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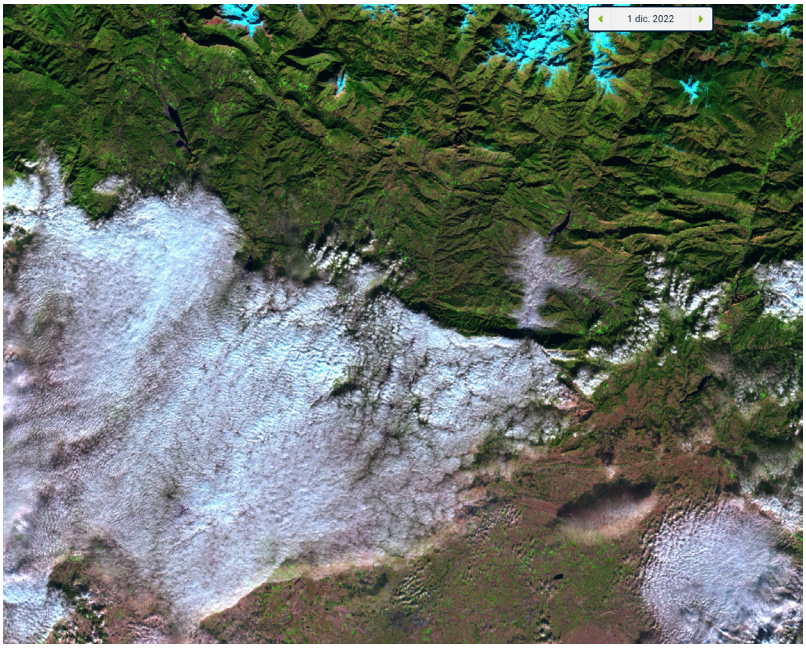
GEWEX is a Core Project of the World Climate Research Programme on Global Energy and Water Exchanges

Studying Land-Atmosphere-Hydrology Interactions in the Ebro Basin with LIAISE



Above are two views of the terrain of the Land surface Interactions with the Atmosphere over the Iberian Semi-arid Environment (LIAISE) field campaign (left image taken by G. Canut from the SAFIRE ATR42 aircraft). The LIAISE project addresses the challenge of predicting changes in the terrestrial water cycle and their impacts on water resources by studying land-atmosphere-hydrology interactions in Spain's semi-arid Ebro basin. See *Boone et al.* on page 11 for the summary of the 2nd LIAISE Workshop.

Inside This Edition

Commentary: When Winter Comes, Spring Is Not Far Away

Xubin Zeng
Co-Chair, GEWEX Scientific Steering Group

Challenges. Winter is coming for Earth system science. In the United States, declining support for research has combined with workforce reductions across government agencies, affecting even some of our GEWEX colleagues. Similar pressures are emerging across the Global North, where rising defense budgets are expected to divert resources away from science. At the same time, tariffs and associated uncertainties have constrained economic growth in many countries, further reducing the investment in science. One direct consequence is a shrinking job market for recent graduates in our field. Funding uncertainties also lead to the acceptance and support of fewer graduate students this year.

Partly because of the decreased support from member states, the World Meteorological Organization has recently reorganized its science, service, and infrastructure departments. As a result, the support for the World Climate Research Programme (WCRP) has decreased in terms of secretariat and travel support. In turn, the WCRP support for GEWEX activities has decreased. Within our own community, the International GEWEX Project Office (IGPO) endured months of funding uncertainty. Thanks to NASA Earth Science, Year 1 support has arrived, bringing relief. Yet questions about the long-term sustainability of the IGPO remain, and with them, uncertainty about the stability of our collective efforts.

Strategy. The overall structure of GEWEX—with its four Panels guiding activities across energy, water, and carbon cycles, and regional hydroclimate—remains strong and appropriate. GEWEX currently coordinates more than 30 ongoing projects, an impressive but challenging portfolio to sustain under current conditions. Facing the above challenges, we must be more deliberate in organizing in-person meetings and conferences. This is also a moment to ask: How can we diversify the sustainable support of IGPO? Which projects remain vital to our mission? Where can we consolidate efforts to maximize impact? And when we consider new initiatives, are we also willing to identify existing projects that should conclude or pause?

As we adapt, we must not lose sight of the human dimension. Funding uncertainties, heavier workloads, and reduced mobility affect not only scientific progress but also the well-being of our colleagues. Caring for one another, and acknowledging mental health as part of community sustainability, is essential.

Opportunities. Despite today's headwinds, science continues to represent the endless frontier, and basic and use-inspired science remains the foundation of technological progress and problem solving. Human activities—from greenhouse gas emissions and aerosol release to land-use change and large-scale engineering projects—have significantly affected the Earth system and, in turn, affected human welfare and public health. Political leaders will eventually recognize that addressing these challenges is not a drag on the economy but an opportunity for innovation, competitiveness, and resilience. GEWEX scientists can accelerate this process by better communicating our science and its societal relevance with the public, government leaders, and the legislature.

As an example, artificial intelligence (AI) has become a national priority in many countries, and the technology sector has poured hundreds of billions of dollars into AI, artificial general intelligence (AGI), and their applications. While financial enthusiasm may prove to be a bubble, AI as the fifth technological revolution is already reshaping weather forecasting and climate research. Within GEWEX, this transformation has begun. A new webinar series launched in 2025 explores the application of machine learning (ML) for land modeling (*https://www.gewex.org/project/ml4lm/*). More opportunities await. By engaging early and critically, GEWEX can help ensure that AI complements, rather than replaces, process-based understanding for advancing Earth system science.

Looking Ahead. These are difficult times, but GEWEX has always been a community defined by resilience and collaboration. The challenges of today—funding uncertainties, organizational shifts, and rapid technological change—are real, yet they also compel us to adapt, prioritize, and innovate. Together, we can ensure that GEWEX not only endures but emerges stronger.

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New GHP Panel Member

Dr. Florentine Weber joins the GEWEX GHP Panel from the Jülich Supercomputing Centre (JSC) and the Center for Earth System Observation and Computational Analysis (CESOC). She focuses on hydrological processes as land-surface interactions, covering decadal climate variability and the impact of irrigation and urbanization in shaping these processes. She has contributed to integrating anthropogenic impacts into weather models at the European Centre for Medium-Range Weather Forecasts (ECMWF) and is currently advancing the EU Weather Generator project, which develops a foundation model for seamless weather and climate prediction. As a former Early Career Representative of the European Geosciences Union (EGU) Hydrological Sciences Division, Dr. Weber connects scientific communities across disciplines, promotes stakeholder engagement, and helps translate ideas into guided scientific progress.

Laura Condon Wins James B. Macelwane Medal

Laura Condon, co-lead for the GEWEX Groundwater Network (GGN) and professor at the University of Arizona, is a recipient of the 2025 James B. Macelwane Medal. Dr. Condon guides GGN (*https://www.gewex.org/ggn/*), a network within the GEWEX Hydroclimatology Panel (GHP) that seeks to constructively link hydrogeology and groundwater modeling to Earth system models in GEWEX.

The James B. Macelwane Medal is awarded by the American Geophysical Union yearly to a small group of early career scientists, all within 10 years of their terminal degree. Winners are chosen for their noteworthy contributions to Earth and space science, with Prof. Condon selected for her efforts to model groundwater-surface water interactions while taking into account human influence[1]. Prof. Condon also co-led the first continental-scale integrated hydrological model that couples subsurface and surface water across the U.S.[1]

1. Scott Coleman, "University of Arizona hydrologist Laura Condon awarded prestigious 2025 James B. Macelwane Medal", University of Arizona College of Science, accessed 14 October 2025, *https://science.arizona.edu/news/university-arizona-hydrologist-laura-condon-awarded-prestigious-2025-james-b-macelwane-medal*.

AGU Award Recipients

Congratulations to the following longstanding GEWEX community members on their American Geophysical Union (AGU) awards!

