelling for weather and climate

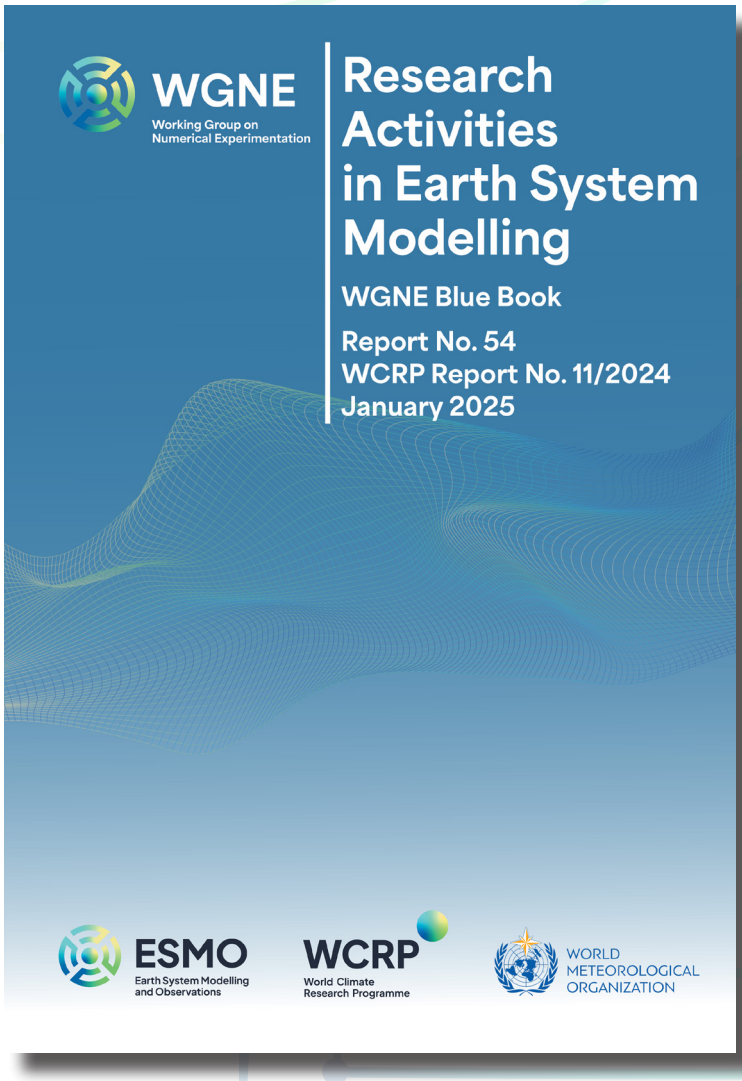


The WGNE Blue Book has been published as a blue-covered book since the early 1970th. Only electronic version is available since 2006.
Past issues can be browsed on the legacy website of WGNE.

The 2024 edition of the **WGNE Blue Book** is here! This legacy publication fosters collaboration and the early exchange of ideas among scientists at the forefront of numerical model development. These models are critical for advancing Earth system simulations and forecasts across various timescales, from short-to-medium range, from subseasonal to seasonal and beyond.

This year's issue features 35 contributions, portraying cutting-edge research and developments in topics such as:

- **Coupled and Earth System Models**: Innovations in modelling climate and Earth systems.
- **Global and Regional Climate Models**: Insights into responses to forcing, subseasonal/seasonal forecasting, and impact studies.
- **Advances in Forecast Models**: Case studies, ensembles, and predictability.
- **Physical Process Parameterization**: Improving model components and system accuracy.
- **Forecast Verification**: Novel tools for diagnosing and addressing systematic errors.
- **Data Assimilation**: Uncoupled and coupled techniques for integrated Earth system analysis and prediction.
- **Ocean, Sea-Ice, and Wave Modelling**: Pioneering developments in these critical areas.
- **Reanalysis and Post-Processing**: Enhanced datasets and statistical methods.
- **Numerical Techniques and Coupling**: Progress in model resolution and component interactions.
- **AI and Machine Learning**: Transforming weather prediction and climate modelling.



Starting this year, the Blue Book will be available through the open repository **Zenodo**, ensuring broader accessibility to the publication. By assigning a DOI (10.5281/zenodo.14753296), this initiative also enhances the potential for referencing the Blue Book in scientific research, supporting its role as a key resource for the community.

The WGNE Blue Book continues to be an invaluable resource for the modelling community, showcasing innovative approaches and facilitating the exchange of ideas that drive the science forward.

