

## COMPETENCY FRAMEWORK FOR PWS FORECASTERS AND ADVISORS

THE COMMISSION FOR BASIC SYSTEMS,

**Noting** the recommendation from the sixteenth session of the World Meteorological Congress (Cg-XVI, Geneva, May-June 2011) that all technical commissions make the definition of competence requirements for the core job-tasks in meteorology and hydrology a high priority activity and incorporate this task into their current work programmes,

**Noting further:**

- (1) That Congress requested that the technical commissions follow the model developed by the Commission for Aeronautical Meteorology (CAeM) in providing top level competence requirements,
- (2) That CBS-15 decided to establish a Competency Framework for Public Weather Services Forecasters and Advisors,
- (3) That this Competency Framework will inform the education and training of forecasters,
- (4) That this Competency Framework was developed in close consultation with the Executive Council Panel on Education and Training and will inform the content of WMO education and training courses, workshops and seminars,

**Considering** the development by the OPAG/PWS of a Competency Framework which describes the basic forecaster competencies, and then adds on those skills and knowledge that are required for effective service delivery and liaison with users (see Annexes I to V this recommendation),

**Recommends** to endorse this Competency Framework, to establish it as a WMO Recommended Practice, and to commend it for publication in the Guide to PWS Practices;

**Requests** the Commission for Basic Systems, in cooperation with the EC Panel on Education and Training, and with assistance from the Secretariat, to prepare a proposal for amendment of the *WMO Technical Regulations* (WMO-No. 49), to incorporate these competencies as Recommended Practice for the PWS forecaster/advisor;

**Urges** Members to make use of this Competency Framework in maintaining and improving the skills and knowledge of staff engaged in the production and delivery of PWS products and services.

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## COMPETENCY FRAMEWORK FOR PWS FORECASTERS AND ADVISORS

### 1. FUNDAMENTAL WMO COMPETENCY REQUIREMENTS FOR A PWS FORECASTER

The competency requirements for the work of an operational PWS forecaster<sup>1</sup> can be divided into five top level competencies. Taking into consideration the following:

- (a) The nationally-defined PWS areas of responsibility;
- (b) Meteorological and hydrological impacts on society;
- (c) Meteorological and hydrological user requirements, local procedures and priorities.

A PWS Forecaster should have successfully completed the BIP-M<sup>2</sup> (as defined in the revised WMO-No. 49, Volume I) and, in taking into account conditions a to c, should be able to perform the work indicated in the five top level competencies below:

- 1. Analyse and monitor continually the evolving meteorological and/or hydrological situation;
- 2. Forecast meteorological and hydrological phenomena and parameters;
- 3. Warn of hazardous phenomena;
- 4. Ensure the quality of meteorological and hydrological information and services; and
- 5. Communicate meteorological and hydrological information to internal and external users.

Each of these top-level competencies is expanded, below, into second-level competencies that are expressed and structured in such a manner as to facilitate the clear application of an assessment procedure. Each is also associated with a range of background knowledge and skills, some of which may not be particular to meteorology and/or hydrology, but which are nonetheless essential in the discharge of a forecaster's duties.

#### 1. Analyse and monitor continually the evolving meteorological and/or hydrological situation

**Competency Description:** Observations and forecasts of weather parameters and significant weather phenomena are continuously monitored to determine the need for

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<sup>1</sup> A PWS forecaster is defined as a forecaster responsible for the preparation and delivery of public weather forecasts and warnings

<sup>2</sup> BIP-M: Basic Instruction Package for Meteorologists

issuance, cancellation or amendment/update of forecasts and warnings according to documented thresholds and regulations.

**Performance Criteria:**

- (a) Analyse and interpret data to identify weather features pertinent to the area of forecast responsibility;
- (b) Monitor weather parameters and evolving significant weather phenomena and validate current forecasts and warnings based on these parameters;
- (c) Evaluate the need for amendments to forecasts and updates of warnings against documented criteria and thresholds.

