

Regional Association IV – Hurricane Operational Plan for North America, Central America and the Caribbean

Tropical Cyclone Programme

Report No. TCP-30

2019 edition

WEATHER CLIMATE WATER



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Organization

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INTRODUCTION

The regional activities under the WMO Tropical Cyclone Programme consist mainly of the programmes pursued by groups of countries acting in concert to improve their warning systems. In Region IV (North America, Central America and the Caribbean) there is a long history of collective action specifically designed to protect people and property from the severe tropical cyclones which are called hurricanes in the Region. A working group, known as the RA IV Hurricane Committee, was established by the seventh session of Regional Association IV (Mexico City, April - May 1977) to promote such activities within the framework of the Tropical Cyclone Programme (Tropical Cyclone Project until Eighth Congress, 1979).

At its first session (San Juan, May 1978), the RA IV Hurricane Committee took a novel approach to its problems by drawing up a RA IV Hurricane Operational Plan with a view to ensuring the most effective co-operation and co-ordination between the countries in preparing and issuing meteorological forecasts and warnings of all tropical cyclones affecting the area. The plan was shortly thereafter adopted by Regional Association IV. It defines the observing, forecasting and warning responsibilities of all cooperating Members and deals with other related items such as terminology and communications. The Committee repeatedly reviews the operational plan and has concluded that it contributes in a very real sense to the improvement of warning systems in the hurricane areas of Regional Association IV. It also serves as a valuable information source for the operational services. Other regional tropical cyclone bodies of the WMO Tropical Cyclone Programme family, the RA I Tropical Cyclone Committee for the South-West Indian Ocean, the WMO/ESCAP Panel on Tropical Cyclones for the Bay of Bengal and the Arabian Sea, the ESCAP/WMO Typhoon Committee and the RA V Tropical Cyclone Committee for the South Pacific and the South-East Indian Ocean have followed this initiative.

As requested by the RA IV Hurricane Committee, the RA IV Hurricane Operational Plan has been made available to all concerned through this document. New editions and supplements will be issued from time to time in the years ahead to reflect further development, updating and other changes to the plan.

RESOLUTION 14 (IX-RA IV) - RA IV HURRICANE OPERATIONAL PLAN
REGIONAL ASSOCIATION IV (NORTH AMERICA CENTRAL AMERICA
AND THE CARIBBEAN)

NOTING:

- (1) Resolution 2914 (XXVI) of the General Assembly of the United Nations - International action for the mitigation of the harmful effects of storms,
- (2) Resolution 13 (IX-RA IV) - RA IV Hurricane Committee,

CONSIDERING:

- (1) The need to enhance the co-operative efforts of countries within Region IV in carrying out effectively their roles in preparing for and issuing meteorological forecast and warnings of all tropical cyclones affecting the area,
- (2) That to achieve this aim it is essential to have an agreed "Hurricane Operational Plan" defining the observing, forecasting and warning responsibilities of all co-operating countries,

DECIDES to adopt the "RA IV Hurricane Operational Plan"*;

AUTHORIZES the president of RA IV to approve on behalf of the Association amendments to this Hurricane Operational Plan, as recommended by the RA IV Hurricane Committee;

REQUESTS the Secretary-General:

- (1) To maintain the WMO publication on the RA IV Hurricane Operational Plan in print and to keep it up to date;
- (2) To inform all Members concerned of any amendments and updating of the publication.

* Published as WMO/TD-No. 494 Report No. TCP-30. Editorial note: From 2015 as WMO-No. 1163.

CHAPTER 1

GENERAL

1.1 Introduction

The purpose of this plan is to enhance the co-operative efforts of Members within WMO Region IV in the carrying out of their roles of preparing for and issuing forecasts and warnings of all tropical cyclones affecting the area. Responsibilities of Members are defined. Tropical cyclone releases issued by the Regional/Specialized Meteorological Centre with activity specialization in tropical cyclone analysis, tracking and forecasting, in Miami (RSMC Miami - Hurricane Center) are explained and examples provided. Observational platforms, including land-based radar, satellites and aircraft reconnaissance are discussed. Where differences exist between the USA's National Hurricane Operational Plan (NHOP) and this plan, aircraft radar and upper-air observations made by the US Department of Defence will comply with USA's NHOP. Communication procedures are outlined with special emphasis on headings required to assure proper computer-processing and distribution of messages. The lists of hurricane names for the Caribbean Sea, Gulf of Mexico, the North Atlantic Ocean and the eastern North Pacific are included.

1.2 Terminology used in RA IV

1.2.1 Standard terminology in RA IV

I. Tropical Cyclone

A warm-core, non-frontal synoptic-scale cyclone, originating over tropical or subtropical waters, with organized deep convection and closed surface wind circulation about a well defined centre.

