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# **Flood related activities relevant to the WMO FFI: current state, proposed actions according to the SAP**

**Commission for Hydrology**

Y. Simonov, J. Maina



# WMO FFI flood related activities

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- Global Flash Flood Guidance System (GFFGS);
- Coastal Inundation Forecast Demonstration Project (CIFDP);
- Severe weather forecast demonstration project (SWFDP);



# Global Flash Flood Guidance System

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## FFI SAP Core Solution 4 - Improvement of Hydrological Forecasting Practices and Products

- a) Prepare detailed national requirements assessment as a basis to jointly develop NMS and NHS tailor-made forecasting products.
- b) Plan and implement improvements in flood forecasting systems.
- c) Take steps to strengthen or upgrade, as required, the application of data management and data assimilation procedures and improved methodologies and models for flood forecasting.
- d) Define and assess the NHSs' needs in terms of meteorological forecasts, with a view to integrate meteorological inputs in flood forecasting.
- e) Develop and adapt hydrological models that suit the user needs as well as the characteristics of the river basin and level of risk.
- f) Exchange software and data/information for hydrological forecasting and prediction.
- g) Provide professional guidance to other NHSs that are developing their flood forecasting abilities and skills in the selection, adaptation, calibration and use of hydrological models to suit operational requirements.



# Global Flash Flood Guidance System

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- h) WMO to promote the application, as required, of remote sensing information for flood forecasting.
- i) Undertake, as required, storm surge modeling activities, possibly in collaboration with other countries of regions that are similarly affected.
- j) Use the probabilistic forecasts from the ensemble prediction systems.**
- k) Continue the development of meteorological ensembles coupled with hydrological models for improving long-range hydrological forecasting.
- l) Expand the forecast products' provision to include long-range hydrological forecasting.**
- m) Develop/improve hydrological modeling for extension and interpolation of hydrological data needs in areas where the networks are inadequate.
- n) Develop decision support systems to assist local authorities, civil protection agencies.
- o) Consider and ensure the participation and involvement of local communities in activities related to hydrological forecasting and warning.
- p) Promote steps in filling gaps in historical time series of data.
- q) Promote steps in using data assimilation in hydrologic models.
- r) Promote the collection of real time data for flood forecasting purposes.



# Global Flash Flood Guidance System (GFFGS)

**FFI SAP Core Solution 4 – “Actions recommended for the improvement of hydrological forecasting practices and products”**

SAP recommendation	Possible action / expected result
d) Define and assess the NHSs’ needs in terms of meteorological forecasts, with a view to integrate meteorological inputs in flood forecasting.	<p>System developers should be involved in formulating “hydrological requirements” (GFFGS) for weather products (resolution-domain, lead time, time step, weather elements, etc.).</p> <p>Participation of system developers (or other representative) in SWFDP sub-projects planning meetings.</p> <p>Better SWDP-GFFGS integration – positive effect</p>



# Global Flash Flood Guidance System (GFFGS)

**FFI SAP Core Solution 4 – “Actions recommended for the improvement of hydrological forecasting practices and products”**

SAP recommendation	Possible action / expected result
j) Efforts should continue to be made to use the probabilistic forecasts from the ensemble prediction systems that will produce different scenarios such as: most likely scenario and extreme scenarios.	Where possible (availability of meteorological ensembles) use ensemble QPF to produce probabilistic flash flood guidance information  Accounting for uncertainty of heavy rain forecast



# Global Flash Flood Guidance System (GFFGS)

**FFI SAP Core Solution 4 – “Actions recommended for the improvement of hydrological forecasting practices and products”**

SAP recommendation	Possible action / expected result
l) Expand the forecast products' provision to include <b>(short-range to medium range)</b> long-range hydrological forecasting through regional climate centres, noting the limitations of such products.	Make steps to upgrading GFFGS to operational distributed flood forecasting system with river routing component, which will allow to increase flood forecast lead time (up to several days or more – depending on river basin size) and make possible flood forecasting for big streams (main river of a basin).  Forecast horizon increased (from 6h to days)



