

# WORLD METEOROLOGICAL ORGANIZATION

WEATHER, CLIMATE AND WATER



## WMO FLOOD FORECASTING INITIATIVE ADVISORY GROUP (FFI AG)

3<sup>rd</sup> Meeting

## FINAL REPORT



5 to 7 December 2017  
Geneva, Switzerland

## LIST OF ACRONYMS

APFM	Associated Programme on Flood Management
CBS	Commission for Basic System
Cg	World Meteorological Congress
CHAMP	Coupled Hydrologic, Hydrodynamic, and Atmospheric Modelling Project
CHy	WMO Commission for Hydrology
CIFDP	Coastal Inundation Forecast Demonstration Project
CoP-FF	Community of Practice on Flood Forecasting
CREWS	Climate Risk and Early Warning Systems
E2E	End-to-End
EWS	Early Warning Systems
FFGS	Flash Flood Guidance System
FF	Flood Forecasting
FFI	Flood Forecasting Initiative
FFI-AG	Flood Forecasting Initiative Advisory Group
GWP	Global Water Partnership
ICHARM	International Centre for Water Hazard and Risk Management
IFM	Integrated Flood Management
NGO	Non-governmental organization
NHSs	National Hydrological Services
NMHSs	National Meteorological and Hydrological Services
NMSs	National Meteorological Services
SAP	Strategy and Action Plan
SWFDP	Severe Weather Forecast Demonstration Project
ToR	Terms of Reference
TSU	Technical Support Unit
TT	Task Team
TT-AG	Task Team on Assessment Guidelines
TT-TFF	Task Team on Interoperable Technologies to Advance Flood Forecasting
USAID	United States Agency for International Development
WBG	World Bank Group
WMO	World Meteorological Organization
WP 1	First Work Plan (2013-2016)
WP 2	Second Work Plan (2016-2019)

**TABLE OF CONTENTS**

INTRODUCTION..... 4

1. OPENING OF THE MEETING..... 5

2. ADOPTION OF THE AGENDA..... 5

3. INTRODUCTION TO FLOOD FORECASTING INITIATIVE AND ITS FRAMEWORK .. 6

4. ACTIVITIES PERFORMED IN THE FRAMEWORK OF THE 3<sup>RD</sup> FFI-AG..... 7

5. ADOPTION OF THE REPORT ..... 13

6. CLOSURE OF THE MEETING ..... 14

7. CONCLUSIONS, RECOMMENDATIONS AND ADVICE ..... 14

ANNEX I..... 17

ANNEX II..... 20

ANNEX III..... 24

ANNEX IV ..... 28

ANNEX V ..... 31

ANNEX VI ..... 35

## **INTRODUCTION**

An Advisory Group to support the World Meteorological Organization (WMO) Flood Forecasting Initiative (FFI) was established by the WMO Congress in 2011. The purpose of this Advisory Group is to ensure that the Flood Forecasting Initiative meets its objective of enhancing the ability of National Meteorological and Hydrological Services (NMHSs) to effectively cooperate to provide improved flood forecasting services.

The FFI-AG first met in 2013, followed by a second meeting in 2015, and a third in 2017. The objective of these meetings were to: review the activities carried out in the framework of the FFI; suggest improvements in the implementation of FFI practices; and agree on activities to be accomplished in the next period.

Many ongoing projects at WMO are related to FFI, with the most activities being undertaken through the Flash Flood Guidance System (FFGS) and the Coastal Inundation Forecast Demonstration Project (CIFDP), with strong linkages with the Severe Weather Forecast Demonstration Project (SWFDP). In addition to those, the Commission for Hydrology, through Resolution 6 (CHy-15), decided to reaffirm its support to the continued implementation of the Flood Forecasting Initiative in accordance with its Strategy and Action Plan. In line with the recommendations made by the Flood Forecasting Initiative Advisory Group (FFI-AG) at its second meeting and its Work Plan 2016–2019, CHy therefore initiated a Community of Practice (CoP) on End-to-End Early Warning System (E2E EWS) for Flood Forecasting (FF).

All these initiatives were reviewed and discussed during the third FFI-AG meeting, and this report summarizes the discussion held. The content of the report is presented according to the development of the meeting. Some aspects of interest linked to the FFI-AG meeting are included in the Annex section.

## **1. OPENING OF THE MEETING**

The WMO Flood Forecasting Initiative Advisory Group (FFI-AG) held its third meeting from the 5<sup>th</sup> to the 7<sup>th</sup> of December 2017 at WMO headquarters, Geneva. The list of participants is provided in ANNEX I.

Mr Harry Lins, President of the Commission for Hydrology (CHy) and Chair of the FFI-AG, opened the meeting at 9:45 on the 5<sup>th</sup> December 2017. He welcomed the participants and recognized the remarkable progress made in the FFI since the last meeting in December 2015. At the same time, he recalled that FFI-AG seeks to improve understanding and collaboration between the meteorological and hydrological services for improving flood forecasting and warning and related practices.

Mr Johannes Cullman, Director of the Climate and Water Department welcomed the participants and expressed special thanks to Yuri Simonov, for his contribution as the driving force behind the whole FFI. He also expressed the need to find a little time in the agenda to explore linkages between the FFI and other initiatives external to WMO, for instance, ICHARM (International Centre for Water Hazard and Risk Management from UNESCO).

Finally, Mr Paul Pilon, Chief of Hydrological Forecasting and Water Resources Division, underlined the advances since the revision of the FFI Strategy and Action Plan (SAP) in December 2015. He noted that Mr Yuri Simonov had received an award by JCOMM recognizing his contributions in strengthening hydrological aspects within the CIFDP. He also thanked external experts for their attendance as well as their continuous efforts since the FFI-AG 2<sup>nd</sup> meeting.

## **2. ADOPTION OF THE AGENDA**

The FFI-AG participants suggested some adjustments to the draft agenda that consisted mainly in changing the order of some of the presentations. In the first day, it was proposed to present the progress made on Tasks 1 to Task 4 from the FFI-AG Work Plan 2016-2019 as adopted at the FFI-AG 2<sup>nd</sup> meeting. Other suggested changes were made and adopted to better mesh with the availability of the presenters. For the last day, Mr Giacomo Teruggi proposed a new presentation to show the results of an Early Warning System (EWS) pilot project implemented by the Foundation Ricaldoni in Uruguay.

The final agenda of the third meeting of the FFI- AG is provided in ANNEX II, and the presentations are available on the WMO webpage<sup>1</sup>.

Participants provided a brief self-introduction. Mr Lins thanked the participants for making the effort to participate in this meeting and encouraged everyone's active participation during the meeting.

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<sup>1</sup> WMO website for presentations is: [http://www.wmo.int/pages/prog/hwrp/flood/FFI\\_AG3.php](http://www.wmo.int/pages/prog/hwrp/flood/FFI_AG3.php)

### **3. INTRODUCTION TO FLOOD FORECASTING INITIATIVE AND ITS FRAMEWORK**

#### **3.1 Background**

The WMO FFI started from an Expert Meeting in 2003 where it was agreed that its objective should be to “Improve the capacity of meteorological and hydrological services to jointly deliver timely and more accurate products and services required in flood forecasting and warning and in collaborating with disaster managers, active in flood emergency preparedness and response”.

