

46th Session of the WCRP Joint Scientific Committee (JSC)

Date: 12-16 May 2025

DEADLINE: end Feb 2025

Instructions

Overarching content/goal: To provide an update on progress made during the last year, and to identify issues etc. in advance of the JSC meeting. This will allow more discussion and less reporting at the JSC meeting itself. The outcomes from this report will also feed into a highlights brochure planned for the first quarter of the year. The Secretariat will arrange calls prior to the JSC meeting with JSC liaisons (as appropriate) to discuss the input and any issues to the JSC meeting itself. Please work with the WCRP secretariat responsible for your activity, in the preparation of the report.

Please keep the information as focused as possible and provide links to websites where more details can be accessed.

Update report for the WCRP Joint Scientific Committee

Digital Earth Lighthouse Activity

1. High-level publications (in particular strategic publications/assessments that are direct outcomes of your activity)

- Webinar series:
 - General webinars (<https://www.wcrp-climate.org/de-webinar-series>)
 - High Resolution Land-Atmosphere Modeling (<https://www.wcrp-climate.org/digital-earths-webinar-series-on-high-resolution-land-model-and-land-atmosphere-coupling>)
- Contributed to publication on new protocol for high resolution km-scale modelling:
 - Takasuka, Daisuke, Masaki Satoh, Tomoki Miyakawa, Chihiro Kodama, Daniel Klocke, Bjorn Stevens, Pier Luigi Vidale, and Christopher R. Terai. 2024. "A Protocol and Analysis of Year-Long Simulations of Global Storm-Resolving Models and Beyond." *Progress in Earth and Planetary Science* 11 (1): 66. <https://doi.org/10.1186/s40645-024-00668-1>.
- As well as major European projects on km-scale modelling:
 - Segura, Hans, Xabier Pedruzo-Bagazgoitia, Philipp Weiss, Sebastian K. Müller, Thomas Rackow, Junhong Lee, Edgar Dolores-Tesillos, et al. 2025. "nextGEMS: Entering the Era of Kilometer-Scale Earth System Modeling." *EGUsphere*, February, 1–39. <https://doi.org/10.5194/egusphere-2025-509>.
- An important foundation for the above is HighResMIP. The new HighResMIP2 protocol has been published:
 - Roberts, Malcolm John, Reed, Kevin A., Bao, Qing, Barsugli, Joseph J., Camargo, Suzana J., Caron, Louis-Philippe, Chang, Ping, Chen, Cheng-Ta, Christensen, Hannah M., Danabasoglu, Gokhan, Frenger, Ivy, Fučkar, Neven S., Hasson, Shabeh ul, Hewitt, Helene T., Huang, Huanping, Kim, Daehyun, Kodama, Chihiro, Lai, Michael, Leung, Lai-Yung Ruby, Mizuta, Ryo, Nobre, Paulo, Ortega, Pablo, Paquin, Dominique, Roberts, Christopher D., Scoccimarro, Enrico, Seddon, Jon, Treguier, Anne Marie, Tu, Chia-Ying, Ullrich, Paul A., Vidale, Pier Luigi, Wehner, Michael F., Zarzycki, Colin M., Zhang, Bosong, Zhang, Wei and Zhao, Ming (2025) High Resolution Model Intercomparison Project phase 2 (HighResMIP2) towards CMIP7. *EGUsphere*. DOI 10.5194/egusphere-2024-2582.

- The urban digital twins effort contributed to a research demonstration project with the WMO to advance forecasting and urban meteorology during the Paris Olympics:
 - <https://wmo.int/media/news/paris-olympics-will-advance-research-weather-forecasting-and-urban-meteorology>
- The urban digital twin effort also contributed to a new global urban data set for high resolution urban modelling:
 - Kamath, Harsh G., Manmeet Singh, Neetiraj Malviya, Alberto Martilli, Liu He, Daniel Aliaga, Cenlin He, et al. 2024. "GLObal Building Heights for Urban Studies (UT-GLOBUS) for City- and Street- Scale Urban Simulations: Development and First Applications." *Scientific Data* 11 (1): 886. <https://doi.org/10.1038/s41597-024-03719-w>.

