EXPERT MEETING: IMPROVING THE EFFICIENCY OF FLOOD FORECASTING SERVICES

Development of a Framework for the Assessment of Service Delivery Capabilities of Hydrological Services

A contribution to the WMO Flood Forecasting Initiative

12 to 14 October 2011
WMO Headquarter, Geneva

FINAL REPORT

Opening of the Expert Meeting

The Director of the WMO Water and Climate Department, Mr. A. Tyagi welcomed participants of the meeting.

In the light of recent flood disasters, he stressed the point that flood forecasting services world wide need to be improved and an adequate framework is needed to engage in activities to achieve this objective in WMO member countries. Mr. Tyagi pointed out that the way in which flood forecasting messages and information are conveyed to both institutional users and the general public is of paramount importance to make forecasting services ultimately useful and effective in saving lives and livelihoods. In this context he mentioned the 2010 flood events in Pakistan. In the context of the expert meeting he mentioned that there is a need to set up a framework where hydrological services tasked with flood forecasting can assess human and professional capacity and then communicate this to policy makers. To give a clear picture, there is a need to provide objective information to decision makers demonstrating current flood

forecasting capabilities and the efficiency of flood forecasting services with a view for their improvement.

The agenda of the Expert Meeting is attached as annex 1 to this report and likewise the list of participants in annex 2. A Glossary of important terms used in the report is provided in annex 3.

Background

Mr. W. Grabs provided a presentation on the key elements of the Strategy and Action Plan (SAP) of the WMO Flood Forecasting Initiative (FFI). Since its establishment in 2003, the objective of the WMO Flood Forecasting Initiative has been 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.

The Strategy and Action Plan (SAP) of the WMO Flood Forecasting Initiative promotes the preparation of national implementation plans. These have to be adapted in accordance with current national and regional flood forecasting capabilities, specific requirements and priorities. 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.

The SAP states that flood forecasting services in many parts of the world do not meet requirements with regard to timeliness, accuracy and user demands. The Activity Plan that has been developed in December 2009 to supplement the SAP provides for a comprehensive overview of activities to improve flood forecasting services in a number of action domains that are critical for flood forecasting, including an improved cooperation between national meteorological and hydrological services and the enhancement of the efficiency of flood forecasting services. The Expert Meeting contributes in particular to three action domains of the SAP, namely:

- Improvement of Hydrological Forecasting Practices and Products
- Strengthening of Institutional Coordination, Cooperation and Integration between NMSs and NHSs
- Formulation of Technical Documentation and Guidelines related to Flood Forecasting

Documents related to the Strategy and Action Plan can be found under:
http://www.wmo.int/pages/prog/hwrp/FloodForecastingInitiative.php

The workshop report summarizes results of discussions and recommendations for further follow-up with a view to develop, establish, test and implement a mechanism that allows the assessment of the efficiency of flood forecasting services provided by agencies that are mandated to issue flood forecasts. This does not entail at this level an assessment of an en-to-end process but limits itself at this phase of its development to the flood forecasting service itself, leaving out aspects of i.e. user-effectiveness, an issue that is important and could be considered in another development phase of the assessment mechanism.

Participants also pointed out that river floods and flash floods should be addressed separately as they entail different forecasting mechanisms and tools, different lead times and even different forecasting and prediction skills.

Rationale of the Expert Meeting

As stated in the Activity Plan of the FFI Strategy and Action Plan, the SAP states that flood forecasting services in many parts of the world do not meet requirements with regard to timeliness, accuracy and user demands. This situation calls for the development of a framework for the assessment of service delivery capabilities of hydrological services with regard to flood forecasting. In particular, the methodology to be developed aims to provide the tools and methods on how a flood forecasting service could be assessed and potential identified for its improvement.

Rationale for an Assessment

Assessments would assist an organization to establish performance benchmarks and to perform a SWOT analysis. In return the results of the benchmarking and SWOT analysis provides the information that is required to define a service improvement plan, leading at its end to an improved effectiveness of flood forecasting services. Participants noted that improved efficiency of flood forecasting services provide an important support for Disaster Risk Reduction (DRR) activities.

Expected outputs from the meeting

Participants reviewed the expected outputs of the meeting and agreed on the following list of outputs:

- Develop a methodology to provide the tools and methods on how flood forecasting service could be assessed and identify potential for its improvement
- Elements of an objective analysis framework to assess flood forecasting services
- Draft benchmark procedure for forecasting services
- Draft criteria and grading scheme for FF service assessment

- Outline of a SWOT Analysis
- Phases of an assessment procedure
- Establishment of a Task Group for follow-up

Participants also commented on issues strongly related to the effectiveness of flood forecasting services while recognizing that these considerations reach beyond the immediate objective of the workshop. Some of these comments are summarized below:

Institutional issues need to be considered including institutional capabilities related to decision-making, communication and outreach and enforcing procedures that need to be embedded in a legal framework supported by by-laws (ordinances, instructions..);

General observations that can be often made include: missing protocols on exchange of information between national organizations; lack of coordination and data exchange in trans-boundary river basins; lack of local scale coordination in risks areas; no coordinated memory consolidation on historical events, lack of disaster coordination and action plan) and infrastructural levels of challenges (including insufficient monitoring networks. A benchmarking procedure should strive to include some of these issues noting however, that the entire assessment procedure needs to be simple and transparent as highly complex assessments would suffer from transparency and possibly credibility by users.

