GFP

global flood partnership

Annual Meeting report 2025

The Future of Flood Resilience: Transdisciplinary Innovations in Science, Policy, and Practice

Kettner A.J., Kugler, Z., Rudari, R., Trigg, M., Sperna Weiland, F., Prades, L., Dasgupta, A., Singh Shrestha, M., Salamon, P., Wu, H., Tellman, B., Cohen, S., and Hawker, L.

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1 Introduction

The Global Flood Partnership (GFP) International Conference 2025, titled "***The Future of Flood Resilience: Transdisciplinary Innovations in Science, Policy, and Practice***", was held in Budapest, Hungary, from September 15–17. The meeting was hosted by Professor Zsófia Kugler at the Budapest University of Technology and Economics (BME). The event brought together 68 participants, who contributed through 11 marketplace booths, 23 poster presentations, 11 Ignite talks, and 11 oral presentations. See also: https://www.globalfloodpartnership.org/events/gfp-annual-conference-september-15-17-2025

The common goals of the GFP annual conferences are as follows: 1) Cultivate a community focused on addressing flooding challenges, aiming to enhance readiness and response to minimize global flood-related losses. 2) Facilitate collaboration between scientific research and operational practices, with the objective of promoting a meaningful exchange between scientists and emergency management professionals. This involves scientists tailoring their systems to meet the requirements of emergency managers, and emergency managers integrating new systems and data into their existing workflows.

The GFP is an international collaborative initiative dedicated to advancing the knowledge and capacity of countries and communities to forecast, monitor, communicate and respond to flood events, thereby strengthening societal resilience. The Partnership's specific objectives include:

Improved Early Warning Systems: Enhance the capabilities of early warning systems for floods by promoting the use of advanced technologies, data, and modeling tools. This includes the risk assessments, development of better forecasting methods and the integration of various data sources including in-situ and space earth observations.

Enhanced Preparedness and Response: Strengthen the capacity of communities and authorities to prepare for and respond to flood events. This involves the development of strategies for risk reduction, preparedness plans, raising awareness and coordinated response efforts to minimize the impact of floods.

Data Sharing and Collaboration: Facilitate the exchange of data, information, and expertise among different stakeholders, including governments, non-governmental organizations, research institutions, academia and the private sector. Collaborative efforts can lead to a more comprehensive understanding of flood risk and more effective response measures.

Research and Innovation: Encourage research and innovation in the field of flood forecasting and monitoring, modeling, and response. This involves supporting the development of new technologies and approaches to improve flood forecasting and management.

Capacity Building: Build the capacity of individuals, communities, organizations, and countries to effectively deal with floods. This includes training programs, workshops, and knowledge-sharing initiatives to empower communities to better understand, mitigate, and respond to flood risks.

Global Coordination: Foster global coordination and cooperation in addressing flood- related challenges. By bringing together stakeholders from around the world, the Global Flood Partnership aims to create a network of expertise and resources to tackle the complex and cross-border nature of flood events.

Group picture during the GFP 2025 annual meeting

The GFP is a collaborative initiative that brings together various organizations, institutions, and individuals with a shared goal of enhancing global preparedness and response to floods. Officially established in 2014, the GFP operates loosely under the framework of the Group on Earth Observations (GEO), an intergovernmental organization promoting the use of Earth observations for societal benefits. The GFP recognizes the increasing frequency and severity of floods worldwide, which pose significant threats to communities, economies, and ecosystems. By

fostering collaboration among scientists, policymakers, humanitarian agencies, and technology experts, the GFP aims to improve early warning systems, enhance risk assessment capabilities, and streamline the exchange of information related to floods. Through its collective efforts, the GFP seeks to leverage the power of technology, data, and expertise to mitigate the impact of floods, ultimately contributing to more resilient and adaptive societies in the face of this growing global challenge. GFP is currently the only international initiative where global flood forecasting, monitoring, and response is considered in an interdisciplinary manner. As of 2025, more than 720 people from 6 continents are members of the GFP.

Similar to previous years the aim of this year's meeting was to foster the dialogue between scientists and users and how GFP products and expert knowledge can work in synergy to provide key information to emergency managers at different stages before, during and after severe flooding. The participants had the opportunity to share their latest relevant research and activities through ignite talks, posters, presentations, and the GFP market booths. The advances and success stories of the partnership were reviewed and the next steps to further strengthen the GFP were discussed.

2 Opening of the conference

The conference opened with remarks from Dr. András Nemeslaki, Vice-Rector for International Affairs, who highlighted the value of building partnerships and enhancing international collaboration. The event was locally hosted by Dr. Zsófia Kugler, Head of the Department of Photogrammetry and Geoinformation, with Dr. Albert Kettner from the University of Colorado Boulder serving as conference chair.

3 Interactive Game

During the 2025 GFP annual conference, we choose to start off with a serious game to create from the beginning an engaging and collaborative atmosphere. Many participants arrive without knowing each other, and games provide a structured yet playful way to overcome initial hesitations. By lowering social barriers, participants feel more comfortable initiating conversations and forming connections.

Serious games also foster networking by encouraging people to interact across institutional, disciplinary, or cultural boundaries. Instead of relying on chance encounters, participants are given opportunities to exchange ideas and discover shared interests early on. This promotes a sense of community, as the group begins to see itself as more than a collection of individuals, it becomes a network with shared experiences.

At the same time, we were hoping to create a more inclusive atmosphere. Games can be designed to give all participants, including those who are shy or new to the field, a chance to engage equally. In addition, the playful format energizes participants, helping them transition from travel fatigue or work-related concerns into an open, participatory mindset.

Led by Dr. Antara Dasgupta, Assistant Professor at Aachen University, and Dr. Lara Prades of

the United Nations, Global Service Centre, the participants played the Shopkeepers dilemma – A game on making decisions under uncertainty. A game developed by HEPEX, a global community of researchers and practitioners in hydrological ensemble prediction (https://hepex.org.au). The HEPEX game "The Shopkeepers' Dilemma" uses a flood scenario to explore how people make decisions under uncertainty, with players choosing whether to do nothing, raise a flood defense, or evacuate. The game highlights the trade-offs between costs, risks, and benefits, showing the importance of probabilistic forecasts in supporting better preparedness and response.