In 2011, the World Meteorological Congress (Cg) passed Resolution 15 (Cg-XVI) establishing the WMO Flood Forecasting Initiative - Advisory Group (FFI-AG) with the objective of providing guidance and advice on the hydrological forecasting elements of a number of flood-related initiatives and programmes in progress under WMO programmes, and to provide broad-based support to improve collaboration between the meteorological and hydrological communities for improved flood forecasting related practices. ANNEX III provides the full text of Resolution 15 (Cg-XVI), including the Terms of Reference (ToR) for the FFI-AG.

In October 2013, the first FFI-AG meeting took place. It reviewed its ToR and developed a Work Plan for the period 2013-2016. The first Work Plan (WP 1) was composed of 9 activities based on the ToR contained in Resolution 15 (Cg-XVI). The activities of WP 1 were divided into various tasks and were given deadlines. It was also agreed that these activities should be updated according to the evolution of the implementation of the Tasks. WP 1 appears in Annex IV of the [report](#) of the first meeting.

The second FFI-AG meeting was held in December 2015, where the WP 1 was reviewed and a new work plan (WP 2) was developed. The WP 2 was composed of four main Tasks which are reflected in Annex VII of the [report](#) of the second meeting.

In December 2017, the FFI-AG held its third meeting where the experts presented a summary of the tasks implemented in WP 2. The status of the activities is reflected in the Work Plan of ANNEX IV as having been “done” and what is yet “to do”.

#### **3.2 Expected Outcomes of the meeting**

The expected outputs from the meeting during its third session were:

1. Agreement on the scope of work and approach to be taken by the FFI-AG, within its ToR;
2. Improved understanding of the current initiatives and activities undertaken in the framework of the WMO FFI;
3. Agreement on specific actions to be taken and an updated Work Plan associated with these actions;
4. Agreement on how the work of the FFI-AG should be undertaken, including its outreach to Members, relevant Commissions, Technical Support Partners, and Donors;
5. Conclusions and recommendations (including target audience), based on the presentations and discussions.

### 3.3 Scope of the Strategy and Action Plan (SAP)

The chair presented the review criteria for the current SAP of FFI, which were the following:

1. The SAP promotes the preparation of national implementation plans, to be adapted in accordance with current national/regional flood forecasting capabilities, specific requirements and priorities.
2. The SAP suggests the implementation of demonstration projects at various levels (country-specific, sub-regional and regional projects), to showcase the value of increased cooperation between National Meteorological Services (NMSs) and National Hydrological Services (NHSs) in flood forecasting .
3. At the regional level, the SAP advocates the establishment of a framework under which partnerships and development assistance could be provided and coordinated amongst services while taking advantage of existing regional and international arrangements.
4. The SAP also addresses requirements of well-established flood forecasting and warning systems for their further improvement through the development and use of new technologies.

## 4. ACTIVITIES PERFORMED IN THE FRAMEWORK OF THE 3<sup>RD</sup> FFI-AG

This section presents a brief overview of the activities discussed during the 3<sup>rd</sup> FFI-AG meeting. It is structured in two parts. The first is a review of progress made in WP 2 (2<sup>nd</sup> FFI-AG). The second is a discussion on what remains to be accomplished and how best to achieve this.

It was recalled that the WP 2 was composed of the four following tasks:

**Task 1:** Ensure that all major demo projects and components, including but not limited to CIFDP, SWFDP, FFGS, include the requirements/best practices for effective and sustainable flood forecasting in their design and implementation;

**Task 2:** Ensure guidance material is available for NMHSs and for donors, NGOs, and other organizations working to strengthen flood forecasting capabilities in national services;

**Task 3:** Facilitate the development of an inventory of existing training programmes and related reference materials across the entire spectrum of training needs for E2E systems for flood forecasting, identifying weaknesses/gaps, and recommending development of additional materials to overcome weaknesses/fill gaps;

**Task 4:** Ensure access to guidance material and training through the IFM HelpDesk.

## 4.1 Review of the implementation of Work Plan 2016 – 2019

### 4.1.1 Task 1

This task involved aspects of governance and advice related to the main projects (CIFDP, SWFDP, FFGS – see Section 5.2). It was composed of 4 items, all of which have been implemented or acted upon:

1. CHy President and FFI-AG members have reported on the FFI-AG progress and collaborative actions to appropriate bodies (i.e. Executive Council - EC).
2. Following FFI-AG advice, CHy adopted Resolution 6 and included in its Work Plan the development of assessment guidelines to assess the efficiency and effectiveness of service delivery capabilities of hydrological services, including the quality of data and maintenance of observation networks.
3. As requested, the positions in the CIFDP Steering Committee were taken by CHY members, with Mr Yuri Simonov having been designated as CIFDP Vice-Chair of the Steering Committee and Graeme Smart, CHy expert, as member of the CIFDP Steering Committee.
4. Presidents of CHy and CBS discussed the possibility of being on the SWFDP Steering Group. At the time it was decided that no CHY expert would be included on the SWFDP Steering Group, but rather that there would be close collaboration between CHy and CBS on the SWFDP.

### 4.1.2 Task 2

This task is linked to the development of assessment guidelines and related material. Mr Simonov reported that there was significant progress made thanks to two CHy Task Teams (TT). Following Resolution 10 (CHy-15) evaluating the development of the Community of Practice on Flood Forecasting (CoP - FF), a meeting was held in November 2017. The TTs worked in parallel sessions to develop these items as part of the E2E EWS for flood forecasting: Evaluation of National Capabilities, Guidance Material, the Interoperable Platform and Models and Training Materials.

The task is divided in three sub-tasks, which were discussed as follows:

*1.a) Requirements/best practices (e.g. open source codes,...) to be taken from existing materials*

No advance has been made on this activity, with activity planned to occur in 2018.

#### Discussion:

This activity, which aims at having a general list of requirements needed for an E2E EWS for FF, might be undertaken considering the contents of the WMO Manual on Flood Forecasting and Early Warning (WMO No. 1072). A summarized version of this manual has



already been developed in the framework of the IFM Tools series (No. 19, Flood Forecasting and Early Warning).

*1.b) Inventory on what is available and what is missing to set up an E2E EWS in flood forecasting*

This activity was advanced by the TT on Interoperable Technologies to Advance Flood Forecasting (TT-TFF<sup>2</sup>). The outcomes were showed by Mr Paul Pilon through a presentation developed by Ms Hwirin Kim, who could not attend due to work commitments in her country.

The TT-TFF prepared a list of freely *available material* within WMO on E2E EWS chain, such as the DEWETRA<sup>3</sup> platform (for the Decision Support System component) and the Meteorological, Climatological and Hydrological Database Management System (MCH)<sup>4</sup>. Both tools are considered excellent examples of building blocks of E2E EWS, which, moreover, are freely available through WMO thanks to the donation of these tools' source codes by the countries that developed them (Italy and Mexico, respectively).

In addition, there are some free runoff and inundation simulation software developed by ICHARM (International Centre for Water Hazard and Risk – UNESCO), such as the Integrated Flood Analysis System (IFAS) and the Rainfall Runoff Inundation (RRI). These have been implemented in developing countries and were proposed to be considered for inclusion in the inventory.