The European, Flood Directive was cited that forces countries to follow the rules set in the directives. Participants recommended investigating whether the Flood Directive contains materials that could be used in support of the development of the assessment procedure. Could go through the Directives and check if something can be used.

Participants felt that there is a need to include flood risk mapping in the forecasting service. This should include flood plain inundation forecasting as part of the forecasting services.

Quality Management in Hydrology and proposed activities to improve flood forecasting services

Participants realized the importance of quality management at all levels as a fundamental component in the improvement of flood forecasting services. Subsequently, Mr. Bruce Stewart made a presentation on the Quality Management Framework – Hydrology as developed by the Commission for Hydrology (CHy). It was pointed out that the main focus is improving the quality of the processes implemented in the National Hydrological Services in activities from taking of observations to the production and dissemination of products and services, including the quantification of uncertainties. CHy has chosen both

standardization of measurements and observations and the status of regulatory and guidance documents/manuals as priority areas of their QMF initiatives. The QMF-H therefore has applications for the improvement of flood forecasting and warning systems and services and the activities of this expert group were seen as important in the identification and development of guidance and materials for improving the efficiency and effectiveness of flood forecasting and warning systems. It was therefore recognized that it was important to maintain a connection between this activity and the evolution of the QMF-H.

Discussion on the proposed methodology to assess efficiency of flood forecasting services

Development steps of the methodology

Conceptually, an objective analysis framework needs to be elaborated that provides details of different capabilities of hydrological services providing flood forecasting. A categorization of capabilities of hydrological services has been outlined in the Strategy and Action Plan.

- A benchmark procedure has to be established for all Action Domains (documented in the SAP) relevant for the forecasting service. Likewise a grading scheme for the assessment, using a catalogue of assessment criteria and weighing factors for Action Domains needs to be established.

- Templates need to be created that allow matching of benchmark criteria with assessment results and provide a forward looking perspective towards the projected institutional and technical capabilities of a given flood forecasting service.

- The entire assessment procedure and description of methodology and assessment process needs to be documented, and training manual for evaluators compiled that allows teams of evaluators to perform assessments of flood forecasting efficiency).

As a way forward, participants recommended to:

- Provide a limited set of case studies…
- Test methodology in selected services
- Where necessary, amend methodology and associated procedures
- Evaluate against a set of minimum objective criteria

The Prime benchmark of the assessment should be: Are user requirements met?

In continuing the discussion, participants developed a basic list of criteria that needs to be considered in terms of institutional and infrastructural issues as well as economic issues:

Institutional issues:

- End-user requirements (demand-driven, supply of information (supply-driven)
- Cooperation and coordination (such as: between institutions and also transboundary…)
- Communication
- Management of information
- Skill levels, capacity building
- Tacit knowledge (institutional memory and also empirical knowledge of long-term experienced staff)
- Empowerment of distributed entities (regional centers or such as community-based systems…)
- Roles and responsibilities set around fixed standards, protocols and procedures (established hierarchies)
- Legal framework that provides a sound mandate for services to be delivered? Legitimation

Infrastructural issues/Technical

- Data acquisition (observations, network adequacy….)
- Data management
- Quality assurance
- Models both hydrological, hydraulic and meteorological (adequacy of models) and model operators (skills)
- Communication
- Distribution and dissemination of information (adequacy, timeliness…)
- What type of information (general, tailor-made)
- Quantification of forecasting uncertainty!
- Performance (technical)
- Quantify performance
- (How to improve)

Participants noted that the uncertainty of forecasting services needs to be communicated to the public. It is however realized that many decision-makers would not yet know how to work with uncertainties as they are used to fixed numbers.

Economic issues

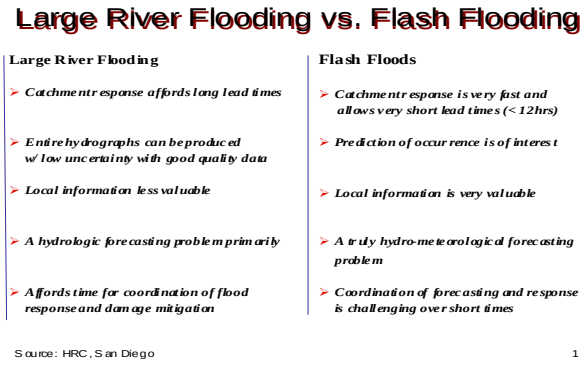
Economic issues determine the sustainability of flood forecasting services and relate basically to the availability of resources to maintain vital services operational. One tool to quantify resources is cost-benefit calculations of the value of services provided.