4 Plenary presentations

Plenary presentations serve a strategic role for the GFP conference, contextualizing the meeting's theme and articulating its relevance to current research and societal challenges. At the same time, they provide an opportunity for synthesizing advances across disciplines, presenting novel methodologies, and highlighting innovative approaches to complex issues such as flood risk assessment and increasing flood resilience. By emphasizing emerging trends and strategic priorities, plenary presentations guide the scientific agenda and help participants identify areas for further investigation and collaboration. By inviting speakers across expertise levels, they facilitate knowledge exchange between academia, practitioners, and policymakers, in the effort to promote interdisciplinary dialogue and catalyze new research directions. In collaboration with the local host Dr. Zsófia Kugler, the GFP Steering Committee invited the following speakers for the plenary presentations:

1. Data user / Data provider awardee: Josselin Gauny, United Nations – Food and Agriculture Organization (FAO), Italy: ***Monitoring flood impacts on agriculture in humanitarian contexts***

   Presentation of FAO DIEM flood monitoring tools: ex-ante exposure analysis platform, ex-post exposure analysis platform (EVE), field data collection, economic losses quantification, household livelihood and food security impact analysis.

2. Stefania Grimaldi, European Commission Joint Research Centre, Italy. ***Improving hydrological forecasts at the global scale: the next major upgrade of CEMS GloFAS***

   The Global Flood Awareness System is a freely available flood forecasting service that is running fully operational as part of the Copernicus Emergency Management Service since April 2018. GloFAS offers a number of products, which are tailored to give an overview of the current and future hydro-meteorological situation.

   The GloFAS dataset is generated using the open source hydrological model OS LISFLOOD: a distributed, physically based rainfall-runoff model. In its current operational version, the global model set-up (GloFAS v4.x) uses a spatial resolution of 3 arcminutes (~5.4 km) and a daily time step.

   In this presentation we describe the next major evolution of OS LISFLOOD and its set-up for GloFAS v5.x. The main changes can be grouped into three categories: 1.) model input; 2.) model improvements; and 3.) calibration and regionalization.

Enhancements in model inputs relate to soil properties, lakes and reservoirs as well as water demand for anthropogenic use. Hydrological model advancements focus on river routing, in particular for mild sloping rivers, a modified reservoir routine, and a new modelling routine which accounts for streamflow leakage. For model calibration and regionalization, the number of calibration stations had been increased by approximately 50%, while work has been done to utilize the power of deep learning during the regionalization of model parameters.

The operational release of GloFAS v5.x is foreseen by the end of 2025: this presentation provides an extensive overview of the major improvements and outcomes.

3. Jannis Hoch, Fathom™, United Kingdom: ***BURGER - A novel global machine learning-based dataset for sub-daily rainfall extremes***

   Pluvial floods are and will remain an important driver of flood risk, especially in an urban context. Recently, several floods triggered by extreme rainfall made the news and led to many casualties, such as those in Valencia and Nepal in 2024. To better prepare for such disasters, urban planners may use pluvial flood maps to assess flood risk and plan accordingly. Typically, such maps are produced by distributing rainfall over topography using a hydraulic model which solves some variation of the shallow water equations. While the decision for a specific hydraulic model may impact pluvial flood maps, here we will focus on the role of pluvial input data.

   Typically, intensity-duration-frequency (IDF) data is used to drive these models, yet these data are highly uncertain due to, for instance, the absence of accurate rainfall observations or the application of extreme value statistics.

   Here, we present results of a sensitivity analysis in which we employed a range of global and national IDF data sets, such as NOAA, DWD, BURGER, GPEX, PPDIST and PXR. Each data set is unique in the amount of data it was produced with, the spatial extent, the spatial regionalization of point-based estimates, the extreme value distribution used, and so forth. All IDF datasets were fed into a hydraulic model (LISFLOOD-FP) using the Chicago Design Storm (CDS) method to produce consistent and comparable maps of pluvial flood hazard for several test cases. Subsequently, the (dis-)agreement of the flood maps obtained is assessed.

   To convert flood maps into impact, they are intersected with exposure data to obtain an estimate of average annual exposure (AAE) to pluvial floods, which is a better measure for assessing the impact of these floods.

   While we expect that intensities extracted from the different IDF data sets will differ markedly, this study will shed light on the impact these differences may have on flood hazard and flood exposure estimates.

4. Tamás Krámer, Budapest University of Technology and Economics, Hungary: ***Flood attenuation revisited: The role of lowland tributaries and bank storage on the Hungarian Danube***

   Floods propagating up tributaries and into adjacent aquifers can increase storage in lowland river systems significantly. Conventional river models that omit these

contributions systematically underestimate the attenuation of flood waves and cannot be calibrated through resistance parameters. If bank storage is modelled as a one-way loss, lateral groundwater waves and return flow will not be resolved, which will reduce the accuracy in settings with conductive alluvial soils and long flood residence times. We quantify the influence of tributary backflow and bank storage on flood propagation along the Hungarian Danube. Finally, we outline practical modelling solutions that improve the prediction for lowland flood forecasting.

5. Zsófia Kugler, Budapest University of Technology and Economics, Hungary: ***Passive microwave radiometry for river gauge monitoring around the globe***

   This presentation highlights the use of passive microwave radiometry (PMR) in combination with the OPERA Dynamic Surface Water Extent (DSWx) product to monitor river discharge and flood dynamics. L-band observations from SMAP and SMOS satellites enable near-daily global measurements of river flow and lake levels across ~2500 sites, offering a unique decadal record of hydrological variability. The 2022 Indus River flood in Pakistan serves as a case study to demonstrate the synergy between PMR-derived river gauge data and OPERA DSWx observations. Results show strong agreement between SMOS flow retrievals and DSWx water extent, with regression statistics ($R^2 > 0.7$) confirming reliability across 25 river stations. While OPERA provides high-resolution water extent metrics, PMR fills critical temporal gaps, ensuring continuity in monitoring flood wave propagation. Together, these datasets offer a powerful framework for improving flood assessment, supporting disaster response, and providing long-term records essential for understanding global hydrologic change.