- | | | |
|----|----------------------------|--|
| A. | <u>Hurricane</u> | A tropical cyclone in which maximum average surface wind (one-minute mean*) is 119 km/h (74 mph) (64 knots) or greater. |
| B. | <u>Tropical storm</u> | A well organized tropical cyclone in which the maximum average surface wind (one-minute mean) is in the range 63-118 km/h (39-73 mph) (34-63 knots) inclusive. |
| C. | <u>Tropical depression</u> | A tropical cyclone in which the maximum average surface wind (one-minute mean) is 62 km/h (38 mph) (33 knots) or less. |

II. Subtropical Cyclone

A non-frontal low-pressure system that has characteristics of both tropical and extratropical cyclones. Like tropical cyclones, they are non-frontal, synoptic-scale cyclones that originate over tropical or subtropical waters, and have a closed surface wind circulation about a well-defined center. In addition, they have organized moderate to deep convection, but lack a central dense overcast. Unlike tropical cyclones, subtropical cyclones derive a significant proportion of their energy from baroclinic sources, and are generally cold-core in the upper troposphere, often being associated with an upper-level low or trough. In comparison to tropical cyclones, these systems generally have a radius of maximum winds occurring relatively far from the center (usually greater than 60 n mi), and generally have a less symmetric wind field and distribution of convection.

- | | | |
|----|-------------------------------|--|
| A. | <u>Subtropical Storm</u> | A subtropical cyclone in which the maximum sustained surface wind is 63 km/h (39 mph) (34 knots) or greater. |
| B. | <u>Subtropical depression</u> | A subtropical cyclone in which the maximum sustained surface wind is less than 63 km/h (39 mph) (34 knots). |

* For converting the wind speeds of different averaging periods such as 1-min, 2-min, 3-min and 10-min, WMO Tropical Cyclone Programme recommends to follow the guidelines as shown in the ATTACHMENT 1-B

III. Post-tropical cyclone

A former tropical cyclone. This generic term describes a cyclone that no longer possesses sufficient tropical characteristics to be considered a tropical cyclone. Post-tropical cyclones can continue carrying heavy rains and high winds. Note that former tropical cyclones that have become fully extra-tropical, as well as remnant lows, are two classes of post-tropical cyclones. The term "post-tropical" is predominantly a convenient communications term to permit the ongoing use of the storm name.

IV. Potential tropical cyclone

In the context of RSMC-Miami National Hurricane Center products, this term refers to a disturbance that has not yet become a tropical cyclone, but which poses the threat of bringing tropical storm or hurricane conditions to land areas within 48 hours.

V. Tropical wave

A trough or cyclonic curvature maximum in the trade wind easterlies or equatorial westerlies. The wave may reach maximum amplitude in the lower middle troposphere, or may be the reflection of an upper-troposphere cold low or equatorial extension of a mid-latitude trough.

VI. Tropical disturbance

A discrete system of apparently organized convection originating in the tropics or sub-tropics, having a non-frontal migratory character and having maintained its identity for at least 24 hours.

VII. Advisory (English messages)

A formal message from a Hurricane Warning Office giving warning information together with details on tropical cyclone location, intensity and movement, and precautions that should be taken. Where possible, the RSMC Miami-Hurricane Center advisory will contain a résumé of all warnings in effect.

- | | | |
|----|--------------------------------|---|
| A. | <u>Hurricane warning</u> | A warning that sustained winds of 64 knots (74 mph or 119 km/h) or higher are expected somewhere within the specified area in association with a tropical, subtropical, post-tropical, or potential tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the warning is issued 36 hours in advance of the anticipated onset of tropical-storm-force winds. The warning can remain in effect when dangerously high water or a combination of dangerously high water and waves continue, even though winds may be less than hurricane force. |
| B. | <u>Hurricane watch</u> | An announcement that sustained winds of 64 knots (74 mph or 119 km/hr) or higher are possible somewhere within the specified area in association with a tropical, subtropical, post-tropical, or potential tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the watch is issued 48 hours in advance of the anticipated onset of tropical-storm-force winds. |
| C. | <u>Tropical storm warning*</u> | A warning that tropical storm conditions, sustained winds within the range 34 to 63 knots (39 to 73 mph or 63 to 118 km/h) are expected within the specified area within 36 hours in association with a tropical, subtropical, post-tropical, or potential tropical cyclone. |