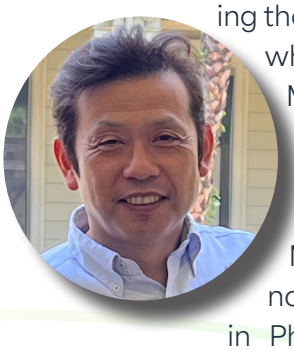
Explore all the advances in numerical modelling with the 2024 WGNE Blue Book release.

4. ESMO welcomes new members and leadership changes

As of 1 January, ESMO has welcomed new members and undergone leadership rotations within several of its Panels, reflecting its commitment to fostering leadership and integrating diverse expertise to advance Earth system modelling and observations.

Scientific Steering Group

Michio Kawamiya has begun his first term as a member of the ESMO Scientific Steering Group, filling the position vacated by Cath Senior, who retired earlier this summer. Michio is the Director of the Research Center for Environmental Modeling and Application (CEMA) at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). Holding a PhD in Physical Oceanography from the University of Tokyo, his research expertise includes **ocean ecosystem and carbon cycle modelling**.



WGSIP Leadership Transition

A leadership transition is also underway within WGSIP. **Debbie Hudson** has stepped in as co-chair. Debbie brings a wealth of experience to the group, ensuring continuity and innovation in addressing subseasonal to interdecadal prediction challenges. **Bill Merryfield**, former co-chair of the Working Group, will continue his contribution to WGSIP as an Emeritus member.

Working Group on Numerical Experimentation (WGNE)

With the start of the new year, **Tim Graham** has assumed the role of WGNE co-chair, succeeding **Nils Wedi** (ECMWF), who concluded his tenure at the end of 2024.

In addition, two new members have joined WGNE, bringing their extensive expertise in numerical modelling:

- **Inna Polichtchouk**, a senior scientist in Numerical Methods at the European Centre for Medium-Range Weather Forecasts (ECMWF), specializes in **km-scale modelling, dynamical core development, and hybrid modelling**. She earned her PhD in Atmospheric Science at Queen Mary, University of London.
- **Martin Köhler**, a researcher at the German Weather Service (Deutscher Wetterdienst), focuses on **seamless simulations**, ranging from large-eddy to climate scales, and the **parameterization of physical processes**. He completed his PhD in Atmospheric Science at the University of California, Los Angeles.

Working Group on Coupled Modelling (WGCM)

The year 2025 will bring significant changes to WGCM as well. Three members have reached the end of their terms and will be stepping down from their roles. **Masahiro Watanabe** will also transition to a new position on the WCRP Joint Scientific Committee, marking the conclusion of his tenure with WGCM. In addition, **Tilo Ziehn** has taken over the role of WGCM co-chair, while **Greg Flato** will continue his involvement in the group as an emeritus member.

To address these membership changes, WGCM issued an open call in December 2024 to fill the vacancies. The group is now in the process of selecting new members, with appointments expected in the coming weeks.

Working Group on Observations for Researching Climate (WGORC)

With the establishment of the new ESMO working group, **Amy Doherty** and **Yuhan Douglas Rao** have started their term as co-chairs of WGORC. An open call for members of the working group will be issued in the coming months.

We want to sincerely thank all outgoing members and leaders of these panels for their invaluable contributions and the time they dedicated to advancing the mission of each working group. Their efforts have been instrumental in driving progress and collaboration across the Earth system science community. Many thanks to **Nils Wedi** (WGNE), **Günther Zängl** (WGNE), **Swapna Panickal** (WGCM), **David Salas y Melia** (WGCM), **Tianjun Zhou** (WGCM), **Masahiro Watanabe** (WGCM), and **Johanna Baehr** (WGSIP)!

Meeting Report

5. ESMO engages at the 6th WCRP International Conference on Reanalysis

By Bimochan Niraula

ESMO was well represented at the International Conference on Reanalysis that took place in October in Tokyo, Japan. Several members of the ESMO Scientific Steering Group (SSG) delivered presentations and actively participated in the closing panel discussion, sharing insights and fostering dialogue with the global reanalysis community.

A dedicated presentation about ESMO's mission and activities highlighted our work, accompanied by a poster that stayed up throughout the conference. As one of the sponsors of the event, ESMO provided financial support for several Early Career Scientists to join the conference.

The conference was a great platform to promote ESMO to the reanalysis community and to explore opportunities for collaboration. We look forward to building on the connections made during the conference and furthering shared goals.

From left to right in the vertical images: Alison Cobb (SSG - ECMWF), Susann Tegtmeier (SSG Co-Chair), and Maureen Wanzala (WCRP) presenting at the conference. In the horizontal images, starting from the top: ESMO representatives enjoying a casual networking moment, and our Scientific Officer at the IPO, Bimochan Niraula, alongside Maureen Wanzala and the Early Career Researchers supported by ESMO, gathered in front of the ESMO poster.