Development of elements of an objective analysis framework on capabilities of hydrological services providing flood forecasting services

Main discussion item had been to develop elements of a draft benchmark procedure for Action Domains documented in the SAP that are relevant for the assessment of a flood forecasting service. Starting points are:

- Identification of benchmark criteria against which to measure performance.
- Countries that "have nothing" will not be considered.
- Assess how well user requirements are met.
- Objective criteria: meeting user requirements
- At the end of assessment procedure a SWOT analysis serves to outline pathways that allow flood forecasting services to improve their services.

The table bellows provides an overview of characteristics of both river flooding and flash floods as participants noted the differences in procedures and capabilities to providing effective services.



More details are given below for the three categories identified in the previous chapter looking at riverine and flash floods separately. Participants agreed that at this stage coastal and urban floods will not be considered in the assessment process. Participants recommended to first look at riverine floods and adjust approaches where necessary for flash floods.

Develop a draft benchmark procedure for Action Domains (documented in the SAP) relevant for the forecasting service.

Following the previous discussions, participants agreed on the following bench-marking criteria:

Institutional:

End-user requirements (demand-driven, supply of information (supply-driven)

- End-users and their requirements identified (stake-holders (i.e. farmers, small business….), sector-line agencies, other cooperating agencies (such as National Disaster Management)…
- Requirements of end-users in terms of timeliness, frequency of updates, accuracy of forecasts, information that is understood and can be interpreted by end-users into actions
- Is regular information/awareness building done for the sectors and stake-holders

Organizational framework

- Legal mandate established recognized and respected by end-users and other relevant organizations
- Adequacy of organizational structure for FF
- Clear responsibilities
- Short decision-making paths
- Clear and established information flow including protocols,
- Standing Operating Procedures
- Roles and responsibilities set around fixed standards, protocols and procedures (established hierarchies)

Cooperation and coordination (such as: between institutions and also transboundary…)

- Cooperating partners identified
- Communication pathways established and routines followed (protocols)
- Established procedures based on cooperation agreements (such as MoU) for sharing data and information
- Existing emergency communication procedures established

Management of information

- Mutual accessibility of information
- Transparency of availably information
- Adequate data and information management systems established

- Common Glossary of terms
- (From management perspective (not technical): Interoperability of data systems from different platforms /providers)
- Regular information updates
- Quality Management Framework
- Review procedure in place to assess adequacy of data and information provided
- Flexibility of data/information management systems (use of data from other organizations)
- Availability and accessibility of historic records including data rescue activities

Skill levels, capacity building

- Number of adequately skilled professionals
- Number of adequately skilled technical personnel
- Number of adequately skilled observers and technical support staff
- Range of expertise
- Skill level adequate to operate flood forecasting models
  - *In case of flash floods: skill levels are adequate to operate flash flood guidance systems or now-casting methods*
- Staff motivation (recognition of services, career development, promotions…)
- Capacity building activities (opportunities for capacity building regular upgrade of skills, introduction to new technologies)
- Internal training programs
- External training programs
- Certification of achieved skills after trainings

Tacit knowledge (institutional memory and also empirical knowledge of long-term experienced staff)

- Institutional transfer of knowledge (staff near pension age to transfer skills and experiences to younger staff in skill transfer activities)
- Distribution of age in organization
- Documentation of best practices

Empowerment of distributed entities (regional centers or such as community-based systems…)

- Community-based (*flash*) flood forecasting systems, established by central agency but maintained by local communities (in selected cases (criteria: limited accessibility, remoteness, lack of telecommunication….), as an outreach of FF services out of reach of central agency.

Infrastructural issues/Technical issues

Data acquisition (observations, network adequacy….)

- Adequacy of observation network to meet requirements (considering also the occurrence of extreme flood events)
- Adequacy of instrumentation
- Operational status of stations including maintenance
- Rating curves regularly updated
- Adequacy of telecommunication systems (reliability, robustness of transmission systems (fallback procedures (using different means of communication, power back-up (UPS))…)
- Standing Operating Procedures (SOPs) for observations existing and enforced
- Availability of geographic information data (i.e. for flood/*flash flood* mapping)

Data management

- Availability of historic records
- Availability of metadata
- Life Databases in place (for forecasting system)
- Archiving database in place
- Quality assurance of observational data
- Interoperability of different databases (such as for precipitation water levels, discharge and others (to be specified))
- Documentation and archiving of flood forecasting information (such as actual forecasts)
- Intake and management of real-time data
- Archive of historic floods

Models both hydrological, hydraulic (adequacy of models)

- Models or other forecasting tools (simple regressions, empiric formula…) used are sufficient to meet user requirements
- Models are regularly re-calibrated
- Adequacy of computing resources and associated hardware
- Validation procedures exist and are followed
- Adequacy of data (type and quantity/quality) to drive the model(s)
- Use of GIS information for flood forecasting (important for flood plains and flood mapping!)
- Capability of the system to integrate multiple data sources (data assimilation), including meteorological information (QPE, QPF, Radar, NWP, soil moisture, satellite data…)
- Ability to run forecasting scenarios

