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

Baltic Earth Enters a New Phase



A refreshed Baltic Earth 2.0 research program, which centers on gaining understanding of the Earth system in the Baltic Sea region, follows on from Baltic Earth phase I and its predecessor, the Baltic Sea Experiment (BALTEX). This photo shows participants of the 6th Baltic Earth Conference held in April 2026. Credit: A. Jedruch, IBES. Read about Baltic Earth 2.0, its new Research Topics, and more starting on page 4.

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Perspectives on a Future PBL Mission

Xubin Zeng
Co-Chair, GEWEX Scientific Steering Group

The planetary boundary layer (PBL) is the lowest layer of the atmosphere and plays a crucial role in weather forecasts, climate feedbacks, air quality, transportation, wind energy, and the rapidly growing unmanned aerial vehicle (UAV)-based low-altitude economy. In spring 2026, I taught a graduate course on the PBL and surface processes. The course was co-listed in atmospheric science, environmental science, hydrology, planetary science, and watershed management, reflecting the deeply interdisciplinary nature of PBL science.

For these reasons, PBL studies have been a central component of GEWEX activities for decades, including the GEWEX Atmospheric Boundary Layer Study (GABLS), the GEWEX Cloud Systems Study (GCSS) PBL clouds Working Group, and the GEWEX Land–Atmosphere Feedback Observatory (GLAFO). While GABLS and GCSS coordinated PBL model intercomparisons, GLAFO provides advanced observations to support next-generation PBL research.

Global characterization of PBL processes requires spaceborne observations, yet the PBL remains poorly observed from space for several reasons. First, the PBL is shallow and contains sharp vertical gradients, which demand fine vertical resolution. Second, it is turbulent and rapidly evolving. Third, signals from backbone passive observations in the PBL are often contaminated by surface emissions and reflectance, especially over land, making retrievals difficult. To address these challenges, here I share my perspectives on future PBL missions, based on my presentation at a recent National Aeronautics and Space Administration (NASA) PBL workshop.

Compelling Reasons. Recognizing the importance of the PBL is only the starting point. The key question is identifying why the PBL deserves higher priority relative to other observables. Strong PBL science alone is not sufficient, especially as the European Space Agency (ESA) has long emphasized applications, and NASA is increasingly doing the same through its recent Earth Science to Action Strategy. As briefly hinted above, better PBL observations from space would have a significant impact on a variety of applications.

However, strong science and applications alone may not be enough to guarantee a dedicated PBL mission, because the broader landscape has changed: support for science is under pressure from rising defense budgets and slower economic growth driven by tariffs, supply-chain uncertainties, and global crises. In this environment, alignment with national priorities becomes essential. For many countries, these priorities now include quantum technologies including computing, artificial intelligence (AI), and energy security. Closer partnerships with the private sector, faster mission cycles, and greater cost efficiency are also increasingly important.

Measurements. PBL impacts on science and applications require temperature, water vapor, and horizontal wind profiles. For example, organized convection depends on water vapor, instability, and horizontal convergence. While hyperspectral infrared and microwave sounders can provide temperature and water vapor profiles, two satellites flying in the same orbit with a controlled time separation enable water-vapor-tracking retrievals of horizontal wind profiles. These winds can then be calibrated and improved using Doppler wind lidar measurements, such as those planned for Aeolus-2 from ESA and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) in the mid-2030s. Water vapor differential absorption lidar (DIAL) complements sounders by constraining their observations with direct and high vertical resolution measurements, leading to much more accurate water vapor and temperature retrievals.

Architecture. The PBL community has long recognized the need to integrate spaceborne, suborbital, and surface-based measurements. This architecture can be further strengthened by long-duration stratospheric balloons, which provide regional coverage and continuous calibration and validation. For instance, launching a PBL satellite in tandem with an existing operational satellite carrying infrared and microwave sounders enables horizontal-wind retrievals without increasing overall mission cost.

Other Factors. The PBL mission should be framed as a next-generation sounding mission for the whole atmosphere, including the PBL, that could serve as a technology demonstration for future operational weather missions. It can also function as a technology pathfinder for planetary atmospheres (e.g., Mars), aligning with national priorities in space exploration. As AI-based models can assimilate data volumes far larger than those used in traditional physical-model data assimilation—often by a factor of 5–10—they will be well suited to handle the huge amount of data from hyperspectral sounders.