- D. Tropical storm watch* An announcement that sustained winds of 34 to 63 knots (39 to 73 mph or 63 to 118 km/h) are possible somewhere within the specified area within 48 hours in association with a tropical, subtropical, post-tropical, or potential tropical cyclone.
- E. Storm Surge Warning: A warning of the danger of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within 36 hours, in association with a tropical, subtropical, post-tropical, or potential tropical cyclone. The warning may be issued earlier when other conditions, such as the onset of tropical-storm-force winds, are expected to limit the time available to take protective actions for surge (e.g., evacuations). The warning may also be issued for locations not expected to receive life-threatening inundation, but could potentially be isolated by inundation in adjacent areas. Storm surge warnings are only issued for the Atlantic and Gulf coasts of the conterminous United States.
- F. Storm Surge Watch An announcement of the possibility of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within 48 hours, in association with a tropical, subtropical, post-tropical, or potential tropical cyclone. The watch may be issued earlier when other conditions, such as the onset of tropical storm-force winds, are expected to limit the time available to take protective actions for surge (e.g., evacuations). The watch may also be issued for locations not expected to receive life-threatening inundation, but could potentially be isolated by inundation in adjacent areas. Storm surge watches are only issued for the Atlantic and Gulf coasts of the conterminous United States.

VIII. Bulletin (Spanish messages)

A formal message from a Hurricane Warning Office giving warning information, together with details on tropical cyclone location, intensity and movement, and precautions that should be taken.

- A. Hurricane Warning (same as English)
- B. Hurricane Watch (same as English)
- C. Gale or Tropical Storm Warning (same as English)
- D. Tropical Storm Watch (same as English)
- E. Advisory Information on tropical cyclone not requiring watches or warnings at this time.

IX. Bulletin (English)

A public release from a weather office issued in the event of the occurrence or forecast occurrence of severe weather, including the developing stage of a tropical cyclone or after formal advisories on a hurricane or tropical cyclone have been discontinued. Bulletins emphasize features which are significant for the safety of the public and summarize all warnings in effect.

* The terms "Tropical Storm Warning" and "Tropical Storm Watch" or their equivalent in Spanish are used in coastal or land area warnings by the RSMCMiami - Hurricane Center and an increasing number of Members.

1.2.2 Meaning of other terms used

I. Local action statements

A public release prepared by a Weather Service Office in or near a threatened area giving specific details for its area of responsibility: (a) weather conditions (b) sections that should be evacuated and (c) other precautions necessary to protect life and property.

II. Hurricane season

The portion of the year having a relatively high incidence of hurricanes. In the Atlantic, Caribbean and the Gulf of Mexico, it is the period from 01 June to 30 November, and in the East Pacific, from 15 May to 30 November.

III. Storm surge

The difference between the actual water level under influence of a meteorological disturbance (storm tide) and the level which would have been attained in the absence of the meteorological disturbance (i.e. astronomical tide).

IV. Storm tide

The actual sea level as influenced by a weather disturbance. The storm tide consists of the normal astronomical tide and the storm surge.

V. "Eye"

The relatively clear and calm area inside the circular wall of convective clouds, the geometric centre of which is the centre of the tropical cyclone (hurricane).

VI. Reconnaissance aircraft centre fix of the tropical cyclone, vortex fix.

The location of the centre of a tropical cyclone obtained by reconnaissance aircraft penetration.

VII. Centre fix of the tropical cyclone

The estimated location of the centre of a tropical cyclone.

1.2.3 Equivalent terms

<u>English</u>	<u>French</u>	<u>Spanish</u>
Advisory	Bulletin spécial	Boletín
Hurricane season	Saison cyclonique	Temporada de huracanes
Hurricane warning	Alerte ouragan	Alerta de huracán
Hurricane watch	Pour les îles françaises: vigilance orange, rouge ou violet (selon le délai) Pré-alerte ouragan Pour les îles françaises: vigilance jaune ou orange (selon le délai)	Aviso de huracán

1.3 The Saffir/Simpson Hurricane Wind Scale

The Saffir/Simpson Hurricane Wind Scale from one to five based on the hurricane's present intensity, used operationally within RA IV is as follows:

<u>One:</u>	Winds	119-153kmh ⁻¹	(74-95m.p.h)
<u>Two:</u>	Winds	154-177kmh ⁻¹	(96-110m.p.h)
<u>Three:</u>	Winds	178-208kmh ⁻¹	(111-129m.p.h)
<u>Four:</u>	Winds	209-251kmh ⁻¹	(130-156m.p.h)
<u>Five:</u>	Winds	252kmh ⁻¹	(157m.p.h) or greater

RA IV HURRICANE COMMITTEE GLOSSARY OF STORM-RELATED TERMS**(other than those in Chapter 1)**

