



World Meteorological Organization
Organisation météorologique mondiale

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Weather • Climate • Water
Temps • Climat • Eau

Our ref.: WDS/MMO/MWF-Framework

GENEVA, 17 November 2014

Annex: 1 (available in English only)

Subject: Marine Weather Forecaster Competence Framework

Action required: Review the draft Marine Weather Forecaster Competence Framework (see Annex) and inform the WMO Secretariat of the approval and/or comments on the document, for its submission to the Seventeenth World Meteorological Congress (Cg-17, 2015), **not later than 15 January 2015**

Dear Sir/Madam,

The World Meteorological Congress, at its sixteenth session (Cg-XVI, May 2011) made special emphasis on service delivery, including climate services, that requires a renewed effort in documenting and ensuring, all relevant processes from physical measurements in observations to forecasts and warnings issued to all user and customer groups are undertaken within a sound Quality Management Framework (QMF). The Congress also requested the technical commissions to develop competencies for their areas of expertise.

In order to develop requirements for marine meteorological and oceanographic services, the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) at its fourth session (JCOMM-4, May 2012), adopted Recommendation 5 – Quality Management Implementation for JCOMM, and formed an ad hoc Task Team on Marine Competency Requirements. This Task Team has successfully developed a draft Marine Weather Forecaster Competence Framework, in close consultation with the relevant expert teams and groups of WMO including the Executive Council Panel of Experts on Education and Training, and the Expert Team on Education and Training of the WMO Commission for Aeronautical Meteorology. These consultations provided valuable guidance as to how the Marine Weather Forecaster Competency Framework should be developed to ensure consistency across the WMO weather service delivery programmes. Furthermore, existing marine weather forecaster competencies that have already been developed nationally and internationally were harmonized and integrated into the draft document.

It should be noted that this competence framework is presented as the minimum standard and Members are strongly encouraged to add components that are specific to their activities.

To: Members of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM-436)

cc: Co-presidents of JCOMM (for information)

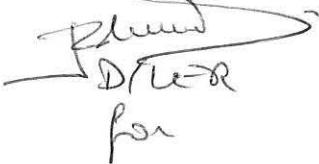
Through this letter, I would like to seek your formal approval of the attached draft in your capacity as a JCOMM Member, and as a JCOMM submission to the seventeenth session of the World Meteorological Congress (Cg-17) in 2015.

To this end, I would like to request your cooperation in providing feedback and comments, if any, to the Secretariat through mmo@wmo.int, **not later than 15 January 2015**.

Upon your positive feedback, the draft Marine Weather Competence Framework will be submitted by JCOMM, as a technical commission, to Cg-17 for its review and guidance, in order to adopt it as part of the WMO technical regulations as recommended practices, as for the competence frameworks of other areas of WMO service delivery. The relevant regulatory documents of WMO, including the *Manual on* and *Guide to Marine Meteorological Services* (WMO-No. 558 and WMO-No. 471 respectively) will also be revised accordingly.

I wish to thank you for your continued support to the activities in Marine Meteorology and Oceanography.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'M. Jarraud', with a long horizontal flourish extending to the right.

(M. Jarraud)
Secretary-General

WMO Marine Weather Forecaster Competence Framework

The following is provided as minimum competence requirements to effectively perform the duties of a marine weather forecaster (MWF). The competence framework identifies the knowledge, skills and behaviours that should be demonstrated. Implicit in the background knowledge and skills for MWF, is the recommendation that they should have successfully completed the Basic Instruction Package for Meteorologists (BIP-M) or relevant parts thereof. It should, however, be recognized that national personnel qualification requirements for MWF, may be set at a higher level, e.g., to also be degree qualified.