2. Capacity Building/Education and Training Highlights

- Participated in several meetings this year to chair and host sessions on km-scale modeling.
- We have been planning a large-scale global pan-hackathon in May of 2025. The planning process has entrained many model groups and is developing and rolling out new technical ideas for km scale models. This will culminate in a week with perhaps 9 nodes on 5 continents with hundreds of participants, most of them young scientists. We have plans for a follow on to reach beyond a core climate modeling community in the future (after we understand the technical aspects of this one).
 - Website: <https://www.wcrp-esmo.org/activities/wcrp-global-km-scale-hackathon-2025>
- The 2025 Climate Modelling Summer School will be held in Cambridge, UK, 7-10 September 2025, and will include lectures, seminars, and practical sessions on state-of-the-art climate modelling, with strong focus on km-scale and supporting technologies.
 - Website: <https://ncas.ac.uk/study-with-us/climate-modelling-summer-school/>

3. Linkages with other Core Projects, Lighthouse Activities, Academy etc.

- We have good active synergies with GEWEX core projects (GLASS and GASS) at process level
 - GASS: Working on a group discussing convective organization
 - GLASS: Active group on km-scale land-atmosphere interactions
 - GEWEX Regional Hydroclimate Projects (RHPs): collaborating
- Collaborating with ESMO on modelling activities as they push to km-scale (e.g. WGNE, WGCM collaborations with km-scale group). Also contributing to machine learning efforts in ESMO.
- Seeking to build connections with RIFS and especially CORDEX to advance building of a 'regional-global alliance'. Numerous collaborations at meetings. Might co-host a meeting with CORDEX.
 - CORDEX collaborations through their framework pilot studies: km scale regional modeling
 - CORDEX collaborations on Urban Digital Twins
- Human system interactions is now pushing forward with Urban Digital Twin group (see outside partnerships)
- We have discussed a joint group on gravity waves at high resolution for modeling and analysis with APARC.
- We regularly participate in most of the core project and lighthouse steering committee meetings.

4. Partnerships with entities outside of WCRP

- New Partnership with WWRP Urban warning program through an Urban Digital Twins Effort.
- Urban Digital Twins effort was involved with WMO high resolution urban forecasting for Paris Olympics.

- *Digital Earth is collaborating with the Earth Visualization Engines (EVE) project on km-scale models. EVE shares a goal with digital of interactive digital information systems. The hackathon idea is one joint effort.*
- *The University of Reading – ECMWF – Met Office – NCAS “Advancing the Frontiers of Earth System Prediction (AFESP) programme has two themes that strongly overlap with WCRP DE: “km-scale modelling” and “Earth System Data Assimilation (for km-scale)”. Both themes include Machine Learning aspects.*

5. Future Science Directions for JSC consideration (e.g., new groups, activities)

- *We are still looking for appropriate ways to engage with human systems and digital twins of the earth beyond Urban Digital Twins (which is going quite well and has good linkages).*

6. New Activities (e.g., structural changes to your activity, plans for databases and other products not covered in the above)

- *Data Assimilation for Climate has evolved into ‘Model-Data Fusion for Climate’ and added a Co-Chair with expertise in Climate and Machine Learning. This effort encompasses DA, but also ML use in models, and for downscaling to human systems. We are planning on making a push to advance both data assimilation, data-model fusion and possibly data use for human systems in this effort.*
- *The km-scale model working group has continued to be active and meet every few months.*
- *Our ‘beyond the physical system’ component has been focusing on Urban Digital Twins, and has a new co-chair (Dev Niyogi, University of Texas).*

7. General (Highlight any other outcomes etc. that you wish to make the JSC and other WCRP activities aware of (in particular regionally focussed activities we could use in any highlights brochure). Are there particular challenges faced in the last year that the JSC should be aware of?

- *Still working on collaborations and role in AI and Climate. Not really sure where that is going to land and how to coordinate it*