Communication

- Documentation of the Information and Communication System related to FF
- Adequacy of communication infrastructure to the FF agency, within the agency and out of the agency

Dissemination of information (adequacy, timeliness…)

- What type of information (general, tailor-made)
- Generation of Flood (risk) maps in place
- Quantification and communication of forecasting uncertainty!
- Means of distribution of FF information (web, sms, phone, fax, bulletins…sirens)
- Adequacy of information provided: Is information in a format to be understood and interpreted by users
- Does forecast needs user requirements

Performance (technical)

- Fallback procedures and trouble shooting procedures established and followed (in case of observation network failures, broken communication lines…)
- Robustness of the FF system (system can work with less data than the system was designed for to use
- Performance monitoring (i.e. using indicators) established and used

Cooperation (such as between institutions and also transboundary)

- Instructions and procedures in-place on lines of command and information, focal points in different institutions
- Type and amount of information including timelines for information and quality requirements
- Action items defined for each receiving point of information
- Monitoring and evaluation of cooperation effectiveness reflecting as a minimum the above mentioned criteria

Economic issues

Budget allocated to FF services

- Availability of resources to maintain vital services operational (such as O&M budget…) (include: salaries, standing costs, administration, O&M, new instruments, cost of computational hardware, capacity building license fees for models, telecommunication costs….)
- Accountability for resources used for the provision of FF services

Sustainability of services

Ensuring continuous, long-term operation and function of FF services

- 24/7 year-round services ensured
- Stable organization
- Long-term budget availability
- Maintenance of skills levels and sufficient staffing
- Continued demand for FF services
- Market-orientation of FF services (self-sustainability issue)

Development of a Draft Grading Scheme for the Assessment of the Efficiency of Flood Forecasting Services

Participants concluded that a grading scheme would be appropriate in the assessment process and proposed the methodology as outlined below.

Methodology:

Grading (scoring) is undertaken on a numbering basis on a scale 0 to 3. Achieving full overall score against all criteria would mean an overall efficient flood forecasting service on the basis of the criteria identified. Institutional issues and technical issues are considered equally important. No relative weights are assigned.
Issues out of control of the institution that delivers Flood Forecasting services (such as budget allocation) are not considered in the scoring exercise.

Meaning of numbers:

0: Not existing or not available
1: Minimum available or existent to perform flood forecasting services on a very rudimentary level,
2: Available or existing to perform flood forecasting services on a satisfactory level,
3: Fully existing or available, fully satisfactory flood forecasting services,

Out of 100% total score, efficiency of FF services is ranked as follows:
Achievement of

0 – 40 Not yet meeting user requirements
41 – 70 Partly meeting user requirements
71 – 100 Overall meeting user requirements

Summary of topics for benchmarking and rating

	Number of topics	Max rating	Sub-total	%
Institutional			**114**	**47,5**
End-user requirements (demand-driven, supply of information (supply-driven)	3	9		
Organizational framework	7	21		
Cooperation and coordination (such as: between institutions and also transboundary…)	4	12		
Management of information	10	30		
Skill levels, capacity building *Tacit knowledge (institutional memory and also empirical knowledge of long-term experienced staff)*	10 3	30 9		
Empowerment of distributed entities (regional centers or such as community-based systems…)	1	3		
Infrastructural issues/Technical			**102**	**42,5**
Data acquisition (observations, network adequacy….)	7	21		
Data management	9	27		
Models both hydrological, hydraulic (adequacy of models)	8	24		
Communication	2	6		
Dissemination of information (adequacy, timeliness…)	5	15		
Performance (technical)	3	9		
Economic issues			**6**	**2,5**
Budget allocated to FF services	2	6		
Sustainability of services			**18**	**7,5**
Ensuring continuous, long-term operation and function of FF services	6	18		
TOTAL	80 topics		240	

If threshold 40 % = 96 points
If threshold 70 % = 168 points

Matching Assessment Results with Benchmark Criteria

The assessment results are benchmarked to the categorization of National Meteorological and Hydrological Services in three capability levels that are part of the SAP of the WMO Flood Forecasting Initiative. The categorization is shown in annex 4 to this report.

Typically, a score of 0 – 40 relates to Level I services, like wise a score between 41 – 70 to a Level II service and 71 to 100 to a Level III service.

Implementation Issues: Applying the Assessment Methodology in Practice

Participants agreed that well-defined procedures were required to implement the Assessment methodology in practice. Other than proposed in the SAP the idea of a life-assessment was skipped as it was seen as too complex at this point and also would require intensive preparations for the exercise. A life assessment would have been conducted for a few days within the organization providing the flood forecasting services in a life simulated flood forecasting scenario and testing the reaction of responsible staff to various critical scenarios (weather conditions, overtopping of banks, damage of networks and/or communication systems, non-plausible model results…). Instead, the workshop participants favored the approach outlined below. As with all other methodologies outlined in the workshop report, participants were cognizant of the necessity that a follow-up task group would go into much more detail to fine-tune methodologies and implementation approaches.

