

ESCAP/WMO Typhoon Committee
Fiftieth Session
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Hanoi, Viet Nam

FOR PARTICIPANTS ONLY
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ENGLISH ONLY

Tropical Cyclone Forecast Competency in the Typhoon Committee Region

(Submitted by RSMCs Tokyo and Honolulu)

ACTION REQUIRED:

The Committee is invited to review and approve Tropical Cyclone Forecast Competency in the Typhoon Committee Region.

APPENDIXES:

- A) DRAFT TEXT FOR INCLUSION IN SESSION REPORT
- B) Tropical Cyclone Forecast Competency in the Typhoon Committee Region

**APPENDIX A:
DRAFT TEXT FOR INCLUSION IN THE SESSION REPORT**

x.x Tropical Cyclone Forecast Competency in the Typhoon Committee Region

1. The Committee noted with appreciation the work of the task team for the development of the final draft tropical cyclone forecast competency in the ESCAP/WMO Typhoon Committee region under the initiative of RSMCs Tokyo and Honolulu.

2. The Committee approved the Tropical Cyclone Forecast Competency as shown in Annex. It also noted with appreciation that RSMCs Tokyo and Honolulu propose to include the approved Competency into TOM for its future update.

APPENDIX B:

Tropical Cyclone Forecast Competency in the Typhoon Committee Region

1. At the 66th World Meteorological Organization (WMO) Executive Council, the need for development of the tropical cyclone (TC) forecaster competencies by regional tropical cyclone committees under the initiative of the Regional Specialized Meteorological Centres (RSMCs) was stressed, in order to ensure the quality of tropical cyclone forecasting services and to meet the users' requirements. The 47th session of the Typhoon Committee (Bangkok, 2015) requested RSMCs Tokyo and Honolulu to develop draft TC forecaster competency as Annual Operating Plan of its Working Group on Meteorology (WGM).
2. At the 10th Integrated Workshop of the Typhoon Committee (Malaysia, October 2015), RSMCs Tokyo and Honolulu reported that they reviewed 1) the WMO International TC Competencies Regional Association (RA) V (version 1.3), and 2) TC Competency developed by the Hurricane Committee Task Team submitted to the RA IV Hurricane Committee in 2014, and found that both describe a list of requirements comprehensively enough to be used as a draft of the TC forecast competencies for the ESCAP/WMO Typhoon Committee. The RSMCs also indicated that all the Typhoon Committee Members have dedicated Meteorological Services, and thus a category for non-forecast offices, namely Category 3 of the Hurricane Committee version would not need to be included into the Typhoon Committee version. In addition, it should be considered that some Typhoon Committee Members still rely on TC forecasts of the RSMCs or other agencies to issue their TC information, TC competency requirements for such Members need to be included.
3. In accordance with the Annual Operating Plan (AOP) in 2016, on 20 October 2016, RSMCs Honolulu and Tokyo circulated the draft of TC forecast competency, which was developed largely based on the WMO International TC Competencies Regional Association (RA) V (version 1.3) to solicit views of the WGM Members and invite them to nominate their focal points (see Appendix I). At the 11th Integrated Workshop of the Typhoon Committee (the Philippines, October 2016), the RSMCs proposed to organize a face-to-face meeting to finalize the draft for approval by the Session, and invited WGM Members to this meeting.
4. The 49th session of the Typhoon Committee approved to establish a task team to finalize the draft tropical cyclone competency and to discuss how to utilize it for future training activities in the Committee region.
5. The RSMCs invited all the focal points/alternates to the meeting of the task team on Tropical Cyclone Forecast Competency in the ESCAP/WMO Typhoon Committee Region jointly hosted by the RSMCs Tokyo and Honolulu in Guam, U.S.A. from 11 to 14 March 2014. In addition, as a preparatory work, a questionnaire to review their current status and future training needs in light of the draft competency was sent to and responded by all the focal points. The responses were utilized for discussion during the meeting. The meeting report is available at http://www.jma.go.jp/jma/en/Activities/ESCAP_WMO_Typhoon_Committee_Task_Team_on_TC_Competency.pdf.
6. RSMCs Tokyo and Honolulu reported the outcome of the task team meeting including the final draft Competency during the 12th Integrated Workshop of the Typhoon Committee (Rep. of Korea, October 2017). WGM concluded that the final draft of tropical cyclone forecast competency to the 50th TC Session for approval and the approved tropical cyclone forecast competency is to be included into the Typhoon Committee Operational Manual (TOM).

7. The final draft Competency prepared by the task team as shown in Annex is submitted to the 50th TC Session for its approval.

Tropical Cyclone Forecast Competency in the Typhoon Committee Region

(Prepared by Task Team on TC Forecast Competency in the Typhoon Committee Region)

Tropical Cyclone Forecast Competency in the Typhoon Committee Region

1. Overview

The establishment of formal competencies for Tropical Cyclone (TC) operations is part of the overall WMO Competency Standards which are a key element of the broader ambition to implement the WMO Quality Management System (QMS) set out in WMO Congress XIV. The tropical cyclone competency approach is essential for defining what is required to do the job, developing the most appropriate training and to demonstrate forecasters can do the job.