2025 AGU Union Fellows

Bjorn B. Stevens, *past member of the GEWEX Cloud System Study (GCSS)*
Norman G. Loeb, *former member of the GEWEX Data and Analysis Panel (GDAP)*
Xin Li, *former member of the GEWEX Hydroclimatology Panel (GHP)*
David M. Lawrence, *former member of the Global Land-Atmosphere System Studies (GLASS) Panel*
Felix W. Landerer, *former member of the GDAP Panel*

2025 Recipient of the AGU Ivan I. Mueller Award for Distinguished Service and Leadership

Jérôme Benveniste, *co-lead on the 2023 European Space Agency-Centre National D'Etudes Spatiales-GEWEX Hydrospace Conference*

2025 Recipient of the AGU William Bowie Medal

Soroosh Sorooshian, *former GEWEX Scientific Steering Group (SSG) Chair*

GLASS GEWEX

GLASS, the GEWEX Global Land-Atmosphere System Studies Panel, invites you to the first Pan-GLASS conference from 6–9 July 2026 in Stuttgart, Germany.

This international meeting will bring together modelers, observationalists, and theoreticians working across scales and disciplines to advance understanding and modeling of land-atmosphere interactions. Topics will span from fundamental processes to operational modeling. Pan-GLASS 2026 will support in-depth discussion and coordination across global research efforts, with a focus on improving representations of the coupled land-atmosphere system in Earth system models. Registration and abstract submission will open in December. Mark your calendars and visit https://www.gewexevents.org/meetings/glass2026/ for more information!

BSRN Operations: A Summary Concerning 2018–2024

Christian Lanconelli
Former BSRN Project Manager

The Baseline Surface Radiation Network (BSRN) is a project of GEWEX and a recognized Global Climate Observing System (GCOS) network. Its main business is measuring downwelling broadband solar and infrared radiation at the Earth's surface, following strict quality standards and calibration traceability. Often, stations report upwelling components and collocated measurements such as UV components and upper air measurements, among others. It was established in 1992 with an initial set of nine stations and has expanded globally, totaling 77 stations (for 13,300+ monthly files of data), of which 43 are currently active, 17 are inactive, 17 are closed, three are candidates (with proposals from China, Cape Verde, and South Korea, with a station in East coastal Antarctica), and five are pending stations (from Ireland, Chile, Cyprus, Thailand, and Indonesia). These new station proposals were collected during the last two BSRN Scientific Review and Workshop meetings held in hybrid form in Ispra, Italy (June 2022) and Tokyo, Japan (July 2024). The first was hosted by the European Commission Joint Research Centre, and the second by the Japan Meteorological Agency. A former meeting, planned to be held in 2020 and hosted in Bologna, Italy, by the Italian National Research Council (Institute of Polar Science), was canceled because of the COVID-19 pandemic. It was replaced by a hybrid meeting focused on BSRN management, Working Group reporting, and new station candidate presentations (October 2020). The program and presentations of these meetings are accessible though the official BSRN web page (*https://bsrn.awi.de/meetings*).

Participants of the 18th WCRP/BSRN Scientific Review and Workshop, held in Tokyo, Japan, July 2024

Out of 10 new station proposals received over the abovementioned meetings, only three [Abashiri (ABS), Magurele (INO), and Lampedusa (LAM)] have completed the process of moving towards operational status, while the others reflect a pending or candidate status. The former refers to issues with completing the station setup, from either a lack of instrumental implementation or analysis issues, while the latter refers to stations that have submitted less than six months of data in a valid BSRN station-to-archive data format and have successfully completed the quality control checks. The timeliness issue continues to affect half of BSRN sites for many different reasons. The BSRN Data Quality Working Group (DQWG) has moved to support station scientists in the analysis of their data by establishing direct contact, holding monthly meetings, developing a few software tools to facilitate a centralized visual quality check, and facilitating the circulation of existing software across the community. Centralization was recently also considered to address the weaknesses related to the variety of approaches from different stations while reporting operational issues. The DQWG also worked to improve BSRN data quality knowledge of legacy data, to identify oversights in reporting, and to harmonize data versioning, discussing future requirements such as new data formats, official quality flag reporting, data gap handling, developing and scouting for software devoted to quality checks, and so on.

A harmonized way to report operational and environmental conditions that can affect instrument performance is crucial to correctly assess measurement uncertainties. By operating in a natural environment, instruments are affected by additional terms of uncertainty related to dusting, rain, riming and icing, and tilting, which should be considered among the uncertainty sources related to the instrument itself. Concerning calibration error, linearity, thermal offsets, and directional response, BSRN already recommends detailed best practices to mitigate their contribution, and eventually relies on the robustness of modern high-class instruments in balancing any systematic deviation.

A lot of concurrent work is still in progress to make steps forward towards the label of robust reference network, issuing Fiducial Reference Measurements (FRM), with a fully-documented uncertainty budget associated with the physical quantities and following the Bureau International des Poids et Mesures (BIMP) guidelines. Until now, the uncertainty was mainly assessed from comparison between redundant instruments and relied on the instrument datasheets (BSRN always adopts the higher quality standards following ISO-9060 guidelines) and calibration certificates, within a robust quality control procedure. The comparison between the shortwave global component and component sum over the whole BSRN archive showed a median (IQR) root mean square deviation of 6.8 (3.9) W/m^2 and an average bias of -0.3±7.1 W/m^2. The variability of these statistics highlights the challenges affecting sites operating in different climate zones, the decentralized analysis, which is the responsibility of individual station scientists and the spread in available resources and expertise across BSRN.

For the longwave (LW) component, the estimation of the uncertainty is more ambiguous, as redundancy for LW is not strictly foreseen in BSRN. Over the last two years, almost 20 stations have already started to submit a new logical record (LR4000) containing the pyrgeometer signals necessary to calculate longwave radiation, which is performed by means of a non-linear equation. The original signals are then necessary to adapt the archived data to any revision of the World Radiation Standards (World Radiation Reference for the shortwave, and World Infrared Standard Group for the longwave) operated by the Physical Meteorological Observatory Davos/World Radiation Center (PMOD/WRC) in Davos.

Instrumental redundancy is implemented through different efforts among BSRN stations and should be reinforced, as it also reduces data gaps related to instrument failures. Geographical gaps remain a weakness for BSRN, as it lacks coverage in Africa, South America, and Asia. Additionally, maintaining operations at existing stations in other regions continues to be a challenge, with half of the stations facing timeliness problems where data reporting is delayed by more than two years from their collection. A stronger interaction with regional networks or private sector initiatives, especially in renewable solar energy, could help to improve geographical gaps, but such collaborations should be supported by regulation-fostering mutual advantages.

The upwelling components are necessary to complete the surface radiation budget. Only part of BSRN is reporting these components (27), including all the polar stations. The Albedo Working Group aims to improve observation capabilities in support of remote sensing calibration and validation activities, and some sites also offer spectral measurements not (yet) included in the BSRN dataset, but of crucial importance for such activities. Although some work has been conducted to evaluate BSRN representativeness at different spatial scales, further efforts are needed to establish robust and site-specific indicators to better support a community that needs fit-for-purpose measurements for a variety of applications.

Delivering the ancillary measurements available over different sites, such as sky condition from sky-cameras, spectral measurements, and atmospheric profiling, was discussed during the last meeting in 2024 and should be pursued to further support studies of the atmospheric radiative processes driving the climate systems.

Finally, I would like to thank my colleagues from my time as BSRN project manager. Working with Dr. Amelie Driemel of the WRMC, as well as reporting and interacting with GEWEX-GDAP and GCOS-Atmospheric Observation Panel for Climate (AOPC) management over the last six years, was inspiring and helped me to better handle the challenges of managing BSRN. I would like to extend my personal best wishes to Dr. Laura Riihimaki and Mr. Sasaki Shun as they assume their roles as project manager and deputy, respectively. My best wishes also go to all the BSRN working group chairs and the entire BSRN community for maintaining and enhancing our knowledge of the surface radiation budget and understanding its regulating processes.

How Well Do We Understand the Water Cycle over the Ocean and Its Role in the Dynamical Coupling of the Atmosphere and the Ocean?