ENGLISH	SPANISH	DESCRIPTION
Analogue method	Método analógico	Forecasting method based on the assumption that a current synoptic situation will develop in the same way as a similar synoptic situation in the past.
Anticyclone	Anticiclón	An area of high pressure, with the highest pressure at the centre. Commonly referred to as "High".
Anticyclogenesis	Anticiclogénesis	Formation of a new anticyclone or intensification of an existing one.
Average one-minute wind speed	Velocidad promedio del viento en un minuto	Determined by averaging observed values from a direct-reading instrument or a recorder over a 1 minute period. The standard height of the wind measuring instrument is 10 meters.
Baroclinic	Baroclínico	An atmospheric state in which the pressure depends upon other variables in addition to density. The isobaric surfaces do not, therefore, coincide with the surfaces of constant specific volume. In a baroclinic atmosphere the variations of the wind with elevation may be quite large.
Barotropic	Barotrópico	A state of the atmosphere in which isobaric surfaces coincide with surfaces of equal density. In a Barotropic atmosphere the variations of the wind with elevation is slight.
Blocking	Bloqueo	Interruption of normal eastward motion due to the stagnancy of an anticyclone (or, less frequently, a cyclone) in their paths.
Circulation	Circulación	General or primary patterns of wind-flow in the atmosphere. Cyclonic circulation is considered positive and Anticyclonic circulation negative.
Climatological forecast	Pronóstico Climatológico	Forecast based on the climate of a region rather than upon the dynamic implications of current weather.
Cold low	Baja fría	Depression or low pressure zone which is cold with respect to its surroundings at the same level of the atmosphere.
Convergence	Convergencia	Increase of mass into an atmospheric layer when the winds are so that there is a net horizontal flow toward inside the layer. Is the opposite to "divergence".
Cyclogenesis	Ciclogénesis	The process that creates a new cyclone or intensifies an existing one.
Cyclone	Ciclón	An area of low pressure, with the lowest pressure at the centre. Commonly referred to as "Low".
Deepening	Profundización	The process by which the central pressure of a system (i.e. cyclone) decreases with time. Deepening is related to cyclogenesis and results in an increase of

ENGLISH	SPANISH	DESCRIPTION
		the wind speed around a low pressure area.
Divergence	Divergencia	Net outward mass flow from a layer of the atmosphere. Is the opposite to "convergence".
Dropwindsonde	Dropwindsonda	A small radio transmitter, that is dropped from an aircraft with a parachute and transmits to the plane data on temperature, pressure, relative humidity and wind.
Extra-Tropical Cyclone	Ciclónextratropical	A cyclone which attributes the majority of its energy from baroclinic processes. An extra-tropical cyclone has significant vertical wind shears, and a distinctive asymmetric temperature and moisture field. It may develop a cold core in its later stages.
Fetch	Fetch	Length of the section over sea water along which wind blows with almost uniform direction and speed. Height of wind waves is function of the fetch.
Filling	Llenado	Process by which the central pressure of cyclones increases. It is the opposite of "deepening".
Flash flood	Crecida repentina	A flood that rises quite rapidly with little or no advance warning; usually as a result of an intense rainfall over a small area, or, possibly a dam failure etc.
Frontogenesis	Frontogénesis	Process of formation or intensification of a front or frontal zone by means of physical (e.g. radiation) or kinematical (e.g. air motion) influences.
Frontolysis	Frontólisis	Process of weakness or dissipation of a front or frontal zone by means of physical (e.g. radiation) or kinematical (e.g. air motion) influences.
Gale	Viento duro	Sustained winds within the range 63 to 117 km/h (39 to 73 miles per hour) (34 to 63 knots).
Gradient	Gradiente	Change rate of any element value with distance in any given direction.
Gust	Racha	Fluctuation in a short time of wind speed with a variation of 10 knots or more between peaks and lowest speeds.
Hurricane centre or eye	Centro u ojo del huracán	The relatively calm area in the centre of the storm. In this area winds are light and the sky often is only partly covered by clouds.
Hurricane Committee	Comité de Huracanes	Regional Association IV (North America, Central America and the Caribbean) Working Group established in 1977 to promote collective action specifically designed to minimize loss of life and damage to property from tropical cyclones in the Region.
Inter-tropical Convergence Zone	Zona de Convergencia Inter-Tropical	Narrow zone where the trade winds of the two hemispheres meet. (It is also known as the Equatorial Convergence Zone).

