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2015 Conference of Global Flood Partnership – Outcomes

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2015

GFP
global flood partnership

Joint Research Centre

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Abstract

From 4-6 May 2015, the 2015 Global Flood Partnership Conference was held at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, US. In the Conference, 76 participants attended coming from 15 countries in 5 continents. They represented more than 50 institutions, including international organisations, private sectors, national authorities, governmental research agencies, not-for-profit organisations and 14 leading universities.

The 2015 conference was framed in the context of the post-2015 development agenda, where nations of the world will set the course for the next 15 years to reduce disasters (Sendai Framework for Disaster Risk Reduction), to develop sustainably (Sustainable Development Goals) and to set legally binding targets for climate change (Climate Change Convention). Floods are central to all three frameworks, as they represent over 50% of disaster losses, set back development when they occur, and are expected to be more frequent and more severe due to climate change.

The Partnership, consisting of leading academics, practitioners, agencies and government representatives, recommended: (1) to foster an open international process for global risk assessment products feeding into political processes, (2) urge funding/hosting organisations to support experimental and pre-operational monitoring and forecasting tools and services for a period of 2 years, during which their value will be systematically analyzed by the Global Flood Observatory analysts and reported on in future GFP conferences; (3) work closely with WMO's Multi-Hazard Early Warning System initiative; (4) liaise with regional and national operational entities.

1. Introduction

From 4-6 May 2015, the 2015 Global Flood Partnership Conference was held at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, US. In the Conference, 76 participants attended coming from 15 countries in 5 continents. They represented more than 50 institutions s, including international organisations (WFP, Red Cross Red Crescent, World Bank GFDRR), private sectors (SwissRe, MunichRe, RMS, AON, Willis Research, Riverside, Google, ESRI, Kisters), national authorities (UK Flood Forecast Centre, Namibia Hydrological Services, Malawi Department of Climate Change and Met Services, Nigeria National Emergency Management Services and Brazil Centre for Disaster Monitoring). From the scientific side, there were governmental research agencies (US NASA, USGS, NSIDC; Japanese JAMSTEC; European ECMWF, JRC) and not-for-profit organisations (Deltares, ITHACA). The academic world was represented by 14 leading universities: Brigham Young University, University of Colorado, University of Amsterdam, University of Leeds, Princeton University, University of Kansas, University of Arizona, University of Bristol, University of Maryland, University of Nebraska, University of Oklahoma, University of Reading, University of Texas Austin, and UCLA.

The 2015 conference was framed in the context of the post-2015 development agenda, where nations of the world will set the course for the next 15 years to reduce disasters (Sendai Framework for Disaster Risk Reduction), to develop sustainability (Sustainable Development Goals) and to set legally binding targets for climate change (Climate Change Convention). Floods are central to all three frameworks, as they represent over 50% of disaster losses, set back development when they occur, and are expected to be more frequent and severe due to climate change.

The conference was hosted at the NCAR Mesa Lab & Fleischmann Building. The organising committee consisted of Tom Hopson (NCAR), Bob Brakenridge (University of Colorado, Director Dartmouth Flood Observatory) and Tom De Groeve, Jutta Thielen, Peter Salamon and Feyera Hirpa (Joint Research Centre of the European Commission). The following organisations provided support to the conference: local transport provided by the University of Colorado, coffee breaks provided by NCAR, funding of international travel of 3 delegates provided by Joint Research Centre, funding of international travel of 1 delegate provided by Red Cross/Red Crescent Climate Centre.

In 2014-2015, the Global Flood Partnership has had many successes, including increased situation awareness for partners (through sharing information and analysis), exploiting innovation and scientific advances (new satellite sensors, new models), and publishing an initial catalogue of tools and services of the partners. Partners discussed advances in science related to early warning, monitoring and risk assessment.

Based on the discussions during the conference, the Partnership, consisting of leading academics, practitioners, agencies and government representatives, recommends the following:

- Regarding global flood risk, to work with international organisations (including UNISDR) to transform the Global Risk Assessment into an open process, taking advantage of available risk information and expertise of many organisations in the Global Flood Partnership and stimulating the uptake of peer reviewed risk data;
- Regarding experimental and pre-operational monitoring and forecasting tools and services in the Global Flood Partnership, urge funding/hosting organisations to support their continuation for a period of 2 years, during which their value will be systematically analyzed by the Global Flood Observatory analysts and reported on in future GFP conferences;
- Regarding global flood forecasting, to work closely with WMO (e.g. the Multi-Hazard Early Warning System initiative) on identifying the role and opportunities

of global forecasting systems as a complementary information source to national forecasting systems.

- To increase local quality and relevance of GPF monitoring and prediction activities, liaison with regional and national operational entities that currently manage data and provide services aligning with GFP focus areas. Seek to engage such entities not solely as potential users providing feedback, but rather as full GFP partners contributing to capability development.