6. Paul Maisey, director of JBA Global Resilience, United Kingdom: ***Go with the flow: reflections on flood modelling for disaster risk finance***

   This presentation reflects on the use of flood modelling to support Disaster Risk Financing (DRF), an emerging approach that provides alternative financial solutions to reduce the economic impacts of extreme events. Unlike traditional insurance, parametric DRF relies on predefined hazard indices to trigger payouts, requiring robust flood and rainfall data for both risk assessment and real-time monitoring. Drawing on JBA Global Resilience's experience in more than 125 countries, the talk explores the technical, scientific, and operational challenges in designing parametric flood products. Key issues include defining flood events, managing data limitations, addressing basis risk, and ensuring alignment between estimated and observed impacts. Lessons emphasize the importance of stakeholder engagement, clarity of objectives, and building local capacity. Advances in satellite observations, modelling, and monitoring provide opportunities to strengthen parametric flood solutions, improve payout reliability, and expand access to financial protection for vulnerable communities worldwide.

7. Bruno Merz, GFZ Helmholtz Centre for Geosciences, Germany: ***Understanding and managing Black Swans***

   Black Swan floods—rare, high-impact, and often unprecedented events—pose significant challenges for risk management and preparedness. The July 2021 floods in

Germany and Belgium, causing €46 billion in damages and 240 fatalities, illustrate how extremes can overwhelm existing hazard assessments and critical infrastructure. Traditional methods underestimate these events because extremes are not simply scaled-up versions of smaller floods; instead, they may arise from complex, non-linear processes and compound drivers. This presentation explores why societies remain unprepared for such events, highlighting psychological biases, the neglect of indirect and intangible impacts, and a narrow focus on average expected damages. Process-based stochastic simulations, long-term synthetic records, and spatial counterfactual analyses provide new avenues for understanding extremes and their uncertainties. By integrating these approaches with scenario development and consideration of cascading impacts, we can better anticipate Black Swan floods and design measures that enhance resilience beyond conventional design standards.

8. Linda Obiero, University of Nairobi, Kenya: ***Factors Impeding Comprehension and Inclusion of Early Warning Messages in Kolwa East Ward, Kisumu County, Kenya***

   The early warning systems (EWS) are vital components of disaster risk reduction strategies, offering cost-effective solutions to minimize the damage caused by flood disasters. Kenya experiences floods annually resulting in displacement food insecurity, and economic hardships of the affected communities. A people centred EWS will be essential to reducing losses and damages caused by floods. This study explored why early warnings doesn't result into an emergency response from the community at risk. The study investigated the barriers to EWS and factors impeding their comprehension and inclusivity. Qualitative research methods were used to conduct the study, key informant interviews and onsite focus group discussions and were conducted at the ward level. Based on our findings, we recommend the need for involvement of all stakeholders in developing and disseminating the EW messages. There is need for integration of indigenous knowledge so as to improve the reliability and usability of the forecasts. The EW messages should be timely and incorporate the needs of the marginalized and vulnerable communities to ensure translation of the messages into disaster preparedness and action. Lastly, there is need for improved governance structure of flood management at the national and county level so as to improve the response capacity of the government.

9. Fabian Borg, Ahead Institute and Foundation for Societal Advancement. ***Climate Command in Action: PHASE 2 Driving Flood Intelligence and Multilevel Preparedness.***

   The increasing frequency and severity of clustered Mediterranean tropical-like cyclones "medicanes" underscore the urgent need for predictive climate intelligence that transcends national borders. Recent events, such as Medicane Helios (2023) in Malta and Medicane Daniel in Greece and Libya, highlight how extreme floods now occur in rapid succession with devastating consequences. To address this challenge, the AHEAD Institute has developed PHASE 2, an AI- and Earth observation–powered digital twin of Malta designed for multilevel Climate Command. Unlike conventional dashboards, PHASE 2 is an operational foresight engine, integrating high-resolution topography,

marine bathymetry, land cover, and in-situ data to simulate compound risks from storm surge, rainfall, and runoff at 15-minute. This enables municipalities, national authorities, and EU institutions to anticipate, plan, and respond in real time. By transforming adaptation into command, PHASE 2 demonstrates how climate foresight strengthens preparedness, informs policy, and supports cross-border resilience across Europe.

10. Nivedita Sairam, GFZ Helmholtz Centre for Geosciences, Germany: ***Quantifying health and wellbeing impacts of flooding***

    Flooding poses not only economic and infrastructural challenges but also substantial health and well-being burdens, which are often underrepresented in conventional risk assessments. This study advances a people-centric approach to flood risk by quantifying health impacts from two case studies: Ho Chi Minh City, Vietnam, and the 2021 floods in Germany. Post-event household survey data from Germany captured socioeconomic characteristics, flood preparedness, exposure, impacts, and recovery trajectories. Analyses reveal that evacuation timing significantly influences long-term psychological burden, with individuals displaced for over 1.5 years experiencing a 15.4% higher psychological toll compared to non-evacuated households. Propensity score matching and causal inference methods were applied to reduce bias and isolate drivers of health outcomes. Findings underscore the need for flood preparedness and recovery policies to prioritize mental health support, strengthen insurance mechanisms, and integrate health-related well-being metrics into adaptation planning for more inclusive and equitable resilience strategies.