# Global Flash Flood Guidance System (GFFGS)

Recommendation	Possible action / expected result
<p>Presentation of flood forecasting products using GIS-WEB based technology, using user-predefined base layers.</p>	<p>Upgrading graphical presentation of forecast - allow background data presentation in the GFFGS user interface (include major cities, gauges location, river network and other layers); make sure output can be in GIS (OGC) format.</p> <p>Improved forecast products presentation</p>





# Global Flash Flood Guidance System (GFFGS)

Recommendation	Possible action / expected result
GFFGS used as the hydrological component of CIFDP	Develop riverine component of GFFGS, implement it existing GFFGS project, where coincides with CIFDP (DR – good area).  Improved forecast products in river coastal areas
Assessment of the country operational network capacity	Based on GFFGS implementation and operation experience prepare county assessment on possible network upgrade (design, configuration, etc.).



# Coastal Inundation Forecast Demonstration Project (CIFDP)

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- joined JCOMM – CHy project;
- multi-hazard early warning system – forecast of the coastal flooding from sea/ocean (storm surge, tides, waves) and riverine flooding (possible overlap with SWFDP and FFGS in some regions) – contribution to DRR Roadmap (in its EWMHS area);
- Two components – sea modeling and river modeling, coupling required (the only FFI project from this point of view);
- Tight interaction of NHS-NMS-National Ocean Service.



# Coastal Inundation Forecast Demonstration Project (CIFDP)

Recommendation	Possible action / expected result
a) Guidance material for river – ocean models coupling	<p>Collect guidance material on how to unite two systems - sea modeling and river modeling - get examples, assess functional needs – what functionality is really needed; pragmatic approaches to do so given different data availability conditions (may serve as a basis for further WMO guidance - in the moment there is no WMO documents on that problem);</p> <p>Guidance material in coastal forecasting (river-ocean coupled model)</p>



# Coastal Inundation Forecast Demonstration Project (CIFDP)

Recommendation	Possible action / expected result
b) Assess NHSs capabilities (data, models, capacity, etc)	<p>Prepare template for collecting information on state of NHS in terms of data availability in the river coastal area (stream gauges, observations, existing models, capacity, historical data, etc.) for estimation NHSs capacity in terms of river forecasting in rivers endpoint</p> <p>Capacity of NHS in terms of riverine forecasting capabilities, forecast model defined (if not yet there)</p>



# Coastal Inundation Forecast Demonstration Project (CIFDP)

Recommendation	Possible action / expected result
c) Show added value if river and ocean components are coupled	Prepare cases for HHSs (e.g. backwater) to increase their involvement in the subprojects
d) System developer identified (for hydrologic component), subproject plans include riverine forecasting	Build connectivity between NHSs and RMCs
e) Donor support for riverine forecast in the coastal area, and coupling	



# Severe weather forecast demonstration project (SWFDP)

**FFI SAP Core Solution 3 – “Actions recommended for the improvement of meteorological forecasting practices and products”**

- a) NMSs should consider the hydrologists' needs in terms of meteorological forecasts.
  - b) Develop or continue the development/improvement QPE and QPF technique.
  - c) Promote arrangements to deliver NWP products for further use at local level.
  - d) Promote the use of MRWF on an operational or semi-operational basis.
  - e) Continue improvement of the meteorological and nowcasting products, both deterministic and probabilistic, particularly in relation to high intensity rainfall.
  - f) Provide advice to NHSs, through specialized meteorologists in the field of forecasting.
  - g) Provide advice to NMSs and NHSs on aspects of downscaling of climate models.
  - h) Study and undertake downscaling of global models.
  - i) Development of calibration techniques for radar and satellite derived data.
  - j) Consider the application of tools of an international nature.
  - k) WMO should promote and organize efforts including case studies (ice and snow floods).
  - l) Develop and make available state-of-the-art NWP products and techniques.
  - m) Continue the development of long-range hydrological forecasting.
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# Severe weather forecast demonstration project (SWFDP)