Concerning *materials and tools needed* to support E2E EWS practices, the TT worked on definitions of Interoperability, Platform, and Interoperable Technology and on the establishment of draft criteria to evaluate flood forecasting models and platforms. The TT agreed on the main criteria for inclusion of platforms and models in the list: must be based on being freely available and operationally used, with low hardware requirements, and sustainable technology and software (models, ...), and easy to use.

Also, a small number of hydrological models, routing models and currently operational platforms were identified as possible candidates for applying the screening criteria. If the screening is passed, these would be suitable for operational hydrological services linked to flood forecasting. Examples of potential technologies include:

- ✓ Hydrological models: HEC-HMS, HYPE, URBS, HBV aka HBV96, GRM , GR4H
- ✓ Routing model: HEC-RAS, MASCARET, TELEMAR
- ✓ Platforms: HEC-RTS, AEGIR + HYFO, K-EWS, SWIFT, POM-Vigicrues

The TT also proposed a draft template to classify and describe the models selected (or to be selected).

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<sup>2</sup> It corresponds to Task Team 2 (TT2) in the [report of CoP](#)

<sup>3</sup> [DEWETRA http://www.cimafoundation.org/en/workshop-on-the-dewetra-platform/](http://www.cimafoundation.org/en/workshop-on-the-dewetra-platform/)

<sup>4</sup> [MCH http://www.wmo.int/pages/prog/hwrp/mch/index.php](http://www.wmo.int/pages/prog/hwrp/mch/index.php)

## Discussion:

To continue developing and improving this activity, the TT proposed a work plan with actions that should be directed by its members. More details about this Item are presented in the [report of the CoP](#).

The FFI-AG was pleased with the outlined activities and invited the TT to continue with its effort.

### *1.c) Guidelines to assess technical capabilities of NHSs*

A Task Team on Assessment Guidelines (TT-AG<sup>5</sup>) has been set up under the leadership of Mr Simonov. The TT-AG has so far developed a draft assessment matrix composed of nine main points that should be considered in the assessments of NHSs.

The draft assessment matrix was presented in excel format. The matrix components were structured following the E2E chain of EWS for FF. In this sense, these components are focused on answering the following questions and addressing related issues:

- I. How are the observations and data acquisition, including the real-time data, done?
- II. Do historical and ancillary data exist? What kind and how are they used?
- III. How is the data management and control done? Do the involved institutions share the data?
- IV. What meteorological forecasts and products are available? How are they shared with NHSs?
- V. Are NHSs providing hydrological forecasts for warning? Are they based on rainfall-runoff models?
- VI. What type of flood forecast products are provided? How are they disseminated and displayed?
- VII. How are the communications to support decision making conceived and broadcasted? Is the community included in the operating procedures?
- VIII. What performance and sustainability measures are implemented (e.g. backup of databases, alternative methods of data acquisition and transmission, alternative generations of alerts in case of system failures).
- IX. Is the EWS managed and operated by adequately trained professionals? Do they have training programs available?

## Discussion:

Format of the matrix: it is intended to make a version of the matrix tailored for each type of flood available. The FFI-AG has agreed that there are general aspects to assess in all NHSs, but that others need to be taken into account, depending on the mechanisms generating the flood (e.g. flash flood or coastal flood, etc.).

The matrix will need to be presented in a more user-friendly format, as the current excel table is not easy to apply during field applications, such as the ones performed in Fiji and Burkina

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<sup>5</sup> It corresponds to Task Team 1 (TT1) in the [report of CoP](#)

Faso by the Secretariat. Once the content is finalized, due consideration will be given to this issue of user-friendliness.

Modalities of conducting the assessment: the target audience for the matrix was discussed, i.e. if the assessment matrix should be used for self-assessment purposes or if an independent expert (consultant) should apply the matrix. Also, considering that it takes a long time to fill the matrix, it is necessary to find a practical and easy way to answer the matrix questions (e.g. by yes or no).

Matrix components: it was noted that an additional category might be needed in the matrix to assess the infrastructure of the NHS (e.g. internet connectivity, power network, basic facilities, etc.). A good example to be considered would be the assessment matrix developed in the framework of the USAID funded project to strengthen the Afghanistan Meteorological Service.

### 4.1.3 Task 3

This task covers training programmes and guidance materials needed for E2E systems for flood forecasting. Its two first Items were also addressed by the TT-TFF and were presented by Mr Paul Pilon on behalf of Ms Hwirin Kim, and he pointed out the most relevant aspects:

1. An inventory about training programmes related to the models and platforms is being developed but it needs to be deepened. At present, the TT-TFF recognised some aspects to consider in the selection of the materials related to hydrological models, such as: a brief and practical introduction to implement it, a simple description of the model structure, examples of case studies. It was highlighted that it would be desirable if the User Manual and Training Material would be available in several United Nations languages.

Mr Pilon remarked that in addition to making a training program on models and platforms, it is essential to develop training programmes focused on strengthening all components of the E2E EWS for Flood Forecasting.

2. It will be possible to build a prioritized list of training materials for E2E EWS for FF after having concluded the inventory previously mentioned.
3. Mr Giacomo Teruggi presented a review of available training programmes and reference materials linked to the five main steps of the E2E EWS for Flood Forecasting and Warning (see below figure). This presentation was assembled in Summer 2017 by a WMO consultant, Mr Shrijwal Adhikari, to collect existing training material developed both in WMO and outside on the different E2E components.



Figure 1. Main steps of the chain E2E EWS for Flood Forecasting.

He concluded that sufficient guidance and training materials related to Steps 1, 2 and 3 step have been developed within and outside WMO. Nevertheless, materials on Step 4, decision support (e.g. adaptation and mitigation solution to flood inundation), and Step 5, response to warnings, (role of public education in disaster preparedness) are scarce.

#### Discussion:

This Task has been partially addressed, but still requires significant effort to complete. On one side, it is necessary to complete the list of training material related to the inventory developed by TT-TFF. On the other, a screening and sorting of the materials collected by the WMO consultant will be needed to select the most relevant materials.

#### **4.1.4 Task 4**

This task focuses on ensuring access to guidance material and trainings through the IFM HelpDesk. Mr Giacomo Teruggi presented the current version of the IFM HelpDesk, and a proposed new structure to integrate the outcomes of the FFI while simultaneously seeking integration of other HelpDesks, such as the Integrated Drought Management Programme (IDMP) and the Global Hydrometry Support Facility (HydroHub).

Currently, the IFM HelpDesk provides information through freely downloadable publications, educational material, databases, and a space to be developed for Questions and Answers. The IFM HelpDesk also has a “Get Help” option, through which users can connect to the TSU requesting rapid guidance, capacity building, or support in the development of pilot projects on IFM.

To showcase and present the outcomes of the FFI, it is planned to re-shape the structure of the IFM HelpDesk. The intent is to provide easy and free access to all FFI materials once they have been developed (i.e. the assessment matrix, the inventory of models and platforms, the related guidance and training materials, etc.), as well as an entry point to the Community of Practice on E2E FF and EWS (CoP). It should be noted that the CoP Task Team (TT-CoP) decided at its meeting in November 2017 that the CoP online space will remain independent from the IFM HelpDesk. Although the two would be independent, the IFM HelpDesk will act as a public interface for some of the CoP products and outcomes. This would allow, besides a higher visibility to the CoP results, also a mutual benefit between the CoP and the network of Support Base Partners (SBPs) that provide specific assistance through the IFM HelpDesk.