11. Jefferson Wong, Luxembourg Institute of Science and Technology (LIST), Luxembourg: ***A Physically Constrained Gradient-based Optimization Method for Flood Water Depth Estimation Using EO-derived Flood Inundation Maps and Topographic Information***

    Accurate and timely flood inundation mapping is critical for emergency response planning, flood risk assessment, and real-time flood monitoring. Earth Observation (EO) data have proven highly effective for rapid flood mapping, offering valuable insights into flood dynamics. However, water depth, which is a key indicator of flood severity and impact, cannot be directly estimated by flood extent mapping alone. Recent advances have demonstrated the potential of combining EO-derived flood extent data with topographic information from Digital Elevation Models (DEMs) for water depth estimation. Yet, many existing methods face challenges related to computational efficiency and the physical plausibility of their estimates. To address these limitations, a novel gradient-based optimization method that integrates EO-derived flood extent information and high-resolution DEM data, while incorporating physical constraints that respect the natural behaviour of water flow is proposed. Unlike existing methods, the proposed method explicitly accounts for the continuity and smoothness of the water surface, ensuring physically plausible water depth estimates. The optimization framework iteratively adjusts the water surface elevation to minimize discrepancies between the observed flood extent and physically constrained topographic relationships imposed by terrain slope and flow connectivity derived from the DEM. The proposed

method was applied to a flood-prone reach of the River Alzette in Luxembourg. Its performance was evaluated against water depths simulated by a calibrated hydraulic model (LISFLOOD-FP) and compared to existing water depth estimation methods. Preliminary results show that the proposed method satisfactorily reproduces water depth patterns consistent with hydraulic model outputs, while substantially reducing computational demand. Moreover, the method outperforms existing methods in both accuracy and physical realism. This research underscores the potential of the proposed method for operational flood mapping and risk assessment. The method offers a scalable solution for near-real-time water depth estimation using readily available EO and DEM data, with significant implications for flood emergency response and risk mitigation.

5 Thematic Workshops

The Global Flood Partnership (GFP) hosts annual conferences that include dedicated two-hour thematic workshops. These workshops provide an interactive platform for in-depth exploration of specific flood-related topics identified jointly by participants and the GFP Steering Committee. Designed to foster knowledge exchange, they bring together researchers, practitioners, and decision-makers to discuss emerging scientific advances, innovative technologies, and operational challenges in flood monitoring, forecasting, and risk management. By focusing on community-driven priorities, the workshops promote collaboration across disciplines and sectors, support the co-development of solutions, and help align scientific progress with practical needs for improved flood resilience worldwide. This year the annual conferences offered two sessions of two workshops:

A hands-on refugee camp flood risk assessment with global data
Discussion lead: Mark Trigg — Professor of Water Risk at the University of Leeds, UK.
What happens when you need to assess flood risk, but there's little or no local data? In this workshop, you'll work in teams to quickly assess five potential sites for a new refugee camp — using only global datasets. This hands-on task will reveal just how far global data has come in enabling fast, practical decision-making, while also making clear where their limitations still lie.

How to improve the usability of provided flood forecast information
Discussion lead: Ervin Zsoter — Analyst at European Centre for Medium-Range Weather Forecasts (ECMWF), UK.
Are you interested in shaping the future of flood forecasting? Join this interactive session to share your insights! We'll explore current flood forecasting systems and invite your feedback on what's missing and how these tools can be optimized to better meet user needs and improve overall usability.

How can Earth Observation (EO) data contribute to improved flood resilience
Discussion lead: Patrick Matgen — Head of Group "Remote sensing and natural resources modelling" at the Luxembourg Institute of Science and Technology (LIST), Luxembourg.
Flooding affects communities worldwide every year. How can Earth Observation (EO) data help strengthen their capacity to prepare for, respond to, and recover from these events? Join

this session to explore how EO data can reduce vulnerability, lessen the impact of floods, and support faster, more effective recovery efforts.

Integrating Local and Indigenous knowledge in co-designing flood management systems
Discussion lead: Zsófia Kugler — Professor at Budapest University of Technology and Economics, Hungary.
Flood Risk Management (FRM) faces complex challenges - from navigating uncertainty in decision-making to addressing existing risks and implementing strategies across the disaster risk reduction (DRR) cycle. This session explored how participatory approaches and inclusive collaboration with local and indigenous knowledge holders can enrich flood management solutions. The workshop discussed how diverse perspectives and knowledge systems can be meaningfully integrated into the co-design of more effective, equitable FRM strategies.

6 Marketplace

The Marketplace session aims at engaging developers and users in direct discussions and feedback; presenting or demoing new tools, online platforms, scientific developments, and new initiatives which are relevant for the GFP. Participants can attend during a period of two hours, booths of interest. Each booth will have one or more fixed hosts who explain or demonstrate the new tool or dataset. The following Marketplace booths were presented during the 2025 GFP conference:

- Frederiek Sperna Weiland, Deltares, The Netherlands. **FloodAdapt, a decision-support tool that seeks to advance and accelerate flooding-related adaptation planning.**
- Michael Kwame-Biney, University of Ghana, Ghana. **Drone-Based Monitoring of Coastal Flooding and Erosion in Ghana.**
- Richa, World Resources Institute India, India. **Perceptions of Flood Adaptation Strategies: Insights from the Kosi Region.**
- Xingong Li, University of Kansas, USA. **Kansas Operational Flood Inundation Mapping System.**
- Dapeng Yu, Previsico, United Kingdom. **Surface water flood forecasting.**
- Josselin Gauny & Andrea Amparore, Food and Agriculture Organization of the United Nations (UN-FAO), Italy. **Monitoring flood impacts on agriculture in humanitarian contexts.**
- Stefania Grimaldi, Ervin Zsoter, and Patrick Matgen, European Commission Joint Research Centre (JRC), Italy; ECMWF, United Kingdom; and Luxembourg Institute of Science and Technology (LIST), Luxembourg. **The Global Flood Awareness System and Global Flood Monitoring product of the Copernicus Emergency Management Service.**
- Paolo Campanella, WASDI SARL, Luxembourg. **RISE by WASDI is an advanced**

Earth Observation tool that enables near real-time satellite environmental monitoring for sustainability, climate resilience, and disaster management.

- Paolo Tamagnone, RSS-Hydro, Luxembourg. **RSS-Hydro's latest innovations in flood monitoring and mapping.**
- Juseth Chancay, Universidad Regional Amazónica Ikiam, Ecuador. **Global water level forecast**.
- Stefano Bagli, Saferplaces, Italy. **Saferplaces global platform**.