## FFI SAP Core Solution 3 – “Actions recommended for the improvement of meteorological forecasting practices and products”

- n) Develop decision-support systems to assist forecast users.
  - o) WMO include in its future plans actions to improve the capacities of NMSs for developing meteorological products for flood forecasting, particularly QPF and probabilistic QPF.
  - p) NMSs pertaining to a certain WMO Region to consider developing jointly, as required, the relevant products for hydrological use in through enhancing their capability in QPF, use of available technology such as ensemble products, and NWP to guide QPF forecasts. [RA I, SADC]
  - q) WMO, with the support of members of Regional Centers, to assist in arranging the distribution, possibly free of charge, to the NMHSs of the countries (as required), of the products generated by the European Centre for Medium- Range Weather Forecasting (ECMWF). In addition, such arrangements are also to be sought with other European Agencies in which members of Regional Centers participate, in particular EUMETSAT. [RAs III/IV]
  - r) WMO to promote and support the international exchange of research addressing the improvement of intense rainfall forecasts in the Mediterranean basin, through projects such as MEDEX. [RAs I-VI. This action should be extended to all member countries that would require such assistance.]
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# Severe weather forecast demonstration project (SWFDP)

**FFI SAP Core Solution 3 – “Actions recommended for the improvement of meteorological forecasting practices and products”**

SAP recommendation	Possible action / expected result
a) NMSs should take into account the hydrologists’ needs in terms of meteorological forecasts for a closer integration of meteorological inputs in flood forecasting.	Formulating “hydrological requirements” for weather products (resolution-domain, lead time, time step, weather elements, etc.).
p) NMSs pertaining to a certain WMO Region to consider developing jointly, as required, the relevant products for hydrological use in through enhancing their capability in QPF, use of available technology such as ensemble products, and NWP to guide QPF forecasts.	Participation of system developers (or other representative) in SWFDP sub-projects planning meetings.  Better SWDP-GFFGS integration – better positive effect





# Severe weather forecast demonstration project (SWFDP)

**FFI SAP Core Solution 3 – “Actions recommended for the improvement of meteorological forecasting practices and products”**

SAP recommendation	Possible action / expected result
b) Continue improvement of the meteorological models and nowcasting products, both deterministic and probabilistic, particularly in relation to high intensity rainfall.	Mark importance of having ensemble weather products (ensemble QPF) for accounting for heavy rainfall forecast uncertainties in flash-flood forecasting.  Could be a part of “Hydrological requirements”
l) Develop and make available state-of-the-art NWP products and techniques from meteorological services, RSMCs and other centers of excellence for application by NHSs.	Ensemble products available for GFFGS (and other projects)



# Climate products for FFI

## FFI SAP Core Solution 3 – “Actions recommended for the improvement of meteorological forecasting practices and products”

- a) NMSs should consider the hydrologists’ needs in terms of meteorological forecasts.
  - b) Develop or continue the development/improvement QPE and QPF technique.
  - c) Promote arrangements to deliver NWP products for further use at local level.
  - d) Promote the use of MRWF on an operational or semi-operational basis.
  - e) Continue improvement of the meteorological and nowcasting products, both deterministic and probabilistic, particularly in relation to high intensity rainfall.
  - f) Provide advice to NHSs, through specialized meteorologists in the field of forecasting.
  - g) Provide advice to NMSs and NHSs on aspects of downscaling, bias correction etc.
  - h) Study and undertake downscaling of global .
  - i) Development of calibration techniques for radar and satellite derived data.
  - j) Consider the application of tools of an international nature.
  - k) WMO should promote and organize efforts including case studies (ice and snow floods).
  - l) Develop and make available state-of-the-art NWP products and techniques.
  - m) Continue the development of meteorological ensembles coupled with hydrological models for improving long-range hydrological forecasting and decision-making under uncertainty.
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