The capabilities available through this network of SBPs are described in a catalogue of services, available through the [APFM website](#).

#### Discussion

The FFI-AG recognized the potential benefit of making use of the IFM HelpDesk to showcase results of the FFI and at the same time act as an entry point to the CoP. Considering the preliminary level of development of the different products under tasks 1 to 3, it was felt that it would be premature to start re-organizing the IFM HelpDesk at this time. The FFI-AG noted the need, as highlighted by the TT-CoP, to involve relevant experts in communication in the website design phase to better showcase and present the outcomes of

the FFI. To achieve this, it is crucial that a Communication/Outreach Officer be made available by the Secretariat to coordinate and assist in the implementation of the new IFM HelpDesk design.

## **4.2 Update/Brief overview of activities considered by the FFI-AG**

FFI-AG was presented with an overview of the activities linked to the E2E EWS for Flood Forecasting and that are of relevance to the FFI. It principally consisted of a review of the main project activities (e.g: SWFDP, CIFDP, CHAMP, FFGS, CAFFG, etc.) with the objective of discussing their progress. ANNEX V (Table 1 and Table 2) lists the topic of each presentation<sup>6</sup> and provides a brief overview of its content.

The presentations provided an excellent overview the current activities related to the FFI, garnering many questions and prompting productive discussion. It was apparent that there were many avenues for possibly increasing synergies and accomplishing the overall goal of the FFI, which is to improve collaboration between the meteorological and hydrological communities for improved flood forecasting related practices.

Moreover, a new initiative called CREWS was cited as a means for least Developed Countries and Small Island Developing States of obtaining financial resources to increase capabilities in EWSs in countries, for example by assisting NMHS in enhancing their related practices. The FFI-AG suggested continuing the implementation of IFM but with an increased focus on E2E EWS for flood forecasting.

### **Remarks**

- The second FFI-AG meeting proved to have effectively streamlined the structure of the FFI, therefore this 3<sup>rd</sup> meeting benefited from having a streamlined Work Plan.
- Collaboration with other Commissions has proved to be effective.
- Further consultations with the FFI-AG might be done as needed through teleconference, especially to opine about the various review issues.
- Membership of the FFI-AG is confirmed based on discussions between the Presidents of CHy, CBS and JCOMM.

## **5. ADOPTION OF THE REPORT**

The meeting participants requested the Secretariat to prepare a draft report of the meeting for their review. The Secretariat will prepare a draft report before the second week of January 2018 and requested the participants to provide comments to this draft two weeks upon receipt. Once comments from participants have been received, the Secretariat will revise the draft report, undertaking an editorial review and consistency check of the material contained therein. The Secretariat will publish the report and its related material on the WMO website and will notify the participants of the meeting.

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<sup>6</sup> For the URL addresses of each presentation please refer to ANNEX VI

## **6. CLOSURE OF THE MEETING**

The session of the FFI-AG was closed at 16:30 on Thursday, 7th December 2017. Mr Paul Pilon thanked the participants for their input and the Chair for enabling a fruitful discussion. The Chair thanked all of the participants, both present and the ones who joined remotely, for their contributions. He also thanked the WMO Secretariat for their outstanding support and making this meeting a success. Mr Lins also took the opportunity to wish everybody a happy and safe holiday season. A date was not set for the next meeting of the FFI-AG but it was mentioned that the next meeting of the FFI-AG should take place before Cg-XVIII, e.g. December 2018, possibly as a teleconference.

## **7. CONCLUSIONS, RECOMMENDATIONS AND ADVICE**

### **Conclusions**

1. The FFI-AG reviewed its ToR and noted that the ToR, as well as the need for an FFI-AG, remain valid.
2. The tasks from the 2016-2019 Work Plan, validated by CHy-15 through Resolution 6, remain valid, taking into consideration the outcomes of the discussions presented above. It was noted that the Preamble to E2E EWS for FF should include a reference to the definition used by UNISDR and to note differences between UNISDR and WMO definitions.
3. FFI-AG noted with appreciation the contribution of USAID and WBG to the discussion and invited them to continue close collaboration on E2E EWS for flood forecasting.
4. Regarding the development of project proposals (e.g., CREWS), a lack of engagement between proposal developers and hydrological experts within the Secretariat was noted. Engagement with the hydrological experts within the Secretariat is required, from the preliminary stages of proposal development through implementation, for the development of sound projects.
5. The current project proposal that was reviewed by FFI-AG (i.e. CREWS Burkina Faso) has to be significantly modified to ensure a proper outcome (rather than intended outcome) is achieved and sustainable.
6. Additional effort is needed to increase consideration of riverine flooding within CIFDP projects in coastal areas.
7. FFI-AG recommended the Secretariat provide the required expertise to properly showcase the outcomes of the FFI in an attractive way, despite the highly technical and specialized level of FFI outcomes.
8. Given its importance in the E2E chain and in overall flood disaster risk management, FFI-AG encourages the Secretariat to investigate ways to incorporate and take advantage of APFM's material in FFI activities.

9. FFI-AG encourages the President of CHy, in consultation with the Secretariat, to look for avenues to take more advantage of the CHAMP initiative and apply it to other areas (e.g. the HydroSOS pilot basins).

### **Recommendations on Independent (External) Reviews**

Noting the outcome of the recent independent review of the APFM and the agreement of CHy and JCOMM to undertake an independent review of the CIFDP, FFI-AG recommends:

1. That CHy and JCOMM proceed with undertaking their independent review of the CIFDP and report the results of the review to the FFI-AG.
2. That an independent review be undertaken of the Flash Flood Guidance System with global coverage. The review should consider if the project is serving the needs of the community, if it is fit-for-purpose and sustainable, and how it should move forward.
3. That FFI-AG, through its Chair, engage CBS and CHy to undertake the review.
4. That FFI-AG, through its Chair, report on the review to EC or Congress, whichever takes place first.
5. That an independent review be undertaken of the Severe Weather Forecast Demonstration Project. The review should consider if the project is serving the needs of the community, if it is fit-for-purpose and sustainable, and how it should move forward.
6. That the results of all reviews be made available to the FFI-AG to allow their full consideration prior to Congress (Cg-18).
7. That the Secretariat take the necessary steps to secure funding to undertake the reviews.
8. In listening to the array of ongoing activities, the FFI-AG felt strongly that there is a clear need for increased human resources to be directed to FFI activities to ensure Secretariat staff support. Therefore FFI-AG recommends to EC that increased staff be allocated within the HFWR Division in order to ensure successful completion of FFI activities for the benefit of Members.

### **Advice**

- Need to move forward with the FFGS Global Workshop particularly to hear Member views on its implementation, but not to be held before September 2018. Participants would be FFGS practitioners and potentially the independent reviewers to present the outcomes of the review. Location to be determined.
- FFI-AG requests CHy President to engage other Presidents at the January 2018 PTC meeting to raise the need for more standardized alerting terminology across disciplines and languages.
- Having considered the report on the pilot project “Expanding the EWS of the city of Durazno to the cities of Artigas and Treinta y Tres”, the FFI-AG requested that the Secretariat contact Fundación Julio Ricaldoni to assess the methodology’s applicability to other basins and within the CoP on E2E EWS for FF approach.

