We have increased knowledge on the changing climate and weather extremes; changing water budgets, lakes, wetlands, groundwater, and rivers; Indigenous community water issues; and changing agriculture and forested basins, including human dimensions and water management solutions in Canada and around the world. We have developed new sensors, satellites, data management, and water prediction models that are world-leading and being applied globally.

We continue to complete and distribute the findings of our research through workshops, sectoral meetings, stories, art, music, model applications, and publications of papers and data.

We now launch the GWF Synthesis in collaboration with our partners while continuing our communication and outreach through regional and sectoral science discussions and custom knowledge translation applications.

Moving Forward–Global Water Futures Observatories (GWFO)

The Canada Foundation for Innovation (CFI)'s Major Science Initiative (MSI) Fund has provided partial funding to 2029 (renewable thereafter) for a subset of GWF called the Global Water Futures Observatories project (GWFO). This will support GWF's management of data, observations and science, some of its outreach and knowledge mobilization with data users, and the operations of 64 instrumented basins, lakes, rivers, and wetlands, 15 deployable observation systems, and 18 state-of-the-art water laboratories that provide urgently-needed scientific data to deliver flood, drought, and water quality solutions. This MSI project sustains the legacy of GWF's unique freshwater observing network and sophisticated data telemetry, storage, management, and visualization system as the GWFO facility. This will keep observational and data aspects of GWF going, will coordinate with science and modelling projects that can leverage the observational data, and will continue to contribute to GEWEX.

GWFO Vision: To operate a national water observatory consisting of a network of instrumented water observing sites, supported by deployable observing systems and major laboratories, that provides open access water data and the necessary infrastructure to collect supplementary data, which informs the development and testing of water prediction models, monitors changes in water sources, underpins diagnosis of risks to water security, and helps design solutions to ensure the long-term sustainability of Canadian water resources.

Principles of Operation/Inclusion for Observation Sites and Laboratories:

- Provide unique water data of interest to characterizing and monitoring the water conditions of Canadian river basins
- Contribute to a critical baseline of water data to the benefit of multiple users
- Support the data collection from, and analysis of, water from the network of instrumented water observing sites
- Adhere to the principles of open access

2023 GEWEX Hydroclimatology Panel (GHP) Meeting

Maynooth, Ireland
5–7 July 2023

Ali Nazemi[1], Paola Arias[1], and Francina Dominguez[2]
GHP Co-Chairs; [2]Past GHP Co-Chair

Following the return of the in-person GHP Panel meeting in Monterey, California in 2022, the 2023 meeting was hosted by Maynooth University in Ireland's only university town. Benefitting from warm and generous Irish hospitality, the meeting provided an opportunity for lively peer-to-peer interactions during morning and afternoon sessions. Although most of the Panel members and project leads attended the meeting in-person, some attendees participated virtually and actively engaged in the discussions. Some procedures set during pandemic, e.g., submission of documents prior to the meeting and allocating most of the meeting time to discussions, are now established as regular routines and have boosted the effectiveness of the GHP meetings quite significantly.

GHP comprises four different types of projects: (1) Regional Hydroclimate Projects (RHPs), aiming at understanding and predicting hydroclimatology in a specific region; (2) Crosscutting 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 hydrologically-relevant data. During the GHP meeting, the group reviewed and discussed the progress of ongoing and prospective projects in these four categories. The Panel also discussed some internal matters, welcomed a new member and Co-Chair, and celebrated the dedicated service of the past Co-Chair and two of the project leads.

Ongoing and Prospective Regional Hydroclimate Projects (RHPs)

RHPs are multidisciplinary projects to improve understanding of the physical and anthropogenic processes that affect water and energy exchanges within a large region. There are currently four ongoing RHPs in the Panel. This includes two mature RHPs, i.e., Baltic Earth and Global Water Futures (GWF), and two initiating ones, the Regional Hydrology Program for the Andes (ANDEX) and the Third Pole Environment-Water Sustainability (TPE-WS). The Panel also hosts three prospective RHPs, i.e., the United States RHP (US-RHP), the Asian Precipitation Experiment (AsiaPEX), and the Central Asia initiative.