Ad Stoffelen
Royal Dutch Meteorological Institute (KNMI), the Netherlands

The troposphere is, to a large extent, defined by deep convection, where deep tropical convection redistributes the heat and moisture collected at the surface upwards throughout the troposphere. On the other hand, the associated precipitating clouds bring large amounts of fresh water to the surface and cold dry air descending to the planetary boundary layer (e.g., King et al., 2022). The oceans contribute the most to this continuous process of redistribution, since the Earth's surface is mostly water. As such, 85% of the water in the atmosphere is evaporated from the oceans (e.g., Ma et al., 2025). Also, about 75% of the rain falls into the ocean (Skofronick-Jackson et al., 2017). Increased greenhouse gasses warm the upper troposphere, hence potentially a stabilizing effect exists, while, on the other hand, increasing surface temperatures suggest increased water vapor content and hence buoyancy from the surface upwards (Richardson et al., 2022). Therefore, an interesting question remains: how do convection processes, cloud dynamics, and associated mesoscale convective systems (MCS) evolve with climate change and could this redefine tropospheric dynamics at large, or perhaps, due to modified surface fluxes, coupled ocean dynamics? Subsequently, how well can the global observing system and Earth system models monitor such changes?

The ocean's atmosphere is generally poorly observed by conventional measurements (Stoffelen et al., 2015). On the other hand, satellite instruments are being used for ocean weather monitoring (Stoffelen et al., 2019), particularly tropical cyclones (Velden et al., 2025). Furthermore, numerous temperature and humidity sounders from satellites provide information on the vertical mass structure of the atmosphere or on winds (Stoffelen et al., 2020; Aeolus DISC, 2025; Richardson et al., 2022), while satellite precipitation instruments provide instantaneous rain rates, such as from the Global Precipitation Mission (GPM; Skofronick-Jackson et al., 2017) or from geostationary satellites. Since moist convection processes are rather small in horizontal extent and short lived, monitoring their time and vertical and horizontal evolution over the ocean is not possible most of the time. So, how do we know whether the associated processes are faithfully represented in climate models and, if so, how would these processes help determine Earth system climate dynamics?

As part of a world-wide effort to seek answers to the questions posed above, the Royal Netherlands Meteorological Institute (KNMI) is involved in a number of satellite missions that help to provide solutions. First, ocean vector wind fields from scatterometers prove to be very effective in providing dynamical information for Numerical Weather Prediction (NWP), while

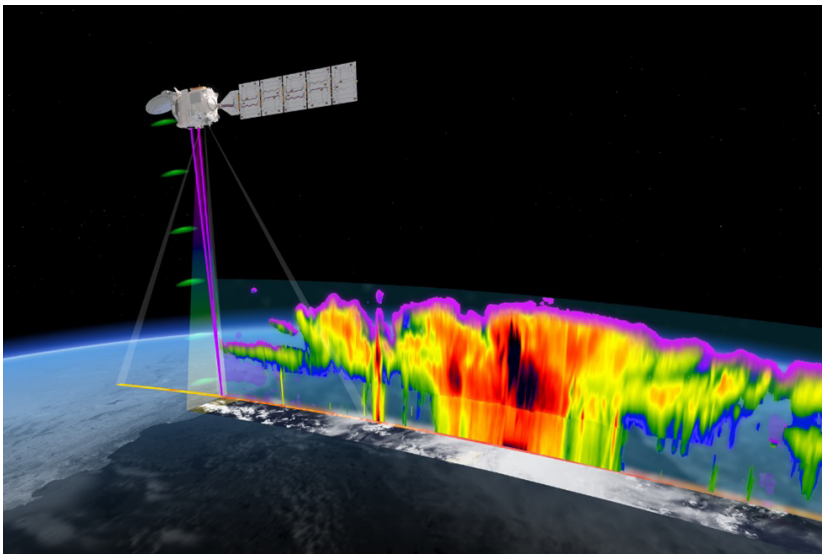

Figure 1. *Depiction of an oceanic moist convection system by the EarthCARE satellite (adopted from https://earth.esa.int/eogateway/news/earthcare-lifetime-update-mission-targets-2034-and-beyond)*

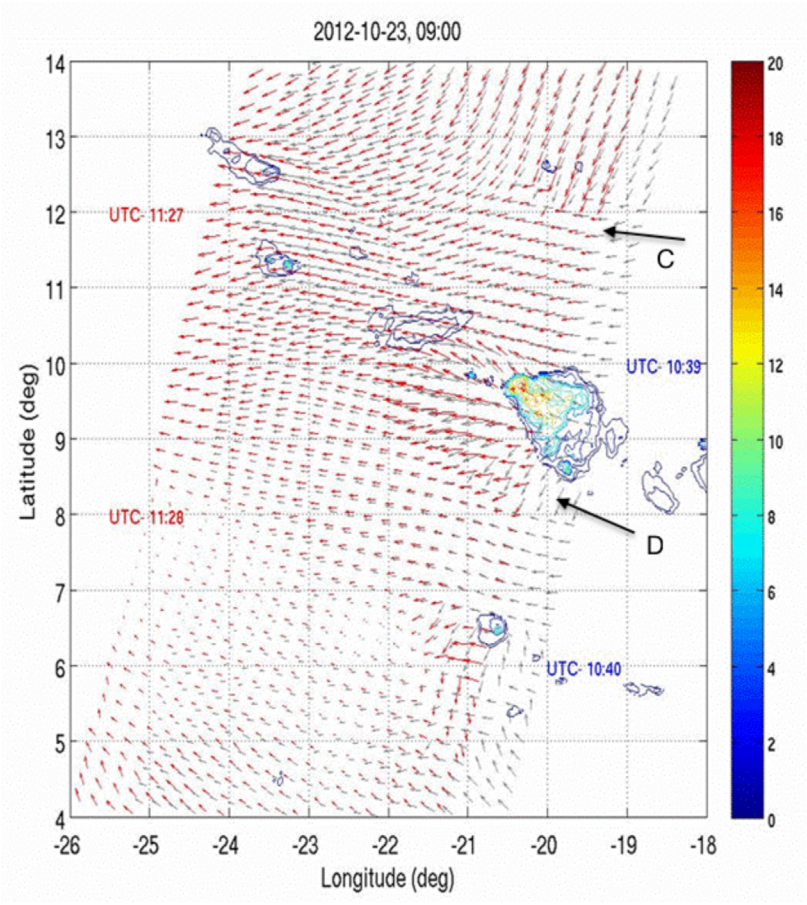

Figure 2*. A satellite view of the interaction of rain and ocean winds in the North Atlantic ITCZ close to the west of coast of Africa. Contours of Meteosat Second Generation (MSG) rain are shown at the time of the pass of ASCAT-A (black), about 49 minutes before the pass of ASCAT- B (red). The color bar shows rain rate in mm/h. Note convective rain cells (>10 mm/h) and nearby areas of strong wind convergence (C) and divergence (D). Adopted from King et al. (2022).*

extreme wind divergence and curl as measured by scatterometers, particularly the Advanced SCATterometer (ASCAT) operating in the microwave C band, proves to be closely associated with heavy moist convection (King et al., 2022). These wind products are available from the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Ocean and Sea Ice Satellite Application Facility (OSI SAF, 2025) and from the EU Copernicus Marine Service (2025). In fact, extreme surface wind convergence appears associated with extreme rain, the latter lagged by about 30 minutes, while in downbursts extreme divergence follows just after extreme rain events. Moreover, extreme curl at the ocean surface is also associated with the atmospheric dynamics near moist convection, mainly due to the generation of short-lived wind shear zones. These temporal associations were made using rain information from geostationary satellites (Xu et al., 2019). Further work on segregating the effects of rain and wind for scatterometers has been performed by Lin et al. (2015), Priftis et al. (2018), and Zhao et al. (2023), inter alia. Furthermore, some data may be further exploited, such as the availability of tandem ASCAT scatterometer passes in the tropics from ASCAT-A, B, and -C, separated by only 50 minutes, which could possibly reveal some further temporal aspects of organized convection.