Advice to the CBS President:

- The Chair of the FFI-AG to coordinate with the President of CBS on CHy expert representation on the SWFDP Steering Group and on each sub-project Management Team, for the purpose of ensuring appropriate incorporation of hydrological forecasting needs in the design and implementation of the SWFDP.

Advice to the Secretariat:

- FFI-AG noted the planned agenda and engagement matrix for the “Global Conference on Prosperity through Hydrological Services” and supports the intent of increasing the visibility of WMO in fulfilling water-related needs around the world. At the same time, FFI-AG drew attention to the fact that this conference constitutes an opportunity for WMO to expand support for provision of hydrological services by Members, and to do that, WMO should consider the mix of external projects that are being presented in the meeting to achieve this end. FFI-AG advice is that the conference organizers ensure that the agenda in its entirety focus on hydrological service delivery and to ensure that contributions from organizations other than WMO conform with this. Moreover, with respect to the engagement matrix design, it is recommended that the subject areas should be limited to three (Hydrological Data Management, Hydrological Products – including forecasting – and Hydrological Services/Product Delivery). In the current design of the matrix, FFI activities would not be identified easily.



**3<sup>RD</sup> MEETING OF THE FLOOD FORECASTING INITIATIVE - ADVISORY GROUP**  
**Geneva, Switzerland 5 - 7 December 2017**

**LIST OF PARTICIPANTS**

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**WMO FLOOD FORECASTING INITIATIVE (FFI)**  
**3<sup>RD</sup> Meeting of the FFI - Advisory Group (FFI-AG 3)**

5 to 7 December 2017. Geneva, Switzerland

**FINAL AGENDA**

**Tuesday 05 December**

- 09:30 Registration
- 09:45 Opening of the Meeting [H. Lins, P. Pilon]
- 10:00 Adoption of the Agenda
- 10:15 Introduction of participants
- 10:30 Introduction to the WMO Flood Forecasting Initiative and its framework (ToR) [H. Lins]
- 11:00 Break
- 11:15 Quick overview of the Work Plan 2016-2017 of the FFI-AG [H. Lins]
- 11:30 **Status of implementation of the Work Plan 2016-2019 of the FFI-AG**
- **Task 1:** ensuring that all major demonstration projects and components, including but not limited to CIFDP, SWFDP, FFGS, include the requirements/best practices for effective and sustainable flood forecasting in their design and implementation [H Lins / P Pilon, 30 min.]
  - **Task 2:** ensuring guidance material is available for NMHSs and for donors, NGOs, and other organizations working to strengthen flood forecasting capabilities in national services.
    - 1.c. Based on inventory and report of November 2013, develop assessment guidelines that point to technical reference material to strengthen weaknesses [Y Simonov, 30 min.]
- 13:00 Lunch
- 14:00 **Status of implementation of the Work Plan 2016-2019 of the FFI-AG (cont.)**
- **Task 2 (cont.):**
    - 1.a. Development of generic and living list of requirements/best practices (e.g. open source codes, free and open exchange of hydrometeorological data) to be taken from the existing materials – CHy [Y Simonov to report on Task Team activities, 30 min.]
    - 1.b. Develop an inventory on what is available and what is missing in WMO and outside WMO to set up an E2E EWS for flood forecasting –

modelling and platforms [P. Pilon to report on Task Team activities, 30 min.]

- 16:50 Update/Brief overview of activities taking into consideration FFI:
- Establishing a Community of Practice for Flood Forecasting [C. Caponi to report on activities, 15 min.]

17:30 Icebreaker event

### Wednesday 06 December

09:00 Brief overview of Day 1 [H. Lins]

09:05 Status of implementation of the Work Plan 2016-2019 of the FFI-AG (cont.)

- **Task 3:** facilitating the development of an inventory of existing training programmes and related reference materials across the entire spectrum of training needs for E2E systems for flood forecasting, identifying weaknesses/gaps, and recommending development of additional materials to overcome weaknesses/fill gaps.
  1. Develop an inventory on what is available and what is missing in terms of training programmes [P. Pilon / H Kim, 30 min.]
  2. Based on inventory, develop prioritized list of training materials that should be developed [H Kim / Secretariat]
  3. Identify relevant training programmes and reference materials within WMO as well as non-WMO programmes related to FF&W [G. Teruggi, 10 min.]
- **Task 4:** ensuring access to guidance material and trainings through the IFM HelpDesk.
  1. APFM TSU to undertake an inventory of the existing guidance material and/or training material and/or expertise through its Support Base already available through the HelpDesk on FF&W [G. Teruggi / APFM TSU]
  2. APFM TSU to design an appropriate interface to offer assistance (Get Help and Help Yourself) in the field of FF&W and solicit feedback from selected FFI-AG members (including link with CHy team under task 2.1) [G. Teruggi / APFM TSU]

11:00 Break

11:10 Update/Brief overview of activities taking into consideration FFI:

- SWFDP - Severe Weather Forecast Demonstration Project and twinning of SA-FFG and SWFDP-SA [A. Harou / E. Poolman, 30 min.]
- CIFDP - Coastal Inundation Forecasting Demonstration Project (including JCOMM-CHy independent review) [E. Cabrera, 30 min.]

13:00 Lunch

- 14:00 Update/Brief overview of activities taking into consideration FFI (cont.):
- CHAMP - Coupled Hydrology Atmospheric Modelling and Prediction and Seamless Forecasting and/or other FFI related activities [V. Fortin, 30 min.]
  - FFGS - Global Flash Flood Guidance System implementation [A. Sayin, 30 min.]
  - CAFFG - Central America FFGS implementation [R. Cerón, 30 min.]

15:30 Break

- 16:00 Linkages with activities from:
- USAID [S. Tokar, 20 min.]
  - World Bank [D. Kull, 20 min.]
  - CREWS [S. Llosa, 20 min.]

17:00 Session adjourns

### Thursday 07 December

09:00 Brief overview of Day 2 [H. Lins]

09:10 Associated Programme on Flood Management (APFM) – Results from independent review of the program + New direction and business/costing model [G. Teruggi / APFM TSU, 30 min.]

09:50 WMO Global Conference on “Prosperity through Hydrological Services” [J. Cullmann / C. Caponi, 15 min]

10:30 Break

11:00 Climate Risk and Early Warning Systems (CREWS) - Burkina Faso [G. Teruggi, 15 min.]

11:45 CHy activity: Preparation and provision of hydrological forecasting requirements on how to formulate numerical weather prediction information for use in flood forecasting to the SWFDP Steering Group [Y. Simonov, 30 min.]