GHP's 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 example for a decentralized and bottom-up governing research program without any core funding, in which individual researchers join forces and share research interests and resources. On the other hand, GWF is an example for a centralized and top-down RHP, with a large amount of core funding. Despite their differences

in pursuing the concept of an RHP, both Baltic Earth and GWF have demonstrated solid and continuous progress and have been quite influential in the policy and decision-making spheres. Baltic Earth's assessment reports and fact sheets are now being translated to various European languages and have become a knowledge base for decision makers in the Baltic Sea region. GWF also played a critical role in the formation of the new Canada National Water Agency that will be headquartered in Winnipeg, Manitoba.

Since the beginning of 2022, ANDEX has been an initiating RHP, with over 60 researchers from seven countries in the region. They updated their Science Plan based on the Panel's response to the initial Science Plan during the ANDEX meeting in Buenos Aires, Argentina (4–6 September 2022), followed by the publication of the institutional dossier in November 2022. Considering the international attention on the first set of ANDEX review papers, the ANDEX team is now working on follow-up review articles on the state of atmospheric and hydrologic modeling in the region. ANDEX also developed a series of Spanish-speaking webinars to reach the local operational and research communities. The Panel was pleased to see ANDEX progress. TPE-WS is another initiating RHP, approved by the Panel in early 2023. The activity had a productive year by setting up new measurement sites and continuing modeling and analyses. These efforts have led to new science advances such as, e.g., understanding the significant overestimation of convective rainfall by climate models over the southeastern Tibetan plateau.

Participants, both in-person and virtual, of the 2023 GHP Meeting

We expect two prospective RHPs, the US-RHP and AsiaPEX, to receive initiating status soon. Following more than two years of hard work, the US-RHP team submitted its Science Plan prior to the meeting. The Panel recognized this as a milestone and is currently reviewing the document and preparing a formal response. After successful publication of its *Bulletin of the American Meteorological Society* (BAMS) paper, AsiaPEX is also finalizing its Science Plan, expected to be received by the Panel by the end of summer 2023. The other prospective RHP, the Central Asia initiative, needs more time to flourish. The core team recently executed an in-person workshop in Tashkent, Uzbekistan (see page 13), to facilitate collaborative discussions for research led by Central Asian researchers. This will be followed by another workshop in 2024 to form a small leadership team and to engage with funding opportunities. The Panel understands the challenges in forming a strong RHP in this region, yet fully recognizes the importance of this activity in an area that was not previously pursued by the GEWEX community.

Ongoing and Prospective Crosscutting (CC) Activities

CCs are integral activities within GHP aimed at addressing the GEWEX Science Questions and creating collaboration between RHPs, other GEWEX Panels, and World Climate Research Programme (WCRP) activities. GHP currently includes three active and four prospective CCs. The oldest CC in the Panel, the Transport and Exchange Processes in the Atmosphere over Mountains Experiment (TEAMx), aims to improve the current understanding of exchange processes in the atmosphere over mountains and how these processes are parameterized in climate models. During the reporting period, TEAMx's BAMS paper was published; the number of observational target areas increased to cover a cross-section from the northern to southern Alps; and the activity reached out to research groups outside of the Alpine region, specifically in the UK and the US, to collaborate in observational and simulation activities.

The 2nd phase of International Network for Alpine Research Catchment Hydrology (INARCH-II) is now progressing through its Common Observation Period Experiment (COPE). INARCH-II also established strong ties with RHPs and other GEWEX and WCRP activities and has become a contributor to the United Nations Educational, Scientific and Cultural Organization (UNESCO) Intergovernmental Hydrological Programme in Mountain Water Sustainability. The 2022 INARCH workshop was held in Baños de Panticosa, Spain (October 18–20, 2022), which will be followed by its 2023 meeting in Stanley, Idaho (October 9–11, 2023). The Panel is pleased with INARCH-II's progress. Determining Evapotranspiration (dET) is another active CC with the goal to advance the determination of evapotranspiration across scales. dET has now published the data related to the Land Surface Atmosphere Interactions over the Iberian Semi-Arid Environment (LIAISE) campaign. This data set can support future process understanding and simulations. The dET team also submitted its revised Science Plan, which is now being reviewed by the Panel.