Scatterometers have also been very useful to monitor persistent NWP or reanalysis model biases (Belmonte Rivas and Stoffelen, 2019), some of which are associated with moist convection complexes. For example, global models lack the extreme updrafts and downdrafts seen by scatterometers. As pointed out above, the updrafts and downdrafts change the air near the ocean surface rather dramatically from warm and moist to cold and dry, respectively, and this is at a relatively high temporal frequency (Priftis et al., 2021). Hence, missing these fast and extensive near-surface exchange processes in the tropical region may strongly affect the tropical model dynamics. Observed higher-level aspects of tropical dynamics, focused on wind shear, have been evaluated in situ (e.g., Houchi et al., 2014) and later by satellites when comparing Aeolus wind profiles to NWP models (Zagar et al., 2025), including aspects of large-scale tropical convection in the Inter-Tropical Convergence Zone (ITCZ) and Hadley circulation. Clouds and moist convection fluxes may be further evaluated through the European Space Agency (ESA)'s 9th Earth Explorer mission Earth Cloud, Aerosol and Radiation Explorer (EarthCARE) (EarthCARE, 2025), which focuses on cloud and radiation properties. Aeolus and EarthCARE furthermore observe aerosol properties, which link to main uncertainties in clouds and precipitation. Allowing continuity on this aspect, Europe is preparing for a second Aeolus mission (Aeolus-2, 2025).

More generally, the sheared interface between the atmosphere and the ocean provides room for organized exchange processes, both in the atmospheric and oceanic boundary layers (Seo et al., 2023; Nuijens et al., 2024), affecting evaporation, wind divergence (and convergence), cloud formation, and precipitation. The 10th ESA Earth Explorer Harmony mission will measure ocean surface winds, waves, ocean motion, sea surface temperature (SST), and cloud boundary properties (Harmony ESA, 2023). It exploits two Thermal Infrared Radiometers (TIR) on tandem satellites, flying in formation with the Copernicus Sentinel-1 satellite, providing high-resolution multiple-angle stereo views from clouds over about 5 minutes, such that parallax measurements allow the determination of cloud boundaries and their movement. By comparing these to simulated model clouds, we plan to evaluate the characteristics of cloud motion in relation to entrainment processes in both observations and cloud-resolving models to reveal basic properties of cloud processes and the modeling thereof. Finally, the ESA Earth Explorer 11 (EE11) WInd VElocity Radar Nephoscope (WIVERN) mission would furthermore provide high-resolution reflectivity profiles of rain, snow, and ice water, which can be used to help achieve a better quantification of the Earth's hydrological cycle and energy budgets (Illingworth et al., 2018).

Our understanding of climate dynamics, in particular the dynamical coupling of the atmosphere and the ocean and the key role of the water cycle over the ocean, appears limited. Nevertheless, dynamical changes in the Earth's system due to climate change may prove catastrophic (van Westen et al., 2024). Over time people have built fitting infrastructure and nature has adapted to the local climate, such that changes in local weather regimes due to climate change may depart dramatically from the local normal weather conditions (Funk, 2021). Observing dynamical aspects of the Earth system is hence key to better understand and predict such changes. As noted above, both existing and future satellite missions may contribute to a better and more complete understanding of Earth system dynamics.

Acknowledgements

Global scatterometer winds from several scatterometers have been developed by and are available from the EUMETSAT OSI SAF while Earth-gridded scatterometer winds are available from the European Union's Copernicus Marine Environment Monitoring Service (EU CMEMS), and several of the publications referenced above were supported by these entities. Furthermore, long-term involvements in the European Remote-Sensing Satellite (ERS), Aeolus, and Harmony ESA explorer missions have molded the perspective sketched above. As such, many international colleagues and the KNMI group for satellite active remote sensing, also involved in EarthCARE, have contributed implicitly to this article.

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Meeting/Workshop Reports

2025 GEWEX Hydroclimatology Panel (GHP) Meeting

9–11 July 2025
Montreal, Canada

Ali Nazemi[1], Paola A. Arias[1], and Rowan Fealy[2]
[1]GHP Co-Chair; [2]Incoming GHP Co-Chair

The 2025 GHP Meeting was held in Montreal, Canada, from 9–11 July 2025. Once again, we had a very fruitful meeting with over 35 in-person attendees during the busiest period, and around 20 online participants. The meeting lasted for three full days, which marked the longest GHP assembly since 2019.

GHP hosts four types of projects: (1) Regional Hydroclimate Projects (RHPs), aiming to understand and predict hydroclimatology in a specific region; (2) Cross Cutting Projects (CCs), encouraging knowledge mobilization and global synthesis of knowledge around a specific topic; (3) Networks, maintaining collaboration and building capacity for activities relevant to GEWEX science; and (4) Global Data Centers, collecting and distributing relevant hydroclimatic data. The 2025 GHP Meeting was an opportunity to demonstrate and discuss advances that these activities provide to regional and global scientific communities, GEWEX, and the World Climate Research Programme (WCRP), as well as other international research organizations. This year we had strong participation from the World Weather Research Programme (WWRP)'s Integrated Prediction of Precipitation and Hydrology for Early Actions (InPRHA) project and Regional Information for Society (RIfS), another WCRP core project.

The main endeavor at the meeting was evaluating the annual progress across our multiple activities, a total of 16 as of 2025. Through multiple years of communal Panel effort, this undertaking is now fully streamlined. Each activity is assigned to one or two Panel members who serve as rapporteurs and lead the annual progress review of the activity and provide written feedback prior to the meeting. The meeting is then allocated to the responses of the activities to the feedback with a follow up discussion, led by the rapporteurs. The effect of these changes has made the meeting incredibly dynamic and effective—and much more beneficial for the Panel and the projects. The sense of communal effort is also apparent now in the way new activities are being evaluated by the Panel. For each new activity, the Panel considers a review period, in which all Panel members are invited to provide feedback. These feedbacks are then consolidated and summarized by the co-chairs and provided to the activity.

The Panel also had multiple inspiring and thoughtful discussions deliberating on the activities and the direction of the Panel moving forward. We also warmly welcomed new Panel members and activity leads and said farewell to some others.

Day 1—Reviewing RHPs and Networks

RHPs are multidisciplinary projects to improve understanding of the physical and anthropogenic processes that affect water and energy exchanges within a specific region. There are currently six ongoing RHPs in the Panel. This includes three mature RHPs, i.e., Baltic Earth, Global Water Futures Observatory (GWFO), and the Regional Hydrology Program for the Andes (ANDEX), along with four initiating RHPs, i.e., Third Pole Environment-Water Sustainability (TPE-WS), the Humans and Hydroclimate in the United States (H_2US), and the Asian Precipitation Experiment (AsiaPEX). We also have a prospective RHP in the Panel, the Central Asia Initiative.

Mature RHPs include large groups of active researchers and established ties with local communities and end-users. As the Panel's oldest RHP, Baltic Earth is an archetypal example for a decentralized and bottom-up research program without any core funding, in which individual researchers join forces and share research interests and resources. The current phase of Baltic Earth is winding down. For around two decades, Marcus Reckermann served as the head of International Baltic Earth Secretariat and played a key role in linking the Panel with Baltic Earth. He has been retired since spring of 2025. To celebrate his contributions, Baltic Earth held a 1-day symposium in the International Maritime Museum of Hamburg, Germany, in which Ali Nazemi represented the Panel and provided a short speech on behalf of GHP. Since then, a new project office has formed, jointly hosted by Leibniz Institute of Baltic Sea Research in Warnemünde, Germany (IOW) and the Institute of Oceanology, Polish Academy of Science, Sopot, Poland (IO-PAN). The Panel wishes Marcus a joyful retirement and looks forward to working with new the Baltic Earth co-leads, Drs. Sonja Ehlers (IOW) and Agnieszka Jedruch (IO-PAN). Baltic Earth plans to submit a new science plan to the Panel by the end of 2025.