ENGLISH	SPANISH	DESCRIPTION
Inversion	Inversión	Condition of the atmosphere when temperature of an air layer increases with height rather than diminish.
Isobar	Isobara	Line connecting points of equal atmospheric pressure on a given surface.
Isochrone	Isocrona	Line connecting all points where a phenomena occurs at the same time.
Isohyet	Isoyeta	Line connecting points where quantity of precipitation collected during a given period has the same value.
Isotach	Isotaca	Line connecting points of equal wind speed.
Isallobar	Isalobara	Line connecting points with the same barometric change during a given period.
Knot	Nudo	Wind speed unit equal to one nautical mile (6.080 feet) (1.8 km) per hour.
Long wave	Onda Larga	Atmospheric waves with wavelength varying from 50° to 120°.
Meridional flow	Flujo meridional	A predominantly north-south wind circulation.
Modelling	Modelización	Use of a theoretical scheme, usually in a mathematical form, of a system or a complex reality that is developed to facilitate its understanding and the study of its behaviour.
Near gale	Viento fuerte	Wind within the speed range 50 to 62 km/h (32 to 38 miles per hour) (28 to 33 knots) (Number 7 of Beaufort Scale).
Numerical Weather Prediction (NWP)	Predicción Numérica del Tiempo (PNT)	Forecast of a pressure field by means of numerical solution of motion equations in a simplified form, usually with the support of electronic computers.
Persistence forecast	Pronóstico de persistencia	Forecast entirely based on tendency to weather persistence.
Polar trough	Vaguada polar	A low pressure trough embedded in the westerly winds prevailing at medium latitudes. They generally move from west to east accompanied by abundant clouds at all levels. Occasionally a well developed polar trough extends until tropical regions. Western Caribbean hurricanes of June and October are frequently formed on polar trough.
Reconnaissance flight	Vuelo de reconocimiento	Flight realized by an aircraft penetrating a tropical storm or hurricane or investigating an area of disturbed weather, with the purpose of carrying out observations.
Recurvature	Recurvatura	Change in the track direction of a tropical cyclone from an initial westward movement until its later normal movement poleward and eastward.
Ridge of high pressure	Cuña de alta presión	Elongated area of high pressure displacing between two depressions or troughs.

ENGLISH	SPANISH	DESCRIPTION
Spiral band	Banda espiral	A long and narrow spiral band found inserted into wind circulation around a hurricane. Convergence and rainfall reach maximum values into spiral bands.
Squall	Turbonada	Atmospheric phenomenon characterized by a very large variation of wind speed: it begins suddenly, has a duration of the order of minutes, and decreases its speed quickly. It is often accompanied by showers or storms.
Squall line	Línea de turbonada	Fictitious moving line, sometimes of considerable extension, along which squall phenomena occurs. They frequently precede cold fronts, but occasionally they are present within the external area of the hurricane cloud cover.
Statistical forecast	Pronóstico estadístico	Objective forecast based on a statistical study of the past behaviour of the atmosphere, expressed in the form of regression formulae, probabilities, etc.
Subsidence	Subsidencia	Slow downfall of an air mass over an extended region. It is usually accompanied by horizontal divergence at lower layers.
Swell	Mar de leva	Any water waves system which has not been generated locally.
Thunderstorm	Tormenta	One or more sudden electrical discharges manifested by a luminous flash (lighting) and a sharp or noisy sound (thunder).
Tornado	Tornado	A severe rotating windstorm of small diameter and great destructive power. It is the most violent natural meteorological phenomenon. With certain frequency they can occur within hurricanes circulation. Although tornadoes associated with several weather situations occur over land areas in many parts of the world, they are relatively frequent in the forward portion of the hurricane periphery.
Tropical weather outlook	Perspectivas del tiempo en los trópicos	A report containing information on possible evolution of tropical weather prepared by RSMC Miami - Hurricane Center from 1 June through 30 November (15 May through 30 November for the eastern Pacific), and transmitted at 0600, 1200, 1800, and 0000 UTC. The outlook discusses which areas are expected to remain stable, which disturbed or suspicious areas are becoming favourable for tropical development during the next 5 days.
Trough of low pressure	Vaguada de baja presión	An elongated area of low pressure with U-shaped or V-shaped isobars which concavities are addressed toward low pressure.
Typhoon	Tifón	Name given to "hurricanes" in the China Sea and, more commonly, in the north-west Pacific Ocean.
Vortex	Vórtice	Any rotating wind system.
Vorticity	Vorticidad	Tendency of a fluid to turn or rotate around an

ENGLISH	SPANISH	DESCRIPTION
		arbitrarily oriented axis.
Waterspouts	Tromba marina	Small, revolving storm over oceans or inland waters. They occasionally move towards inland and cause some damage, but winds are less severe than those in tornadoes, which they resemble in appearance.
Wind	Viento	The horizontal movement of the air with respect to earth surface.
Wind shear	Cizalladura del viento	Space variation of wind speed in a given direction (horizontal or vertical).
Wind stress	Fuerza del viento	The drag or tangential force per unit area exerted on the surface of the earth by the adjacent layer of moving air.