Setting-up of an Assessment Team

To prepare teams of evaluators for their mission, identified teams (preferably drawn from hydrological services with recognized standards in flood forecasting) need to be trained using assessment criteria and benchmarking procedures as described above. To be effective, a number of these teams in each WMO Region would need to be identified and trained. Once a flood forecasting service has requested for an assessment (***note:*** all assessments to be undertaken exclusively on a voluntary, demand based request), the following steps could be envisaged:

Preparatory Phase

- Identification of development objectives and assessment of the present status of flood forecasting services and capabilities including identification of reporting lines and procedures;
- Agreement on the overall procedure for the assessment in terms of time, infrastructure used, and staff to take part in the assessment.

- Agreement on objectives and additional, service-specific criteria to be used for the assessment.

- Intense consultation with the requesting organization regarding insight in the methodology used and understanding the environment (environmentally, technically, institutionally..) under which the specific service is operating.

Assessment Phase

The actual assessment would last over a period of 3-4 days.

Phase I: General discussion with the concerned service and working through the benchmark criteria including scoring.

Phase II: Interview with the forecasting team on a list of specific topics with a view to obtain insight in the robustness and flexibility of the flood forecasting service in a real situation. Objective of the interview phase is to test the ability of the participating personnel to react and adapt to different situations. Issues in the interview would be such as: complications in the flood forecasting process such as a flood release from dams, overtopping of a levee, failure of critical gauging stations or means of communication, non-availability of critical meteorological data, breaks in the communication process or chain….).

Phase III: A SWOT analysis will be prepared based on the observations of the assessment team and the feed-back from officials of the hydrological service. This analysis can then be used by the hydrological service with advice from the assessment team to generate a foreword-looking quality management perspective with a focus to improve on flood forecasting services in critical benchmark criteria and overall performance. It needs to be noted, that the entire assessment procedure is undertaken on a relative scale, not comparing a Level I Service with the advanced capabilities of a Level III Service (see annex 4), but rather conducting the assessment in a way that would show the pathway to improve on one level. Participants remarked that especially this issue needs to be further discussed and clarified.

Phase IV: Preparation of an interim report and discussion of this report with concerned staff of the flood forecasting service.

Post assessment activities

Established by the service, an in-house Task Team could be established to work out on actions as a response to the results and recommendations of the assessment exercise.

Participants envisaged as an option, the planning and implementation of necessary improvement measures could be undertaken in form of a Technical Assistance project.

Outline of a SWOT analysis and Options for Improvements of Flood Forecasting Services

The SWOT analysis is the principal tool to develop options for improvements of flood forecasting services based on the results of the assessment exercise. The recommended actions are then proposed to be integrated into the institutional development and capacity building process of the service.

The SWOT analysis would be undertaken on the basis of the scores achieved and structured in the following manner:

Strengths
High-scoring benchmark criteria

Weaknesses
Low-scoring benchmark criteria

Opportunities
Improvement opportunities based on the identified weaknesses

Threats (Risks) – Implicit to the organization
Low scoring benchmark criteria that are especially critical for achievement of an effective flood forecasting service

Threats/Risks – External to the organization
(such as: Insufficient budget, budget cuts, staffing….)

Outline of an Instruction Manual for Assessment Teams

As outlined above, participants felt that as pre-requisite for the application of the assessment exercise, comprehensive guidance materials need to be developed ensuring that different assessment teams would conduct the assessment exercise in a fully comparable, highly standardized and objective manner. Participants recommended the outline for an instruction manual to be developed as shown below.

Table of Contents of the Instruction Manual for Evaluators

Introduction
    Signing up for an assessment (on-demand, voluntary base, confidentiality)
Preparation of an assessment agreement/Letter of Intent Elements of an agreement
    Purpose of the assessment
Selection of participants of the organization

Skill levels/ requirements for the assessment team

Selection of the assessment team
Confidentiality
Format of the assessment
    Dates, duration, local set-up
    Preparation on the side of the organization (based on consultations, questionnaires)
    Preparation on the side of the assessment team

Objective of the assessment of FF services
Expected outputs
Expected outcomes

Description of the general methodology

Definition of benchmark criteria
Introduction to the scoring system
Interpretation of the scores
Translating scores into a SWOT analysis

Preparatory phase
Assessment phase (benchmarking exercise, scoring, interviews)
SWOT Analysis
Discussion of results, recommendations
Presentation of results to the management of the concerned organization

Finalization of the final draft report
Endorsement by WMO's Technical Commission for Hydrology (CHy)

Proposed follow-up as a result of the assessment (as part of the recommendations based on the findings and subsequent discussions with representatives of the organization)

Proposal for an ex-post analysis that is an impact analysis after a specified time, i.e. after 1-2 years.