Meeting Report

6. WGSIP activities at the latest Greater Horn of Africa Climate Outlook Forum (69th GHACOF)

By Masilin Gudoshava and Ángel Muñoz

On 20-21 January, 2025, Masilin Gudoshava (WGSIP member) and Ángel G. Muñoz (WGSIP co-chair) participated in the 69th Greater Horn of Africa Climate Outlook Forum (GHACOF), co-organised by the Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC), and held in Addis Ababa, Ethiopia.

The forum, part of IGAD´s Regional Strategy for Mainstreaming Climate Services in Key Socio-Economic Sectors for Sustainable Development, focused on the theme "**Climate Services for Closing the Early Warning gap together**", and brought together climate scientists, researchers, users from key socio-economic sectors, governmental and non-governmental organizations, development partners, decision-makers, media, and civil society stakeholders. It was, as it usually happens, preceded by a **climate prediction development workshop** (13-17 January 2025). The workshop brought together forecasters from the ICPAC member states, ICPAC scientists and climate scientists from Global Producing Centres.

During the GHACOF, the performance of the October-December (OND) 2024 regional forecast was reviewed and discussed, with sector coordinators presenting reports on the impacts of the season. The two-month lead objective seasonal forecast for March-May 2025 was also presented, along with recommendations and management strategies for various sectors. **Co-production workshops** with key sectors (agriculture and food security, water, energy, health, livestock, media and disaster risk management) were held on 20 January. Gender experts actively participated in all sector breakout sessions to ensure the **development of inclusive and gender-responsive advice**.

The GHACOF has produced state-of-the-art **objective, multi-model ensemble forecasts**, using models from both the North American Multi-Model Ensemble (NMME) and the Copernicus Climate Change Services (C3S). The GHACOF currently uses three different statistical calibration approaches, which are combined to produce the final, consolidated forecast. The techniques include linear regression, logistic regression and canonical correlation analysis.

Our WGSIP representatives Masilin and Ángel had meetings during the GHACOF to discuss the present forecasting methodology, particularly the calibration and ensemble approaches, but also to explore ways in which intraseasonal signals - especially the Madden-Julian Oscillation - can be used as additional predictors in the forecasting system.

On 22 January Ángel also participated in the pre-launch of Ethiopia's Ag-DataHub, a platform that brings together data from different sources to enable **data-driven decisions to improve agricultural productivity and sustainability**. The Ag-DataHub is a collaboration between the Ethiopian Ministry of Agriculture, the CIAT-Bioversity Alliance, and the International Livestock Research Institute (ILRI), among others.

More information, including the full agenda, can be found in the meeting's webpage.

7. Advancing KM-scale modelling: the 2025 Digital Earths Global Hackathon

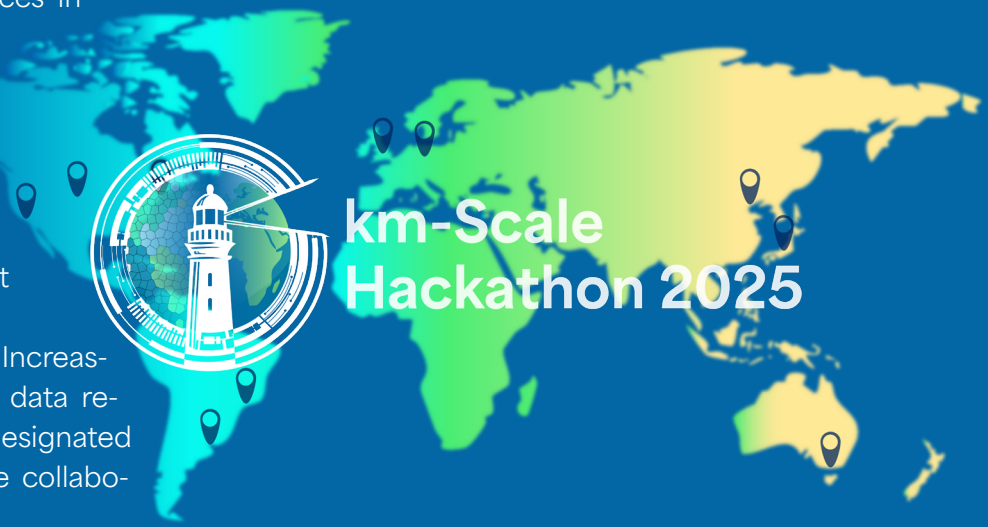
The WCRP Digital Earths Lighthouse Activity is spearheading the 2025 Global Hackathon on km-scale modelling, with support from leading initiatives such as Destination Earth (DestinE), Next-GEMS, WarmWorld, Earth Visualization Engines (EVE), European Eddy-Rich Earth System Models (EERIE), ESMO, and the CMIP panel. This collaborative effort will take place on 12-16 May 2025 and aims to accelerate progress in storm-resolving models through global cooperation and knowledge sharing. This global initiative will involve 9 nodes across the globe, working simultaneously.