2. Conference proceedings

Opening Session

Dr. James Hurrell, director of NCAR, opened the conference by warmly welcoming the participants to NCAR. The NCAR is a U.S. federal government funded research and development center devoted to service, research and education in the atmospheric and related sciences. NCAR's mission is to understand the behavior of the atmosphere and related physical, biological and social systems; to support, enhance and extend the capabilities of the university community and the broader scientific community – nationally and internationally; and to foster transfer of knowledge and technology for the betterment of life on Earth.

The meeting was organised with the first day focusing on the Partnerships achievements and objectives for the next year, the second day focusing on discussing research advances, and the third day on the user perspective. There was lots of room for discussions and interaction through presentations, posters and ignite talks, and workshops.

Defining the partnership

Tom De Groeve (JRC) presented the achievements of the GFP in the past year, as well as the changing context of the Global Flood Partnership leading to new challenges and opportunities.

In the past year, the major floods included the May 2014 floods in the Balkans (affecting 3.1m people and killing 53) and the South-East African floods, in particular affecting Malawi, in January 2015 (affecting 638 000 people and killing at least 79). During the floods, the partners of the GFP were actively producing and sharing information on the mailing list and feeding analytical products to information teams in response organisations. The European Commission Emergency Response Coordination Centre and the World Food Program were among the many beneficiaries of GFP products. Increasingly, situation awareness products include data from pre-operational systems run by GFP partners (see http://erccportal.jrc.ec.europa.eu/Maps/Daily-maps for examples).

2014-2015 was also a year full of innovation and scientific advances. New satellites and sensor data became available and were used operationally (e.g. NASA GPM, ESA Sentinel). Mapping programmes (Copernicus, Charter for Disasters, UNOSAT) were triggered efficiently and coordination through the International Working Group on Satellite Emergency Mapping (IWG-GEM), the GDACS Mapping System (SMSS) and CEOS/GEO related initiatives ensured reduced overlap to the minimum. New global flood forecasting information became available including JRC/ECMWF GloFAS (launched at this conference) and GLOFFIS (to be available in June 2015), and the existing UoM GFMS was improved. Regarding flood risk products, two big efforts were released in March 2015 respectively in the UNISDR Global Risk Assessment Report (GAR2015, based on flood risk work of CIMA) and Aqueduct (by University of Amsterdam and Deltares and hosted by WRI). Details of these innovations and many more are available in the talk and poster summaries below.

Most importantly in 2015 is the political context of the renewal of three major international frameworks on disaster risk, sustainable development and climate change. These frameworks, along with the 2016 framework on urbanization (UNHABITAT), drive the political agenda, putting risk and science as the centre of the discussions. In the recently signed Sendai Framework for Disaster Risk Reduction (SFDRR), all governments agreed to reduce disaster risk globally by focusing on 7 targets, of which 6 are relevant to GFP. The Sustainable Development Goals (SDG), involving many more stakeholders and larger budgets that the SFDRR, is aiming at an agreement in September 2015 on 17 goals and 50 targets, many relevant to GFP. Finally, also the UN Framework for Climate Change (UNFCC) will set targets in December 2015.

Of the Sendai framework, targets 1 to 4 regard the recording of disaster losses (respectively killed, affected, direct economic loss and damage to critical infrastructure) in a systematic way, driven by national governments. This is compatible with the GFP objective of launching a Global Flood Observatory (GFO) to collect impacts of major floods in a systematic way. The JRC, being involved in both GFO and the working groups on indicators for SFDRR, is ensuring compatibility and exchange of knowledge between the communities to come to the best standards. Targets 5 and 7 of the SFDRR address both early warning systems and risk assessment, compatible with GFP's global systems on flood forecasting and flood risk. In fact, GFP partners have been heavily involved in the preparations to the World Conference on Disaster Risk Reduction, notably CIMA contributed with the global flood risk model used in GAR2015.

Next the strategic direction of the GFP was discussed. Based on a SWOT analysis, the strengths and opportunities as well as the challenges were identified and discussed. These were further discussed during the three day conference.

Progress in the partnership

Global Flood Tools and Services

Feyera Hirpa (JRC) provided an overview of the results of the survey on tools and services. A draft publication is circulated for review and completion. All delegates were invited to complete the survey on http://portal.gdacs.org/Global-Flood-Partnership/Global-Flood-Toolbox.

Peter Salamon (JRC) discussed the vision of the GFTS to develop the partnership in three steps:

- Catalogue of tools and services
- Co-visualization of (near real-time) data: map views and time series
- Integrated added-value products

New services / viewers include: GFDRR Think Hazard; DFO MODIS layers.

Co-visualization is achievable through WxS services and is already available in several partners. Co-visualization of time series is achievable through SoS services. JRC and Deltares are working on a prototype version integrating DFO, GloFAS and GLOFRIS data.

Developing integrated add-value products requires resources. The time series integration falls in this category.

Hessel Winsemius (Deltares) discussed data exchange standards, i.e. NetCDF-CF (with metadata) served through OpenDAP, which allows both visualization products (WxS) and data grids. It also supports time series. The workshop on Wednesday will tackle the conversion of existing data from GFP partners into NetCDF.

Webinars on this topic were considered very useful and should be disseminated in the partnership. These may be useful for GFP partners to convert their data, but also - for instance - to approach local/national weather forecasting systems and help them make data available for global models.