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A New H3S Cohort Brings Community and Mentorship to Early Career Hydrologists

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The American Geophysical Union Hydrology Section Student and Early Career Subcommittee (AGU H3S) was thrilled to welcome 26 new members this spring, expanding our team to 40 total members from 35 institutions, with nearly 20% located outside of the US! Since then, we have been working to develop exciting and useful programming for the community.

This fall, we plan to host several webinars as part of our annual Navigating (Beyond) Academic Waters (NAW) series, co-developed with the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI). Fall webinars include:

- November 19: *The Connected Researcher: Building Networks That Bridge Academia, Industry, and Beyond*

Recent webinars include *Navigating Today's Federal Job Market* and *The Scientist Behind the Science: The Power of Storytelling in Academic and Professional Spaces*. Past NAW webinars have had more than 100 participants! All past recordings can be viewed on YouTube at https://www.youtube.com/@CUAHSI/playlists.

We are also convening several sessions at the AGU Fall Meeting, including the annual Thinking Outside the Box Plot: Communicating Science Beyond the Paper session (https://agu.confex.com/agu/agu26/prelim.cgi/Session/280379), which focuses on creative methods of science communication, and one union session: Navigating Broader Impacts in Changed Political Climate (https://agu.confex.com/agu/agu26/prelim.cgi/Session/282446).

Finally, stay tuned for 2026 Catchment Cup (formerly known as River Cup), which will be starting in October! You can follow this event and our other programming through our various social media platforms and website:

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Facebook: https://www.facebook.com/people/American-Geophysical-Union-Hydrology-Section-Student-Subcommittee-H3S/100085410937806/?locale=pt_BR#

From the 2024 GEWEX ECR Workshop to a Global Research Collaboration

Valentina Rabanal[1], Kristen Whitney[2], Jon Cranko Page[3], Yeliz Yilmaz[4], Carla Gulizia[5], and Hiroki Okachi[6]

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A new paper in *Earth's Future*, "Democratizing Hydroclimate Science for Just and Resilient Futures," carries forward work begun at the 2024 GEWEX Early Career Researcher Workshop.

Prior to the 9th GEWEX Open Science Conference held in July of 2024, 49 early-to-mid career researchers and practitioners from 19 countries gathered to discuss "Extremes in the water cycle and risks to society: Understanding 'actionable' information in hydroclimate research." The workshop was developed with support from early-career researcher networks. The Young Earth System Scientists (YESS) community played a key role in its organization and subsequent article preparation, while the Japanese ECR community also partnered in co-organizing the event, hosted by Hokkaido University.

The paper argues that closing the gap between hydroclimate knowledge and its use requires attention to who shapes research questions, whose knowledge is recognized, and how limited



***Figure 1**. From workshop to publication: GEWEX organized and funded the 2024 GEWEX Early Career Researcher Workshop in Sapporo, Japan, with key organizational involvement from YESS and co-organizing support from AGU-H3S and the Japanese ECR community. The workshop brought together 49 participants from 19 countries [Panel (a)] and led to a writing collaboration whose authors span 17 countries. Panel (b) shows workshop participants on the Hokkaido University campus. Source: Whitney et al. (2026), Figure 2, CC BY-NC.*

resources, benefits, and decision-making power are shared. It identifies three connected priorities:

- Building trust through sustained co-production
- Designing information around specific decisions and local conditions
- Governing emerging technologies—including artificial intelligence, machine learning, and Earth observation systems—responsibly

Case studies show how early-to-mid career scientists are already putting these ideas into practice. The authors also call on universities, funders, and research organizations to support longer-term career pathways, recognize policy and community engagement, reduce language and resource barriers, and invest in co-produced research led by Global South partners.

The paper is a direct outcome of GEWEX's support for early-career participation. It also demonstrates what can follow when that support extends beyond attendance: new relationships, collaborative leadership, and research shaped by perspectives from across regions and institutions.

Read the open-access article at *https://doi.org/10.1029/2026EF008172*.



UMAP2027 aims to bring together weather and climate scientists, including both observationalists and modelers, to discuss the key issues of atmospheric science. UMAP 2027 will cover atmospheric processes at the microphysical, turbulence, and mesoscales that control the atmospheric boundary layer, clouds, precipitation, and radiation balance.

The conference will be organized around the following topics:

- Convective organization and mesoscale circulations across cloud regimes
- Microphysical processes (including aerosol-cloud interactions) controlling cloud phase and precipitation
- Extratropical and cold clouds and their energy and moisture budgets
- Interactions between land, clouds and precipitation: processes, impacts and predictability

Mark your calendar for this upcoming event. Visit *https://www.gewexevents.org/meetings/umap2027/* for important updates and details.