GWFO is evolving out of Global Water Futures (GWF), which is now sunsetting, and is a Canada-wide freshwater research facility. Both GWF and GWFO are flagship examples of centralized and top-down RHPs, with large core funding. Despite major differences with Baltic Earth in pursuing the RHP concept, GWF also delivered major scientific advances through new observations, models, and predictive tools, and supported the formation of national water forecasting systems. It also changed the Canadian water research landscape through its Indigenous engagement and policy influence. GWFO aims at continuing the operation of GWF observatories to support critical water research and safeguard Canadian water resources in an era of rapid change. ANDEX is the newest mature RHP in the Panel, as the ANDEX implementation plan was approved by the Panel right after the Montreal meeting. ANDEX takes a bottom-up approach to the RHP concept, and is formed by a diverse network of mainly early- and mid-career South American scientists who work together in a suite of projects. The momentum in ANDEX is boosting several interactions with other GHP activities, e.g., the International Network for Alpine Catchment Hydrology, Phase 2 (INARCH-II), and WCRP initiatives, e.g., the Cli-

In-person and online participants of the 2025 GHP Meeting, held in Montreal, Canada

mate and Ocean Variability, Predictability and Change (CLIVAR)/GEWEX Monsoon Panel, the Climate and Cryosphere (CLiC) project, the Regional Information for Society (RIfS) project, and the My Climate Risk Lighthouse Activity. ANDEX is planning to have its first annual meeting after becoming a mature RHP in October 2025 in Mendoza, Argentina.

TPE-WS is a world-class scientific program in the Tibetan Plateau devoted to understanding water and energy cycles in Asia's high mountains. TPE-WS continues its field experiments for understanding the land-surface and land-atmosphere interaction processes based on comprehensive in situ measurements. The RHP plans to use the gathered observations the regional hydrological cycle through collaboration with some GHP activities, i.e., INARCH-II, AsiaPEX, and determining Evapo-Transpiration (dET). TPE-WS is also planning to investigate the role of combining boundary layer measurements (i.e., radiosonde, microwave radiometer, wind profiler, laser raindrop spectral, etc.) on better modeling of precipitation processes in climate models. The Panel is extremely pleased with how TPE-WS is developing.

H_2US is envisioned as a ten-year effort to understand and characterize the physical processes of the water, energy, and carbon cycles in the U.S. during the Anthropocene, and is driven by the need for actionable science solutions to achieve water,

food, energy, and ecological security. The activity continues convening the community through bi-weekly Affinity Group meetings and leveraging National Science Foundation (NSF) National Center for Atmospheric Research (NCAR) visitor funds to mobilize visitors. H_2US is also starting a National Aeronautics and Space Administration (NASA)-funded project to develop a report on water cycle observing system priorities. In addition, the RHP is investing in small-scale, leveraged projects such as investigating snow water equivalent biases, building a LOwer Troposphere Observing System (LOTOS), and focusing on improved understanding and characterization of human use of water in water resource and hydrometeorological models across scales. Given current challenges in securing funds in the U.S., H_2US leans toward a Baltic Earth-like approach to build its implementation plan and to pursue coordinated efforts among non-federally funded activities.

The AsiaPEX team submitted its revised Science Plan just prior to the Montreal meeting. The activity had a fruitful year. It continues its field observations and plans for a monsoon campaign from winter 2028/2029 to summer 2030. Such data collection will support investigating the extremes and precipitation predictability in eastern Asia and lead to better modeling capabilities. GHP's only prospective RHP, the Central Asia Initiative, now has a core team from the region and is advancing toward a coordinated downscaling effort in the region. At this stage, the activity has not been able to secure funding. With the current U.S. funding situation, the activity is looking for alternative sources of financial support. The Panel recognizes existing challenges, yet fully agrees on the importance of this initiative.

GHP Networks foster collaborations and capacity building activities relevant to GEWEX science. They may transition into an RHP or a CC, or, alternatively, an RHP or CC may shift into a Network upon completion. GHP currently hosts two active Networks, the Pannonian Basin Experiment (PannEx) and the Global Groundwater Network (GGN). PannEx aims to provide a better understanding of Earth system processes over the Pannonian Basin. The activity started as an initiating RHP and later evolved into a vibrant group of scientists from different disciplines interested in the hydroclimatic processes of the region. During the reporting period, PannEx had organized and participated in multiple workshops, mainly around micrometeorological measurements. GGN's mission is to constructively link hydrogeology and groundwater modeling to Earth System Modeling capability in GHP, GEWEX, and beyond. GGN's Science Plan was approved by the Panel in May 2025. The activity is now establishing working groups and organizing a workshop in March 2026 at the Eastern Institute of Technology in Ningbo, China.

Day 1 concluded with a lively discussion on how the Panel can create synergies between RHPs and how the knowledge accumulated in RHPs can be synthesized.

Day 2—Reviewing CCs and Data Centers and Joint Meeting with RIfS and WWRP-InPRHA

CCs are integral activities within GHP aiming at addressing the GEWEX science questions and creating collaboration between RHPs, other GEWEX Panels, and WCRP activities. GHP currently includes four active and one prospective CC. The oldest CC in the Panel, the Transport and Exchange Processes in the Atmosphere over Mountains Experiment (TEAMx), aims at improving the current understanding of exchange processes in the atmosphere over mountains and how these processes are parameterized in climate models. The activity is now booming, with seven new projects started during the reporting period and a further eight waiting for funding decisions. Multiple years of observational effort can now support modeling studies and the first set of modeling intercomparison results have now been produced. The Panel is extremely pleased with the progress made by TEAMx. Another mature CC is INARCH-II. During the reporting period, the activity held a major workshop in China where new directions and activities were discussed. The Common Observing Period Experiment (COPE) is now concluded and the data are being published in multiple special issues. The activity is now moving toward its diagnostic phase to address key INARCH science questions. It also plans for renewal as a GEWEX CC Project beyond 2026.

The Panel also includes two newly-approved CCs, the Global Flood CC and the River Experiment (RivEx). Flood CC aims at mobilizing the science community for better understanding of global flood processes and improved application of flood research and knowledge across science and engineering disciplines. As a first step, the activity is now planning for a Flood Model Intercomparison Project (FMIP) and forming its scientific groups around three pillars: hydrologic factors for flood generation, spatiotemporal variability of flooding under non-stationarity, as well as land use assessment, and risk and exposure of flooding on society. The activity also continues its monthly meetings, and explores funding avenues to enrich and continue planned activities. RivEx focuses on river flows and puts into the context both their accessibility for water supply and their role in causing devastating disasters through flooding. The RivEx vision is to create an estimate of surface water everywhere, at all times by merging numerical modeling and multiple satellite assets with in situ observations operationally, such that it can be used to support decision making for water resources management and water-related disaster mitigation. This ambition is pursued through benchmarking the current state of hydrological modeling capabilities, identifying hotspots of anthropogenic influences on global surface water, and setting up a framework to optimally ingest an increasing number of observations for more accurate reproduction of surface water stores and fluxes. The activity has submitted various proposals to attract funding and has organized regular meetings for the next 18 months.

After a couple of years in hiatus, dET has gone through a structural reorganization and is under a new leadership team, with the emphasis on the need to address uncertainties in Evapo-Transpiration (ET) modeling through coordinated efforts across ground measurements, land surface models, and remote sensing algorithms. The activity is planning to launch a coordinated ET Model Intercomparison Project (MIP) to system-

atically quantify uncertainties across measurement techniques and models. This will lead to the development of integrated frameworks for blending modeling results, remote sensing products, and ground-based data to better represent ET at the global scale. The activity plans to focus in the coming months on summarizing the previous phase of dET before its hiatus and announcing its new phase to recruit new members.

GHP currently includes two Global Data Centers, the Global Precipitation Climatology Centre (GPCC) and the Global Runoff Data Centre (GRDC). Both data centers had an extremely fruitful year. Apart from GPCC's steady progress on precipitation data acquisition and processing, the second version of homogenized data for Europe (HOMPRA-Europe2) is now completed. Future plans include moving toward more automatic data retrieval using application programming interfaces (APIs) and open data portals, improving data integration and quality control, reviewing and enhancing the existing interpolation tool, and producing the next versions of precipitation analyses. GRDC focuses on acquisition, harmonization, and storage of global historical river discharge data. The global usage of GRDC data continues to increase and the center is successfully progressing, continuously adding new data into the system. As of June 2025, GRDC hosts more than 11,000 in situ data from 160 countries around the world. During the reporting period, GRDC contributed to the World Meteorological Organization's State of the Global Water Resources Report 2025, and extended the Caravan data set. New developments of GRDC will include adding water level data, enhancing the usage of the Baltic Sea Experiment (BALTEX) data set with water quality data, and including Surface Water Ocean Topography (SWOT) satellite data.