Preparation of the Assessment Plan (Subjects, timelines, resource allocation, activities, logistics ….), such as through a GANTT-chart.

Annexes to the Manual

Sample agreement/Letter of intent
Template for an assessment report
Template for the SWOT analysis
Benchmarking procedure and scoring tables
Glossary of Terms

Requirements for the Assessment Team

The professional skills of the assessment team are crucial to the success of the assessment exercise and indispensible to be trustworthy on the side of the service requesting for an assessment. Participants therefore recommended that the team consisting of 2-3 experts should consist of team members having specific skills including administrative, technical and operational experience. Overall, the team should be able to cover the issues documented in the benchmark criteria.

The team members should:

- have been working for a range of NMHS services covering different levels of service capabilities (such as described in the three categorization levels) and have operational knowledge;
- be well-versed and instructed of the content and objectives of the assessment as well as the assessment procedure itself;
- know the local language, or, if not, have a good proficiency in English or other language generally understood in the requesting service of a country.

Communicating the Benefits of Assessments for Flood Forecasting Services

The benefits that can be derived from an external assessment for the requesting need to be carefully promoted. The general view of participants has been that an assessment should provide a pathway to improvement, not a relative ranking of flood forecasting services, exposing their weaknesses. Some benefits are listed below:

- Motivation of forecasting teams
- Platform for identification for improvements
- Means to solicit enhanced external support (in-country and from external development partners)
- Advertise skills and service delivery capabilities to users

- Looking forward to improving service delivery capabilities
- Incentive for organizational/institutional reform
- Incentive for improved inter-agency cooperation
- ..
- ..

As an additional incentive for organizations to request external assessment, participants recommended to introduce a certification for the participating organization. This certification would not go to the extent of an ISO certification but basically could recognize visibly to the outside that a specific service has undergone an external assessment organized by WMO and receive a certificate of WMO to that effect, which could be seen as a sign for quality improvement of the service.

Elements of a Foreword-Looking Quality Management Perspective with a Focus to Improve on Flood Forecasting Services

Participants noted that the assessment of flood forecasting efficiency could constitute a major component of the Quality Management Framework (QMF) of WMO in general and in hydrology and water management in particular.

Participants recommended that a subject-oriented Task Group should be established (see below) to provide advice on what guidance materials CHy should produce in order to improve the QMF including:

- Guidance on institutional issues
- Guidance on technical issues
- Guidance on modeling
- On performance monitoring
- Cost-benefit of FF services
- Guidance on user-interface mechanisms
- Required capacity building and training activities
- …and more

Likewise, guidance on user-interface mechanisms should be added, depending on the end-user community). Participants noted that the application of standards needs to be embedded in all steps of the flood forecasting service.

Establishment of a Task Group "Assessment of Efficiency of Flood Forecasting Services"

The Expert Group recommended that a Task Team on **"Assessment of Efficiency of Flood Forecasting Services"** be established with the objective to finalize the assessment methodology and implementation materials for which this workshop had laid the ground base.

Members of the Task Team should be the participants of the meeting and including Dr Yan Huang who during a teleconference had agreed to be member of the team. The Expert Meeting strongly suggested that CHy needs to be represented in the team. Further Task Team members should come from national hydrological services. It is recommended that the total number of members of the Task Team should not exceed 10 experts; where further expertise is necessary, additional experts could be invited on an ad-hoc basis.

The preferred mode of work of the Task Team would be on the basis of email correspondence, regular teleconferences and at least one face-to-face meeting at an advanced stage of the preparation of the Guideline document.

Agreement on Deliverables and Terms of Reference

Finalize a peer-reviewed Guidance Document for the assessment of Flood Forecasting Services: The Instruction Manual is the principal deliverable of the Task Team.

Basic Terms of Reference are:

Actively participate in email correspondence and teleconference as required

- Review the meeting report and in particular make amendments, where appropriate to its contents (such as the benchmark criteria, scoring system…)
- Further elaborate the assessment methodology (including the interview part)
- Develop a more detailed implementation plan for assessment exercises
- Develop the templates as indicated in the meeting report
- Collect and integrate additional comments from expert relevant to the subject into the draft final document
- Participate in a formal editing meeting
- Assist in the peer review of the final draft document
- Prepare the final document for publication
- Prepare a procedure for the testing of the methodology
- Drafting of a shortlist of potential candidate services for testing the assessment

Proposed Follow-up Activities

- The report of the Expert Meeting should be discussed during CHy-14 and later on distributed through the CHy Portal to get additional comments and start to work. For example, comments should check whether the methodology is feasible and practical, if the scoring is balanced etc.
- Each participant of the expert meeting could send the report to 10 appropriate and "useful" people, and ask them for comments.
- The Strategy and Action Plan and other documents prepared for the meeting could be sent as well as background documents. If preferable, the links can be sent instead of as attachments.
- The date and time of a follow-up meeting should be determined as soon as possible once progress is achieved sufficiently to make the meeting of Task Team fruitful. The date and time of the meeting should be determined at least four months in advance.
- A short-list of potential candidate services for first assessment should be drafted before the editorial meeting.
- Overall peer-review needs to be sought from CHy