The hackathon will focus on three key objectives:

- Promoting Global Collaboration - Facilitating the sharing of best practices in process-based analysis of km-scale simulations, enabling international teams to work together on analyzing high-resolution models at global and regional scales.
- Enhancing Accessibility - Increasing access to high-quality data resources, supported by designated ambassadors to streamline collaboration and data sharing.
- Expanding Long-Term Access - Laying the groundwork for a more connected, accessible, and sustainable data-sharing ecosystem.

Expected outcomes include fostering an open and collaborative research community, refining best practices in coding and data workflows, developing common standards for weather and climate data, and advancing storm-resolving models for improved prediction capabilities.

This hackathon represents a unique opportunity for experts to engage in cutting-edge research and drive the future of Earth system modelling. Find all the information on the ESMO website.



Paper Highlights

8. An innovative approach of seasonally evolving prediction of the East Asian summer rainfall led by the WGSIP member

By Hong-Li Ren

An international team of researchers has published their latest findings in Nature Communications, titled "Skillful seasonal predictions of continental East-Asian summer rainfall by integrating its spatio-temporal evolution." This study introduces an **innovative approach** that can significantly **improve seasonal predictions of the spatiotemporal evolution of East-Asian rainfall anomalies**, outperforming current state-of-the-art dynamical models, and showing a potential in forecasting climate disasters.

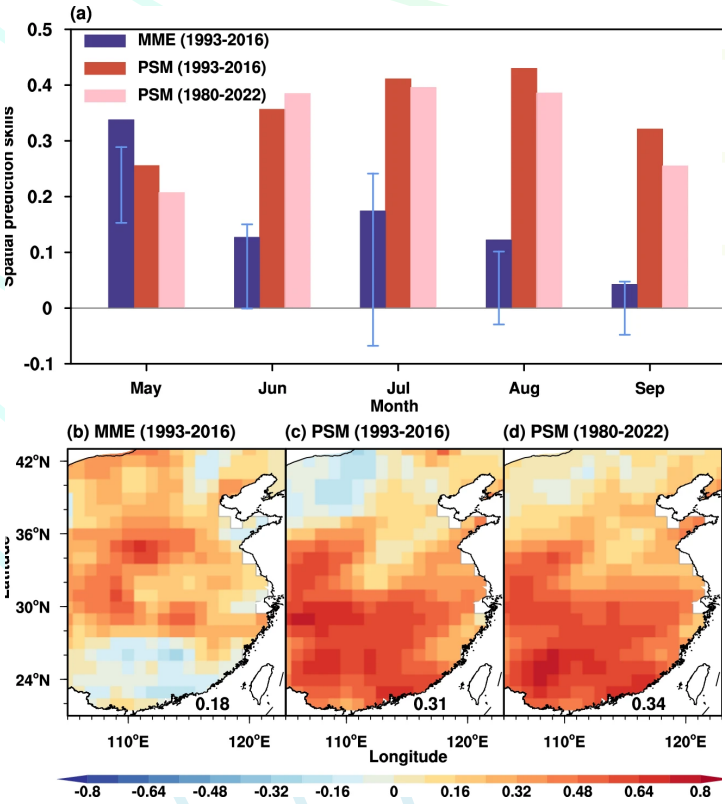
Skillful seasonal climate prediction is critical for food and water security over the world's heavily populated regions, such as in continental East Asia, profoundly influencing human lives and socio-economic activities. However, accurate seasonal predictions of East-Asian rainfall evolution pose a considerable challenge, primarily reflected in the limited forecasting capabilities of the current best dynamical models worldwide. The study presents an innovative approach that improves prediction skills significantly in continental East-Asian summer rainfall evolution.

By effectively integrating the spatiotemporal evolution of rainfall anomalies, it successfully captures crucial predictable information and filters out unpredictable noise that interferes with variations in large-scale precipitation signals. This enables the **identification of the most effective predictors** with superior indicative significance, such as El Niño-Southern Oscillation (ENSO). As a result, the presented model significantly improves seasonal predictions for both the spatiotemporal evolution and conventional summer mean of continental East-Asian rainfall anomalies, with prediction skills at least twice as high as those of current dynamical models. This advance marks a crucial step toward providing skillful seasonal predictions to populations in need of new tools for managing risks of near-term climate disasters, such as floods and droughts under climate change.