The afternoon of Day 2 was dedicated to a joint meeting between GHP, RIfS, and WWRP-InPRHA. RIfS aims at providing actionable climate information at the regional scale. RIfS also hosts the Coordinated Regional Climate Downscaling Experiment (CORDEX) and the Global Extremes Platform (GEP). RIfS has collaborative ties with ANDEX and there is an interest in both GHP and RIfS to initiate a joint activity in Africa. InPRHA is a new research project within the WWRP context aimed at integrating advanced forecasting systems into early warning and action mechanisms to enhance resilience to natural and societal hazards. This project leverages multidisciplinary approaches, including meteorological, hydrological, and social sciences, to bridge the gap between prediction and early action. There are several synergies between InPRHA and GHP, particularly with the Flood CC and RivEx.

Day 2 finished with a discussion on how we can synergize different CC projects and how CCs can act as platforms to foster collaboration between other GEWEX Panels, WCRP activities, and beyond.

Day 3 – Internal Panel Business

Day 3 of the meeting was dedicated to the Panel's internal business. Peter van Oevelen, the International GEWEX Project Office (IGPO) Director, who attended the meeting virtually, provided some updates on the IGPO's status, particularly in a time of multiple uncertainties. We also had presentations from three new Panel members, Georgia (Gia) Destouni, Florentine Weber, and Carla Gulizia. Gia Destouni is a Professor of Hydrology in the Department of Physical Geography, Stockholm University. Her research looks at flows, storages, availability and quality of water, and their interactions with land, atmosphere, ocean, climate, and societal factors. Florentine Weber is an early career scientist based in the European Centre for Medium-Range Weather Forecasts (ECMWF). Her research focuses on understanding how anthropogenic activities impact land surfaces and weather patterns. Carla Gulizia is a Research Scientist at the Argentinean National Council of Scientific and Technical Research based in the Research Center of the Sea and the Atmosphere, and she is also an Assistant Professor at the Department of Atmospheric and Oceanic Sciences, Faculty of Science, at the University of Buenos Aires. Her research focuses on the study of the hydroclimatology of southeastern South America and its response to different local and regional climatic forces in the context of climate change. The Panel is extremely excited to have these new members and is looking forward to working with them. At the same time, GHP acknowledges the insightful contributions from Dr. Anna Sörensson, who joins the WCRP Joint Scientific Committee, and Dr. Ivana Stiperski, who left GHP after concluding her 4-year term. GHP wishes both past members the best in their next endeavors.

GHP is closely linked with the GEWEX Panel on Global Land-Atmosphere System Studies (GLASS) through a number of joint activities. To facilitate the relationship between the two Panels, GHP Member Joshua Roundy of Kansas University serves as the GLASS-GHP liaison. During the 2025 GHP Meeting, Josh presented a comprehensive summary of GLASS activities. Synergies between Irrigation and dET were discussed extensively and it was decided that Bob Su and Li Jia, current dET leads, along with Ali Nazemi, attend the GLASS annual meeting to promote collaboration between the two Panels on the topic, which is of the enormous interest of both Panels.

The Panel also discussed the possibility of reviving Precipitation over Mountainous Terrain (MOUNTerrain), currently an inactive project that is both important and timely. Discussions included how current CCs such as INARCH-II and TEAMx can provide some momentum to this activity. We also discussed the GEWEX Scientific Steering Group's feedback, including the recommendation for a Pan-GHP meeting in 2027. Baltic Earth expressed an interest in hosting this meeting. This will be investigated further by the Panel co-chairs and the Baltic Earth leads.

As a final discussion, Ali Nazemi announced that he would step down as the Panel co-chair at the end of 2025, and Panel member Rowan Fealy is appointed as the next co-chair. The Panel also decided that the 2026 GHP Meeting will be held in Medellín, Colombia, hosted by GHP co-chair Paola Arias. We very much look forward to our next meeting in Medellín!

2025 Joint UTCC PROES and GDAP Meetings

19–23 May 2025
Paris, France

Hirohiko Masunaga[1], Claudia Stubenrauch[2], and Tristan L'Ecuyer[1]

[1]GEWEX Data and Analysis Panel (GDAP) Co-Chairs; [2]Upper Tropospheric Clouds and Convection (UTCC) Process Evaluation Study (PROES) Lead

The GEWEX Upper Tropospheric Clouds and Convection (UTCC) Process Evaluation Study (PROES) and GEWEX Data and Analysis Panel (GDAP) jointly held a week-long meeting from 19 to 23 May 2025 at the Jussieu campus of Sorbonne University in Paris. A common lunch and Wednesday afternoon session fostered interactions among scientists from the UTCC PROES and GDAP communities.

UTCC PROES is a GEWEX activity to deepen our understanding of the physical processes underlying convection and anvil clouds, sharing scientific interests with different GEWEX Panels, especially the Global Atmospheric System Studies (GASS) Panel and GDAP. Two UTCC PROES breakout meetings were held in 2022 and 2023, during the Pan-GASS meeting in Monterey, California, USA, and the joint Cloud Feedback Model Intercomparison Project (CFMIP)–GASS meeting in Paris, France, the latter in combination with the GASS project on mesoscale organization of deep convection.

The UTCC PROES project, initiated under GDAP and now continued within GASS, seeks to improve our understanding of tropical upper tropospheric (UT) cloud feedbacks. By bringing together experts in observations, radiative transfer, and process and climate modeling, the project fosters interdisciplinary collaborations. The 2025 hybrid UTCC PROES meeting gathered 30 participants in person and 15 online. Discussions were organized around five main themes:

- Feedbacks of UT clouds
- Microphysics—radiative heating—circulation
- Process-oriented studies using km-scale models and observations
- Observational studies and data sets
- Deep convection and its organization

Each session combined review talks, targeted presentations, and open discussions. The full agenda and presentations are available at: *https://www.gewexevents.org/meetings/utcc2025/agenda/*.

Since the first UTCC PROES meeting in November 2015, important progress has been made within the research community. Nevertheless, UT clouds remain a major challenge for climate prediction. Current feedback analyses based on theory, simulations, and observations provide valuable insights into underlying mechanisms, but critical questions persist, particularly regarding the prediction of changes in ice cloud optical depth.

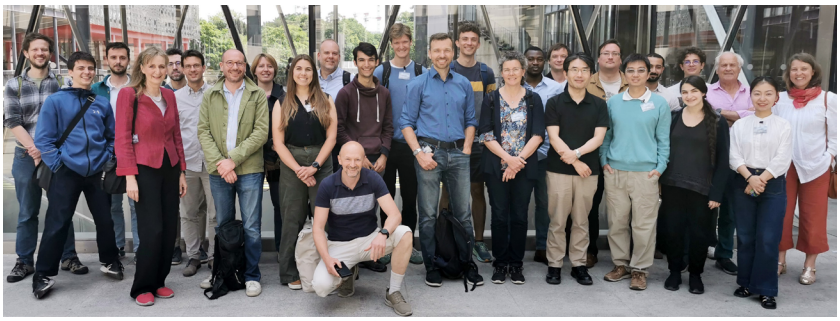
A key contribution of UTCC PROES has been the development of synergistic data sets for process studies and model evaluation. Tracking methods have been applied to data and more recently also to km-scale simulations, using cold infrared brightness temperatures to track deep convection. Using precipitation allows us to track both deep and shallow convection. Combining a complementary UT cloud system concept—based on cloud pressure, emissivity, and precipitation— with Machine Learning techniques has made it possible to capture a full 3D description of these systems (available at *https://gewex-utcc-proes.aeris-data.fr/data/*). The analysis of these data has shown that mesoscale convective organization enhances atmospheric radiative heating and steepens vertical gradients. The lifetime and maximum size of the mesoscale convective systems (MCS) also increase with organization. Indices to identify mesoscale convective organization are not yet conclusive, compared to the proxy of system size, at similar maturity stage and precipitation. Process studies based on the concept of cloud systems and their tracking lead to a better understanding.