Action: calendar of courses (webinars, courses); also on request.

Global Flood Observatory and Record

Bob Brakenridge (U Colorado) pitched the idea of a global infrastructure for flood observation and forecasting, similar to an existing system for earthquake monitoring. He provided an overview of available data and services, not integrated. Station data (sensors), media (sometimes overflow), rainfall accumulation and routing, microwave detection and mapping.

Comment: Centralization vs localization for hydrology is an ongoing debate: centralization is successful for hurricanes and storm surges, but not so sure for flood forecasting. So it is controversial.

Human component in GFO is essential, notably for the impact values. Purely geophysical system is only support.

Users

Training activities were discussed. The following activities might be considered useful:

- inventory of (Global) Flood related user guidance / training activities given and planned this year by the partners in this working group. That may lead to ideas on connecting to existing courses with GFP input and partners
- discussion with other working groups, e.g. Monitoring, and model inter-comparison, on which (intermediate) results they would like to disseminate through training workshops.
- identify 2/3 activities for joint user guidance/training, with a draft time-line.

Example: At UNESCO-IHE in November/December 2015, a proposal for a refresher course can be prepared for alumni, to be held eg in Southern Africa region, Sept-Oct 2016. Here we can involve partners from the GFP.

Scientific talks

Maturity and Impact of Earth Observation (David Green)

NASA's applications program looks at observation and monitoring, data management and analysis, modeling and mapping, assessment and prediction and capacity building and education. NASA supports global and multi-hazard projects, including research, applied science, flight and technology.

The GFP framework is much in line with NASA strategy. The importance is the arrows between the boxed ("maintain", "run", "integrate"). "You'll never be able to make flood people collaborate, but you can make them coordinate". In the aftermath of Sendai, US suggests that GEO priority area for disasters will be floods.

What are the questions that the GFP wants to answer? This can inform NASA funding programming.

Global Flood Monitoring System (GFMS) (Bob Adler)

The Global Flood Monitoring System (GFMS) provides real-time calculations using satellite rainfall and a hydrological model (VIC). Resolution ⅛ degree (land surface model) and routing at 1km. GFMS will upgrade with GPM IMERG multi-satellite product, automatic reprocessing to beginning of TRMM era. Also use NWP products.

Next steps: continue operations with improvements, use new precipitation information (GPM/IMERG), add a dam module and address input from users. GFMS is trying to connect with partners interested in running the system operationally, adapting to partners requirements. Work with GFP and others to inter-compare with other systems and improve.

Change from TRMM to GPM: different time/space resolution probably imply different intensity calibration. GPM is global, so there are better flood products over land in polar areas. Should be a significant improvement.

GloFAS Forecast Viewer (Peter Salamon)

JRC officially released the GloFAS Forecast Viewer to the Global Flood Partnership. Peter explained the background of the GloFAS system, including input (ECMWF ensemble forecasts), cascade of HTESSEL (surface) and LISFLOOD (groundwater and routing). Flood severity is classified using flood return periods calculated by long-term climatology (ERA-INTERIM), displayed as threshold and return period hydrographs. New since last year is the use of a new drainage network, a new river width map and the use of 30 year ERA-Interim GPCP v2.2 correction.

At www.globalfloods.eu, anyone can access the GloFAS Forecast Viewer, accepting the terms and conditions. The viewer shows predicted accumulated precipitation and return period exceedences for hydrological data, including graphs for reporting points. The graphs include hydrographs and persistence graphs. Webinars are available on YouTube.

Ongoing developments: (1) use of ECMWF reforecast instead of reanalysis dataset, i.e. a retrospective run using most recent model, (2) calibration of GloFAS using GFDS data, (3) flood risk assessment in real time: this is done by linking coarse scale forecasts with high-res global flood hazard catalogue, (4) incorporation of lakes and reservoirs, (5) co-visualization of GFP services and tools and (6) several other developments.

A first intercomparison of global flood hazard models (Mark Trigg)

Global Flood Models - hazard mapping - are now a practical reality. The research compared GLOFRIS, MATSIRO + CaMa-Flood, ECMWF + CaMa-Flood, SSBN and CIMA. It is analogues to Atmospheric Model Intercomparison Project (AMIP). Questions is: are the models fit for purpose?

The comparison was done in Africa through a geospatial analysis of flooded area, for return periods of 25, 100, 250, 500 and 1000 years. It had an analysis of water mask and implications by assessing GDP and population exposure.

Total flooded area (of continent) for 500/1000 year return periods varies from 10% to 5%. Reported uncertainty doesn't overlap with all models, so it is model-specific uncertainty. Also spatial differences when mapping catchments. Regarding GDP, outputs range from 9% to 20% of GFP (1000 return period). For population similar differences are noted.

When looking in detail, e.g. Niger/Benue River confluence, there is good overlap as hydrodynamics is constrained to river valleys, but wide divergence in the flat area upstream of the city of Onitsha. For the Nile delta (a complicated area to model), all models fail as they use HydroSHEDs, which doesn't include bifurcations. In addition, the fact that the errors in the SRTM DEM are more important in flat areas such as this make accurate extents challenging.