Baltic Earth 2.0: The Next Phase of Baltic Earth

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Baltic Earth 2.0 is an open international research network that brings together established and early career scientists as well as stakeholders. The aim of Baltic Earth 2.0 is to advance the Earth system understanding of the Baltic Sea region to support science-based management under increasing climatic, environmental, and human pressures. Baltic Earth 2.0 focuses on the atmosphere, land, and marine environments of the Baltic Sea and its drainage basin and promotes comparative research with other similar marginal sea regions worldwide.

Compared with its first phase, Baltic Earth 2.0 operates with a renewed organizational structure, including a new secretariat and revised science steering and senior advisory groups. Since 2025, the International Baltic Earth Secretariat (IBES) has been jointly hosted by the Leibniz Institute for Baltic Sea Research Warnemünde (IOW, Germany) and the Institute of Oceanology of the Polish Academy of Sciences (IO PAN, Poland). Furthermore, the Grand Challenges defined in the previous Science Plan from 2017 have been replaced by a set of Research Topics (RTs), and a new Science Plan has recently been published (*https://doi.iow.de/10.12754/misc-2026-0001*).

The Research Topics are:

- RT1: Climate variability and teleconnections
- RT2: Small-scale (sub-mesoscale) processes and their impacts on large-scale Baltic Sea circulation
- RT3: Natural hazards and their impacts
- RT4: Sea level and coastal change
- RT5: Biogeochemistry of the Baltic Sea–Linking observations and modeling
- RT6: Multiple drivers of Earth system changes
- RT7: Marginal Seas – Humans and environment
- RT8: Future projections of the Baltic Sea region
- RT9: Philosophical aspects related to Baltic Sea Earth system research

In addition, a working group focusing on Education organizes summer and winter schools and other capacity-building activities.

Every two years, Baltic Earth Conferences bring together

researchers from across the Baltic Sea region and beyond to exchange the latest scientific findings and strengthen interdisciplinary collaboration on Earth system research. This year, the 6th Baltic Earth Conference was organized in Heringsdorf (Usedom Island, Germany) from 13–17 April 2026. The conference program was structured around the Research Topics of the new Baltic Earth 2.0 Science Plan and included sessions on topics such as Climate variability and teleconnections, Biogeochemistry, Baltic Optics, and Philosophical aspects of Baltic Sea Earth System Research. The program also featured five keynote lectures delivered by internationally-recognized experts from different fields of Baltic Earth research. In total, 131 participants from 14 countries (Germany, Poland, Estonia, Latvia, Lithuania, Finland, Sweden, Denmark, Belgium, Ukraine, France, Italy, China, and the USA) attended the conference, with 41% being early career researchers. The participants presented 64 oral presentations and 55 posters, highlighting recent advances in understanding the Baltic Sea Earth system and its response to environmental and climate change. Beyond the scientific sessions, the conference offered dedicated opportunities for networking and community building, including an Early Career Scientists event and social activities, fostering interactions between established and early career researchers.

Furthermore, the 8th Baltic Earth Winter School on "Earth System Science for the Baltic Sea region" was held in Tallinn, Estonia, from 23–27 March 2026. International lecturers from the Tallinn University of Technology (Estonia), the University of Tartu (Estonia), IOW (Germany), the University of Leipzig (Germany), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT; Germany), the Finnish Meteorological Institute, the University of Helsinki (Finland), and IO PAN (Poland) introduced 41 international early career scientists to a wide range of Baltic Earth topics, including climate change, climate physics, physical oceanography, biogeochemistry, coastal erosion, and satellite remote sensing. Participants ranged in educational levels and included one Bachelor's student, four Master's students, 33 PhD students, and three Postdocs from Estonia, Germany, Latvia, Lithuania, Poland, Sweden, the UK, and the USA. In addition, the program provided opportunities for participants to present their research, exchange ideas, and receive valuable feedback. Networking was further encouraged through activities such as an excursion to the Estonian Maritime Museum.

As an open research network, Baltic Earth welcomes scientists from the fields of meteorology, hydrology, oceanography, regional climate research, biogeochemistry, numerical modeling, and related disciplines, as well as social sciences addressing human–environment interactions, to be part of the Baltic Earth community. More information about how to participate in Baltic Earth can be found on the Baltic Earth website at *https://baltic.earth/participate*. Furthermore, one can subscribe to the Baltic Earth Newsletter to stay informed about current Baltic Earth activities at *https://baltic.earth/news/subscribe*.