As a WGSIP member, Prof. Hong-Li Ren is the corresponding author of the study, who is from the Chinese Academy of Meteorological Sciences (CAMS). Co-authors include Jieru Ma from CAMS, Ming Cai from Florida State University, Yi Deng from Georgia Institute of Technology, and Chenguang Zhou, Jian Li, Huizheng Che, and Lin Wang, also from CAMS.

To read more:

Jieru Ma, Hong-Li Ren*, Ming Cai, Yi Deng, Chenguang Zhou, Jian Li, Huizheng Che, Lin Wang. Skillful seasonal predictions of continental East-Asian summer rainfall by integrating its spatio-temporal evolution. Nature Communications, 16: 273 (2025). https://www.nature.com/articles/s41467-024-55271-1



The multi-year mean forecast skills assessed by the spatial pattern correlation against the total rainfall anomalies for each month in the multi-model ensemble (MME) mean of the dynamical models and the physical-statistical prediction model (PSM). The blue line segments represent the ranges of prediction skills derived from individual dynamical models. The temporal correlation skills for predicting summer mean rainfall anomalies in June-July-August (JJA) are shown for (b) MME mean and (c, d) PSM. The regional mean of the prediction skill is displayed in the bottom right corner of (b) to (d).

Community Insight

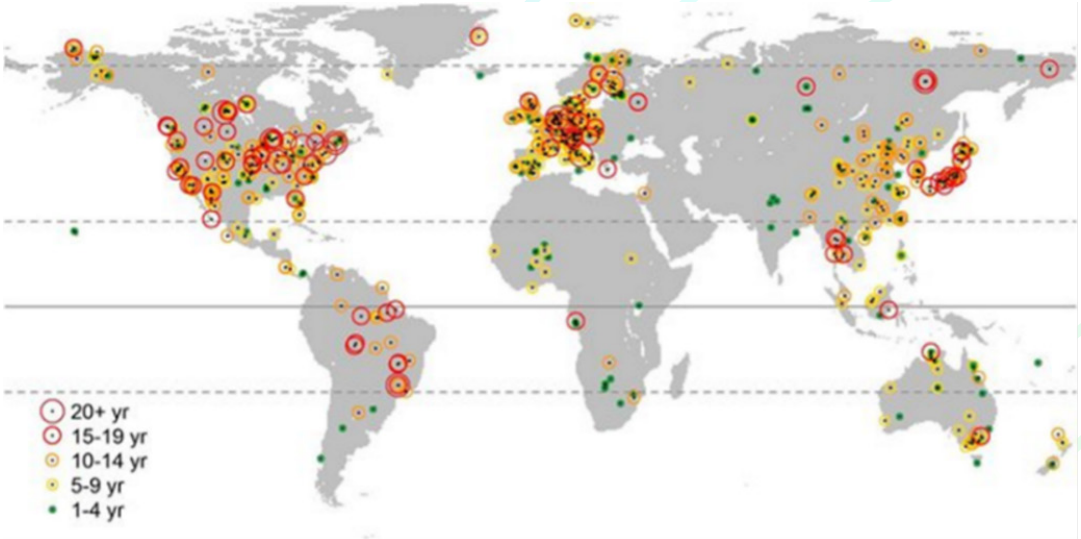
9. Strengthening carbon observation networks in the Southern Hemisphere: insights from South Africa

By Mohau J. Mateyisi & Felix V. Skhosana

The quantification of emissions and the uptake of atmospheric greenhouse gases, such as carbon dioxide (CO_2), underpins the global efforts to mitigate climate change and environmental adaptation. Research efforts towards accurately estimating the (CO_2) feedback are disproportionately concentrated in the Northern Hemisphere due to limited observational infrastructure over the Southern Hemisphere. The findings of the recent PLUMBER2 (Abramowitz et al., 2024) study **comparing the performance of land surface models (LMs) and out-of-sample empirical models** demonstrate the value of observations in driving evaluation of process-based models and hence the underlying scientific knowledge.

The study findings reflect that out-of-sample empirical models perform better than current operational LMs given the same predictors for some sites. A model evaluation study on evapotranspiration conducted at the Skukuza flux tower site (shown in Figure 1), demonstrated that **accurate site-specific vegetation and soil parameterization led to improved outputs by LM** (Khosa et al., 2019). Clearly, improved spatial representation of observations of climate and flux datasets could open-up opportunities for improvement of LMs and hence Earth system models. This calls for **innovative observation infrastructure collaborations models** focusing on flux observation sparse regions.