Conclusions: this research wouldn't be possible without GFP. Large differences between the model results (magnitudes, spatial patterns, exposure implications), exercise also provided useful feedback to modellers. Way forward: collaborative effort to push this forward, addressing many challenges.

Discussion: suggestion to do for Australia (where others have continental result). Suggestion to share layers on GFP and population.

Cloud-based global flood forecasting system (Jim Nelson)

Jim discussed the Tethys Platform, which is an application development tool, as well as an application developed using the platform. There is a move to develop application in the cloud. CI-Water is a project that enhances access to data and computationally intensive applications.

The Tethys framework combines open source tools, combined in Python SDK. The TethysCluster allows to connect it to Microsoft Azure and Amazon Web Services. The components include: GIS (Geoserver, 52north, PostGIS), visualization (Google Earth, Google Maps, OpenLayers, Highcharts), and data set storage (ckan, Hydroshare).

One application is the CUAHSI - HydroServer Lite. This was used in a hackaton in summer 2015 to address downscaling global models, resulting in the ECMWF-RAPID tool. Some features include interactive modification of routing storage.

Improving risk awareness through collaborative research (Albert Weerts and Lydia Cumiskey)

Deltares develops the Delft FEWS model - Open Shell Forecasting System. Current project is Eart*H_2O*bserve. Deltares invested in a research infrastructure to combine many efforts in a single framework: the iD-Lab, or interactive laboratory, focused on disaster management. Some systems include GLOSSIS global storm surge forecasting system, hurricane system, GLOFFIS global flood forecasting information system (based on GFS and ECMWF).

HEPEX - The Hydrologic Ensemble Prediction Experiment (Andy Wood)

Operational flood monitoring and prediction currently exists at two distinct end points of a range of complexity and degree of human forecaster involvement. The prevalent, locally relevant prediction practice involves the forecasting paradigm from the 1980s, offering highly calibrated/tailored local (often deterministic) forecasts, delivering key inputs for water and energy management and hazard avoidance. It relies heavily on human expertise and applies real-time ad hoc adjustments to models and data, thus is not scalable (except through FTEs). The new global monitoring and forecasting paradigm, in contrast, is automated, using supercomputing, GIS, satellite inputs, global hyper-resolution terrain data -- but is not locally tailored, has little calibration, and typically reports outputs as percentiles rather than absolute flow values because the latter are not reliably simulated. The philosophy is different -- based on the hope that superior physics and ever higher resolutions alone will substitute for the human expertise added in the traditional paradigm, resulting in model accuracy by default.

HEPEX started in 2004 at ECMWF, and like GFP has ties to research and users, as well as to WMO WCRP and to national operational hydrometeorological services. After 10 years, HEPEX is lively (even fun!) community, runs joint experiments (ensemble hydrological experiments) and has an active online collaboration point: http://hepex.irstea.fr. Systems like EFAS and GLOFAS are prime examples of science/operational outcomes aligned with HEPEX.

HEPEX's essential focus is on advancing the elements of 'hydrologic prediction science' needed to make modern, ensemble prediction systems work *well* (rather than just execute and produce output) and be suitable for supporting water/energy/hazard management decisions. A central emphasis on ensembles responds to the need to quantify uncertainty in hydrologic predictions so as to support risk based decision making. HEPEX approaches are in a sense geared toward achieving the types of corrections that human forecasters make in the traditional forecasting paradigm (eg, objective in place of manual data assimilation). Other focus areas are regional parameter estimation, calibrated downscaling, post processing, verification, end-user communication.

Making flood risk information actionable – Aqueduct (Philip Ward)

Global flood risk models are increasingly becoming available and are useful tools to assess and manage risk. GLOFRIS is a state-of-the-art standard global flood risk assessment model, that uses the standard risk concept whereby risk is a function of hazard, exposure, and vulnerability. GLOFRIS has been used in practice, for example to carry out quick scan analyses of flood risk in GFDRR target areas. The workshop on "What can('t) we do with global risk models" was very interesting to gauge experience and expectations from developers and end-users on the uses and limits of global flood risk models. Barriers to risk management include: lack of user capacity to access information, too complex information for decision makers, information not available when needed. Aqueduct has the objective to overcome these barriers.

Aqueduct Global Flood Analyzer (www.wri.org/floods) allows any user to do an on-the-fly risk assessment for any country, state, or river basin in the world. The project is led by the World Resources Institute (WRI), and funded by the Netherlands Ministry for Infrastructure and the Environment. It is a collaborative effort developed by a consortium of WRI, the Institute for Environmental Studies of the VU University Amsterdam, Deltares, Utrecht University, and PBL Netherlands Environmental Assessment Agency.The user defines a flood protection level (e.g. 10 year protection), after which the tool estimates the risk, as well as the avoided risk. Risk is expressed in Aqueduct in terms of several indicators: annual expected urban damage, annual exposed population, and annual exposed GDP. The tool also makes projections given scenarios of both climate change and socioeconomic development. The user has tools to explore reduction options: change of flood protection level. Global Aqueduct statistics show that 15 countries account for 80% of population exposed.