**1.1 Background knowledge and skills**

- (a) An understanding of the key elements of synoptic and mesoscale meteorology, dynamical, and physical meteorology, and core analytical/diagnostic skills to the level of a BIP-M;
- (b) Application of the theory, methods and practices of meteorological and/or hydrological analysis and diagnosis;
- (c) The ability to visualize/conceptualize meteorological and/or hydrological information in multiple dimensions (spatial, temporal);
- (d) The appreciation of the influence of topography, land cover, and (if relevant) bodies of water and/or snow fields on local meteorology;
- (e) Interpretation in-situ and remote-sensed observations and data;
- (f) Understanding of the characteristics of meteorological and hydrological sensors and instruments; and
- (g) Familiarity with the acquisition, processing and assimilation of meteorological and hydrological data, including quality control.

**2. Forecast meteorological and hydrological phenomena and parameters**

**Competency Description:** Forecasts of meteorological parameters and phenomena are prepared and issued in accordance with documented requirements, priorities and deadlines.

**Performance Criteria:**

- (a) Forecast weather phenomena and parameters as required, including forecast uncertainties and using appropriate tools;
- (b) Ensure that forecasts are prepared and issued in accordance with national practices, relevant codes and technical regulations on content, accuracy and timeliness;

- (c) Make every effort to ensure that forecasts of weather parameters and phenomena are consistent (spatially and temporally) across boundaries of the area of responsibility as far as practicable, whilst maintaining meteorological integrity. Monitor forecasts/warnings issued for other regions, and liaise with adjacent regions as required.

## **2.1 Background knowledge and skills**

- (a) Core diagnostic and prognostic skills to a BIP-M level;
- (b) Demonstrates a knowledge of the methods used in Numerical Weather Prediction (NWP), including EPS where used, and other forecast tools;
- (c) Knowledge of the strengths and limitations of the NWP models used in the forecast office, and forecast adjustments required to accommodate these;
- (d) Critical comparison of a variety of forecast models, interpretation of observational data, and climatological data and integration of this information to make a reasoned estimation of the most likely evolution of the weather, of alternative evolutions, and the uncertainties associated with each;
- (e) Interpretation of model outputs at different time ranges;
- (f) Sound judgement and flexibility in determining which observational, model and contextual information is most relevant in a wide variety of circumstances;
- (g) Knowledge of weather impact on the user.

## **3. Warn of hazardous weather**

**Competency Description:** Warnings are issued in a timely manner when hazardous conditions are expected to occur, or when parameters are expected to reach documented threshold values, and updated or cancelled according to documented warning criteria.

### **Performance Criteria:**

- (a) Forecast hazardous weather phenomena, including spatial extent, onset/ cessation, duration, intensity and temporal variations;
- (b) Ensure that warnings are prepared and issued in accordance with national thresholds for hazardous weather, national formats, practices, codes and technical regulations on content, accuracy and timeliness;
- (c) Make every effort to ensure that warnings of hazardous weather phenomena are consistent (spatially and temporally) across

boundaries of the area of responsibility as far as practicable, whilst maintaining meteorological integrity;

- (d) Monitor forecasts/warnings issued for other regions, and liaise with adjacent regions as required;
- (e) Knowledge of the consequences of warnings on users decisions,

#### **1.1 Background knowledge and skill**

- (a) Knowledge of the specific product preparation and dissemination systems used in the forecast office;
- (b) Knowledge of the policies, procedures and criteria for issuing warnings.

### **4. Ensure the quality of meteorological and hydrological information and services**

**Competence description:** The quality of meteorological and hydrological forecasts, warnings and related products is maintained by the application of approved quality management processes.