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7 Ignite presentations

Ignite presentations are introduced in the GFP conferences to rapidly communicate key ideas, spark curiosity, and stimulate discussion. With a strict format of short, fast-paced talks (5 minutes per presenter), they encourage clarity, focus, and creativity in delivery. Their purpose is not to provide exhaustive detail, but to introduce innovative concepts, highlight emerging challenges, or share practical experiences that can inspire deeper conversations. By condensing complex ideas into accessible snapshots, the Steering Committee hopes that this session energizes the audience and promote broad engagement across disciplines. The following topics were presented during the 2025 GFP conference:

- Michael Kwame-Biney, University of Ghana, Ghana. **Assessing the Impact of Sea Level Rise, Precipitation, and Subsidence on Flooding Trends in Coastal Communities of Ghana**.
- Lahcen Goumghar, Ibn Tofail University, Morocco. **Comparative Analysis of Traditional and Advanced Boosting Models for Flood-Prone Area Prediction and Model Explainability: A Case Study from the Upper Draa Basin, Morocco.**
- Richa, World Resources Institute India, India. **Understanding Household Migration Decisions in Response to Floods: A Case Study of North Bihar, India.**
- Md Humayain Kabir, Danube University Krems/University of Graz/Chittagong University, Austria. **Advancing flood resilience in Bangladesh: Transdisciplinary approaches to adaptation, policy, and practice.**
- Sahara Sedhain, Faculty of Geo-information Science and Earth Observation, University of Twente, Netherlands. **Triggering Anticipatory Action before Floods: What is working and what is evolving?**
- Fancisco Lozada, Erasmus Mundus MSc Geospatial Technologies. Universitat Jaume I / WWU Münster / NOVA IMS), Mexico. **AI-Enhanced Multi-Sensor Flood Detection: Integrating Senti-nel-1 & Sentinel-2 for Disaster Management.**
- Ayesha Tariq, University of Münster (ERASMUS MUNDUS Student), Germany. **Integrating Sentinel-1 and Sentinel-2 with AI for Enhanced Flood Monitoring and Disaster Response.**
- Wanyun Shao, University of Alabama, USA. **Transdisciplinary Approaches to Understand Flood Risk in Coastal Areas.**
- Michael Meadows, RMIT University, Australia. **Correcting vertical errors in a global DEM using a Mixture-of-Experts ensemble model.**
- Eleonora Panizza, CIMA Research Foundation, Italy. **Beyond Housing Damage: The Social Dynamics of Flood-Related Mobility**.
- Yared Abayneh Abebe, Delft University of Technology and Pandemic & Disaster Preparedness Center, the Netherlands. **Flood impacts on healthcare facilities and**

disaster preparedness – A systematic review.

8 Guided Tour of the Kvassay Dam complex

Half a day was reserved for a guided tour of the Kvassay Barrage complex in South Budapest. The Kvassay Barrage complex at the northern entrance of the Soroksár–Ráckeve Danube branch in Budapest serves a vital role in flood protection by regulating water exchange between the main Danube channel and the side branch. In preparation of the guided tour, Dr. Kovács Péter, representative of the Middle Danube Region Water Directorate, gave an introduction to the Kvassay barrage complex.

Recently upgraded with high-capacity pumps, sluices, and reinforced floodwalls, the more than 100 years old structure can now limit inflow during high river discharge, protecting adjacent urban and industrial areas along the side branch from inundation. At the same time, its modern pumping station ensures continuous flow during low-water periods, preserving ecological and hydrological stability. The integration of real-time SCADA (Supervisory Control and Data Acquisition) control allows dynamic management of water levels, enhancing resilience against both flood surges and drought conditions in the context of increasing hydrological variability.

9 Panel Discussion

Introduction

Flooding is the most frequent natural hazard worldwide, accounting for nearly half of all recorded events, with South and East Asia among the most affected regions. Intensifying climate variability and increasingly erratic monsoon rainfall have contributed to more severe and frequent disasters, causing loss of lives, livelihoods, agricultural productivity, and hydropower, while displacing millions. These impacts threaten progress toward the United Nations Sustainable Development Goals.

The United Nations Office for Disaster Risk Reduction (UNDRR) defines four essential pillars of an effective early warning system (EWS): (i) risk knowledge, (ii) monitoring and warning, (iii) communication and dissemination, and (iv) response. These interconnected components must be integrated across sectors and governance levels, with robust feedback mechanisms to ensure continuous improvement. A weakness in any one pillar, or lack of coordination between them, risks undermining the effectiveness of the entire system.

Investing in early warning systems, through timely data sharing, strong institutional frameworks, effective risk communication, and community engagement, is critical for saving lives, protecting assets, and building resilience in vulnerable regions. With the global Early Warnings for All (EW4ALL) initiative, launched at COP27, the international community has committed to achieving universal coverage by 2027. As this deadline approaches, the urgency to strengthen and expand EWS has never been greater.

On Day 3 of the conference, a dedicated panel discussion was convened to assess progress, share experiences, and connect with ongoing initiatives on early warning systems. The session brought together experts and stakeholders to reflect on both achievements and remaining challenges. Before presenting a summary of the discussion, we provide a brief introduction to the panel Chair and its three members.

Bio sketches panel chair and members

Bio of panel Chair, Dr. Mandira Singh Shrestha

Dr. Mandira Singh Shrestha is a Senior Water Resources Specialist affiliated with Water Centre 21 Pahal in Kathmandu, Nepal. She brings over 30 years of research experience spanning climate services, disaster risk reduction, and water resources management. Her expertise lies in transboundary flood forecasting and monitoring, the application of satellite-based products, regional cooperation, and hydrological and hydraulic modelling for hydropower development. She has also led initiatives on early warning systems and end-user engagement to reduce risks and strengthen resilience. Recently, her research has focused on localizing climate services for agriculture and tourism, enhancing communication of early warning information to the last mile, and building institutional capacity to address future climate change projections. Dr. Shrestha holds a Ph.D. in Engineering from Kyoto University, Japan, an M.S. in Civil Engineering from the University of Washington, Seattle, USA, and a B.S. in Civil Engineering from the Indian Institute of Technology, Roorkee, India.