One of the innovative infrastructure collaborating approaches towards strengthening long-term eddy covariance (EC) observations for carbon dioxide and energy flux was recently tested in South Africa (Bieri et al., 2022). The collaboration model included : I) an inclusive planning phase that entail local partners and stakeholders' consultation, identification of existing knowledge and, infrastructure coverage gaps; II) funding mobilisation phase focusing on support the long-term infrastructure establishment, operation and transfer, knowledge co-creation and dissemination through open-access publishing and data sharing; III) build-up phase which led to expansion of the collaboration across disciplines on technical (including installation, refining, updating equipment), scientific and societal aspects; IV) operationalization phase which included development



Skukuza Tower
(since 2000)

Map of active and historical FLUXNET tower sites across the world. The colour and size of the circle indicate the duration of the measurements as of December 2015. The solid and dashed lines denote the equator, the Tropic of Cancer/Capricorn, and the Arctic Circle, respectively (adopted from Chu et al. 2017). Flux Tower Photo: Credit to Dr. Felix Skhosana.

of training courses, workshops, public outreach, community education, regular infrastructure maintenance and researcher exchanges between local and international collaborating institutions; V) The observation infrastructure transfer phase to local collaborators guided by Memorandum of Understanding (MoU) or informal agreements. The collaboration model outcomes included:

1. Strengthening technical expertise necessary for the maintenance of eddy covariance towers in the long term,
2. Introduction of a new generation of students and hence improved local capacity to enter the field of research,
3. Improved uptake and use of EC data by researchers working in related fields included land surface components of Earth system models,
4. Facilitated knowledge exchange, and
5. Student co-supervision between institutions in an international partner country and locally and led to joint scientific publications.

The demonstrated observation infrastructure collaboration model, if scaled up in the Southern Hemisphere could potentially benefit: 1) capacity for emission inventories across countries, 2) development of long-term GHG observation networks, and 3) the global scientific community via improved availability of data.

To read more:

Abramowitz, G., Ukkola, A., Hobeichi, S., Cranko Page, J., Lipson, M., De Kauwe, M. G., Green, S., Brenner, C., Frame, J., Nearing, G., Clark, M., Best, M., Anthoni, P., Arduini, G., Boussetta, S., Caldararu, S., Cho, K., Cuntz, M., Fairbairn, D., Ferguson, C. R., Kim, H., Kim, Y., Knauer, J., Lawrence, D., Luo, X., Malyshev, S., Nitta, T., Ogee, J., Oleson, K., Ottlé, C., Peylin, P., de Rosnay, P., Rumbold, H., Su, B., Vuichard, N., Walker, A. P., Wang-Faivre, X., Wang, Y., and Zeng, Y.: On the predictability of turbulent fluxes from land: PLUMBER2 MIP experimental description and preliminary results, Biogeosciences, 21, 5517-5538, https://doi.org/10.5194/bg-21-5517-2024, 2024.

Khosa et al., 2019 F.V. Khosa, G.T. Feig, M.R. van der Merwe, M.J. Mateyisi, A.E. Mudau, M.J. Savage Evaluation of modeled actual evapotranspiration estimates from a land surface, empirical and satellite-based models using in situ observations from a South African semi-arid savanna ecosystem.

Mari Bieri, Justin Du Toit, Nnditshedzeni Eric Maluta, Brian Mantlana, Mohau Mateyisi, Guy F Midgley, Shingirirai Mutanga, Graham von Maltitz, Christian Brummer Integrating Project-Based Infrastructures with Long-Term Greenhouse Gas Observations in Africa. Clean Air J. 2022, 32 (1). https://doi.org/10.17159/caj/2022/32/1.13081.

10. WGNE initiative on conservation in Earth system models

By Romain Roehrig and Peter Lauritzen

Conservation issues in Earth system models are a complex topic where the devil's in the details. It is also an important topic for both weather prediction and climate studies, with often undetermined, possibly overlooked, impacts on model performance.

The WGNE has recently initiated a series of bi-monthly, 1-hour virtual discussions to share practice and ongoing research on this subject among interested modelling groups, starting with the model atmospheric component. The goals of these discussions include:

- Illuminating the inner workings of our modelling systems,
- Sharing insights on what works well (and what doesn't),
- Assessing the impact of certain errors, and
- Working towards compiling a WGNE table on physics-dynamics coupling and energy budgets.

For selected topics, the organizers may invite experts from other fields (e.g., convection specialists when discussing the heat content of falling precipitation) to provide additional insights.