#### **Performance Criteria:**

- (a) Apply the organization's quality management system and procedures;
- (b) Organize the work required on each shift to ensure that forecasts and other output are issued in good time according to agreed policies and procedures;
- (c) Validate meteorological and hydrological data, products, forecasts and warnings (timeliness, completeness, accuracy);
- (d) Assess the impacts of known error characteristics (bias, achievable accuracy of observations and sensing methods);
- (e) Monitor the functioning of operational systems and take contingency actions when necessary;
- (f) Contribute to the preparation and maintenance of operational manuals.

#### **4.1 Background knowledge and skills**

- (a) Has the ability to respond to changing work patterns and demand, ensuring continuity of service to users;
- (b) Necessary time and work flow management skills;
- (c) An appreciation of the varied technical knowledge and methodologies necessary across a multi-disciplinary team;

- (d) The ability to respond to changing user requirements, to embrace innovative techniques and technology;
- (e) The ability to learn from and apply past experience to improve the quality of forecasts and warnings.

## **5. Communicate meteorological and hydrological information to internal and external users**

**Competency Description:** User requirements are fully understood and are addressed by communicating concise and complete forecasts/warnings in a manner that can be clearly understood by the users.

### **Performance Criteria:**

- (a) Ensure that all forecasts/warnings are disseminated through the authorized communication means and channels to designated user groups as specified in relevant standard operating procedures;
- (b) Explain meteorological/hydrological data and information, including uncertainties where required, and deliver briefings and provide consultation to meet specific user needs as required.

### **5.1 Background knowledge and skills**

- (a) Skills in the presentation of forecast and warning information to the public across all relevant media, including impact information as required;
  - (b) Knowledge of protocols for presenting warning information to emergency management partners, including information on likely impacts and mitigation activities if relevant;
  - (c) An awareness of user's needs for, and use of, meteorological and/or hydrological information;
  - (d) Awareness of the application of meteorology and hydrology to human activities and specific users.
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## **2. COMPETENCY REQUIREMENTS FOR WEATHER BROADCASTERS AND COMMUNICATORS**

These competency requirements are for PWS forecasters who specialize in media work and routinely present weather information on radio or television, or prepare material for weather websites. They build upon, and should be read in conjunction with, the fundamental WMO competency requirements for a weather forecaster, although it is recognized that some people engaged in weather broadcasting may not come from a forecasting background.

There are three top-level competencies for the work of weather broadcasters, which are as follows:

- (a) Oral, written and graphical communication via media;
- (b) Use of appropriate tools and systems for the delivery of meteorological and, where appropriate, hydrological information to end-users;
- (c) Self-management and team-working within a media environment.

Each of these areas is expanded below into second-level competencies that are expressed and structured in a manner that facilitates the clear application of an assessment procedure. Not all of these second-level competencies will be relevant to each weather broadcaster; the individual context of each weather broadcaster will need to be considered when establishing relevancy.

### **1. Oral, Written and Graphical Communication**

- (a) Shows an awareness of the range of users reached through media forecasts;
- (b) Demonstrates an understanding of the likely impact of upcoming weather on users and their activities;
- (c) Can identify the key points in a weather story and develop these into a coherent narrative or presentation;
- (d) Is capable of articulating the weather story in clear and natural language using correct grammar, and achieving a well-paced delivery of information during weather broadcasts;
- (e) Can prepare effective weather graphics that visually communicate the weather story;
- (f) Is able to communicate the concept of forecast uncertainty to viewers and listeners in terms they can understand;
- (g) Presents warnings of meteorological and hydrological hazards clearly and effectively, including information on possible mitigating actions where appropriate;

- (h) Demonstrates an understanding of the working environment of journalists and other media professionals;
- (i) Creates and delivers presentations on meteorological and hydrological topics to external agencies and to the public;
- (j) Is capable of preparing and delivering educational material to a wide range of audience, from children to fellow-professionals.