The advent of global cloud-resolving models (GCRMs) represents a major step forward, revolutionizing MCS research by explicitly resolving convection. At the same time, these models highlight the critical influence of ice microphysics parameterizations, which strongly control upper-tropospheric heating and cooling. Results presented at the meeting also underscored the complexity of convective systems, which often extend beyond the classical "convective core plus cirrus anvil" picture. Many include layered cloud structures beneath the anvil and thin cirrus above and around, pointing to the need for more integrated approaches. Therefore, it may be time to connect studies of deep convection with those of shallow convection, building links with other GASS projects.

Wednesday afternoon was devoted to crosscutting discussions on selected topics shared by UTCC PROES and GDAP. The session began with a brief report of the UTCC PROES meeting by Claudia Stubenrauch. Sandrine Bony, as GASS co-chair, outlined ongoing GASS projects and presented new insights gained on perspectives of convective dynamics and organization. Among the variables essential for analyzing convective dynamics is in-cloud vertical motion. Three short talks were given to introduce recent and future satellite missions targeting vertical motion measurements: Earth Cloud, Aerosol and Radiation Explorer (EarthCARE), INvestigation of Convective UpdraftS (INCUS), and Convective Core Observations through MicrOwave Derivatives in the trOpics (C^2OMODO). The day concluded with discussions of existing data sets of radiative heating rates and their differences due to retrieval techniques.

Thursday and Friday were dedicated to discussions and presentations on GDAP projects and activities. GDAP's projects currently emphasize understanding Earth's Energy Imbalance (EEI) and coordinating the International Satellite Cloud Cli-

matology Project-Next Generation (ISCCP-NG) product while continuing existing cooperation with the Baseline Surface Radiation Network (BSRN) and Global Precipitation Climatology Centre (GPCC). GDAP also supports efforts to assess global observational data sets such as the GEWEX Water Vapor Assessment Phase II (GVAP-II) and an emerging cloud tracking assessment as well as plans to renew the cloud, precipitation, and radiation assessments.



In-person participants of the hybrid UTCC PROES meeting in 2025, at Sorbonne University in Paris, France

Claudia Stubenrauch presented the updated cloud assessment database. The continuous effort being conducted under the GEWEX initiative to study consistency, discrepancies, and complementarity among satellite cloud products is valuable for data users and highly appreciated by the weather and climate science communities. Benoit Meyssignac updated the Panel on the latest EEI assessment activities, summarizing recent work analyzing a variety of observations from in situ measurements of ocean heat content (OHC) to radiative imbalance at the top of the atmosphere from satellite observations. Emerging concerns include a notable increase in EEI trends in the past two decades, which is a topic of interest shared with the Explaining and Predicting Earth System Change (EPESC) Lighthouse Activity.

Markus Ziese reported the status of database statistics and data processing for GPCC. GPCC provides a long-term record of quality-controlled monthly and daily global precipitation over land by integrating gauge-measured surface precipitation from different sources across the world. Ali Behrangi outlined the Global Precipitation Climatology Project (GPCP) version 3.3, which is the latest version just released in February 2025. GPCP, a satellite-based global precipitation data set calibrated with gauge adjustment over land, has been substantially refined in quality and resolution in version 3.3 since its earlier version of 2.2.

Helen Brindley introduced Far-infrared Outgoing Radiation Understanding and Monitoring (FORUM), a European Space Agency (ESA) Earth Explore mission carrying an infrared spectrometer with a broad wavelength range containing far-infrared. The FORUM mission, as well as the ongoing National Aeronautics and Space Administration (NASA) Polar Radiant Energy in the Far InfraRed Experiment (PREFIRE), is designed to offer unique opportunities to retrieve water vapor and ice cloud properties, exploiting previously unexplored far-infrared radiation. These new measurements are expected to give us a more complete picture of Earth's radiation budget than before as they fill in the spectral gap in the past observational records.

Methods and technologies for radiative flux measurements have evolved since the GEWEX Radiation Flux Assessment Report was published in 2012, motivating a new assessment of radiation data sets. Recent improvements include spaceborne radar and lidar measurements of clouds and aerosols, which are crucial for evaluating the vertical structure of atmospheric radiative heating. It could be beneficial to coordinate a renewed radiative flux assessment with other GDAP activities such as the cloud assessment and BSRN.

The demand for a next round of precipitation assessment was also discussed. Although the joint International Precipitation Working Group (IPWG)/GEWEX Precipitation Assessment Report was published in 2021, many global precipitation data sets have been updated. A future assessment could slightly shift its focus so that the assessment report is user-oriented as well as provider-driven. This could be done by including a chapter that conveys guidance to general users; for example, the data sets suitable for specific applications (climate data record, near-real-time monitoring, etc.), in addition to the renewed analysis of product intercomparison.

Given challenges with making measurements in the Arctic and Antarctica, a new initiative targeted at the polar component of Earth's energy and water cycle would be a welcome addition to the GDAP portfolio. Key questions include how well we understand the processes behind the regional water and energy budget in the polar regions and at their boundaries, what are the key variables to focus on (e.g., surface albedo), and to what extent the existing satellite products, field experiments, reanalysis data, and numerical models can advance our understanding of those processes and variables. The GDAP polar science initiative would benefit from collaborations with related activities outside GEWEX, such as the WCRP core project Climate and Cryosphere (CliC).

Laura Riihimaki gave an update on the status of BSRN. While dedicated work is being done by the BSRN team to improve the quality and availability of data, there are rising concerns regarding the maintenance of BSRN stations for various reasons, including funding limitations and political instability. GDAP's role and strategies to tackle the urgent challenges faced by BSRN were discussed. Andy Heidinger presented ISCCP-NG, a high spatial/temporal resolution product of radiance and cloud properties from the geostationary-ring satellite constellation. Efforts are underway to recalibrate Level 1G radiances to homogenize the data quality across different instruments and to assess the Level 2 cloud retrievals in comparison with other satellite products.

Among the diverse applications of the ISCCP-NG data is cloud/convection tracking, a project that recently joined the GDAP portfolio. Hanii Takahashi and Juliet Pilewskie reviewed the ex-

Participants of the hybrid GDAP meeting in 2025, at Sorbonne University in Paris, France

isting software and data sets to track the evolution of convective cloud systems using satellite data and numerical simulations. Interested scientists gather regularly at convection tracking workshops and special sessions at international conferences. The latest move was to organize sub-groups focused on several key topics such as algorithm intercomparison, multivariate tracking methods, and the environmental influences on tracking performance.

Convection tracking potentially provides a unique source of precipitation and radiation data useful for land surface processes and could be of interest for the Global Land-Atmosphere System Studies (GLASS) Panel. This is just one of many possible cross-panel interactions between GDAP and GLASS, which was the last topic of discussion on Thursday. After a brief introduction to GLASS given by Yunyan Zhang, the Panel discussed ideas promoting crosscutting collaborations within GEWEX.

GDAP annual meetings have the tradition of inviting local scientists from the hosting institute or other institutes in the area. Friday opened with science talks by two French scientists. Hélène Brogniez summarized ongoing studies using synthetic satellite data in preparation of the C^{2}OMODO mission. Filipe Aires detailed novel analysis strategies to evaluate the water cycle over land by integrating diverse data into hydrological budgets. The two presentations were followed by a brief report of the GVAP-II status outlined by Marc Schröder.

WCRP published a short report in 2015 highlighting the needs and best practices for data assessments as conducted over the years by GDAP. Tristan L'Ecuyer led the discussion on possible updates of the assessment best practices to accommodate emerging needs such as open science requirements. The last point of discussion during the Panel meeting was the lack of continuity of Earth observing satellite missions for radiation and precipitation measurements. This is closely related to the presentation on Thursday by Yoko Tsushima, representing the Cloud Feedback Model Intercomparison Project (CFMIP), who expressed concerns about the anticipated absence of Earth radiation budget instruments beyond Libera aboard the Joint Polar Satellite System (JPSS)-4. Satellite precipitation measurements will face the same challenge as conically scanning microwave radiometers, particularly those in a sun-asynchronous orbit crucial for inter-calibration, disappear from the future mission inventory in the 2030s. GDAP plans to work with space agencies and relevant organizations, urging them to recognize the necessity of radiation and precipitation monitoring without gaps.