12:30 Lunch

13:20 Review of adjustments to the Work Plan (duplication, what is missing, future needs, etc.) [H. Lins]

- Proposal for future actions

14:00 Adjustments to the Work Plan 2016-2019 of the FFI-AG

- Task 1
- Task 2
- Task 3
- Task 4

- 15:00 Discussion on the main conclusions and recommendations from the third FFI-AG meeting for Executive Council in June 2018 and other important initiatives [H. Lins]
- 16:00 Process for adoption of the Report of the 3<sup>rd</sup> meeting of the FFI-AG
- 16:05 Next steps
- 16:15 Final remarks
- 16:30 Closure

## Resolution 15 (Cg-XVI)

### ESTABLISHMENT OF AN ADVISORY GROUP FOR THE WMO FLOOD FORECASTING INITIATIVE (WMO FFI-AG)

THE CONGRESS,

#### Noting:

- (1) Resolution 21 (Cg-XV) – Strategy for the Enhancement of Cooperation between National Meteorological and National Hydrological Services for Improved Flood Forecasting,
- (2) The Action Plan that was developed at the request of the Commission for Hydrology (CHy) in December 2009 in support of the Strategy and Action Plan of the WMO Flood Forecasting Initiative,

#### Recalling:

- (1) That both Resolution 3 (CHy-XIII) – Hydrological forecasting and flood management and Resolution 21 (Cg-XV) called on the president of the Commission to establish an appropriate management mechanism in support of the WMO Flood Forecasting Initiative (FFI),
- (2) That the objective of the WMO FFI is to: *“Improve the capacity of meteorological and hydrological services to jointly deliver timely and more accurate products and services required in flood forecasting and warning and in collaborating with disaster managers, active in flood emergency preparedness and response”*,

#### Considering:

- (1) That improved hydrological forecasting, including the provision and promotion of flash floods guidance, seasonal flow prediction and coastal storm surge flood forecasting activities require close collaboration among the experts from various technical commissions,
- (2) The need to improve flood early warning system capabilities,
- (3) The need to make use of seasonal climate outlooks being produced on an operational basis and being strengthened through the Global Framework for Climate Services,
- (4) That an overarching Technical Group is required to provide guidance and advice on the hydrological forecasting elements of these initiatives,
- (5) That such an Advisory Group will provide broad-based support to improve collaboration between the meteorological and hydrological communities for improved flood forecasting practices,

#### Decides:

- (1) To define the scope of the WMO Flood Forecasting Initiative to include all the hydrological forecasting activities, such as those related to flash floods and riverine floods, including



seasonal forecasts and coastal flooding due to storm surges;

- (2) To establish the WMO Flood Forecasting Initiative Advisory Group (FFI-AG) with terms of reference as per the annex to this resolution;

**Requests** the Secretary-General, as appropriate and within the available budgetary resources, to take all necessary actions to support the establishment of the WMO FFI-AG and its activities;

**Requests** the president of the Commission for Hydrology to report periodically to the Executive Council on the progress of the activities of the WMO FFI-AG;

**Invites Members:**

- (1) To actively support the tasks of the Advisory Group, including by facilitating the participation of dedicated experts in sessions of the Group;
- (2) To ensure that National Meteorological Services and National Hydrological Services work in close collaboration in the provision of critical inputs to the Group;
- (3) To promote recommendations of the Group on a national basis;
- (4) To contribute to the Voluntary Cooperation Programme Fund and the Hydrology and Water Resources Trust Fund in support of the implementation of activities recommended by the Group.

## Annex to Resolution 15 (Cg-XVI)

### FLOOD FORECASTING INITIATIVE ADVISORY GROUP TERMS OF REFERENCE AND COMPOSITION

Developed in 2003, the WMO Flood Forecasting Initiative (FFI) is based on an analysis of the weaknesses of current forecasting systems, with a view to enhancing the ability of National Meteorological and Hydrological Services (NMHSs) to cooperate in an effective manner to provide improved flood forecasting services.

The Fifteenth World Meteorological Congress in 2007 endorsed the Strategy and Action Plan for the Enhancement of Cooperation between National Meteorological and National Hydrological Services for Improved Flood Forecasting. At its thirteenth session in 2008, the Commission for Hydrology (CHy) recognized a range of other initiatives associated with the FFI, such as the Flash Flood Guidance System (Resolution 3 (CHy-XIII) – Hydrological forecasting and flood management). Subsequently the Coastal Inundation Forecasting Demonstration Project (CIFDP) was initiated jointly by CHy and the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). Seasonal hydrological flow forecasting based on regional climate outlooks has also been initiated by CHy and the Commission for Climatology.

Both Resolution 3 (CHy-XIII) – Hydrological forecasting and flood management and Resolution 21 (Cg-XV) – Strategy for the Enhancement of Cooperation between National Meteorological and National Hydrological Services for Improved Flood Forecasting called on the president of CHy to establish an appropriate management mechanism in connection with these initiatives. Considering the cross-cutting nature of the guidance required for providing technical oversight, it is proposed to establish an overarching Advisory Group for the Flood Forecasting Initiative (FFI-AG) to advise on the hydrological forecasting elements of these initiatives.

#### Terms of reference

The WMO Flood Forecasting Initiative Advisory Group (WMO FFI-AG) shall:

1. Consider and advise on the concept, objectives, expected benefits/costs, strategy, action plan and future development of the WMO FFI;
2. Review and assess the status of the WMO FFI and progress towards its objectives, and propose strategies for any necessary remedial action;
3. Review and assess the progress of specific WMO FFI projects upon request;
4. Advise on standards (including, but not limited to, methodologies, techniques, technologies, and so forth) for the robust and sustainable implementation of the WMO FFI;
5. Review the relationship of the WMO FFI with other relevant international programmes, particularly from the point of view of coordination and avoidance of overlap, and propose any necessary actions;
6. Identify and evaluate constraints on, and potential risks to, the future implementation and sustainability of the WMO FFI, and propose strategies to minimize those risks. Risks include, inter alia, those of a financial, technical, operational and institutional/political nature;
7. Consider and propose plans for effective advocacy of the WMO FFI (as appropriate), and ways and means to assure its future sustainability and appropriate expansion;

8. Promote awareness about raising the social and economic benefits and value of flood forecasting systems, including a community development approach;
9. Review and advise on its terms of reference and composition.

### **Composition**

The WMO FFI Advisory Group shall be composed of:

1. The president of the WMO Commission for Hydrology (chair);
2. One representative with flood forecasting experience from CHy, and representatives of other WMO Technical Commissions as and when needed;
3. One representative from each active financial partner involved in the WMO FFI projects.

### *Observers*

1. Representatives from WMO FFI operational projects invited on an ad hoc basis;
2. Representatives from relevant WMO Programmes as required;
3. Regional Hydrological Advisers and/or representatives of regional association working groups on hydrology;
4. Representatives of potential financial partners that could contribute to the WMO FFI.

The Director of the Climate and Water Department of the WMO Secretariat shall act as secretary to the WMO FFI-AG.

Resolution on the web (please see page 200 of Cg(16) Abridged final report with resolutions, WMO-No. 1077):

[https://googledrive.com/host/0BwdvoC9AeWjUazhkNTdXR XUzOEU/wmo\\_1077\\_en.pdf](https://googledrive.com/host/0BwdvoC9AeWjUazhkNTdXR XUzOEU/wmo_1077_en.pdf)

**Updated WP 2. It corresponds to a review of the activities “Done” or “To Do” established on WP 2 - Workplan (2016-2019) Version 2.0 – updated on December 7, 2017**

*This Workplan was developed at the Third Session of the Flood Forecasting Initiative – Advisory Group (FFI-AG), held December 5-7, 2017, Geneva, Switzerland. The activities relate to the Terms of Reference for the FFI-AG as documented in the Annex to Resolution 15 (Cg-XVI) and to the changes agreed upon during discussions on Task 1 and Task 4 of the FFI-AG Workplan (2013-2016) Version 2.0. The expected deadlines of individual tasks are agreed upon by the FFI-AG and the person(s) responsible for it. The Workplan will be periodically updated as the status of the implementation of Tasks change.*

**Preamble:**

The Flood Forecasting Initiative (FFI) is a framework to promote the enhancement of flood forecasting capabilities of National Meteorological and Hydrological Services (NMHSs).