## **2. Effective use of tools and systems**

- (a) Exhibits a working knowledge and understanding of the function and, where appropriate, operation of the different technological elements (PCs, servers, mixers, amplifiers, cameras, etc.) commonly employed in weather broadcasting;
- (b) Displays a working knowledge of the weather graphics software packages used to prepare weather bulletins, and an ability to exploit this knowledge effectively;
- (c) Applies routine production protocols appropriate to the service provision environment;
- (d) Designs and incorporates new graphic elements into a weather bulletin while maintaining alignment with broader editorial policies.

## **3. Self-management and team-working**

- (a) Has knowledge of the editorial policy applied to weather broadcasting, and is capable of developing and proposing revisions to such policies in response to changing circumstances, both meteorological and otherwise;
- (b) Delivers weather broadcasts reliably and on-time in accordance with broadcast schedules;
- (c) Implements, where relevant, the “Single Official Voice” policy in respect to warnings of severe weather and other public safety messages;
- (d) Presents an appearance which enhances the brand value both of the NMHS and the broadcaster, and does not detract from, or conflict with, the proper tone of the weather message;
- (e) Exhibits the confidence to express personality in a manner that facilitates the authoritative delivery of the weather forecast;
- (f) Contributes to the promotion of weather presentation services to broadcast companies, and articulates the benefits of good weather broadcasting practices both within the NMHS, and to non-meteorological broadcast management;

- (g) Does not allow commercial sponsorship to unduly obscure, or conflict with, the weather message;
  - (h) Critiques their own and other broadcasters performances in a constructive and positive manner;
  - (i) Mentors junior colleagues and provides support and advice as required.
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### **3. COMPETENCY REQUIREMENTS FOR PWS ADVISORS ENGAGED IN USER INTERACTION, MEDIA LIAISON AND OUTREACH ACTIVITIES**

These competency requirements are for PWS Advisors who specialize in media liaison work and in education / outreach. They build upon, and should be read in conjunction with, the fundamental WMO competency requirements for a PWS forecaster, although it is recognized that some people engaged in media liaison and outreach on behalf of NMHSs may not come from a forecasting background.

There are four top-level competencies for the work of media liaison and outreach, which are as follows:

- (a) Oral and written communication;
- (b) Use of appropriate tools and systems required for the delivery of meteorological and hydrological information to end-users;
- (c) User interaction;
- (d) Self-management and team-working in a media environment.

Each of these areas is expanded below into second-level competencies that are expressed and structured in a manner that facilitates the clear application of an assessment procedure. Not all of these second-level competencies will be relevant to each PWS Advisor; the individual context of each PWS Advisor will need to be considered when establishing relevancy.

#### **1. Oral and Written Communication**

- (a) Exhibits an awareness of the range of users reached through media;
- (b) Demonstrates an understanding of the likely impact of upcoming weather on users and their activities;
- (c) Is capable of presenting warnings of meteorological and hydrological hazards clearly and effectively including information on possible mitigating actions where appropriate;
- (d) Demonstrates an understanding of the working environment of journalists and other media professionals;
- (e) Is able to communicate in an effective and timely manner;
- (f) Exhibits an ability to work closely with colleagues responsible for communication and public affairs in the NMHS and assists in preparing press releases or interviews as required;
- (g) Can prepare and deliver educational material in clear and appropriate language to a wide range of audience, from children to fellow-professionals;

- (h) Demonstrates an appropriate understanding of the scope and limitations of forecasts and warnings, and communicates appropriate levels of confidence and uncertainty effectively.

**2. Use of appropriate tools and systems required for delivery of meteorological and hydrological information to end-users**

- (a) Demonstrates a knowledge of the channels used to communicate weather and related information, and an ability to exploit this knowledge effectively;
- (b) Demonstrates knowledge of the routine production protocols appropriate to their own service provision environment.

**3. User interaction**

- (a) Can provide guidance to users to assist them in developing a proper integration of meteorological and hydrological information in decision-making;
- (b) Has the ability to provide advice and comments on the development of meteorological and hydrological services and products in accordance with user requirements;
- (c) Demonstrates an ability to advise users on of the scope and limitations of forecasts and warnings and their application to effective decision-making, appropriately aligning uncertainty and confidence levels with scientific guidance.