Next Steps: Agreement on a Work Plan and Milestones

- Finalize meeting report
- Seek guidance from CHy-14
- Place report on the CHy portal for comments and consider attaching links/attachments to baseline documents to the email correspondence
- Participants of the expert meeting will send the report to a number of suitable reviewers for comments
- Establish formally the Task Team
- Develop work plan for the Task Team
- Produce draft assessment document
- Develop guidance for expert reviewers
- Seek additional guidance from experts who have commented on the document earlier (with a short deadline) Get peer-review from CHy Conduct editorial meeting
- Publish document
- Drafting of a shortlist of potential candidate services for testing the assessment during editorial meeting

Closing remarks

Participants thanked Wolfgang Grabs for his useful ideas and experience, and for guiding the meeting in such an efficient way. Participants highlighted the usefulness of the wide range of expertise at the meeting that fostered fruitful

discussions. Participants thanked Paolo Reggiani for chairing the meeting. Participants also felt they were all on the "same tune".

Annex 1

EXPERT MEETING: IMPROVING THE EFFICIENCY OF FLOOD FORECASTING SERVICES

Development of a Framework for the Assessment of Service Delivery Capabilities of Hydrological Services

A contribution to the WMO Flood Forecasting Initiative

12 – 14 October 2011
WMO – Headquarter, Geneva

Agenda

WEDNESDAY, 12 OCTOBER

Morning Session (09:00 – 12:30)

Opening of the Expert Meeting

Expected outputs from the meeting

Introduction: Key elements of the Strategy and Action Plan (SAP) of the WMO Flood Forecasting Initiative (FFI)

Quality Management in Hydrology and proposed activities to improve flood forecasting services

Teleconference with Dr. Yan (China): Inputs from the perspective of the Yellow River forecasting services

Discussion on the proposed methodology to assess efficiency of flood forecasting services

Afternoon Session (13:30 - 17:00)

Country presentations on current practices in flood forecasting, highlighting on efficiency aspects

General discussion on technical and institutional aspects to improve forecasting service delivery under different settings and capabilities of hydrological services

Development of elements of an objective analysis framework on capabilities of hydrological services providing flood forecasting services

THURSDAY 13 OCTOBER

Morning Session (09:00 – 12:30)

Develop a draft benchmark procedure for Action Domains (documented in the SAP) relevant for the forecasting service.

Develop a draft grading scheme for flood forecasting service assessment

Matching assessment results with benchmark criteria

Afternoon Session (13:30 - 17:30)

Implementation issues: Applying the assessment methodology in practice

Issues to be considered in the preparatory phase of the assessment

Issues to be considered during the assessment phase

Proposed follow-up activities

FRIDAY, 14 OCTOBER

Morning Session (09:00 – 12:30)

Outline of a SWOT analysis and options for improvements of flood forecasting services

Outline of an Instruction Manual for assessment teams

Training requirements

Communicating the benefits of assessments for hydrological services

Afternoon Session (13:30 - 16:00)

Elements of a foreword-looking quality management perspective with a focus to improve on flood forecasting services

Summary of outputs from the Expert Meeting
Establishment of a Task Group “Assessment of Efficiency of Flood Forecasting Services”;

Agreement on deliverables and Terms of Reference

Next steps: Agreement on a work plan and milestones

Closing remarks

Annex 2

Expert Meeting, Geneva 12-14 October 2011
List of Participants

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* by teleconference

Annex 3

Glossary of Terms

The following terms are briefly explained to ensure a common understanding of the terms used in the outline to improve the efficiency of flood forecasting services within a framework for the assessment of service delivery capabilities of hydrological services for flood forecasting.

Overview of the WMO Flood Forecasting Initiative:

Developed in 2003, the WMO Flood Forecasting Initiative (FFI) is based on the analysis of weaknesses of current forecasting systems and with a focus to enhance the ability of National Hydrological and Meteorological Services (NMHSs) to cooperate in an effective manner to provide improved flood forecasting services. The objective of the initiative 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". The report can be found under: http://www.wmo.int/pages/prog/hwrp/FloodForecastingInitiative.html .

The synthesis report is available under:

http://www.wmo.int/pages/prog/hwrp/flood/wmo_FFI_StrategyActionPlan.html

Action Domains

In the context of the Flood Forecasting Initiative, an Action Domain describes a specific area where through a number of targeted activities improvements in flood forecasting services can be achieved. The Strategy and Action Plan as well as the Activity Plan identify 10 Action Domains including, amongst others: Improvement of Hydrological Forecasting Practices and Products, Improvement of Hydrological Forecasting Practices and Products, Promoting Training and Capacity Building in NMHSs, Strengthening of Institutional Coordination, Cooperation and Integration between NMSs and NHSs. See also: http://www.wmo.int/pages/prog/hwrp/documents/FFInitiativePlan.pdf

Activity Plan

The activity plan is part of the report documented under (http://www.whycos.org/hwrp/flood/pdf/FINALREPORT_09032010.pdf),

Annex 6 of this report provides the consolidated activity plan for the Strategy and Action Plan of the WMO Flood Forecasting Initiative.