**Task 1:** by ensuring that all major demo projects and components, including but not limited to CIFDP, SWFDP, FFGS, include the requirements/best practices for effective\* and sustainable flood forecasting in their design and implementation;

**Task 2:** by ensuring guidance material is available for NMHSs and for donors, NGOs, and other organizations working to strengthen flood forecasting capabilities in national services;

**Task 3:** by facilitating the development of an inventory of existing training programmes and related reference materials across the entire spectrum of training needs for E2E systems for flood forecasting, identifying weaknesses/gaps, and recommending development of additional materials to overcome weaknesses/fill gaps;

**Task 4:** by ensuring access to guidance material and training through the IFM HelpDesk.

**Task 1 – Items** (Governance and advice)

*by ensuring that all major demonstration projects and components, including but not limited to CIFDP, SWFDP, FFGS, include the requirements/best practices<sup>7</sup> for effective and sustainable flood forecasting in their design and implementation.*

1. President and members of the FFI-AG to report on progress and collaborative actions to appropriate bodies on FFI-AG advice
2. FFI-AG to advise CHy on continuing the efforts associated with assessing efficiency (effectiveness) of service delivery capabilities of hydrological services (link to existing report Nov 2013) including the quality of data and maintenance of observation networks – H. Lins by AWG-3 (Feb 2016)<sup>8</sup> (**Done**)

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<sup>7</sup> Refer to Task 2 item 1.a

<sup>8</sup> A.L. Aldana volunteered

3. Advise the President of CHy that the Vice-Chair of the CIFDP Steering Committee be taken from CHy – accomplished December 2015 (**Done**)
4. Take similar action for the SWFDP (President CHy to coordinate with President CBS on CHy reOn the SWFDP Steering Group) – H. Lins by end Jan 2016 (**really not Done, alternate arrangement needs to be made**)

## **Task 2 – Items** (Assessment guidelines and related material)

*by ensuring guidance material<sup>9</sup> is available for NMHSs and for donors, NGOs, and other organizations working to strengthen flood forecasting capabilities in national services*

1. Recommend to CHy that it establish a team to develop assessment guidelines for End-to-End Early Warning Systems (E2E EWS) for flood forecasting (outcome of the task 1 item 3), based in part on the WMO Manual on FF&W – CHy (through AWG); by Feb 2016 (**Done**)
  - a) Development of generic and living list of requirements/best practices (e.g. open source codes, free and open exchange of hydrometeorological data) to be taken from the existing materials – CHy (Y. Simonov) by CHy XV (Dec 2016) (**To Do**)
  - b) Develop an inventory on what is available and what is missing in WMO and outside WMO to set up an E2E EWS for flood forecasting – Secretariat by CHy XV (subsequent to Dec 2016) (**To Do**)
  - c) Based on inventory and report of November 2013, develop assessment guidelines that point to technical reference material to strengthen weaknesses – ongoing iterative process through 2018 - (**CHy has underway**)

## **Task 3 –Items** (Training and guidance material)

*by facilitating the development of an inventory of existing training programmes and related reference materials across the entire spectrum of training needs for E2E EWS for flood forecasting, including the identification of weaknesses/gaps, and recommending development of additional materials to overcome weaknesses/fill gaps.*

1. Develop an inventory on what is available and what is missing in terms of training programmes – Secretariat by CHy XV (Dec 2016) (**CHy has underway**)
2. Based on inventory, develop prioritized list of training materials that should be developed – Secretariat by CHy XV (**after Task 3.1 accomplished, CHy lead**)
3. Identify relevant training programmes and reference materials within WMO as well as non-WMO programmes related to FF&W – Secretariat by CHy XV (**To Do**)

## **Task 4 –Items** (Use of the IFM HelpDesk)

*by ensuring access to guidance material and training through the IFM HelpDesk*

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<sup>9</sup> recognizing that different audiences need different services (guideline documents for each stakeholder - NMHSs, donors, general public)

1. Request the APFM TSU to undertake an inventory of the existing guidance material and/or training material and/or expertise through its Support Base already available through the HelpDesk on FF&W – March 2016 (To Do)
2. Request the APFM TSU to design an appropriate and functional interface to offer assistance (Get Help and Help Yourself) in the field of FF&W and solicit feedback from selected FFI-AG members (including link with CHy team under task 2.1) – June 2016 (To Do)

## Overview of activities taken into consideration by the FFI-AG

### Main Flood Forecasting activities

The presentations in the 3<sup>rd</sup> Meeting of FFI-AG provide an excellent compendium of the FFI-related projects that have been taking place. A brief overlook of each presentation is given in this annex.:

Presentation	Presenter	From
<b>CoP</b> - Establishing a Community of Practice for Flood Forecasting	Mr Claudio Caponi	WMO Secretariat
<b>SWFDP</b> - Severe Weather Forecast Demonstration Project and twinning of SA-FFG and SWFDP-SA	Mr Eugene Poolman	South African Weather Service
<b>CIFDP</b> - Coastal Inundation Forecasting Demonstration Project (including JCOMM-CHy independent review)	Mr Edgar Cabrera	WMO Secretariat
<b>CHAMP</b> - Coupled Hydrology Atmospheric Modelling and Prediction and Seamless Forecasting and/or other FFI related activities	Mr Vincent Fortin	Hydrological Forecasting Environment and Climate Change Canada
<b>FFGS</b> - Global Flash Flood Guidance System implementation	Mr Ayan Sayin	WMO Secretariat
<b>CAFFG</b> - Central America FFGS implementation	Mr Roberto Cerón	Ministerio de Ambiente y Recursos Naturales El Salvador

Table 1. Presentations about FFI-related projects

**CoP** on FF: following a meeting of the CoP on FF in November 2017, a common understanding of its concept was reached among the Task Team members. The work plan for the implementation of the CoP spans to last quarter 2020, and it is planned to launch officially the CoP on the occasion of CHy-16 in 2020. More information on this activity can be found in the CoP on FF meeting report available at [this link](#).

**SWFDP**: this project, at present, covers eight sub-regions and provides over 75 developing countries weather information upon which to base warnings of hydro-meteorological hazards. It focuses on improving severe weather forecasting by applying the “Cascading Forecasting Process” through Numerical Weather Prediction. The current system generates QPF (quantitative

precipitation forecast) products at 5x5 km spatial resolution to 5 days, but in some regions products are available at 2x2km up to 48 hours. All projects have included regular training programme based on the regional and national needs. Further SWFDP component implementation in others regions is subject to availability of funding.

**CIFDP:** since 2009 the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) and the CHy implemented this project with the goal of reducing vulnerability in coastal areas and to reduce the risk of disaster from flooding. The presentation highlighted CIFDP integration of river flow, storm surge, wave and flood forecasting to enhance coastal inundation forecasting and warning systems, that can be sustained by the responsible national agencies. It has been implemented in four countries from the tropical belt in different regions. A review of the CIFDP has been requested by JCOMM and CHy.