The first two sessions were held in October and December 2024 and focused on mass conservation and mass fixers. The next discussion is expected to be held end of February/early March. For any further information, please contact Peter Lauritzen (NCAR) and Romain Roehrig (Météo-France).

Paper Highlights

11. Can terrestrial rivers impact sub-seasonal to seasonal climate variability?

By Ankur Srivastava

The freshwater from terrestrial rivers has a significant impact on the ocean dynamics. This freshwater impacts the ocean salinity, changing the ocean density, stratification, and circulation. Can these changes to ocean dynamics feedback to the atmosphere and impact the sub-seasonal to seasonal (S2S) scale atmospheric dynamics and precipitation variability? In which regions are such feedbacks important? If this feedback is important for S2S scale climate variability, how do we include them in our coupled models? We set out to explore the answers to some of these questions.

The observations collected during the Bay of Bengal (BoB) Monsoon Experiment revealed that freshwater from large terrestrial rivers in the region reduces the mixed layer depth in the northern BoB from 30 m to 10 m, resulting in the formation of a 30 m thick barrier layer. BoB is a convectively active region with the sea-surface temperature (SST) remaining close to the convection threshold throughout the year. During the boreal summer, SST changes associated with large changes to the mixed layer depth can significantly impact the synoptic to intra-seasonal scale convective systems associated with the Indian Summer Monsoon (ISM).

To assess this, we coupled a river-routing model to a coupled model used for seasonal prediction of ISM. Such a coupling ensures that temporally varying river discharge reaches the ocean in response to upstream precipitation. On comparing this with a control simulation where annual mean runoff is prescribed, we find that some of the systematic biases at S2S time scales improve. The track density of synoptic scale tropical storms during monsoons, aka the monsoon low-pressure systems, and the associated terrestrial rainfall improves. The repeated northward excursion of the Intertropical Convergence Zone (ITCZ) associated with the boreal summer intra-seasonal oscillations strongly modulates rainfall over the Indian subcontinent.

The phase speed of this northward propagation is slower than observed in many coupled models. The enhanced air-sea interactions in the BoB, affected by the realistic representation of upper ocean stratification, improve the northward propagation speed of the convection band. Additionally, rivers impart significant inter-annual variability to the mixed layer heat budget terms at monthly time scales. The scale interactions between the synoptic, intra-seasonal, and seasonal time scales improve the seasonal prediction skill of the monsoon rainfall over India. Thus, we demonstrate that river runoff can have important implications for the S2S scale variability and predictions.

To learn more:

Ankur Srivastava, Suryachandra A. Rao, Subimal Ghosh (2024). Impact of river freshwater on subseasonal to seasonal variability in a climate model Research activities in Earth system modelling. Working Group on Numerical Experimentation. WCRP Report No.12/2024. WMO, Geneva.

Ankur Srivastava, Suryachandra A. Rao and Subimal Ghosh (2023). Improving the subseasonal variability of the Indian summer monsoon in a climate model. International Journal of Climatology, 43(11), 5227-5247, https://doi.org/10.1002/joc.8142.

Ankur Srivastava, Suryachandra A. Rao and Subimal Ghosh (2023). Bay of Bengal upper-ocean stratification and the sub-seasonal variability in convection: Role of rivers in a coupled ocean-atmosphere model. Special issue of Mausam, 74, 2 (2023), Fifth Volume of the book series, The Global Monsoon System. https://doi.org/10.54302/mausam.v74i2.6011.

Srivastava, Ankur, Anguluri, S. R., & Ghosh, S (2022). Impact of riverine freshwater on Indian Summer Monsoon: Coupling a runoff routing model to a global seasonal forecast model. Frontiers in Climate, https://www.frontiersin.org/articles/10.3389/fclim.2022.902586/full.

Paper Highlights

12. How much do people trust scientists?

By Sara Pasqualetto

In recent years, concerns about declining public trust in science and scientists have intensified, particularly in the wake of the pandemic's widespread impact on daily life. Narratives of "science-related populism," which frame scientists as part of an elite detached from common sense and public interests, have gained traction, potentially undermining the role of science in decision-making and the effectiveness of evidence-based policymaking. But is this perceived crisis of trust as widespread as feared? How do people view scientists, and how much trust do they place in their roles within society?

The paper "Trust in Scientists and Their Role in Society Across 68 Countries" seeks to answer these questions. It examines public trust in scientists and the factors that weigh in on it, such as demographics, ideologies, attitudes, and national contexts. Drawing on **data from 71,922 respondents across 68 countries**, the study evaluates trust using four dimensions: competence, benevolence, integrity, and openness.