In the coming years, improvements to Aqueduct will include: cost and benefits of dike protection, effectiveness of intervention strategies (spatial planning, nature-based options), coastal risk (using the Delft-3D model to develop a time-series of global tide and storm surge as part of the EU-RISES project), and including land subsidence.

A global protection standards database (method developed by Jongman et al, Nature Climate Change) is being developed through combining modelling, literature reviews, existing databases and expert meetings. This could be improved in the future through crowdsourcing - it would be interesting to discuss whether GFP could house such a database.

Swiss Re's "Mind the risk" (Joshua Woodbury)

Mind the risk is a report on the flood risk. Insured flood losses increased by 12% per year since 1970. Mind the risk focuses on hazards with return period of 100 years or less for metropolitan areas. Indicators include people potentially impacted and value of working days lost.

The results show 379m people potentially affected by river flood (EQ 283, wind 157, SS 33, TS 12). Greater Hong Kong area: 12m, Shanghai: 11.m, Kolkata, 10.5m. Top 10 cities for riverine floods are in Asia, except Mexico City and Cairo. Regarding storm surge, Amsterdam and New York are only cities not in Asia.

SwissRe's flood models (available for many countries in the world) estimate expected losses through distribution of property values, hazard, vulnerability and insurance conditions. Global Flood Zones are indicative flood hazard zones for 100 and 500 years periods with 90m resolution based on geostatistical regression approach. Combined with the Flood Events modelling concept (event set provides event return periods > 10000 years) where flood protection measures and dams considered.

Request if SwissRe can share the Flood Zones for some areas (e.g. Africa) for comparison.

WISER, a weather climate change impact study at extreme resolution (Alan Gadian)

WISER is focused on high resolution extreme weather events. Using high spatial and high temporal resolution, extreme convective storms can be modelled. These account for the bulk of disaster costs. WISER wants to derive decadal time scale changes in general precipitation over UK and Western Europe, and predict changes in quantity and frequency of severe and hazardous convective rainfall. WISER will calculate data and statistics for future severe weather of direct relevance to policy makers in Europe. Computations will become available by 2016, data will be available on BADC (British

Atmospheric Data Centre). Early results show that PDF tails are better estimated and small scale events are better captured at global level.

NASA ARSET Capacity Building for Flood Management (Brock Blevins)

ARSET (http://arset.gsfc.nasa.gov/) is NASA Applied Sciences Capacity Building Program. The goals is to increase the utility of NASA earth science and model data for policy makers, regulatory agencies, and other applied science professionals in the areas of Health and Air Quality, Water Resources, Eco Forecasting, and Disaster Management. ARSET has 51 trainings reaching 2700+ users and 700+ organisations.

The training workshop lifecycle identifies mature results from science projects, identifies host institutions, develops training and evaluates the feedback from the process to improve the capacity building process, more tailored to needs.

ARSET can help disseminate GFP data products and/or decision support tools to national and international end-user organisations; provide end-users' comments and feedback to GFP; develop joint collaborative training with GFP partners.

Listserv: https://lists.nasa.gov/mailman/listinfo/arset

Global Flood Tool and Flood-FINDER (James Verdin)

Updates on the Global Flood Tool was presented. Also the Flood-FINDER project was presented. The project of UNITAR/UNOSAT, CIMA and USGS, with support for CERN IT department, aims at using forecasted flood inundation models to trigger satellite acquisitions.

Global Flood Partnership at World Food Programme (Emily Niebuhr)

Emily discussed the needs of WFP for flood-related information. WFP has used GFP regularly to get situational awareness, and feeds this information in preparatory actions for emergencies.

Namibia Water Authorities (Pauline Mufeti)

Comprehensive overview of the many tools and services used by the Namibian authorities for flood monitoring. The tools include services provided by international partners, locally run tools through sustained capacity building and maintaining programs and national tools.

UK Flood Forecasting Centre (Crystal Moore)

Crystal discussed the UK Flood Forecasting Centre, which has a wide range of activities. Special attention was given to communication of flood information to and from various actors.

Experiences in Nigeria (Kayode Fagbemi)

Kayode presented the national system for flood forecasting and emergency response in Nigeria. After major floods in 2012, Nigeria started working with the international community to improve national capacity for monitoring, forecasting and management floods. The GFP is an interesting network for capacity building projects, and responds to the current needs of Nigeria.

CEMADEN, Brazil (Marcio Moraes)

Marcio showed the national system for flood forecasting and emergency response in Brazil. Brazil has an advanced monitoring centre, which also invests in infrastructure (rain gauges) and research.

Ignite Talks

17 Ppsters were introduced in 1 minute Ignite Talks.

- Huan Wu, Bob Adler, et al.
- Race Clark, Stu Frye et al.
- Albert Kettner, Bob Brakenridge, Tom De Groeve et al.
- Liz Stephens, Florian Pappenberger et al.
- Mari Tye, Cindy Bruyere, et al.
- Guy Schumann et al.
- Dai Yamazaki
- Calum Baugh, Florian Pappenberger
- Florian Pappenberger et al.
- Rebecca Emerton
- Elena Cristofori et al.
- James Verdin, Kristine Verdin et al.
- Cyndi Castro et al.
- Maurizio Savina et al.
- Andrew Kruczkiewicz et al.
- Morgan Ross, Guy Schumann, Emily Niebuhr, et al.
- Andrew Smith

Workshops

Workshop: What can('t) we do with global flood risk models?