GHP also includes four prospective CCs at different levels of development. The most advanced prospective CC is the Flood CC, which looks at a wide spectrum of challenges around understanding flooding processes from observations to model de-

velopment to socio-economic impact assessments. Following the survey executed in 2022, the core team will have its first online workshop in September 2023, in which experts from across the globe will discuss various aspects related to flooding in three parallel sessions. The Flood CC also proposed a session in the upcoming American Geophysical Union (AGU) Fall Meeting, which can connect the activity with the broader research community. It is quite evident that these activities will soon result in the formation of working groups and converge to defined research objectives that can be articulated in a Science Plan. In contrast, activities related to the Precipitation over Mountainous Terrains (MOUNTerrain) are in hiatus. MOUNTerrain aims at better process understanding, model development, and prediction of precipitation in mountainous terrains. The Panel considers MOUNTerrain both an important and timely activity, particularly in the context of the Global Precipitation Experiment (GPEX) project, yet it also recognizes the current challenges due to the lack of an active leadership team. The Panel discussed various options to recruit experts to take the lead and move toward a comprehensive research agenda that is distinct from, but complementary to, the activities of INARCH and TEAMx.

The meeting also included presentations that envisioned and pitched new activities, possibly in the form of new CCs. Stefan Kollet (Research Centre Juelich and University of Bonn) discussed the prospects for a GEWEX groundwater activity and the current challenges and opportunities in considering groundwater reserves and fluxes in the context of regional and global Earth system modeling. The Panel is fully supportive of this new endeavour and provided some suggestions toward better formation of this activity. Cedric David [National Aeronautics and Space Administration (NASA)'s Jet Propulsion Laboratory] also presented a vision for a global river network observational and modeling initiative, given the new opportunities rising from the emergence of the Surface Water and Ocean Topography (SWOT) data. The Panel fully recognizes the need for this initiative and can clearly see how it can complement and contribute to several GHP activities. The Panel looks forward to seeing how this activity evolves.

Ongoing and Prospective Networks

GHP Networks foster collaborations and capacity building activities relevant to GEWEX science. They may transition into an RHP upon successful initiation of research activities and sourcing of funds; or, alternatively, an RHP may transition into a Network upon completion. GHP currently hosts one active and one prospective Network. PannEx, a GHP network aiming to provide a better understanding of Earth system processes over the Pannonian Basin, is an active Network that started as an initiating RHP, and later evolved into a vibrant group of scientists from different disciplines interested in hydroclimatic processes of the region. During the reporting period, PannEx had multiple workshops and meetings and started the second edition of a special journal issue on Climatic Extremes in the Pannonian Basin.

After the official sunset of the Hydrological Cycle in Mediterranean Experiment (HyMeX) in 2020, a new group of young researchers from the region have been developing the second phase of HyMeX, initially as an RHP. Despite efforts made, the team has not yet converged toward an RHP, and it was suggested that the team organize itself as a Network, allowing for more flexibility in the research and outreach agendas. As the activity was absent in the meeting, the Panel will seek updates during the remainder of 2023.

Data Centers

GHP currently includes two Global Data Centers, the Global Precipitation Climatology Centre (GPCC) and the Global Runoff Data Centre (GRDC). GPCC is well-connected to other GHP and GEWEX activities. Steady progress was reported related to precipitation data. In parallel, GRDC focuses on acquisition, harmonization, and storage of global historical river discharge data. The center progresses very well and new data are continuously added into the system. Also, the usage of GRDC data has significantly increased since the launch of its online tool that made GRDC data accessible to the broader research community. Both GPCC and GRDC are going through leadership changes. After years of service, Udo Schneider (the ex-director of GPCC) and Ulrich Looser (the director of GRDC) are retiring and these data centers will enter a new era. GHP greatly appreciates Udo and Ulrich's years of selfless service to the GEWEX and broader research communities and is looking forward to working with new leadership teams.

Historically, the information related to surface water storage for current and future GHP activities was held by the International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE) in Russia. The Panel has commented for a number of years regarding the outdated and/or inaccessible information and the fact that HYDROLARE has been rather inactive. The Panel understands the current difficulties for Russian-based scientists to be involved in global initiatives; however, it also recognizes that a number of GHP activities need access to lake and reservoir storage and flux data. On this basis, the Panel decided to pronounce HYDROLARE dormant for the time being and approach other data opportunities, particularly through satellite remote sensing.