**4. Self-management and team-working**

- (a) Can work in a cooperative fashion with colleagues from an NMHS, with representatives of users and, where appropriate, with journalists and other media staff;
  - (b) Presents a professional appearance which enhances the brand value of the NMHS;
  - (c) Demonstrates appropriate levels of trust, integrity, consideration of user needs, timeliness, confidentiality and discretion in all work activities;
  - (d) Is capable of ensuring consistency of message both across the NMHS and with stakeholders, both internal and external;
  - (e) Mentors junior colleagues and provides support and advice as required.
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#### **4. COMPETENCY REQUIREMENTS FOR A DISASTER PREVENTION AND MITIGATION WEATHER ADVISOR**

These competency requirements are for weather advisors who work in the area of Disaster Prevention and Mitigation (DPM) and engagement with the Emergency Management (EM) community. They build upon, and should be read in conjunction with, the fundamental WMO competency requirements for a PWS forecaster, although it is recognized that some people engaged in liaison and outreach in EM on behalf of NMHSs may not come from a forecasting background. In such cases, the DPM Advisor needs to work closely with the PWS forecaster to develop the products and services indicated in the following sections. A DPM Advisor, taking into consideration the conditions (a) to (c) below:

- (a) The nationally-defined PWS areas of responsibility;
- (b) Meteorological and hydrological impacts on society;
- (c) Meteorological and hydrological societal requirements, local procedures and priorities.

They should be able to perform the work (in close association with the PWS forecaster if needs be) indicated in the five top level competencies below:

1. Communicate warnings and associated information, including uncertainties and confidence levels, to users;
2. Develop products, procedures and services to meet user needs;
3. Develop and manage DPM stakeholder relationships;
4. Promote and implement impact assessments and community outreach; and
5. Ensure the quality of information, services and procedures.

Each of these top-level competencies is expanded below into second-level competencies that are expressed and structured in such a manner as to facilitate the clear application of an assessment procedure. Each is also associated with a range of background knowledge and skills which may not be particular to meteorology and/or hydrology, but are nonetheless essential for the discharge of the weather advisor's duties.

##### **1. Communicate warnings and associated information, including uncertainties and confidence levels, to users**

- (a) Demonstrates the capability to present information during severe weather events through all relevant media;
- (b) Is capable of tailoring weather warning products for communication to disaster management decision-makers and other partners;

- (c) Can effectively communicate appropriate levels of confidence and uncertainty to support effective decision-making;
- (d) Demonstrates an ability to communicate information to users, including disaster management decision-makers, on the expected impacts of severe weather.

**2. Develop products, procedures and services to meet user needs**

- (a) Demonstrates a knowledge of the meteorological and hydrological information requirements of the disaster management and civil protection community;
- (b) Is capable of ensuring that the design and dissemination schedule of warnings meets the decision-making needs of the disaster management community in safeguarding life and property;
- (c) Can contribute to the development of very short-range forecasting and nowcasting methods and products tailored for the disaster management community;
- (d) Can contribute to the development of DPM user-focussed probabilistic forecast products based on Ensemble Prediction System (EPS);
- (e) Can contribute to the development of impact-based forecast products designed to assist emergency management agencies with their decision-making processes;
- (f) Can contribute to the improved dissemination of warning information through effective utilization of current and emerging communication technologies; and
- (g) Is capable of applying new technology and scientific research in Multi-Hazard Early Warning Systems (MHEWS).