Global scale flood risk models have become a reality. A range of global flood risk models have been developed for assessing both current and future risk and for forecasting and real-time flood analysis. Increasingly, these 'quick and not so dirty' methods are being used in practice, for a large range of uses and applications, and by an increasing range of practitioners and decision makers. However, global flood risk models clearly have their limits, and there is often a mismatch between the envisaged use of model results by practitioners and the actual capability of the models. Therefore, this workshop was held to open a dialogue between users and modellers to critically address the question 'What can('t) we do with global flood risk models?'.

Ignite-style presentations were given by 7 users/developers to provide examples of how global flood risk models are already being used in practice, how the model proved useful in these examples, and what challenges were faced.

- Josh Woodbury (Swiss Re) - points to the difference in granularity between hazard and exposure data, which can lead to misidentifying areas in different flood zones (e.g. 100 and 500 year return period zones).
- Dai Yamazaki (JAMSTEC - Japan Agency for Marine-Earth Science and Technology): We can already simulate flood extent and depth and therefore roughly estimate global risk. However, there are large uncertainties in GCM and topography data. To address this, models need to be continually improved, and uncertainty assessment is required.
- Nicola Pasquale (Munich Re): describes difficulty in simulation of global risk due to lower resolution of SRTM data, which leads to uncertain hazard data. Ask the question, what can we actually do with global flood risk models?
- Andrew Smith (SSBN Flood Risk Solution): We can use current generation of global flood risk models to make large scale planning decisions, but cannot be used to carry out building

scale flood risk assessments. Major challenges are the spatial resolution of the hazard data (ca. 90m) and inaccuracies in topography data.

- Brenden Jongman (GFDRR, World Bank): We can use global flood risk models to identify and flag areas where it is important to account for hazards and to inform development. For example, global hazard layers are being used in the GFDRR's THOR tool to provide hazard data where no data from more local models are available.
- Emily Niebuhr (presented by Philip Ward) (WFP): Global flood models have been used by WFP to monitor flood disasters around the world, for example in Malawi, Mozambique, and Bolivia. Country Offices have indicated that they found this information quite helpful when providing assistance during crises.
- Erin Coughlan de Perez (Red Cross Red Crescent Climate Centre): the use of global scale flood forecasting models is being tested for possible use in forecast-based financing. A challenge is still setting thresholds for taking action; information of uncertainty is also critical.

Next, all participants were asked to answer 2 questions on post-it notes:

Users

- For what purpose do you (or would you like to) use global flood risk models?
- What is the main challenge you face (or expect to face) in the use of these models in practice?

Developers

- For what purpose are you developing global flood risk models?
- What do you think the main challenge is for the use of these models in practice?

The findings were then discussed in plenary. Purposes of the models listed by users included: planning interventions; starting communication about risk issues; showing how often actions may be taken in vain based on flood forecasts; planning for "no regret" measures; and estimating the expected loss over the year for managing a portfolio. Developers stated several of these purposes, as well as the scientific use of the models (improving understanding of processes) and using the global models to make/force local models. In terms of main challenges, both developers and users recognised the challenge of resolving the global granularity of the model outputs with the needs of local decision-makers. Also, the need for improved accuracy, and information about the accuracy/uncertainty of models, was seen by both groups as being very important. Other challenges stated by users include: how to communicate real-time forecast information and risk information to end-users; the provision of false alarm rates and hit rates when thresholds are case-specific; the mismatch between the resolution of hazard and exposure data; definitions about risk – both in terms of long term and real-time studies; and making the data usable, e.g. a need to link with decision support systems to connect with local knowledge. Developers mentioned: how to communicate real-time forecast information with users; how to assess forecast skill; the need for better DEMs, especially in the vertical resolution (not per se higher horizontal resolution); the lack of data on past flood events for validation purposes (both gauge data and impact data). Interestingly, the developers need the end-users in order to be able to improve their models: users can rigorously assess the quality of the data since they have a better knowledge of their case study regions. Critical feedback from users can therefore help to improve flood risk models. In this way, there appears to be a healthy two-way relationship between users and developers.

Workshop on Global Flood Observatory

A preliminary Global Flood Observatory Team has been assembled to begin providing quality-controlled flood event coding and characterization via a web site developed at the

Joint Research Centre, Ispra, Italy. The workshop had the scope to organize this team, determine the scope and limitations of the first phase of the GFO, discuss procedures on how to enter floods in a collaborative and distributed way, and show how each team member can enter new flood events into the online system. The system then becomes fully operational immediately after the meeting.