Meeting/Workshop Reports

The GEWEX Water Vapor Assessment (G-VAP): Summary of the 9th Workshop

22–23 April 2026
Copenhagen, Denmark

Marc Schröder[1], Tim Trent[2], Shu-peng Ho[3], and Participants of the 9th G-VAP Workshop

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The main purpose of G-VAP is to quantify the state-of-the-art in water vapor products being developed for climate applications and, by doing so, support the GEWEX Data and Analysis Panel (GDAP) in selecting suitable water vapor products for its production of globally-consistent water and energy cycle products. Workshops are held every 1–2 years to discuss recent findings, further refine the G-VAP plan, implement new activities, and draft and consolidate the assessment results.

The 9th G-VAP Workshop was hosted by the Danish Meteorological Institute (DMI) in Copenhagen, Denmark, and took place on 22 and 23 April 2026. Approximately 35 participants (~20 in-person) from research institutes [Consiglio Nazionale delle Ricerche (CNR), Institut de Physique du Globe de Paris (IPGP), Karlsruhe Institute of Technology (KIT), Max Planck Institute for Chemistry (MPI-C), Royal Observatory of Belgium], universities (City College of New York, Colorado State University, Free University of Berlin, Ghent University, Maynooth University, Utrecht University, University of Yaoundé, University of Leicester, University of Maryland-College Park), weather services [Agencia Estatal de Meteorología (AEMET), DMI, Deutscher Wetterdienst (DWD), the Ethiopian Meteorological Institute, the National Oceanic and Atmospheric Administration (NOAA), the MetOffice], companies (PlanetIQ, Serco) as well as space agencies [Deutsches Zentrum für Luft- und Raumfahrt (DLR), the European Space Agency (ESA), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)] attended the workshop. The G-VAP Workshop webpage contains the agenda and, linked via the agenda, the presentations: *https://www.gewexevents.org/meetings/gvap2026/*. A group photo of workshop participants is shown in Figure 1. The main objectives of the 9th Workshop were to present updates on water vapor data records, discuss the latest results from analysis of atmospheric water vapor and its role in the climate system, plan the finalization of the World Climate Research Programme (WCRP) report on G-VAP results, discuss and plan the future of G-VAP, and liaise with related initiatives and projects.



Group photo of participants of the 9th G-VAP workshop

The workshop started with a welcome address by DMI and introductory presentations on G-VAP and on the objectives of the meeting. This was followed by a brief block of presentations related to the retrieval and generation of water vapor profiles. Shu-peng Ben Ho presented "Using STAR GNSS Radio Occultation Data as a Diagnostic Tool to Validate NOAA NCEP GEFSv12 Reforecasts". The talk showed that independently processed, multi-mission Center for Satellite Applications and Research (STAR) Global Navigation Satellite System (GNSS) Radio Occultation (RO) monthly humidity records can serve as a stable benchmark for evaluating NOAA/National Centers for Environmental Prediction (NCEP) Global Ensemble Forecast System version 12 (GEFSv12) reforecasts and reanalysis across multiple pressure levels and forecast lead times. Initial results indicated coherent regional and vertical humidity biases, including tropical wet biases near 500 hPa and persistent tropical dry biases near 200 hPa, pointing to contributions from initial conditions, forecast lead-time dependence, and model physics that require further diagnosis. After a break, a series of presentations provided updates on retrievals, satellite-based data records, and related validation results. It also contained presentations on ground-based and in situ data records such as near-surface humidity from the Met Office Hadley Centre International Surface Dataset of Humidity (HadISDH) as well as total column water vapor (TCWV) from GNSS and application examples, e.g., via the liaison with the GEWEX Upper Tropospheric Clouds and Convection Process Evaluation Study (UTCC PROESS) on convection and links to water vapor. The next day began with a presentation on the Global Climate Observing System (GCOS) Status Report and the high-priority action plan, followed again by a series of presentations on satellite-based retrievals and data records of atmospheric water vapor, with a focus on ESA and EUMETSAT activities in this context. The last presentation introduced the Working Group on Observations for Researching Climate (WGORC) and summarized feedback on G-VAP from GDAP. During the remainder of the workshop, the focus was on formal aspects: drafting the WCRP report on G-VAP and discussing priorities for future activities.