**3. Develop and manage DPM stakeholder relationships**

- (a) Demonstrates a capability to establish and maintain working relationships at operational and technical levels with the emergency management community;
- (b) Can build and maintain relationships with the media to enable optimal communication of warnings and information prior to, during and after high impact weather events;
- (c) Is able to facilitate coordination between the NMHS and relevant agencies to improve emergency planning, preparedness, and response to weather threats, with particular emphasis on the specific needs of megacities where appropriate;

- (d) Can assist in the design of effective warning signal systems for coordinated emergency response to meteorological and hydrological hazards;
- (e) In close coordination with the emergency management authorities, can contribute to the development of response advice and call-to-action statements based on the potential impact of hazards; and
- (f) Is able to manage an appropriate level of expectation in NMHS capacity among DPM stakeholders.

**4. Promote and implement impact assessments and community outreach**

- (a) Can participate in the assessment of the socio-economic impact of meteorological and hydrological events, in collaboration with relevant experts;
- (b) Is able to foster coordination with socio-economic experts in order to evaluate the benefits of meteorological and hydrological early warning systems; and
- (c) Demonstrates an ability to promote community awareness and preparedness for high impact meteorological and hydrological events through public education and outreach.

**5. Ensure the quality of information, services and procedures**

- (a) Can facilitate sustainable and formalized feedback mechanisms, including user-based service assessment and product verification, for evaluating and improving warnings;
- (b) Has the ability to work with disaster management authorities to strengthen the role of NMHSs as the “Single Official Voice” for warnings of high impact weather events;
- (c) Can contribute to the development of a communication strategy to ensure credibility of, and effective response to, warnings of high impact weather events;
- (d) Can coordinate standard operating procedures relating to multi-agency and multi-hazard risk management and emergency planning;
- (e) Is able to contribute to the development of documentation and archiving systems for meteorological and hydrological hazard and impact data, including quality assurance and data management;
- (f) Can engage effectively with international projects including the World Weather Information Service (WWIS), the Severe Weather Information Centre (SWIC), METEOALARM, the Severe Weather Forecasting

Demonstration Project (SWFDP) and other WMO initiatives as appropriate.

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**5. COMPETENCY REQUIREMENTS FOR PERSONS ENGAGED IN THE INNOVATION, IMPROVEMENT AND DELIVERY OF METEOROLOGICAL AND HYDROLOGICAL SERVICES AND PRODUCTS**

These competency requirements are primarily aimed at NMHSs personnel who are engaged in the area of innovation, improvement, and delivery of meteorological and hydrological services and products. They should be read in conjunction with the competency requirements for a PWS forecaster, although it is recognized that many people engaged in these aspects of NMHSs work may not come from a forecasting background.

- (a) Knowledge of meteorology and hydrology, as well as models and systems used in operational forecasting;
- (b) Ability to apply existing and new technologies effectively;
- (c) Knowledge of user requirements for applications of meteorological and hydrological information.

Each of these competencies is expanded below into second-level competencies that are expressed and structured in a manner that facilitates the clear application of an assessment procedure.

**1. Knowledge of meteorology and hydrology, as well as models and systems used in operational forecasting**

- (a) Demonstrates knowledge of the application of meteorology and hydrology to the improvement of existing services and the creation of new products;
- (b) Demonstrates an understanding of the methods used in meteorological and hydrological modelling.

**2. Effective application of existing and new technologies**

- (a) Demonstrates the ability to optimize the systems used to produce and disseminate meteorological and hydrological services and products;
- (b) Shows a thorough knowledge of visualization and display systems used for weather information;
- (c) Keeps abreast of relevant scientific and technological advances and can specify, lead or contribute to the development of products and services relevant to his/her own NMHS to meet user needs; and
- (d) Demonstrates an ability to respond quickly to changing user needs and/or changing technologies.

**3. Knowledge of user requirements for applications of meteorological and hydrological information**

- (a) Maintains an awareness of users' current and future requirements for meteorological and hydrological services;
  - (b) Demonstrates an ability to create and deliver presentations on topics related to service improvements to users, and to relevant external agencies;
  - (c) Demonstrates effective communication skills to both internal and external stakeholders and is able to adjust key messages and content for different audiences;
  - (d) As required, contributes to the development of training material relating to service innovations and improvements.
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