There was agreement to keep the initial phase simple, focused on recording flood impacts for major floods as well as a bounding polygon. Major floods need to be defined. Current definitions include:

- Severity 1 (DFO criteria): large flood events (often causing significant human and economic damage); with an estimated (commonly from news reports) mean return period (recurrence interval, or average interval between two events with magnitude equal to or greater than the level concerned) of the order of ~ 10 years.
- At least 10 people killed, declaration of national emergency (CRED EM-DAT criteria)
- At least 1 person killed or 100Keuro damage (RMS criteria)

Participants urged to make the GFO archive compatible with existing good practices on recording loss data, but also to think of additional requirements (e.g. increase spatio-temporal resolution, record sub-events, record additional loss parameters) to make the GFO record useful for the flood risk community.

The organisations that expressed interest in participation are: University of Colorado, Joint Research Centre, Ithaca

Based on the number and availability of participants, a duty roster will be set up.

Draft GFO Guidelines have been developed and a first version will be completed by Bob Brakenridge for review by June 2015. After review by GFO analysts, coordination sessions will be organised by teleconference to initiate GFO operations.

Workshop: Forecast-based humanitarian action

Forecast-based humanitarian action: during the 2 hour workshop we were introduced to flood early warning systems from around the world (Uganda, UK, Nigeria, Europe, Bangladesh) and in use by different organisations (Red Cross, UK Flood Forecasting Centre, Nigerian National Emergency Management Agency).

Participants were then invited to 'vote with their feet' to prompt discussion on issues such as the accuracy and use of probabilistic forecast information, whether we are / need to be forecasting flood impact as well as flood hazard, and who uses the forecast and whether there is engagement with the users of the forecast information. Much of our discussion focussed on what could be offered from global-scale information, and how applicable that is for local-scale decision making. Participants were asked to make pledges for how they will contribute to this work in the future. These, and a report on the session will be available in due course, and will be used to feed into a DFID report on the topic.

Workshop on Microwave Remote Sensing

Bob Brakenridge - Advances in microwave remote sensing for flood monitoring

The Dartmouth Flood Observatory has around 280 RiverWatch sites. Calibration using rating curves and processing of microwave signals can yield quantitative data on flow and runoff on daily and monthly basis, as well as low flow statistics and return period estimations. The data and rating curve calculation are available, and inform the site quality value.

New visualisation products include Google Earth Engine animations using Landsat data shows the dynamics in rivers, e.g. hydromorphological stations and reach inundation plots.

Return periods are calculated each year, and a plot of the change in return period calculations is available. It informs issues on stationarity: changes due to longer time series or due to changes in climate.

Setting up a site takes about 4 hours of processing, including validation of location, retrieving results from model, and establishing the rating curve.

Bob Adler - Global Flood Modelling System

The Global Flood Modelling System of University of Maryland allows to map various variables in 3h time steps at 12km and 1km, and allows to show time series of the geophysical data parameters. Real time and forecasted inundation maps at 1km are available in experimental mode.

There is interest in having the data available as NetCDF and WxS services. Data is available as binary file.

Feyera Hirpa / Beatriz - Calibrating models with microwave data

Feyera presented the work of Bea on using microwave data to calibrate global flood forecasting models (GloFAS). The study compared uncalibrated model results, results calibrated by ground discharge, by GFDS discharge and using only the raw GFDS signal (not converted to discharge). The gain obtained (using KGE measure) varies in different basins, but there is gain in most cases. The continuous (spatial and temporal) availability of the signal is a strong advantage. The main limitations are: no information on volume, noise-to-signal approach is high in some locations. The work will be expanded to the whole globe, and ways to assimilate data in GloFAS model will be studied. Also post-processing methods will be considered.

Albert Ketner - GEOSUR

Dartmouth Flood Observatory products are integrated in a map viewer for the GeoSUR area. The layers include a two-week MODIS-based flood map (compared to normal water layer) and the RiverWatch points.

Tom De Groeve - GFDS data availability

Tom De Groeve explained how the GFDS data is produced and how it is accessible. The data is available in various formats in http://www.gdacs.org/flooddetection. Time series data processing can be set up on demand, making the data available as XML or CSV.

Workshop on Standardizing data into NetCDF-CF

Hessel Winsemius and Fedor Baart

The goal of this workshop is to enable contributors of the Global Flood Partnership (across any of the GFP pillar that contributes data), to deliver data in the GFP selected standard NetCDF with CF convention metadata. NetCDF is a widely used data format for storing large amounts of structured and unstructured data. The Climate and Forecast conventions are a metadata standard that is widely used in the meteorological and hydrological community to help understand the content of a dataset.

We will introduce the format itself, its structure compared to GIS formats and its benefits for sharing and dissemination. We will introduce the audience to the Climate and Forecast (CF) conventions for metadata.

To make the workshop practical, encouraging and above all, fun, we will provide hands-on training in establishing a well-formatted, well-described and standardised file from your own data. We will prepare a number of examples from data that is provided from participants. To attend this workshop, please bring a sample of your own dataset and a laptop computer. We will support the use of at least two programming languages: MATLAB and python, but please indicate if you use a different language in this form.