Throughout the workshop, presentations sparked lively discussions. A few aspects from presentations and discussions are summarized below. This includes a review of workshop results on addressing the objectives.

The presentation on change-point detection sparked discussions about the definition of refractivity in ground-based and satellite-based GNSS measurements. Colleagues at DMI suggested organizing a small-scale workshop on this topic. In GNSS-based TCWV data, confidence in break point detection is increased through an objective analysis of break points in neighboring stations. In G-VAP, confidence could be increased by using a small ensemble of independent data records as "references" to detect breakpoints and by adopting methods from the GNSS community to assess confidence objectively. Such an improvement of G-VAP approaches would be very reasonable. However, it is currently pursued only on a best-effort basis.

Related to this topic, in situ observations over the ocean show a decrease in relative humidity. As such, this behavior does not meet expectations; further analysis is needed to identify potential reasons for it, e.g., by assessing the stability of the in situ observations across multiple independent data records.

In a presentation on the GCOS Status Report and high-priority action plan, it was emphasized that a critical moment in the global observing system has been reached. Both the space-based and in situ components are under considerable stress, and it seems that a potential absolute decline in the ability to observe the Earth system is materializing. If no immediate action is taken, the ability to observe critical components of the Earth system will decrease and may even experience discontinuities for decades to come. For water vapor in particular, observations in the upper troposphere and lower stratosphere (UTLS) region have been identified as at-risk in GCOS's assessment. Several related satellite missions are seen as at-risk or as having emerging discontinuities, despite GCOS's decade-long request to ensure continuity of limb-sounding missions. Also, the GCOS Upper-Air Network (GUAN) is degraded, which reduces long-term monitoring capabilities through in situ measurements and the reliability of validation results for remaining satellite missions. G-VAP shares concerns about the significant reduction in the ability to sample the UTLS region with satellites and in situ measurements. This region is subject to climate change impacts, strongly modulating first-order climate change through feedback mechanisms, and remains partly the subject of scientific analysis to better constrain our understanding of physical processes with more precise observations. G-VAP was encouraged to participate in the review of the new GCOS Implementation Plan.

As said, space-based capabilities for monitoring the stratosphere have declined significantly. An additional contribution discussed the use of Infrared Atmospheric Sounding Interferometer (IASI) measurements to retrieve information on water vapor in the stratosphere. It was shown that IASI has demonstrated the feasibility of detecting extreme anomalies in stratospheric water vapor content during the early days of the Hun-

ga Tonga eruption in 2022. For large-scale anomalies, after resampling and averaging, MUlti-platform remote Sensing of Isotopologues for investigating the Cycle of Atmospheric water (MUSICA) IASI v4 and microwave limb sounder (MLS) v6 measurements agree within 2% for stratospheric columns and within 3.5% for stratospheric profiles. Observations from IASI may provide a stable long-term reference for connecting or inter-calibrating past and future limb sounders.

Over the past years, various results from G-VAP have been published in a collection of peer-reviewed articles in Copernicus journals, i.e., *Atmospheric Chemistry and Physics*, *Atmospheric Measurement Techniques*, *Earth System Science Data*, *Hydrology and Earth System Sciences*; see https://acp.copernicus.org/articles/special_issue1118.html. The overall structure of the WCRP report on G-VAP was confirmed during the workshop: the report will primarily consist of summaries of G-VAP results from the peer-reviewed literature. At the workshop, participants were also invited to include more recent, not-yet-published results. The co-chairs will invite participants to an online meeting in October 2026 to agree on the last steps to finalize the report; all input to the report needs to be available by the end of September. It was agreed to submit the report to GDAP for review in late 2026.

During the last GDAP meeting in May 2025, G-VAP received support from GDAP to continue its activities on atmospheric water vapor, also after the publication of the WCRP report on G-VAP. Based on the consensus at this G-VAP workshop, G-VAP will also continue beyond the finalization of current activities. Also, in line with GDAP recommendations, G-VAP will focus on scientific analysis. This time, a special issue is not envisaged. Instead, results from G-VAP analysis will ideally be published in peer-reviewed literature within approximately the next 2 years. The following activities were agreed upon at the workshop:

- Continue updating the G-VAP data archive with public and free access data and add new data and versions, as well as the ensemble mean and associated statistics (lead: T. Trent, M. Schröder; contributors: data record principal investigators)
- Update the overview of available water vapor data records on the G-VAP webpage (lead: co-chairs; contributors: data record principal investigators)
- Analyze biases between reference observations as a function of small-scale variability (lead: X. Calbet; contributor: O. Bock)
- Analyze the stability in near-surface humidity observations (lead: K. Willett, M. Schröder, T. Trent; contributors: O. Bock)
- Assess uncertainty related to the stability of TCWV data in support of the Earth Energy Imbalance and sea level rise community (lead: K. Fennig; contributor: M. Schröder)
- Approach development of a global merged TCWV data record (lead: L. Lelli; contributor: G. Koren)

The following list includes recommendations for future activities of G-VAP and even the wider community for which responsible persons have not yet been identified:

- Joint analysis of tropopause temperatures and stratospheric water vapor
- Assessment of changes in cloud top over stratocumulus regions
- Analysis of precipitation, clouds, water vapor, and radiation in anomaly space using mesoscale convective system tracks
- Analysis of Level 2 uncertainties in GNSS and microwave-imager-based TCWV data
- Analysis of ozone, water vapor, and aerosols in populated regions using the Flexible Combined Imager (FCI)

Regarding the G-VAP data archive, the original temporal coverage of each individual data record will be preserved, i.e., the data will not be provided over a common period anymore, as in the first version of the archive. Together with the data providers, it will be assessed to what extent the archive can be extended in time continuously. It is foreseen that the development of ensemble means and associated statistics will be coordinated with the Coupled Model Intercomparison Project (CMIP) and Rapid Evaluation Framework (REF) via the Observations for Model Intercomparisons Project (obs4MIPS). In general, a strong interest was expressed in enhancing efforts on cross-essential climate variable analysis. G-VAP is very open to incorporating additional community activities into its plans.

Further, it was discussed how G-VAP can enhance its impact. Options include approaching *Bulletin of the American Meteorological Society* (BAMS) State of Climate authors and World Meteorological Organization (WMO)/Copernicus Climate Change Service (C3S) European State of the Climate authors to consider using the G-VAP archive. Also, G-VAP can regularly provide a summary of anomaly analysis based on the archive to the *GEWEX Quarterly*, or, with lower frequency, publish a small-scale anomaly or trend paper in the peer-reviewed literature.

Finally, new recommendations were made at the close of the workshop. Given the nature of radio occultation observations, the observed differences between related observations from different processing centers should be minimal. It is recommended that the International Radio Occultation Working Group (IROWG) should approach the harmonization of radio occultation measurement processing. A strong request from GCOS to ensure the continued availability of key measurements and observations was presented at the workshop. G-VAP endorses these requests and underscores the significant relevance of ground-based and in situ observations as a backbone of the global observing system and its objective of protecting society and nature.

The next workshop will take place at the Met Office, Exeter, UK, tentatively in April or May of 2028.

BSRN 2026 Meeting Report

22–26 June 2026
Palaiseau, France

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Over 40 participants joined the 19th Baseline Surface Radiation Network (BSRN) Scientific Review and Workshop in person at the Site Instrumental de Recherche par Télédétection Atmosphérique (SIRTA) Atmospheric Research Observatory in Palaiseau, France from 22–26 June 2026, and another 25 or so joined virtually.

The meeting brought station scientists from around the world together with stakeholders from the satellite, modeling, solar energy, and other communities to discuss new scientific insights from the BSRN data, the latest surface radiation measurement technologies, and BSRN processes and procedures.

New this year, a half-day training workshop was held to train new station scientists and the wider community on best practices for surface radiation measurements. This workshop was recorded and will be available in the future as a resource for new scientists joining the network.

Dr. Atsumu Ohmura joined as the keynote speaker to give an overview of the history of BSRN. His perspective throughout the meeting helped the community to consider the strengths of BSRN, as we discussed the next-generation challenges and scientific questions related to surface radiation.

When BSRN was started, it was largely formed to solve specific problems related to radiative transfer and closure within models and satellite validation. As the record lengthens, continuity is a very important consideration. The longer the data record, the more valuable it becomes because it allows us to better separate internal system variability from trends, and gives us the ability to ground-truth longer records stitched together from different satellite instruments and algorithms.