ACRONYMS:**SIGLAS:**

GOES	GOES	Geo-stationary Operational Environmental Satellite
HOMS	HOMS	Hydrology Operational Multipurpose System
IOC	COI	Intergovernmental Oceanographic Commission
RSMC	CMRE	Regional Specialized Meteorological Centre
TCP	PCT	Tropical Cyclone Programme
WWW	VMM	World Weather Watch Programme. Consists of the following elements: - GOS (SMO) - Global Observing System; - GTS (SMT) - Global Telecommunication System; - GDPS (SMPD) - Global Data Processing System.

GUIDELINES FOR CONVERTING BETWEEN VARIOUS WIND AVERAGING PERIODS IN TROPICAL CYCLONE CONDITIONS

This note is based on recommendations from Harper et al. (2010) and extracts from Knaff and Harper (2010), providing advice on why, when and how "wind averaging conversions" can be made.

a) Why Convert Wind Speeds?

From the observational perspective, the aim is to process measurements of the wind so as to extract an estimate of the **mean** wind at any time and its **turbulence** properties. From the forecasting viewpoint, the aim is, given a specific wind speed metric derived from a process or product, to usefully predict other metrics of the wind. Typically these needs revolve around the concept of the mean wind speed and an associated peak gust wind speed; such that the statistical properties of the expected level of wind turbulence under **different exposures** can be used to permit useful conversions **between peak gust wind speed** estimates.

b) When to Convert Wind Speeds?

Wind speed conversions to account for varying averaging periods only apply in the context of a maximum (peak gust) wind speed of a given duration observed within some longer interval. Simply measuring the wind for a shorter period of time at random will not ensure that it is always higher than the mean wind (given that there are both lulls and gusts). It is important that all wind speed values be correctly identified as an estimate of the **meanwind** or an estimate of a **peakgust**.

Once the mean wind is reliably estimated, the random effects of turbulence in producing higher but shorter-acting wind gusts, typically of greater significance for causing damage, can be estimated using a "gust factor". In order for a gust factor to be representative, certain conditions must be met, many of which may not be exactly satisfied during a specific weather event or at a specific location:

- Wind flow is turbulent with a steady mean wind speed (**statistically stationary**);
- Constant surface features exist within the period of measurement, such that the boundary layer is in equilibrium with the underlying surface roughness (**exposure**);
- The conversion assumes the mean wind speed and the peak gust wind speed are at the same **height** (e.g. the WMO standard observation height +10 m) above the surface.

c) How to Convert Individual Point-Specific Wind Speeds

Firstly, the mean wind speed estimate V should be explicitly identified by its averaging period T_o in seconds, described here as V_{T_o} , e.g.

V_{600} is a 10-min averaged mean wind estimate;

V_{60} is a 1-min averaged mean wind estimate;

V_3 is a 3-sec averaged mean wind estimate.

Next, a peak gust wind speed should be additionally prefixed by the gust averaging period τ , and the time period over which it is observed (also termed the **reference period**), described here as V_{τ, T_o} , e.g.

$V_{60,600}$ is the highest 1-min mean (peak 1-min gust) within a 10-min observation period;

$V_{3,60}$ is the highest 3-sec mean (peak 3-sec gust) within a 1-min observation period.

The "gust factor" G_{τ, T_o} then relates as follows to the mean and the peak gust:

$$V_{\tau, T_o} = G_{\tau, T_o} V$$

where the (true) mean wind V is estimated on the basis of a suitable sample, e.g. V_{600} or V_{3600} .

On this basis, Table 1 provides the recommended near-surface (+10 m) conversion factors G_{τ, T_o} between typical peak gust wind averaging periods, which are a strong function of the exposure class because the turbulence level varies depending on the surface roughness. Table 1 only provides a range of indicative exposures for typical forecasting environments and Harper et al. (2010) or WMO (2008) should be consulted for more specific advice regarding particular types of exposures - especially if it is intended to calibrate specific measurement sites to "standard exposure".

Table 1 Wind speed conversion factors for tropical cyclone conditions (after Harper et al. 2010).