These competencies have been devised to be consistent with the actual work in TC Warning offices and other tropical cyclone services.

As well as those listed under particular elements, the following are required:

- General weather forecasting and forecast preparation skills.
- General synoptic analysis techniques (including data limitations).
- Ability to analyse and synthesize a range of data types in order to apply relevant weighting to each data type where appropriate.
- Numerical Weather Prediction (NWP) – interpretation of model output; knowledge of model strengths and limitations; and model comparisons.

2. Tropical Cyclone Forecast Competency in the Typhoon Committee Region

There are two competency units identified for Tropical Cyclone Forecast Services in the ESCAP/WMO Typhoon Committee region. The first unit is applicable to dedicated or specialized forecasters working in TC forecast agencies, such as RSMCs, at a senior or independent, unsupervised level providing a range of TC forecast services (**Category 1**). The second unit applies to general forecasters who provide a range of TC forecast services based on information from the 'parent' RSMC or other agencies, and/or available data (**Category 2**).

2.1 Category 1

This competency unit is relevant to dedicated or specialized TC forecasters working in a TC office at an unsupervised level. It includes:

- analyzing broad-scale environment and determine TC position, intensity and structure;
- forecasting TC track, intensity and structure;
- determining potential TC-related hazards;
- formulating and issuing TC-related warning products;
- communicating relevant TC information to internal and external stakeholders.

2.2 Category 2

This competency unit is relevant to general forecasters who provide a range of TC forecast services based on information from the 'parent' RSMC or other agencies, and/or available data. It includes:

- accessing, interpreting, and adapting TC analysis and forecast;
- determining potential TC-related hazards;
- formulating and issuing TC-related warning products;
- communicating relevant TC information to internal and external stakeholders.

Performance criteria and background knowledge and skills of each of the above items for Category 1 and 2 are shown in Annex. Each Member, including not only its National Meteorological and Hydrological Service but also all the other government entities in charge of its official TC-related forecast/warning service, is encouraged to meet either Category 1 or Category 2.

3.0 National Variation

The context of these competencies may vary from office to office according to:

- national climatology and impacts;
- national geography especially as how it affects hazards including storm tide, rainfall and wind;
- observation networks (including surface, upper air, weather radar, aircraft)
- variation in products issued and briefing requirements;
- boundaries of forecast areas;
- communication language(s);
- procedures for handling external enquiries;
- communication technology for warning transmission and for briefings;
- national and international regulations;
- operational forecast systems, procedures and warning thresholds;
- risk assessment and estimation of forecast uncertainties;
- types and use of forecast guidance.

Analyze broad-scale environment and determine TC position, intensity and structure (for Category 1)		
Description		
A range of observational information is analysed to interpret the synoptic scale environment, the position, intensity and structure of the tropical circulation		
Performance criteria		analyzes the synoptic scale environment to assess the likely influence on the disturbance in a range of situations
		determines TC centre location and current movement in accordance with standard operating procedures in a range of situations
		determines TC intensity in accordance with standard operating procedures in a range of situations
		determines TC structure in accordance with standard operating procedures in a range of situations
Background	Knowledge	standard operating procedures for TC analysis
		basic TC climatology and general impacts of ENSO on TC behaviors
		capabilities and limitations of different observational data types
		TC structure dynamics and conceptual models
		synoptic scale factors that affect the tropical cyclone intensity including shear, ocean temperatures, upper-level flow, stability, landfall, vorticity and low to mid-level moisture
		strengths and limitations of intensity analysis methods including Dvorak technique and other ones, such as ADT, CLOUD, AMSU intensity estimation, and SATCON.
	Skills	uses data viewing software and other applications in the forecast process
		interprets observations, weather radar and satellite derived information such as scatterometry and cloud drift winds
		interprets satellite imagery including water vapor, visible, infra-red, and microwave for TC analysis
		uses Dvorak technique for TC centre location and intensity estimation.
		estimates the intensity from a number of inputs
		interprets wind shear from shear analyses and prognoses
		assesses the environment for motion and intensity changes
interprets NWP guidance material		

Forecast TC track, intensity and structure (for Category 1)		
Description A range of information including numerical weather prediction NWP and objective aids in addition to an understanding of conceptual synoptic forecast approaches are used to forecast the track, intensity and structure in warning products that are issued in accordance with documented procedures.		
Performance criteria	interprets NWP-predicted synoptic scale environment to assess the likely influence on the disturbance in a range of situations	
	determines TC forecast track in accordance with standard operating procedures in a range of situations	
	determines TC forecast intensity in accordance with standard operating procedures in a range of situations	
	determines TC forecast structure in accordance with standard operating procedures and timelines in a range of situations	
Background	Knowledge	standard operating procedures for TC forecasts
		relative strengths and limitations of NWP in predicting cyclone movement, structure and intensity
		basic concept of rapid intensification/weakening, landfall process, and extra tropical transition
		verification results of official TC forecasts and NWP guidance
		basic theory of TC ensemble forecasts
		synoptic factors that affect TC genesis, motion, intensity, and structure
		track forecasting techniques including consensus and ensemble forecasts
	intensity forecasting methods	
	Skills	evaluates model predictions against observed conditions to assess the most likely forecast environment for motion and intensity changes
		evaluates TC genesis potential using observations and NWP guidance including ensembles
interprets NWP guidance material including ensemble output to determine forecast uncertainty		
	uses software systems to determine forecast parameters	