However, the scientific problems of interest also change with time. Among the future directions discussed at the meeting was how to integrate with other networks in order to stay on the cutting edge of scientific research. Many next-generation scientific problems relevant to surface radiation measurements are interdisciplinary and support collaboration between terrestrial, ocean, ice, and atmospheric communities because broadband surface radiation is the energy source for physical, biological, and geologic processes within the Earth system. One important conversation was how to best engage in other priorities of GEWEX, such as interacting with communities who work with the full surface energy budget, of which radiation is one component. This has included conversations with the ocean community as well in order to create a more consistent global record of surface radiation.

Another conversation involved how to best interact with the Aerosol, Clouds, and Trace Gases Research Infrastructure (ACTRIS) observational platform in Europe with its new infrastructure and systems related to observational data, as well as the international Network for Detection of Atmospheric Composition Change (NDACC), with which BSRN is a cooperating network. Broadband radiation is particularly important for understanding the net impact of aerosol and clouds on shortwave (solar) radiation, and water vapor on broadband longwave (terrestrial) radiation. As many in the network also have expertise in spectral radiation and some colocated instrumentation, additional measurement expertise can cross-over with trace gases and spectral albedo.



In-person participants at the 19th BSRN Scientific Review and Workshop outside of the SIRTA Atmospheric Research Observatory in Palaiseau, France

BSRN hopes to focus cross-network work on providing expertise in radiation measurements, colocating measurements when it is strategic, and building dialogues between communities for richer scientific collaborations.

Both the past and future were recognized at the meeting. We honored the Tamanrasset Observatory for 100 years of meteorological observations, and took time to remember Emilio Cuevas, a valued BSRN station scientist and colleague. Three new stations, Andes East Santiago (Chile), Limassol (Cyprus), and Wuying (China), were approved to become candidate BSRN stations. The group also voted to introduce an executive committee in order to build a broader leadership group. This will be developed over the next year.

Reports were given by chairs from the uncertainty, data quality, ocean, longwave, albedo, value added products, solar energy, and BSRN manual working groups. Of particular importance is the work being done to prepare for changes in the longwave reference standard by collecting raw pyrgeometer data and testing methods to process historical data. Significant progress has also been made in estimating uncertainties for 1 minute shortwave data, working towards Global Climate Observing System reference network standards.

The 19th BSRN Scientific Review and Workshop in Palaiseau turned out to be a very productive week. Participation was high throughout, and the BSRN community both online and on-site shared measurement techniques, code and scientific insights, and helped overcome open problems of individual station scientists, even outside the scheduled sessions. Our hosts provided delicious lunches each day of the meeting, facilitating the informal conversations, and despite the heat wave, the group carried the discussions through to concrete results.

Summary Report of the 4th GEWEX Workshop on Central Asia

12–14 May 2026
Osh, Kyrgyzstan

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Introduction

One of the priority areas of the GEWEX program is the improved understanding of the impacts of Earth system variability and change on water availability and food security across mountain ranges and river basins. GEWEX was founded over 30 years ago with the objective of addressing significant gaps in the understanding of Earth's energy and water cycles, given a lack of information about basic fluxes and reservoirs of these cycles.

Central Asia as a region is extremely vulnerable to Earth system change. The majority of its water resources are from summer melting of the regions' mountain glaciers and annual snowpack. In a warming world, glacial extent and volume, as well as snowpack, are declining. Agriculture is an important basis of the region's economies and is highly dependent upon irrigation, but also vulnerable to rising growing season temperatures. For the region to efficiently and effectively adapt to these changes, it needs significantly-improved observational networks and modeling that can provide more useful information for policymakers to invest in Earth system adaptation. Initial steps for the proposed Regional Hydroclimate Project (RHP) in Central Asia have been to identify the relevant scientific and socio-economic community, its interests, priorities, and current capabilities and capacities. For more information about the Central Asia initiative, visit *https://www.gewex.org/central-asia-initiative/*. GEWEX has organized three earlier workshops on this project.

Purpose

The overall purpose of this 4th Central Asia Workshop was to examine models and datasets to better understand the future climate and water resources of Central Asia. Learning how to use these data to plan for future fieldwork and further modeling efforts was another goal of the meeting, which will enable better water resource planning in addition to addressing the gaps in our knowledge.



Participants of the 4th Workshop on Central Asia

The workshop agenda is available at: *https://www.gewexevents.org/meetings/central_asia_2026/agenda/*. All of the presentations are available by clicking on the appropriate agenda item.

The first day of the workshop began with a welcome presentation given by the Osh State University Vice Rector, Elzarbek Esharov.