Exposure at +10 m		Reference Period T_o (s)	Gust Factor G_{τ, T_o}				
Class	Description		Gust Duration τ (s)				
			3	60	120	180	600
<i>In-Land</i>	Roughly open terrain	3600	1.75	1.28	1.19	1.15	1.08
		600	1.66	1.21	1.12	1.09	1.00
		180	1.58	1.15	1.07	1.00	
		120	1.55	1.13	1.00		
		60	1.49	1.00			
<i>Off-Land</i>	Offshore winds at a coastline	3600	1.60	1.22	1.15	1.12	1.06
		600	1.52	1.16	1.09	1.06	1.00
		180	1.44	1.10	1.04	1.00	
		120	1.42	1.08	1.00		
		60	1.36	1.00			
<i>Off-Sea</i>	Onshore winds at a coastline	3600	1.45	1.17	1.11	1.09	1.05
		600	1.38	1.11	1.05	1.03	1.00
		180	1.31	1.05	1.00	1.00	
		120	1.28	1.03	1.00		
		60	1.23	1.00			
<i>At-Sea</i>	> 20 km offshore	3600	1.30	1.11	1.07	1.06	1.03
		600	1.23	1.05	1.02	1.00	1.00
		180	1.17	1.00	1.00	1.00	
		120	1.15	1.00	1.00		
		60	1.11	1.00			

Some example applications of the above recommendations are:

- To estimate the expected "off-land" 3-sec peak gust in a 1-min period, multiply the estimated "off-land" mean wind speed by 1.36
- To estimate the expected "off-sea" 3-sec peak gust in a 10-min period, multiply the estimated "off-sea" mean wind speed by 1.38
- To estimate an "at-sea" 1-min peak gust in a 10-min period, multiply the estimated "at-sea" mean wind speed by 1.05

Note that it is not possible to convert from a peak gust wind speed back to a **specific** time-averaged mean wind - only to the **estimated true mean** speed. Hence to estimate the "off-sea" mean wind speed given only a peak observed gust of 1-min duration ($\tau = 60$ s) measured in a 10-min period ($T_o = 600$ s), multiply the observed 1-min peak gust by $(1/1.11) = 0.90$. This does not guarantee that the estimated mean wind will be the same as

the 10-min averaged wind at that time but, because the 10-min average is normally a reliable estimate of the true mean wind, it will likely be similar. In all cases, measurement systems should aim to reliably measure the mean wind speed and the standard deviation using a sample duration of not less than 10-min (WMO 2008), i.e. V_{600} . Additional shorter averaging periods and the retaining of peak information should then be targeted at operational needs.

d) Converting Between Agency Estimates of Storm Maximum Wind Speed V_{max}

This is a slightly different situation from converting a point specific wind estimate because the concept of a storm-wide maximum wind speed V_{max} is a metric with an associated spatial context (i.e. anywhere within or associated with the storm) as well as a temporal fix context (at this moment in time or during a specific period of time). While it may be expressed in terms of any wind averaging period it remains important that it be unambiguous in terms of representing a mean wind or a peak gust. Agencies that apply the WMO standard 10-min averaged V_{max} wind have always applied a wind-averaging conversion to reduce the maximum "sustained" 1-min wind value (a 1-min peak gust) that has been traditionally associated with the Dvorak method (Dvorak 1984, Atkinson and Holliday 1977)³. As noted in the previous section, it is technically not possible to convert from a peak gust back to a specific time-averaged mean wind - only to the estimated true mean wind speed. However, in Harper et al. (2010) a practical argument is made for nominal conversion between $V_{max_{60}}$ and $V_{max_{600}}$ values via an hourly mean wind speed reference, and the recommendations are summarised in Table 2.

It can be noted that the recommended conversion for at-sea exposure is about 5% higher than the "traditional" value of 0.88 (WMO 1993), which is more appropriate to an off-land exposure. This has special implications for the Dvorak method because "at sea" is the typical exposure of interest where such conversions have been traditionally applied.

Table 2 Conversion factors between agency estimates of maximum 1-min and maximum 10-min averaged tropical cyclone wind speed V_{max} . (after Harper et al. 2010).

$V_{max_{600}}=K V_{max_{60}}$	At-Sea	Off-Sea	Off-land	In-Land
K	0.93	0.90	0.87	0.84

e) References

Atkinson, G.D., and C. R. Holliday, 1977: Tropical cyclone minimum sea level pressure/ maximum sustained wind relationship for the Western North Pacific. *Mon. Wea. Rev.*, **105**, 421-427.

Dvorak, V.F., 1984: Tropical cyclone intensity analysis using satellite data. NOAA Tech. Rep. NESDIS 11, *National Oceanic and Atmospheric Administration*, Washington, DC, 47 pp.

Knaff, J.A. and B.A. Harper, 2010: Tropical cyclone surface wind structure and wind-pressure relationships. In: Proc. WMO IWTC-VII, *World Meteorological Organization*, Keynote 1, La Reunion, Nov.

Harper, B.A., J. D. Kepert, and J. D. Ginger, 2010: Guidelines for converting between various wind averaging periods in tropical cyclone conditions. *World Meteorological Organization*, TCP Sub-Project Report, WMO/TD-No. 1555.