Bio of panel member Dr. Linda Obiero

Linda is an early career researcher and lecturer in the Department of Earth and Climate Sciences, Faculty of Science and Technology, University of Nairobi. She holds a PhD in Environmental Governance and Management from the University of Nairobi. Her research interests include climate change and adaptation, disaster preparedness and management and integrated natural resources. She teaches undergraduate and postgraduate courses, supervises and mentors postgraduate students, and has multiple publications. She has conducted research on climate change governance, natural resource management, and resource use efficiency. She was the principal investigator for a project on Early Warning Early Action in Kisumu County funded by the Global Disaster Preparedness Center of the American Red Cross. She is currently co-implementing a European Union-funded project on climate information services and nature-based solutions for climate adaptation among vulnerable communities in Turkana.

Bio of panel member Andrea Amparore

Andrea Amparore is a Data Manager with FAO's Office of Emergencies and Resilience, with over 15 years of experience at JRC, FAO, and WFP. He has worked as a GIS Developer and Project Manager, specializing in the use of data science and geospatial technology to support emergency preparedness and response. Andrea has been deployed to several major humanitarian crises, providing technical support to UN agencies and humanitarian clusters. He conceived and developed WFP's Automated Disaster Analysis and Mapping (ADAM) system and designed the data architecture behind FAO’s Data in Emergencies programme, where he currently leads a team of data engineers and analysts.

Bio of panel member Dr. Andrew Kruczkiewicz

Andrew Kruczkiewicz is a hydrometeorologist at Columbia University, New York. He is affiliated with the Climate School, National Center for Disaster Preparedness and the International Research Institute for Climate and Society. His work focuses on forecasting extreme events, climate risk assessment, and integration of climate data within policy and

decision making. Andrew conducts research on extreme weather and climate events focusing on both individual hazards, such as cyclones, floods as well as compound events. Andrew is Principal Investigator of sponsored research from NASA, The International Federation of Red Cross and Red Crescent Societies, World Bank, International Organization for Migration and UN OCHA. He is faculty lecturer in the Columbia Climate School's Climate and Society graduate program and is Co-Director of the Climate School Network: Sustainable and Resilient Living in an Era of Increasing Disasters. Andrew is Science Adviser at the Red Cross Red Crescent Climate Center and is an adjunct researcher at the University of Twente in The Netherlands.

Summary

The panel discussion highlighted significant advances in flood forecasting over the past decade yet emphasized that translating early warnings into timely anticipatory action remains a critical challenge. Climate change is driving more frequent, intense, and compound hazards, amplifying uncertainty and the urgency to act. Participants underscored the need to address data-related barriers: while some contexts face data scarcity, others contend with data abundance and noise. Effective data integration, structuring, and simplification are essential to connect evidence to decision-making.

Community engagement emerged as central. Early warning systems often operate at national or regional scales, but impact depends on reaching and empowering at-risk communities. Experiences from Kenya illustrated the need for diverse communication channels—ranging from SMS, radio, and public meetings to social media and interactive maps—to effectively reach different generations and marginalized groups. Clear, accessible, and inclusive messaging is vital.

The discussion further emphasized institutionalizing anticipatory action, co-designing triggers and thresholds, and bridging science with local knowledge, including citizen science. Political, social, and technical dimensions must be jointly considered, with stronger global coordination and integration across institutions. Ultimately, building resilience requires iterative, community-centered approaches, science translators, and a lifecycle perspective that connects producers, intermediaries, and end users.

10 Awards

GFP invites flood data users and providers, and early career participants to compete for the annual “GFP User and Early Career Awards”. Participants can only compete for one award. The award ceremony was held at the GFP meeting, and winners had the opportunity to give a plenary presentation to highlight their work.

The Early Career Award should recognize contributions that are closely aligned with the conference theme and demonstrate significant potential to advance scientific understanding with practical applicability. The submission should be based on a scientific publication or extended abstract. The Data User / Data Provider Award should acknowledge work that exemplifies effective, real-world application of data, particularly where it has demonstrably improved decision-making or operational outcomes. Examples include successful implementations in humanitarian contexts or other use cases where data integration has materially enhanced user efficiency or informed critical interventions.

Among the numerous award applications, the GFP Steering Committee selected two equally

outstanding candidates for the Early Career Award and one for the Data User / Data Provider Award. Unfortunately, the Early Career Awardees were unable to attend the meeting. Consequently, only the Data User / Data Provider Awardee was able to deliver a plenary presentation in recognition of their achievement.

The Early Career awardees are:

Muhammad Adnan, Asian Institute of Technology (AIT), Thailand**.** Developing an innovative framework to apply a conceptual, deterministic, hydrologic-hydrodynamic model and remote sensing data to develop flood inundation maps**.**

Allan Ouko, Ohio University, USA. Disaster Risk Governance in Transition: How Institutional Responses Shape Flood Risk in Nairobi's Informal Settlements.

The Data User / Data Provider Awardee is:

Josselin Gauny, UN-FAO, Italy. Co-developing and implementing the Events Visualization in Emergency (EVE) platform in African countries.

11 Conference outcomes

The Global Flood Partnership (GFP) has made remarkable progress since its inception in 2014. At that time, near-real-time, on-demand flood mapping tools were not available, limiting the ability of disaster managers to rapidly assess flood impacts. A decade later, four operational global systems now provide critical capabilities for disaster response and risk management. The OPERA (Observational Products for End-Users from Remote Sensing Analysis) mission delivers global surface water extent products by integrating optical and synthetic aperture radar (SAR) data, producing consistent and timely inundation maps for hydrologic applications. The Global Flood Monitoring (GFM) component of the Copernicus Emergency Management Service generates daily, high-resolution global flood extent maps from Sentinel-1 SAR data, directly linked to the Global Flood Awareness System (GloFAS) for situational awareness and early warning. The NASA supported Global Flood Monitoring System (GFMS), built on the DRIVE hydrological model and driven by GPM satellite near-real-time precipitation and GEOS-5 precipitation forecasts, provides global near-real-time flood detection and forecasting since 2010, bridging satellite-NWP precipitation products with hydrologic modeling. Finally, NASA's MODIS and VIIRS near-real-time flood products, distributed through Worldview and the LANCE system, provide frequent global flood observations at moderate resolution (250–500 m), supporting rapid assessments and complementing higher-resolution datasets. Together, these systems represent a fundamental shift toward operational near-real-time global flood monitoring.