Other Businesses

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 (Kansas University) serves as the GLASS-GHP liaison. GHP was particularly interested in knowing how activities are progressing in the Irrigation CC, an activity that is relevant to RHPs and could be linked to CCs, e.g., dET. The Panel was pleased to see that after a year of hiatus, the activities have been boosted and are taking shape; e.g., the review paper summarizing advances in irrigation models is published. However, the Panel raised a number of concerns and suggestions related to future activities of the Irrigation CC. It was decided that these issues will be discussed between the Panels' leadership.

As GHP activities are growing in number and size, discussions were made on more engagement between Panel mem-

bers and/or activities. Several suggestions were made such as having quarterly online meetings, interim reporting by activities through online presentations, and establishing a new reporting procedure, including assignment of two rapporteurs per activity during each reporting cycle. The procedure for considering new (self-)nominations was also discussed, and the Panel agreed that the assignment of new members should be based on matching GHP needs with candidates' expertise, along with consideration of regional and gender diversity. It was decided that the GHP Co-Chairs will work on integrating these ideas and will propose new operational procedures for internal Panel affairs and activities.

GHP is continuously enriched through new Panel members. This year, GHP welcomed a new member, Dr. Michael Bosilovich, a NASA Scientist based in Greenbelt, MD and an ex-GEWEX Science Steering Group (SSG) member. Dr. Bosilovich's main expertise is in climate reanalysis for quantifying the elements of water and energy cycles. Due to his long involvement with GEWEX, Dr. Bosilovich brings seniority and memory into the Panel. The Panel looks forward to benefiting from his depth and breadth of knowledge and expertise. After four years of dedicated service, Francina Dominguez stepped down as the GHP Co-Chair and Paola Arias was appointed as the new Co-Chair. The Panel greatly appreciates Francina's service and wishes all the best to Paola in the new role. *Go n-éir a bóthar leat*!

Sonia Seneviratne and Bart van den Hurk Elected to IPCC Bureau

Sonia Seneviratne and Bart van den Hurk were recently named members of the Intergovernmental Panel on Climate Change (IPCC) Bureau at the end of July. Prof. Dr. Seneviratne will be a Vice-Chair for Working Group I, and Prof. van den Hurk will serve as Working Group II Co-Chair. Prof. van den Hurk formerly chaired the Global Land-Atmosphere System Studies (GLASS) Panel and co-chairs the Land Surface, Snow and Soil Moisture Model Intercomparison Project (LS3MIP). Prof. Seneviratne was a member of both GLASS and the GEWEX Data and Assessments Panel (GDAP) and Co-Chair of the GEWEX Scientific Steering Group (SSG).

New Abbreviations and Acronyms List Now Online

The new abbreviations and acronyms list is now available at https://www.gewex.org/abbreviations-acronyms/.

GEWEX/WCRP Calendar

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

29–31 August 2023—VII Convection-Permitting Climate Modelling Workshop—Bergen, Norway
22 September 2023—1st Global Flood Crosscutting Project Workshop—Online
25–29 September 2023—International Conference on Regional Climate (ICRC)-CORDEX 2023—Trieste, Italy
9–11 October 2023—2023 Fall INARCH Workshop—Stanley, ID, USA
16–20 October 2023—2023 Sun-Climate Symposium—Flagstaff, AZ, USA
19–20 October 2023—2023 GEWEX Data and Analysis Panel (GDAP) Meeting (*by invitation only*)—New York, NY, USA
23–27 October 2023—WCRP Open Science Conference 2023—Kigali, Rwanda
27 November–1 December 2023—Hydrospace 2023—Lisbon, Portugal
11–15 December 2023—AGU Fall Meeting—San Francisco, CA, USA, and Online
28 January–1 February 2024—104th AMS Annual Meeting—Baltimore, MD, USA
13–17 May 2024—5th Baltic Earth Conference—Jūrmala, Latvia
7–12 July 2024—9th Global Energy and Water Cycle Open Science Conference—Sapporo, Japan

GEWEX QUARTERLY

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Peter J. van Oevelen, Director
Shannon F. Macken, Editor

International GEWEX Project Office
c/o George Mason University
111 Research Hall, Mail Stop 6C5
4400 University Drive
Fairfax, VA 22030 USA

E-mail: contact@gewex.org
Website: *http://www.gewex.org*