Benchmark

Benchmarking is the process of comparing organizational processes and performance metrics to best known practices such as from other organizations that are taken as reference. Dimensions typically measured are quality, time and cost and, in the context of the workshop "Efficiency". In the process of benchmarking, best practices are identified, and the results and processes of those practices compared to the organization's one's own results and processes. In this way, Benchmarking is used to measure performance using specific indicators such as "Efficiency" resulting in a metric of performance that is then compared to others. Also referred to as "best practice benchmarking" or "process benchmarking", this process is used in management and particularly strategic management, in which organizations evaluate various aspects of their processes in relation to best practices of other organizations. This then allows organizations to develop plans on how to make improvements or adapt specific best practices, usually with the aim of increasing aspect of performance. Benchmarking may be a one-off event (such as through an assessment, but is often treated as a continuous process in which organizations continually seek to improve their practices. (Adapted from: Wikipedia)

Efficiency

Efficiency in general describes the extent to which time or effort is well used for the intended task or purpose. It is often used with the specific purpose of relaying the capability of a specific application of effort to produce a specific outcome effectively making best use of resources. Note that the term "efficient" is often confused and misused with the term "effective". In general, efficiency is a measurable concept, quantitatively determined by the ratio of output to input. Compare with "effectiveness", which is a vague, non-quantitative concept, mainly concerned with achieving objectives. In many cases, efficiency can be expressed as a result as percentage of what ideally could be expected, hence with 100% as ideal case, such as "perfect" flood forecasting services. (Adapted from: Wikipedia)

SAP Final Report

This report can be found under:
http://www.wmo.int/pages/prog/hwrp/documents/FFInitiativePlan.pdf

SAP – Supplement

The Supplement can be found under:
http://www.wmo.int/pages/prog/hwrp/documents/FFISupplement.pdf

Service Capability

In the context of "efficient flood forecasting services", service capability is understood as the capability of an organization to deliver flood forecasting information making best use of its resources (professionals, technical infrastructure, data and modelling, communication, organizational structure….) to deliver timely and accurate forecasting information. This may be benchmarked against best practices of other organizations to identify areas of improvement of a flood forecasting service.

SWOT Analysis

SWOT analysis is a strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in achieving an objective in an organization, here: Improved Flood Forecasting services. It involves specifying the objective of the organization (in flood forecasting) and identifying internal and external factors that are favorable and unfavorable to achieve that objective. A SWOT analysis starts with defining a desired end state or objective. A SWOT analysis may be incorporated into the strategic development model of the organization concerned. SWOT is particularly helpful in identifying areas for development.

Strengths: characteristics of the organization or flood forecasting team that give it a potential to deliver towards the objective of the service.
Weaknesses: are characteristics that place the organization or team at risk to not achieving a given objective or expectation.
Opportunities: *external* chances to improve on the current situation.
Threats: *external* elements in the working environment that could cause trouble for reaching an objective.

Identification of SWOTs is essential because subsequent steps in the process of planning for achievement of the selected objective may be derived from the SWOTs.
First, the decision makers have to determine whether the objective is attainable, on the basis of the SWOT. If the objective is NOT attainable the objective needs to be re-defined and the process repeated. (Adapted from: Wikipedia)

Annex 4

Categorization of National Meteorological and Hydrological Services (NMHSs)

(based on 86 countries, status 12/2006)

- ***Level I*** - Flood forecasting and warning services are limited or not operational, and a significant upgrading and strengthening of the basic data collection and transmission networks is required. In these cases there is insufficient network coverage and data exchange to enable a sufficient amount of data for hydrological forecasting. Generally, there is very limited coordination between NMSs and NHSs, as well as weak dissemination of warnings to users. Some countries issue only qualitative weather forecasts and only a simple warning system for the main river water levels is operational when these reach critical values. This system is usually based on simple statistical methods and forecasts, if available, are disseminated by phone calls or radio.

- ***Level II*** - The basic infrastructures for flood forecasting and warning services are in place. However, upgraded data management procedures and improved methodologies and models for flood forecasting are required. In most cases, there is little experience in operational practice of advanced hydrological simulation and forecasting models. Regression or other simple models are generally used to forecast the peak of the water wave and approximate time of transit. In many cases, the level of coordination between NMSs and NHSs still needs to be strengthened.

- ***Level III*** – These have well-established flood forecasting and warning services with high quality products and opportunities for further improvement through the use of new technology. The systems normally combine products and information from both meteorological and hydrological services. Different tools and methods are used to produce the flood forecasts and warnings (e.g. NWP, QPF, radar, satellite images, hydrological and statistical models and other approaches). Warnings generally are communicated through various media to Government and Civil Protection Agencies, industry and the public.