Flood forecasting has also seen substantial advances. Introduced as a pre-operational prototype in 2011, GloFAS became a fully operational component of the Copernicus Emergency Management Service in 2018. Continuous updates have since enhanced its accuracy, resolution, and usability, providing short-, medium-, and long-term forecasts that inform decision-making at global and regional scales.

These achievements result from the collective efforts of numerous research and operational teams worldwide and cannot be attributed solely to the GFP. However, the GFP community has played a critical role in identifying key weaknesses and gaps in flood monitoring and forecasting, thereby guiding scientific and operational advancements in the field. The successes are not only technological but also collaborative. By fostering dialogue between scientists, practitioners, and decision-makers, the partnership has helped identify knowledge gaps and catalyzed innovation in both forecasting and monitoring. These efforts have significantly strengthened the global capacity to anticipate and respond to floods. Nevertheless, challenges remain. Despite advances in warning procedures, citizen awareness, and monitoring systems, floods continue to result in substantial losses and, in many cases, higher-than-expected casualties.

Recognizing both the achievements and persisting challenges, participants of the GFP conference proposed the development of a Review and Perspective article. This publication will synthesize the progress made over the past decade, critically assess current limitations in areas such as flood forecasting, monitoring, response, and the translation of early warnings into timely anticipatory action, and outline strategic priorities for the coming five years. By taking stock of advances and charting future directions, the GFP community aims to accelerate innovation, strengthen operational systems, and ensure that science-driven tools more effectively translate into reduced disaster risk and improved resilience worldwide.

12 Sponsors

Support from sponsors is paramount to guarantee the success of the conference. The Global Flood Partnership (GFP), a non-profit entity, is operated entirely by volunteers. The GFP philosophy is to give everybody the opportunity to participate and make use of materials or knowledge made available through the GFP. To encourage broad participation and uptake, no membership fees or registration costs are charged. The dedicated members of the GFP government body contribute through in-kind support, generously devoting their time to sustain and advance the GFP.

Nevertheless, organizing conferences entails significant expenses, encompassing both direct related event costs such as venue rental, audiovisual equipment usage, and refreshments during the breaks, as well as broader expenditures aimed at facilitating the participation of individuals from less developed countries. Donor funds are crucial for enabling these participants to share their invaluable flood-related knowledge, experiences, as well as their needs. The GFP is particularly committed to fostering the attendance of young professionals from underprivileged regions, thereby nurturing their careers, and bolstering the conference's success.

Given that the impact of flooding disproportionately affects economically disadvantaged communities, GFP's policy extends to offering awards for outstanding presentations by junior specialists, further incentivizing their participation.

The Steering Committee members of the GFP therefore expresses their sincere gratitude for the generous support provided by the **Budapest University of Technology and Economics,**

Hungary, the **United Nations - Office for Outer Space Affairs - UN-SPIDER**, as well as by **European Centre for Medium-Range Weather Forecasts (ECMWF)** which were instrumental in the success of the GFP Annual Conference. A special mentioning goes out to **RSS-Hydro**, who offered financial support that in the end was not utilized.

Annex 1. Participants

First Name	Last Name	Affiliation	Country
Sultan Kamal	Abdulazeez	National Space Research and Development Agency	Nigeria
Yared Abayneh	Abebe	Delft University of Technology and Pandemic & Disaster Preparedness Center	Netherlands
Syed Hammad	Ali	Glacier Monitoring Research Centre (GMRC) WAPDA	Pakistan
Andrea	Amparore	Food and Agriculture Organization of the United Nations	Italy
Stefano	Bagli	Saferplaces	Italy
Mark	Bernhofen	University of Oxford	United Kingdom
Fabian	Borg	Ahead Institute and Foundation for Societal Advancement	Malta
Paolo	Campanella	WASDI SARL	Luxembourg
Chloe	Campo	RSS-Hydro	Luxembourg
Juseth	Chancay	Universidad Regional Amazónica Ikiam	Ecuador
Gabriele	Coccia	CCRIF SPC	Italy
Lorant	Czaran	United Nations Office for Outer Space Affairs (UNOOSA)	Austria
PRIYANKO	DAS	Princeton University	United States (USA)
Antara	Dasgupta	RWTH Aachen University	Germany
Ahmed	Ekzayez	White Helmets	Syria
Josselin	Gauny	FAO	Italy
Lahcen	Goumghar	Ibn Tofail University	Morocco
Joshu	Green	University of Southampton	United Kingdom
David	Green	Green Resilience Inisghts	United States (USA)
Stefania	Grimaldi	European Commission Joint Research Centre	Italy
Neil	Gunn	WTW	United Kingdom
Jannis	Hoch	Fathom	United Kingdom
Paul	Hosch	RWTH Aachen University	Germany
Juliane	Huth	German Aerospace Center (DLR)	Germany
Md	Kabir	Danube University Krems/University of	Austria

Humayain		Graz/Chittagong University	
Albert	Kettner	DFO - Flood Observatory at the University of Colorado	United States (USA)
Tamas	Kramer	BME	Hungary
Andrew	Kruczkiewicz	Columbia University / Red Cross Red Crescent Climate Centre / University of Twente	United States (USA)
Zsofia	Kugler	Budapest University of Technology and Economics	Hungary
Michael	Kwame-Biney	University of Ghana	Ghana
Victor	Lagutov	UN FAO Regional office for Europe and Central Asia	Hungary
Xingong	Li	University of Kansas	United States (USA)
Yinxue	Liu	Loughborough University	United Kingdom
Fancisco	Lozada	Erasmus Mundus MSc Geospatial Technologies. Universitat Jaume I / WWU Münster / NOVA IMS)	Mexico
Paul	Maisey	JBA Global Resilience	United Kingdom
Patrick	Matgen	Luxembourg Institute of Science and Technology	Luxembourg
Michael	Meadows	RMIT University	Australia
Bruno	Merz	GFZ Helmholtz Centre for Geosciences	Germany
Issa	Mohammed	Civil society	Kenya
Hamidreza	Mosaffa	University of Reading	United Kingdom
Sharqua	Naz	University of Muenster	Germany
Linda	Obiero	University of Nairobi	Kenya
Eleonora	Panizza	CIMA Research Foundation	Italy
SOFIA	PAPADOPOULOU	ARISTOTLE UNIVERSITY OF THESSALONIKI	Greece
Lara	Prades	UN	Spain
	Richa	World Resources Institute India	India
Beatrice	Richieri	Friedrich-Alexander-Universität Erlangen-Nürnberg	Germany
Raquel	Rodriguez Suquet	CNES	France
Roberto	Rudari	CIMA Research Foundaiton	Italy
halidou	saibou	Chambre de Commerce et D' industrie du Togo	Togo