The marine environment includes the open and coastal ocean, estuaries, large lakes, rivers and their interfaces with the land and the atmosphere. It is recognized that there will be considerable variation in the legitimate functions of Marine Weather Offices worldwide. Consequently, it is not possible to write a document that exactly matches every office's function. Once this generic competence framework is adopted, the Marine Weather Service will need to define how the competencies relate to their own national operations. That is, the Marine Weather Office will have to adapt the competencies, associated underpinning knowledge and performance criteria that are specific to their functions and region. Therefore, the performance criteria should be applied within the context of the following conditions:

1. For the area of responsibility – refer to WMO-No: 558, *Manual on Marine Meteorological Services*, Volume 1 – Global Aspects and Volume II, Regional Aspects;
2. In consideration of the impact of meteorological phenomena, variables and parameters on marine operations; and
3. In compliance with marine user requirements, international regulations, local procedures and priorities.

The competence requirements are as follows:

1. Analyse and monitor continually the marine weather situation;
2. Forecast marine weather phenomena, variables and parameters;
3. Warn of hazardous phenomena;
4. Ensure the quality of meteorological information and services;
5. Communicate meteorological information to internal and external users.

Note: As this competence framework is recommended and generic to all providers of marine weather forecast and warning services, no priority is stated to either the phenomena or parameters. Any priorities should be established by the Marine Weather Service.

Format of the Framework

The framework is provided under the following headings:

1. The recommended element of competence;
2. Competence description;
3. Performance criteria;
4. Background knowledge and skills.

The details within each of the headings describe the aspects of competence recommended for an effective service. The specific performance criteria for a given meteorological service's marine programme should reflect the roles and responsibilities of the office's service.

The role of marine weather forecasters will continue to change in response to evolving technology and user requirements. Such a change will require high standards of competency and underlying knowledge with a focus on continuous improvement. This framework is presented in an attempt to anticipate as far as possible those changes in the future. However, a review cycle of not more than 3-5 years as part of the overall quality management and risk management approach is strongly recommended.

An overall quality management and risk management approach is strongly recommended.

1. ANALYSE AND MONITOR CONTINUALLY THE MARINE WEATHER SITUATION	
Competence Description:	
Continuously monitor current observations, advisories, forecasts and warnings of weather and marine parameters and variables and significant weather phenomena. Determine the need for issuance, cancellation or amendment/update of advisories, forecasts and warnings according to documented thresholds and regulations. The marine environment includes the open and coastal ocean, estuaries, large lakes, rivers and their interfaces with the land and the atmosphere.	
Performance Criteria	
1.	Maintain a weather watch over marine weather situation, evolving significant weather phenomena and, where available, advisories issued by other meteorological services, model guidance.
2.	Compare current forecasts and warnings against observed conditions.
3.	Based on the Weather Watch, appraise and validate the requirement for an amendment to the valid forecasts against established and documented criteria.
Background knowledge and skills	
•	Knowledge of the marine and weather products (routine and non-routine) and their issue times and priorities used in the region.
•	Knowledge of non-routine product triggers (threshold for gale warnings, special marine warnings, storm warnings, wave warnings).
•	Knowledge of meteorological analysis techniques (subjective and objective).
•	The ability to interpret: <ul style="list-style-type: none"> - Radar and satellite imagery to identify fog, severe convective system, tropical cyclone, thunderstorms, squalls, sea ice and other potentially dangerous phenomena; - Numerical weather prediction guidance (including Ensemble Prediction Systems), marine products and other forms of objective guidance, and their assimilation into forecast/warning preparation; - Observed variables and parameters when there are differences between automatic sensor technologies and manual observing techniques and the impact on forecast and warning products; - Coded real-time raw data including buoy and ship reports.
•	Knowledge of relevant observing systems, platforms, and sensors that may include remote sensing (satellite altimeters, scatter meters, microwave sensors; radar, lightning detection systems); in-situ sensors (anemometers, tide gauges, moored wave buoys, drifting buoys, bottom pressure sensors); human observing procedures (ship, shore) and how their advantages and limitations vary with respect to prevailing seasonal and meteorological conditions.
•	Knowledge of bathymetry, local topography, coastal geomorphology, marine climatology and local weather systems and their potential impacts on winds, waves and other phenomena in the forecast area of responsibility.
•	The ability to perform manual/subjective analyses (including techniques for analysis in data sparse areas).
•	The ability to perform image analyses.
•	The ability to perform statistical data analyses.
•	The ability to apply statistical analysis and other informational techniques to data which has a geographical or geospatial aspect.