Workshop on Understanding Probabilistic Forecasting

Florian Pappenberger & Calum Baugh (ECMWF)

In this workshop we aimed to define probabilistic forecasting and highlight how it can be used in the prediction of extreme meteorological events. Florian outlined the merits of ensemble based probabilistic forecasting, for example its treatment of inherent forecasting uncertainties, and contrasted this with the over-statement of certainty within traditional deterministic forecasting.

The workshop was structured around three rounds of audience participation. In the first, each audience member played the role of a flood forecaster who had to use probabilistic forecasts of precipitation, combined with information about initial river levels, to decide if they wanted to pay for flood protection, with a penalty for missed predictions. The predictions were used differently by different audience members, some were willing to take risks whilst others took a zero-risk approach based on the desire to prevent any missed events.

Next, to highlight the different perceptions of what extreme events are, we engaged in participatory mapping. The audience was invited to write on poster maps of the world their estimates of maximum daily temperature and 24 hour precipitation during spring. This provoked a discussion firstly about the precise definition of these variables and then showed large variations within particular regions. The estimates of extremes were largely defined in areas where participants had lived for a significant period time and hence had acquired sufficient local knowledge.

Finally we introduced how comparing cumulative distribution functions (CDFs) from a model forecast and model climatology could be used to predict extreme events. A case study of snowfall in New York and Boston on 27th January 2015 was used. The audience was split into groups, each of whom were given daily model climatology and model forecast CDFs in the week leading up to the event. Half the groups received the CDFs for New York, the other half for Boston, however the groups were not told about which they had received. For each day the groups had to estimate the amount of snowfall and whether they would issue an extreme snowfall warning. All groups did issue an extreme snowfall warning, reasons included the forecast CDF being beyond the extremes of the climatology, persistency in consecutive forecasts, the shape of the CDFs and the median of the forecast CDF exceeding the extremity of the climatology CDF. The subsequent discussion highlighted flaws in the binary no-warning/warning approach of the exercise, in reality it is possible to issue different levels of warnings. Also raised was the importance of communicating the uncertainty along with any issued warnings.

Outcomes of the conference – lessons for GFP

Strengths and challenges

The Global Flood Partnership is a unique forum linking interdisciplinary teams at global level across multiple policy fields. It has a definite added value, and participants support its enabling role in the advancement of global flood risk and early warning.

The main added value of the Partnership is the annual conference for networking and exchange of information. There are also concrete deliverables, including a Global Flood Observatory. Although coordination of teams across countries is challenging, these projects are supported by all participants, and many volunteer to contribute.

Partnership agreement

The Global Flood Partnership will establish **formal arrangements to register partners**. GFP Partners sign a declaration to respect Guidelines of the GFP. The Joint Research Centre of the European Commission will act as the secretariat and will collect the declaration and publish a list of partners.

This is a light procedure allowing to have a formal list of partners and clear agreements on data exchange. The partnership agreement does not have legal force.

Funding opportunities

It was recommended to develop a **standard letter of support to GFP partners** to include in funding proposals.

It is also recommended to provide an overview of upcoming funding opportunities, including: Global Challenge Fund, Rockefeller Foundation, Google Earth Engine Awards.

Work plan

Tools and Services

Several viewers will be developed to showcase GFP services. Viewers incorporating GFP layers will be set up by JRC (Peter Salamon, Tom De Groeve), University of Colorado (Albert Kettner), Deltares (Hessel Winsemius), Google Crisis Response (tbc), World Bank / GFDRR Think Hazard (tbc).

The catalogue of tools and services will be completed and made available in the GFP website

Global Flood Observatory

The Global Flood Observatory will be started by the JRC, and progressively other teams will be added to the editors. The purpose is to demonstrate its feasibility and added value by the next conference, where it will be evaluated.

GFP website

The GFP website will be migrated to a different URL, and reorganized to show the most relevant content. The new URL will be http://gfp.jrc.ec.europa.eu. A more general URL can be assigned later on (e.g. globalfloodpartnership.org).

Conclusion – Recommendations from the workshop

Based on the discussions during the conference, the Partnership, consisting of leading academics, practitioners, agencies and government representatives, recommends the following:

- Regarding global flood risk, to work with international organisations (including UNISDR) to transform the Global Risk Assessment into an open process, taking advantage of available risk information and expertise of many organisations in the Global Flood Partnership and stimulating the uptake of peer reviewed risk data;
- Regarding experimental and pre-operational monitoring and forecasting tools and services in the Global Flood Partnership, urge funding/hosting organisations to support their continuation for a period of 2 years, during which their value will be systematically analyzed by the Global Flood Observatory analysts and reported on in future GFP conferences;
- Regarding global flood forecasting, to work closely with WMO (e.g. the Multi-Hazard Early Warning System initiative) on identifying the role and opportunities of global forecasting systems as a complementary information source to national forecasting systems.
- To increase local quality and relevance of GPF monitoring and prediction activities, liaison with regional and national operational entities that currently manage data and provide services aligning with GFP focus areas. Seek to engage such entities not solely as potential users providing feedback, but rather as full GFP partners contributing to capability development.

Further information on the conference can be found on the GFP website:

http://gfp.jrc.ec.europa.eu

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