The Land surface Interactions with the Atmosphere over the Iberian Semi-arid Environment (LIAISE) Second Workshop Summary

Toulouse, France
22–23 May 2025

Aaron Boone[1], Martin Best[2], Jennifer Brooke[2], Oscar Hartogensis[3], Mary Rose Mangan[3], Belén Martí[1], Josep Ramon Miró[4], and Jan Polcher[5]

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The Second International Land Surface Interactions with the Atmosphere over the Iberian Semi-arid Environment (LIAISE) Workshop was held from 22–23 May 2025 at the International Conference Center (Centre International de Conferences, CIC) at Météo-France in Toulouse (*https://www.gewexevents.org/meetings/liaise2025/*). The goal of this meeting was to bring together researchers specializing in estimating the various components of the surface water and energy cycles experimentally using in situ observations, via remote sensing data and/or models, from the leaf to the regional scale.

Background

A key challenge in environmental science is predicting future changes in the terrestrial water cycle and their impacts on water resources. The LIAISE project (*https://www.hymex.fr/liaise/*) addresses this by studying land-atmosphere-hydrology interactions in Spain's semi-arid Ebro basin, an intensively farmed "bread basket" region. The study area spans the Catalan counties of Urgell and Pla d'Urgell in northeastern Spain, characterized by a hot, semi-arid Mediterranean climate and a sharp contrast between irrigated farmland and adjacent dry natural zones. Water is primarily supplied by artificial reservoirs in the Pyrenees and delivered via an extensively modified river and canal network. As irrigation expands and climate pressures mount, better field and remote sensing observations are essential for understanding land processes and their influence on the water cycle. Recent advances in land surface and atmospheric monitoring, along with improved quality and resolution of remote sensing data, are enhancing our understanding of both natural and human-driven processes and their feedbacks with the atmospheric boundary layer and basin-scale hydrology. A central aim of LIAISE is to leverage these developments to improve predictions of how human activity affects regional energy and water cycles.

Workshop Themes

Most of the results presented at the workshop were based on data from the 2021 LIAISE field campaign (Boone et al., 2025);

Instruments at various sites throughout the LIAISE project's study area

the data are available at https://liaise.aeris-data.fr. The workshop was structured into three sessions aligned with the themes of the project's working groups. The first session focused on land surface processes, highlighting monitoring of the surface energy budget through both in situ measurements and model-based approaches, as well as remote sensing algorithms for estimating irrigation (Le Page et al., 2023) and their integration into models. It also covered process studies on evapotranspiration (ET), photosynthesis, solar-induced fluorescence (SIF), and soil moisture. The second session examined anthropogenic impacts on regional atmospheric circulations, including studies of sea breezes (Lunel et al., 2024), nocturnal jets and turbulence, land-atmosphere coupling using large-eddy simulations (Mangan et al., 2024), and boundary layer evolution (Brooke et al., 2023). The third session addressed hydrological processes, with topics such as reservoir monitoring and modeling (including irrigation release), streamflow simulation and validation, and basin-scale hydrology and water balance—particularly in the context of semi-arid, human-influenced systems. A total of 28 participants attended the 1.5-day workshop.

Next Steps

LIAISE has launched three new initiatives that will eventually be open to participation from external research groups and modeling teams. The first is a land surface model (LSM) intercomparison project, which involves offline simulations of the surface energy budget and land surface processes at eight contrasting local-scale sites during the Long Observation Period (LOP), spanning several months of the main plant growth cycle. These sites feature diverse land cover, ranging from irrigated crops and grasslands to natural drylands. A primary goal is to improve the representation of irrigation in LSMs. Building on insights from the first LIAISE mesoscale model intercomparison project (Jimenez Cortez et al., 2025), a second-phase initiative has begun. It emphasizes incorporating irrigation processes, particularly important for operational numerical weather prediction (NWP) models at kilometer-scale resolution. The third initiative focuses on obtaining a multi-model basin-scale water budget estimation for the Ebro basin, explicitly accounting for anthropogenic influences. Preliminary results from regional-scale LSM simulations at kilometer resolution (using three datasets covering 1989–2013 and WFDEI 0.5° forcing as a baseline) were presented at the workshop. Initial experiments used default LSM configurations, either without irrigation or with simplified schemes. Future experiments will incorporate irrigation and river routing to evaluate the added value of high-resolution spatial and temporal forcing data. Overviews and calls for participation in these initiatives will be announced in upcoming issues of the *GEWEX Quarterly*.

A meteorological tower at the Ivars site

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RivEx Community Meetings

The River Experiment (RivEx) is a global research initiative dedicated to advancing our understanding of Earth's most renewable and accessible freshwater resource: our rivers. RivEx brings together a diverse, international community of scientists to create a common strategy for improving and comparing our hydrological models, ultimately turning advanced global science into actionable knowledge that benefits local communities worldwide.

We hold quarterly virtual meetings with our entire membership to share progress, exchange ideas, and build consensus. To stay informed about our activities and receive meeting invitations, please sign up for our mailing list by by sending a message to the International GEWEX Project Office at *contact@gewex.org*. A partial quarterly meeting schedule is below; meetings start at 07:00 Pacific Time. For more information and to see the full meeting schedule, please visit *https://www.gewex.org/river-experiment-initiative/*.

Tue, 11 Nov 2025	Community Open Science Practices *Cédric David*
Tue, 13 Jan 2026	Hydro conditioned topography & Hydrogeomorphology & Topo-bathymetry *Dai Yamazaki & Peirong Lin*
Tue, Apr 14 2026	In situ Observations & Satellite Observations *Simon Mischel & MJ Tourian*
Tue, Jul 07 2026	SWOT observations *Guy Schumann*

Climate and Cryosphere

Open Science Conference

Wellington, New Zealand • 9–12 February 2026

As a pan-cryospheric meeting, the Climate and Cryosphere (CliC) Open Science Conference (OSC) will address all elements of the cryosphere and its climate connections. Scientists, researchers, scholars, practitioners, educators, and stakeholders are invited to come together at the nexus of climate and cryosphere to learn from one another, identify knowledge gaps, and address emerging challenges. From modelers and observationalists to social scientists and community organizers, leading and emerging experts as well as early career researchers (ECRs) are welcome to present their work and discuss the state of cryospheric science.

Register now at clic2026.com/registration. More information is available at clic2026.com.

GEWEX/WCRP Calendar

For the complete Calendar, see http://www.gewex.org/events/

18 November 2025—10th Machine Learning for Land Modeling (ML4LM) Webinar: Machine Learning for Benchmarking Land Surface Models—Virtual

2–3 December 2025—Future Directions for Earth Observations and Data Stewardship: A Workshop—Washington, D.C., USA

5 December 2025—Global Flood CrossCutting Initiative Monthly Online Meeting—Virtual

10 December 2025—11th Machine Learning for Land Modeling (ML4LM) Webinar: General Discussion and Future Plans—Virtual

14 December 2025—3rd GEWEX/LS4P-II International Workshop—New Orleans, LA, USA

15–19 December 2025—AGU25—New Orleans, LA, USA

11–12 February 2026—Ecosystem Services of Green Building Envelopes: Observations and Modelling—Braunschweig, Germany

23–27 February 2026—WCRP School on Climate Prediction Across Timescales—Buenos Aires, Argentina

9–12 March 2026—5th Workshop on Convective Organization—São Paulo, Brazil

9–13 March 2026—CMIP Community Workshop 2026—Kyoto, Japan

23–27 March 2026—8th International Baltic Earth Winter School on "Earth System Science for the Baltic Sea Region"—Tallinn, Estonia

23–27 March 2026—38th GEWEX Scientific Steering Group (SSG-38)—Bonn, Germany

GEWEX QUARTERLY

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