2. FORECAST MARINE WEATHER PHENOMENA, VARIABLES AND PARAMETERS	
Competence Description: Forecasts of meteorological parameters and phenomena are prepared and issued in accordance with documented requirements, priorities and deadlines.	
Performance Criteria	
1.	Analyse and diagnose the weather and marine situation as required for the preparation and issue of forecasts.
2.	Prepare forecasts for the following weather phenomena and parameters and variables, including spatial extent, onset/cessation, duration, intensity and temporal variations: *For High Seas, Coastal forecast requirements: <ul style="list-style-type: none"> • Wind including directional variability, speed and wind gusts; • Sea state. Note: the definition pertaining to sea state should be that normally used by the Marine Weather Service but with due reference to the stated WMO definition; • Damaging large waves or multiple swell systems; • Precipitation and associated horizontal visibilities; • Fog or mist, and associated horizontal visibilities; • Other types of obscuration to visibility, including smoke, haze, sand-storms, dust-storms, blowing snow, volcanic ash/rock and associated horizontal visibilities; • Sea ice state; • Synoptic situation for tropical, sub-tropical, temperate and polar climate zones as required; • Thunderstorms, heavy precipitation with poor horizontal visibility, down-burst/microburst, squalls or gust front, hail, tornadic/water spout activity; • Freezing spray or precipitation, snowfall; • Icing on the vessels or structures; • Tropical cyclones/hurricanes/typhoons; • Icebergs and their movement. Other international/national forecast requirements as listed under Regional Variations.
3.	Ensure that forecasts are prepared and issued in accordance with Part I and II of WMO-No. 558, <i>Manual on Marine Meteorological Services</i> and/or national standard operating procedures including format, codes and technical regulations on content, accuracy and timeliness.
4.	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. This will include monitoring forecasts/warnings issued for other regions, and liaison with adjacent regions as required.
Background knowledge and skills	
•	Knowledge of methods for predicting meteorological and oceanographic conditions and their application.
•	Knowledge of forecasting models (deterministic and ensemble output) including wave models.
•	Knowledge of remote sensing applications.
•	Knowledge of forecast preparation systems (including software).
•	Knowledge of areas of responsibility (local and regional), and in particular forecast boundaries and associated observation sites.
•	Knowledge of forecast issue times and work priorities.
•	Knowledge wave types and characteristics; wave generation and decay; and shallow water wave characteristics.
•	Knowledge of ocean and tidal currents, tsunami and drifting of objects.
•	The ability to forecast sea ice extent, thickness, concentration, stage of development, drift, deformation, growth and melting.
•	The ability to forecast icebergs and their movement.

3. WARN OF HAZARDOUS PHENOMENA	
Competence Description:	
Warnings are issued in a timely manner when hazardous conditions are expected to reach documented threshold values or impacts and as appropriate, amended or cancelled, according to documented criteria.	
Performance Criteria	
1.	Forecast and warn for the following hazardous weather phenomena, variables and parameters, including spatial extent, onset/cessation, duration, an intensity and its temporal variations:
a.	Tropical Cyclone / hurricanes / typhoons
b.	Wind Hazards
c.	Thunderstorms, heavy precipitation with poor horizontal visibility, down-burst/microburst, squalls or gust front, tornadic hail, tornadic/water spout activity
e.	Ice accretion <ul style="list-style-type: none"> • freezing spray or precipitation and icing on the vessels or structures • snowfall
f.	Restricted Visibility (less than 1nm) <ul style="list-style-type: none"> • reduced horizontal visibility caused by precipitation, fog, smoke, smog, dust, smoke, haze, sand-storms, dust-storms and blowing snow • reduced horizontal visibility caused by volcanic activity
g.	Unusual and hazardous sea-ice conditions <ul style="list-style-type: none"> • exceptional and rapidly changing sea ice conditions • icebergs
h.	Storm-induced abnormal water (sea) levels <ul style="list-style-type: none"> • sea level and storm surge • harbour seiches
i.	Unusual and hazardous wave conditions
j.	Tsunami
2.	Ensure that warning products are prepared and issued in accordance with thresholds for hazardous weather as per Parts I and II of WMO-No. 558, <i>Manual on Marine Meteorological Services</i> and/or national SOPs including formats, codes and technical regulations on content, accuracy and timeliness.
3.	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. This will include monitoring forecasts/warnings issued for other regions, and liaison with adjacent regions as required.
Background knowledge and skills	
•	Knowledge of SOPs for warning.
•	Knowledge of marine warning criteria – amendment criteria.
•	Ability to utilize forecasting models (deterministic and ensemble output).
•	Knowledge of areas of responsibility (local and regional), warning boundaries.