Access, interpret, and adapt TC analysis and forecast (for Category 2)		
Description		
Guidance products from RSMC and other agencies are appropriately interpreted and assessed. Technical information including satellite and other observational information are interpreted taking into consideration the guidance products		
Performance criteria		evaluates and adapt TC analysis and forecast based on information from RSMCs or other TC forecast agencies, and/or available data
		interprets technical forecast guidance in order to assess impact potential upon forecast region of responsibility
		interprets observational and satellite information appropriately
Background	Knowledge	standard operating procedures for TC analysis and forecasts
		capabilities and limitations of different observational data types
		TC structure dynamics and conceptual models
		synoptic scale factors that affect the tropical cyclone intensity including shear, ocean temperatures, upper-level flow, stability, landfall, vorticity and low to mid-level moisture
		relative strengths and limitations of NWP in predicting cyclone movement, structure and intensity
		synoptic factors that affect TC genesis, motion, intensity, and structure
		track forecasting techniques including consensus and ensemble forecasts
		intensity forecasting methods
	strengths and limitations of Dvorak technique, and other intensity analysis guidance, such as ADT, CLOUD, AMSU intensity estimation, and SATCON	
	Skills	uses data viewing software and other applications in the forecast process
		interprets observations, weather radar, satellite and satellite derived information at a general level
		assesses the environment for impact on the TC at a general level
		interprets NWP guidance material
interprets official TC forecast products from official agencies		

Determine potential TC-related hazards (for Category 1 &2)		
Description Potential TC-related hazards such as high winds, rainfall, waves and storm surge are determined, taking also into consideration mesoscale weather phenomena, for key locations according to appropriate thresholds and including estimates of uncertainty.		
Performance criteria	forecasts extent of cyclonic winds (e.g. gales, storm force) and onset times for key locations using available guidance in a range of situations.	
	forecasts rainfall using available guidance in a range of situations and liaise with relevant organizations to determine potential flooding and landslide.	
	forecasts waves in accordance with standard operating procedures.	
	forecasts storm tide potential considering various TC forecast scenarios and confidence levels (worst case, most likely, alternate TC forecast scenario).	
Background	Knowledge	standard operating procedures for TC-related hazards including wave and storm surge associated with tropical cyclones.
		potential TC-related hazards in a range of synoptic and mesoscale situations in consideration of local characteristics such as shapes of coastline and topographic affects
		basic theory of wave and storm surge
	Skills	interprets guidance material of NWP and/or other Centres such as RSMCs.
		assesses rainfall potential using probabilistic rainfall guidance, such as eTRaP and consensus model guidance (OCF, PME).
		determines onset, duration, coverage and associated uncertainties of weather phenomena
		interprets TC storm surge forecast guidance

Formulate and issue TC-related warning products (for Category 1 &2)

Description

Forecast production systems are used to produce and disseminate a range of TC-related warning products according to operating procedures.

Performance criteria		liaises effectively with internal staff in the development of TC forecast scenarios and impact on other services.
		formulates TC-related warning products, in consideration of potential impacts, in accordance with standard operating procedures in a range of situations.
		determines the appropriate key messages for general and technical audiences in a range of situations.
		issues the range of TC-related warning products in accordance with standard operating procedures and timelines in a range of situations.
Background	Knowledge	standard operating procedures for warning issuance and contingency plans of relevant DRR authorities such as local governments.
		local characteristics of potential impacts of tropical cyclones
		level of threat posed by storm tide
		user needs and significant impact thresholds
		product styles and standards
	Skills	uses appropriate software to determine range of potential impacts and produce warning products
		communicates with colleagues to formulate warning products
		compiles products and key messages for different audiences
converts technical concepts into concise and easy to understand language		

Communicate relevant TC information to internal and external stakeholders (for Category 1 &2)		
Description Forecasters are required to communicate information to internal and external users appropriate to their needs.		
Performance criteria		logically structures briefings and presentations to contain relevant, timely, and understandable information
		delivers briefings, presentations and interviews to suit the intended audience explaining technical information in concise, clear and easy to understand language
		communicate with related internal and external parties, such as DRR emergency managers, RSMCs, other TC forecast centres and weather services in neighboring areas
		responds to requests for information appropriately
Background	Knowledge	principles of effective communication, including presentation and interviews
		presentation and meeting formats and requirements
		legislation, regulations, policies, procedures and guidelines relating to workplace communication in the public sector such as privacy, confidentiality, freedom of information
	Skills	compiles products and key messages for different audiences
		converts technical concepts into concise and easy to understand language
		facilitates and engages in communication exchanges
		uses equipment for presentations