**CHAMP:** this project is mainly focused on improving the atmospheric, hydrological and hydrodynamic forecasting by coupled numerical modelling of these three components. A real-time coupling of models was implemented and is operational in the Great Lakes region of USA and Canada that provides forecasts of the physical state of the hydrosphere using different models in each country. It was shown that in larger watersheds the forecasts have better performance. This projects plans at later stages to increase the resolution of the atmospheric model component from 10 km to 2.5 km and improve data assimilation of streamflow observations and lake levels.

**FFGS:** this system is currently available in more than 60 countries, and it generates flash flood early warning products using, in part, state-of-the-art hydrometeorological forecasting models. The FFGS is an operational WMO project linked whenever possible with the SWFDP project to improve flash flood forecasting. Central America is a pioneer in the implementation of the FFGS, and its **CAFFGS** ongoing project provides guidance products, in real time, related to flash floods. Servers have been installed in Costa Rica for gathering data from participating countries and product generation and dissemination. Hence, future activities will focus on increasing data availability, monitoring operational processes, and performing verification studies. FFI-AG proposed to have an external review of the FFGS, in line with the one performed for CIFDP or APFM.



Linked Flood Forecasting activities

Synergy between some organisations, projects or activities has been created contributing to enhancing the collaboration between the meteorological and hydrological national services for improved flood forecasting practices, which is the purpose of the FFI. In the following table the presentations made during the FFI-AG meeting are summarized.

Presentation	Presenter	From
<b>USAID</b> - United States Agency for International Development	Ms Sezin Tokar	USAID. USA
<b>WBG</b> - World Bank Group	Mr Daniel Kull	World Bank Group Switzerland
<b>CREWS</b> -Climate Risk and Early Warning Systems	Ms Silvia Llosa	CREWS Secretariat Switzerland
<b>CREWS Burkina Faso Project</b>	Mr G. Teruggi	WMO Secretariat
<b>APFM</b> - Associated Programme on Flood Management - Results from independent review of the programme and its new direction and business/costing model	Mr G. Teruggi	WMO Secretariat
<b>WMO Global Conference</b> on Prosperity through Hydrological Services	Mr Claudio Caponi	WMO Secretariat
<b>CHy activity:</b> Preparation and provision of hydrological forecasting requirements on how to formulate numerical weather prediction information for use in flood forecasting to the SWFDP Steering Group	Mr Yuri Simonov	Hydrometeorological Centre of Russia Russian Federation

Table 2. Presentations on activities linked to FFI

Each of these presentations highlighted the aspects related to Flood Forecasting and Early Warning System, mainly focusing on developing countries. The **USAID** presentation recalled that the number of natural disaster caused by hydrometeorological events are increasing in the last years, where flood events count for 43% of the events with flash floods accounting for the highest mortality rate globally. It was noted that there is a global increasing trend in flood related losses. USAID has promoted the development of many projects such as the FFGS. It also continually supports other initiatives, such as CIFDP, WRN (Weather-Ready-Nation), Regional and Global Trainings, and Mentoring.

The **WBG** representative remarked that it is a bank and not a donor. It was mentioned that many loans have been assigned to Flood Risk Management and related activities where WMO have provided technical expertise. During the **CREWS** presentation, Ms Llosa mentioned that the initiative was launched in 2015 at Paris COP21, with the objective of increasing the capacity of Least Developed Countries and Small Island Developing States to generate and communicate effective, impact-based, multi-hazard, gender-informed early warning. It was mentioned that the current focus areas are African countries and the Pacific region. In the framework of CREWS, Mr Teruggi presented the first findings from an assessment visit in the framework of the **CREWS** component in **Burkina Faso**.

The **APFM** presentation highlighted the outcomes of the independent review performed in 2016 following the first 15 years of APFM activity. It was made clear that there is a need to continue implementing IFM but using a new approach. It was also specified that this program was mostly dependent on reimbursable funding but there was no business model was available to assist it and staff in working with donors to obtain funding. To this end, a Business Model is being implemented, combining WMO and GWP contributions, developing project proposals to be submitted to major funds, and seeking funds of financial partners to support in the APFM core activities (such as development of guidance material, management of the HelpDesk and of its related network of SBPs). The review also called upon the need to increase focus on E2E EWS for flood forecasting.

Mr Claudio Caponi announced to FFI-AG that WMO is planning a global conference from 7 to 9 May 2018 titled "**Water Conference**" to create better interfaces between hydrological services and decision-makers in order to generate better social benefits. It will also allow the promotion of water related activities of WMO and its partners (UNESCO-IHP, UNECE, etc.), which have been already contacted to express their interest through an engagement matrix. It might therefore be of interest to the FFI-AG to make use of this opportunity to showcase some of the FFI outputs.

Regarding to **CHy activities**, Mr Simonov showed in his presentation that as the rainfall-runoff is a non-linear process, it is necessary to ensure reliable and accurate rainfall forecasts in order to reduce the amplification of errors in the hydrological modelling process. In this sense, the NWP rainfall outputs need to be consistent with the real-time gauge rainfall data (e.g. in spatio-temporal structure..); also the NWP spatial resolution should be adapted to finer scales making their products more suitable for hydrological applications such as flood forecasting.

Another FFI activity was related to the **pilot project** to extend the **EWS** of Durazno to the cities of *Artegas and Treinta y Tres in Uruguay*. This pilot was implemented by WMO over the period 2013-2015 through Fundación Julio Ricaldoni (Uruguay). Its aim was to apply a coupled model (hydrological and hydrodynamic, using U.S. Army Corps of Engineers HEC packages) fed by real-time data for the Cuareim and Olimar rivers. Additional information is however needed from Fundación Ricaldoni to assess the performance of the coupled model.

## List of presentations and their linked URL address

### Concerning Work Plan 2016-2019

[On Task 01](#): Governance Advise

[On Task 02](#): Interoperable Technologies

[On Task 02](#): Assessment Guidelines

[On Task 03](#): Available Missing Training Programmes

[On Task 03](#): Relevant Training Programmes for E2E for Flood Forecasting

[On Task 04](#): HelpDesk Interface Support for Flood Forecasting

### Concerning main Flood Forecasting activities

[CoP FF](#) – Community of Practice on Flood Forecasting

[SWFDP](#) - Severe Weather Forecast Demonstration Project

[SWFDP-SARFFG](#) – SWFDP Southern Africa Region Flash Flood Guidance System

[CIFDP](#) - Coastal Inundation Forecasting Demonstration Project

[CHAMP](#) - Coupled Hydrology Atmospheric Modelling and Prediction and Seamless Forecasting

[FFGS](#) - Global Flash Flood Guidance System implementation

[CAFFGS](#) - Central America FFGS implementation

[USAID](#) - United States Agency for International Development

[WBG](#) - World Bank Group

[CREWS](#) - Climate Risk and Early Warning Systems

[CREWS Video](#)

[CREWS Burkina Proposal](#)

[APFM](#) - Associated Programme on Flood Management

[WMO Global Conference](#) – Water Conference

[NWP for FF](#) – Numerical Weather Prediction for Flood Forecasting (a)

[NWP for FF](#) - Numerical Weather Prediction for Flood Forecasting (b)

[EWS Pilot Project Uruguay](#) – Early Warning System initiative in Uruguay