4. ENSURE THE QUALITY OF METEOROLOGICAL INFORMATION AND SERVICES
Competence Description: Forecasts, warnings and related products are provided within a quality management framework.
Performance Criteria
1. Apply the organization's quality management system and procedures as required.
2. Assess the impact of known observational error characteristics (e.g. bias, achievable accuracy and limitations of observations and sensing methods) on forecasts and warnings.
3. Verify and validate marine meteorological data, products, forecasts and warnings (timeliness, completeness, and accuracy), using real-time checks.
4. Monitor the functioning of operational systems, gather and assess customer comments, suggestions and complaints, and take remedial actions when necessary.
5. Identify and evaluate weather forecasting and warning problems and determine appropriate corrective and preventive actions for continuous improvement.
Background knowledge and skills
• Knowledge of quality management principles, practices and procedures.
• Knowledge of SOPs for forecast and warning.
• The ability to utilize verification techniques and statistics.
• Knowledge of contingency plans.
• Knowledge of customer needs.
• Knowledge of relevant customer operations, and needs for and applications of forecasts, including: <ul style="list-style-type: none"> - Customer operations (e.g., procedures, tactics, planning processes and cycles); - Customers' limitations, including operating limits, legal constraints, geopolitical limits); - Customers' desired outcomes from operation.
• General knowledge of customer terminology (e.g., nautical terms, acronyms, abbreviations, technical terms related to forecast variables (e.g., state of the sea, currents, waves, tides), customer preferred measurement units).
• Knowledge of customer communication and security systems, if required.
• Knowledge of the Impact of weather variables and phenomena on customer operations/activities.

5. COMMUNICATE METEOROLOGICAL INFORMATION TO INTERNAL AND EXTERNAL USERS
Competence Description: Marine weather forecasts and warnings are communicated in a timely manner to meet user community needs.
Performance Criteria
1. Ensure that all forecasts and warnings are disseminated via the authorized communication channels to user groups.
2. Provide marine weather briefings as necessary, and provide consultation to meet specific user needs.
3. Utilize forecasts and warnings of meteorological parameters and phenomena to describe their impact on marine operations.
Background knowledge and skills
• Knowledge of primary users and operations and weather sensitivities.
• Knowledge of available communication systems, techniques and methodologies.
• Ability to ask users the appropriate questions so as to better understand their needs.
• Ability to utilize cross-boundary consistency techniques – national and international.
• Ability to communicate effectively, orally, graphically and in writing (level of details to meet the identified suit for the needs of specific users).
• Ability to communicate at an acceptable level of language proficiency.

REGIONAL VARIATIONS

Regional variations referred to within the document may include but are not limited to the following:

- Agreed and documented criteria and thresholds
 - The range of weather and ocean phenomena including but not restricted to:
 - tsunami
 - tides, sea level and storm surge
 - ocean currents and drifting of objects
 - sea surface temperature and salinity where required
 - volcanic activity cloud amount and type
 - volcanic ash deposition
 - significant debris post tropical cyclones and tsunami
 - Appreciation of the types and use of forecast guidance
 - Designated offices responsible for advice on volcanic ash, tropical cyclones/hurricanes/typhoons, sea ice and ice bergs and tsunami
 - Regional regulations
 - Boundaries of forecast and warning areas
 - Communication language(s)
 - Communications technology for forecast and warning transmission, and for weather briefing
 - Forecast database(s) utilized – gridded/text/graphical/digital, etc.
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