In his opening presentation, Peter van Oevelen laid out the key objectives for the Central Asia Initiative and future Regional Hydroclimate Project:

- Strengthen regional scientific networks, connecting scientists and practitioners
- Engage climate applications and policy communities in translating state-of-the-art scientific knowledge
- Stewardship and improvement of observational networks and monitoring programs
- Transfer state-of-the-art scientific knowledge to applications and policy
- Improve understanding of regional weather and climate variability and change
- Improve climate predictions and weather and hydrological forecasting, especially by using high resolution modeling (<4 km)

Michael Brody then discussed policy issues related to management of future water resources in Central Asia under significant uncertainty. This is a region where heavily-irrigated agriculture plays a critical economic role. Glaciers are melting, and models show a very uncertain quantity of precipitation, dependent upon the various emission scenarios. Critical questions for climate adaptation include:

- How much new water infrastructure—particularly storage—will have to be built?
- Where will it need to be built?
- When does it need to be built?
- How much will it cost?

After these introductory presentations, the technical presentations started. Xin Li, director of the National Tibetan Plateau Science Data Center (TPDC), provided an overview of the Institute's work. Their topics and presentations included:

- Accessing and utilizing datasets from the Third Pole Environment (TPE) Data Repository, specifically tailored to regional needs; and
- Introducing the Institute's eco-hydrological model for the Tibetan Plateau river basin and its potential application in the endorheic river basins of the Pan-Third Pole region, with the theme of improving understanding of water resources in Central Asia.

Min Feng then presented on *Remote Sensing Big Data for the Advancement of Data in the Periglacial Environment*, and introduced the TPDC.

Then Xiaoduo Pan led a hands-on training with the TPDC platform workflows and water body change monitoring tutorials. Day 1 finished with Baohong Ding giving an introduction to the distributed multi-sphere hydrological model (WEB-DHM), which continued with training in the use of the main content of this model.

Day 2 began with an online presentation by Stefan Rahimi of the University of Wyoming of his efforts in regional downscaling modeling for Central Asia and a summary of the team's work to date.

Ben Jarihani, of James Cook University, Australia, gave an overview of emerging satellite platforms for hydrological monitoring. These include precipitation missions, soil moisture sensors, evapotranspiration products, terrestrial water storage, altimetry systems, and snow monitoring platforms. There was additional discussion on the role of cloud-based platforms such as Google Earth Engine (GEE), and advances in the use of AI. Practical exercises, which could all be applied in Central Asia, followed the conversation.

The workshop concluded on Day 3 with open-ended discussions on the integration of these approaches and potential cooperative projects.

The next steps are multifold. First, we plan to continue holding workshops in the region and will see if we can expand them into a more consistent training program tailored to local needs. An online workshop is planned for late 2026 using regional downscaling to showcase Stefan Rahimi's work on Central Asia, serving as a follow-up to his online presentation during this workshop. We are planning a visit to several locations in Kyrgyzstan for a potential field campaign tackling land-atmosphere processes in spring 2027. A large part of this exercise is community building and networking: as such, we invite interested parties to contact us (*gewex@gewex.org*) and present their ideas and possible contributions.

GEWEX/WCRP Calendar

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

6 November 2026—Global Flood CrossCutting Initiative Monthly Meeting—Online

12 November 2026—ML4LM Webinar on "Physics-informed Machine Learning for Land Data Assimilation"—Online

18–19 November 2026—Southwestern U.S. Weather and Water Resilience Workshop—Tucson, AZ USA, and online

7–11 December 2026—American Geophysical Union 2026 Annual Meeting—San Francisco, CA, USA

10 December 2026—ML4LM Webinar on " Key Challenges and New Scientific Studies for Improving Our Understanding of the L-A System"—Online

10–14 January 2027—American Meteorological Society Annual Meeting—Denver, CO, USA, and online

1–4 February 2027—Convection-Permitting Modeling Workshop 2027—Sydney, Australia

15–19 February 2027—7th WGNE Workshop on Systematic Errors in Weather and Earth System Models (SEW 2027)—Pune, India

15–19 March 2027—39th Session of the GEWEX Scientific Steering Group—Washington, DC, USA

23–25 August 2027—WWRP 2027 Conference on Advancing Weather Science for Resilient Societies—Nanjing, China

Photos from the 2026 Pan-GLASS Conference, held in Stuttgart, Germany, this past July, are now available at *https://www.gewexevents.org/meetings/glass2026/gallery/*.

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