Nivedita	Sairam	GFZ German Research Centre for Geosciences	Germany
Sahara	Sedhain	Faculty of Geo-information Science and Earth Observation, University of Twente	Netherlands
Wanyun	Shao	University of Alabama	United States (USA)
Stavroula	Sigourou	NOA	Greece
Mandira	Singh Shrestha	Water Centre 21 Pahal	Nepal
Jan	Sodoge	Helmholtz-Centre for Environmental Research	Germany
Frederiek	Sperna Weiland	Deltares	Netherlands
Ali	Surojaya	RWTH Aachen University	Germany
Jumpei	Takami	United Nations Office for Outer Space Affairs	Austria
Paolo	Tamagnone	RSS-Hydro	Luxembourg
Ayesha	Tariq	University of Münster (ERASMUS MUNDUS Student)	Germany
Mark	Trigg	University of Leeds	United Kingdom
Maaike	Uijttenboogaard	The Netherlands Red Cross 510	Netherlands
Frank	Wesonga	Civil society	Kenya
Jefferson	Wong	Luxembourg Institute of Science and Technology	Luxembourg
Dapeng	Yu	Previsico	United Kingdom
Jie	Zhao	TUM	Germany
Ervin	Zsoter	ECMWF	United Kingdom

Annex 2. Post conference evaluation results

A post conference survey went out to all participants to evaluate the conference experience, how the GFP annual conference can improve, and if participants have an interest in hosting a GFP annual conference. 18% of all the participants responded by providing feedback. Below are the questions and responses.

Question 1.

The conference included the following elements: icebreaker game, plenary presentations, ignite talks, poster session, marketplace, field excursion, thematic workshops, panel discussion, Early career dinner, and a regular Dinner.

Are there elements you would like to see added or removed, or other changes you would suggest for the program?

The survey feedback was overwhelmingly positive, highlighting the conference as well-structured, diverse, and balanced in format. Participants appreciated the mix of plenary talks, Ignite talks, thematic workshops, and informal networking opportunities such as dinners, which facilitated meaningful conversations and collaboration. Several noted the program's strong diversity in topics, participants, and perspectives, and praised the representation of community voices, particularly from Kenya.

Suggestions for improvement were generally minor and constructive. These included providing a preliminary handbook of abstracts to help participants prepare in advance, offering a plenary recap of workshop outcomes, and ensuring better preparation for interactive activities like the exercise game. Some participants suggested refining the Marketplace session, which felt too similar to a poster session, or moving it earlier in the schedule to avoid fatigue. A few respondents recommended more cross-cutting discussions, for example broadening tool-focused sessions, expanding policy- and decision-maker perspectives, and inviting additional external groups or sectors (e.g., engineering, insurance, philanthropy, AI).

Overall, most participants expressed strong satisfaction with the current conference format, with several noting that no changes were necessary and that the program seemed to reflect thoughtful fine-tuning over multiple iterations.

Question 2.

Do you feel that sufficient time was allocated to each conference element (icebreaker activity, plenary presentations, ignite talks, poster session, marketplace, field excursion, thematic workshops, panel discussion, Early Career dinner, and conference dinner: https://shorturl.at/j5W0S), or should more (or less) time have been given to certain elements?

Feedback on time allocation was generally positive, with most participants agreeing that the schedule was well-balanced and allowed them to engage in all sessions. Respondents appreciated that the overall timing felt appropriate and did not require major adjustments.

A few minor suggestions emerged. Several noted that the icebreaker activity was longer

than necessary and could be shortened to leave more time for interaction later in the program. Similarly, some recommended clearer facilitation, such as giving plenary speakers time signals to keep sessions on track. The Marketplace drew mixed comments: while some felt it needed more time, others suggested restructuring it as an evening social with sponsors. Ignite talks were considered slightly rushed, and participants recommended allocating more time for them, possibly by reducing less essential activities.

Another recurring idea was to enhance cross-session engagement: participants wanted summaries of workshops they could not attend to avoid missing insights.

Overall, the consensus was that time was well allocated, with only small refinements suggested to improve flow and maximize opportunities for interaction.

Question 3.

GFP deliberately rotates the locations of its 3-day conferences across different continents to enhance diversity and improve accessibility for participants. Therefore, we are always looking for local hosts who help co-organize a GFP conference.

If you are interested in being a local host, leave your name and email address below and we will follow up with you.

We will follow up with those that indicated they might be able to host a GFP meeting.

Question 4.

Is there anything else you would like to share with us?

Participants expressed strong appreciation for the conference, describing it as a valuable learning experience that successfully bridged science, policy, and practice. Many praised the thematic workshops for being engaging and insightful, and several attendees, especially first-time participants, emphasized how welcoming and inspiring the GFP community felt. The event was noted to have met or exceeded expectations, with many looking forward to future conferences.

Suggestions for strengthening future GFP meetings included expanding participation, particularly from underrepresented regions such as Eastern Europe, and increasing involvement of social scientists to improve discussions on how scientific information flows to governments, communities, and practitioners. Some respondents highlighted the importance of continuing to strengthen the science–policy–practice interface to enhance relevance and impact.

At an organizational level, one respondent suggested reviewing GFP's formal status, such as developing a charter, terms of reference, or even evolving into a nonprofit foundation similar to the Global Earthquake Model.

Overall, participants expressed gratitude for the smooth organization and the opportunity to connect across disciplines, regions, and roles. The conference was seen as both impactful and inclusive, with clear enthusiasm for its continuation and growth.