The findings reveal that while a **majority** of respondents **perceive scientists as having high integrity,** trust levels vary across demographics. Women, older individuals, and people with higher education exhibit greater trust, and possible correlations between trustworthiness and correlates like political orientations and religion are examined. Notably, **openness** remains an area for improvement, particularly regarding transparency in funding, data sources, and communication. In this respect, **83%** of respondents **believe scientists should engage with the public about their work**, with strong agreement among African participants in particular. The authors emphasize the importance of fostering genuine dialogue, recommending against top-down communication in favor of participatory approaches that consider diverse societal perspectives.

In one key finding, the study confirms a negative correlation between **Social Dominance Orientation (SDO)**, which represents "the degree to which individuals desire and support group-based hierarchy and the domination of 'inferior' groups by 'superior' groups" (Sidanius and Pratto 1999) and trust in scientists, aligning with prior research suggesting that academic institutions are sometimes perceived as challenging social hierarchies.

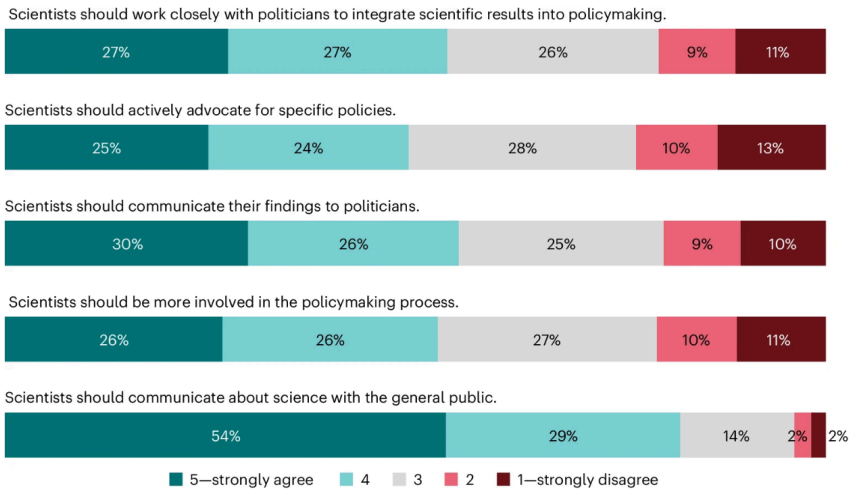
When asked about research priorities, respondents highlighted public health, energy solutions, and poverty reduction as areas needing more attention, contrasting with a perceived overemphasis on defense and military research.

While trust levels and priorities vary by country and context (a clearer breakdown of results by country can be found in this data visualization tool), the study challenges the notion of a global trust crisis in science. Instead, it underscores the **pivotal role of trust** in enabling science to address societal challenges and calls for targeted strategies to strengthen trust across diverse communities.

The paper was published last month in *Nature Human Behaviour*: Cologna, V., Mede, N.G., Berger, S. et al. Trust in scientists and their role in society across 68 countries. Nat Hum Behav (2025). https://doi.org/10.1038/s41562-024-02090-5

Fig. 4: Normative perceptions of scientists in society and policymaking.

From: Trust in scientists and their role in society across 68 countries



13. 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!

February 2025

4 February 2025 (16:00 UTC): Webinar: A Global Pan-Hackathon for Km-Scale Models - register here

5 February 2025: Streamlining model selection – a collaborative virtual workshop (CMIP) – online

March 2025

17-21 March 2025: 8th WMO International Workshop on Monsoons (IWM) – Pune, India

April 2025

27 April - 2 May 2025: EGU General Assembly 2025 – Vienna, Austria

May 2025

12-16 May 2025: WCRP Digital Earths Global KM-Scale Hackathon – 9 nodes worldwide

12-16 May 2025: 46th session of the WCRP Joint Scientific Committee (JSC-46) – Paris, France

June 2025

02-04 June 2025: EXCLAIM Symposium 2025 - Zurich, Switzerland

22-27 June 2025: Machine Learning for Actionable Climate Science: Exploiting Machine Learning to Enhance Earth System Modeling and Analysis Across Scales – Smithfield, Rhode Island, United States

23-27 June 2025: ESA Living Planet Symposium 2025 – Vienna, Austria

July 2025

20-25 July 2025: BACO2025 - Busan, Republic of Korea
Abstracts submission deadline: 15 February 2025

August 2025

18-22 August 2025: AMS 27th Conference on Satellite Meteorology and Oceanography - San Diego, USA
Abstracts submission deadline: 13 March 2025

September 2025

15-19 September 2025: EUMETSAT Meteorological Satellite Conference 2025 - Lyon, France
Abstracts submission deadline: 08 February 2025

December 2025

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

= 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**

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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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