WMO 1993: Global guide to tropical cyclone forecasting. Tropical Cyclone Programme Report No. TCP-31, *World Meteorological Organization*, WMO/TD - No. 560, Geneva.

WMO 2008: Guide to meteorological instruments and methods of observation. *World Meteorological Organization*, WMO-No. 8, 7th Ed, 681pp.

³ As detailed in Harper et al. (2010), this traditional assumption is without a firm basis.

CHAPTER 2

RESPONSIBILITIES OF MEMBERS

2.1 Forecasts and warnings for the general population

The area of responsibility of RSMC Miami for issuing tropical and subtropical cyclone advisories is the North Atlantic Ocean, the Caribbean Sea, Gulf of Mexico, North Pacific Ocean eastward from 140°W.

2.1.1 In Region IV the responsibility for preparing and issuing warnings is as follows:

Antigua & Barbuda	The islands and coastal waters of Antigua, Anguilla, Barbuda, British Virgin Islands, Montserrat, Nevis and St. Kitts;
Aruba (The Netherlands)	The island and coastal waters of Aruba;
Bahamas	The islands and coastal waters of the Bahamas and the Turks and Caicos Islands;
Barbados	The islands and coastal waters of Barbados, Dominica, St. Vincent and the Grenadines;
Belize	The islands, coastal waters and inland areas of Belize;
Bermuda	The islands and coastal waters of Bermuda;
Canada	The islands, coastal waters and inland areas of Canada;
Cayman Islands	The islands, and coastal waters of Cayman Islands;
Colombia	The islands, coastal waters and inland areas of Colombia;
Costa Rica	The islands, coastal waters and inland areas of Costa Rica;
Cuba	The islands, coastal waters and inland areas of Cuba;
Curacao	The islands and coastal waters of Curacao
Sint Maarten	Sint Maarten
Dominican Republic	The islands, coastal waters and inland areas of the Dominican Republic;
El Salvador	The islands, coastal waters and inland areas of El Salvador;
France	The coastal waters and islands of Martinique; Guadeloupe (Grande Terre and Basse Terre); Marie-Galante, Desirade and Les Saintes; St Barthelemy; St Martin;
Guatemala	The coastal waters and inland areas of Guatemala;
Honduras	The islands, coastal waters and inland areas of Honduras;
Jamaica	The coastal waters and islands of Jamaica;
Mexico	The islands, coastal waters and inland areas of Mexico;
Netherlands	The islands and coastal waters Bonaire, Saba and St. Eustatius;
Nicaragua	The islands, coastal waters and inland areas of Nicaragua;
Panama	The islands, coastal waters and inland areas of Panama;
Saint Lucia	The island and coastal waters of Saint Lucia;
Trinidad and Tobago	The islands and coastal waters of Trinidad, Tobago, and Grenada and its dependencies;
United States of	The islands, coastal waters and inland areas of the United States of America, including Puerto Rico and the US Virgin Islands. In addition, the USA has agreed to issue warnings for Haiti, and its coastal waters. Forecasts issued by the USA are discussed in Chapter III;
Venezuela	The islands, coastal waters and inland areas of Venezuela.

The dissemination of these warnings within each country or territory is the responsibility of that country or territory.

2.1.2 Some countries have established the following backups for Watches, Warnings and agreed-upon essential products which should include terminal forecasts for main airports. Details of these products are arranged bilaterally.

- (a) Barbados will take over the responsibility of Antigua & Barbuda and/or Saint Lucia;
- (b) Antigua & Barbuda will take over the responsibility of Barbados with respect to the islands and coastal waters of Dominica.
- (c) Trinidad and Tobago will take over the responsibility of Barbados with respect to the islands and coastal waters of Barbados and St. Vincent and the Grenadines. Trinidad and Tobago will serve as a secondary backup to Barbados with respect to Saint Lucia;
- (d) USA will take over the responsibility of Bahamas and Jamaica;
- (e) USA will take over the responsibility of Curacao and Sint Maarten
- (f) Barbados will take over the responsibility of Trinidad and Tobago.
- (g) The Cayman Islands will take over responsibility for Belize, with Jamaica serving as a secondary backup to the Cayman Islands with respect to Belize.
- (h) Jamaica will take over the responsibility of the Cayman Islands;
- (i) USA, the backup to RSMC Miami for the Atlantic basin tropical cyclone advisories is the Weather Prediction Center (WPC), in Washington D.C.. The Central Pacific Hurricane Center in Honolulu, HI backs up the NHC on eastern North Pacific basin advisories.
- (j) Canada (CHC) is backed up at the Newfoundland and Labrador Weather Office in Gander, Newfoundland, Canada
- (k) The Netherlands will take over responsibility for Aruba.

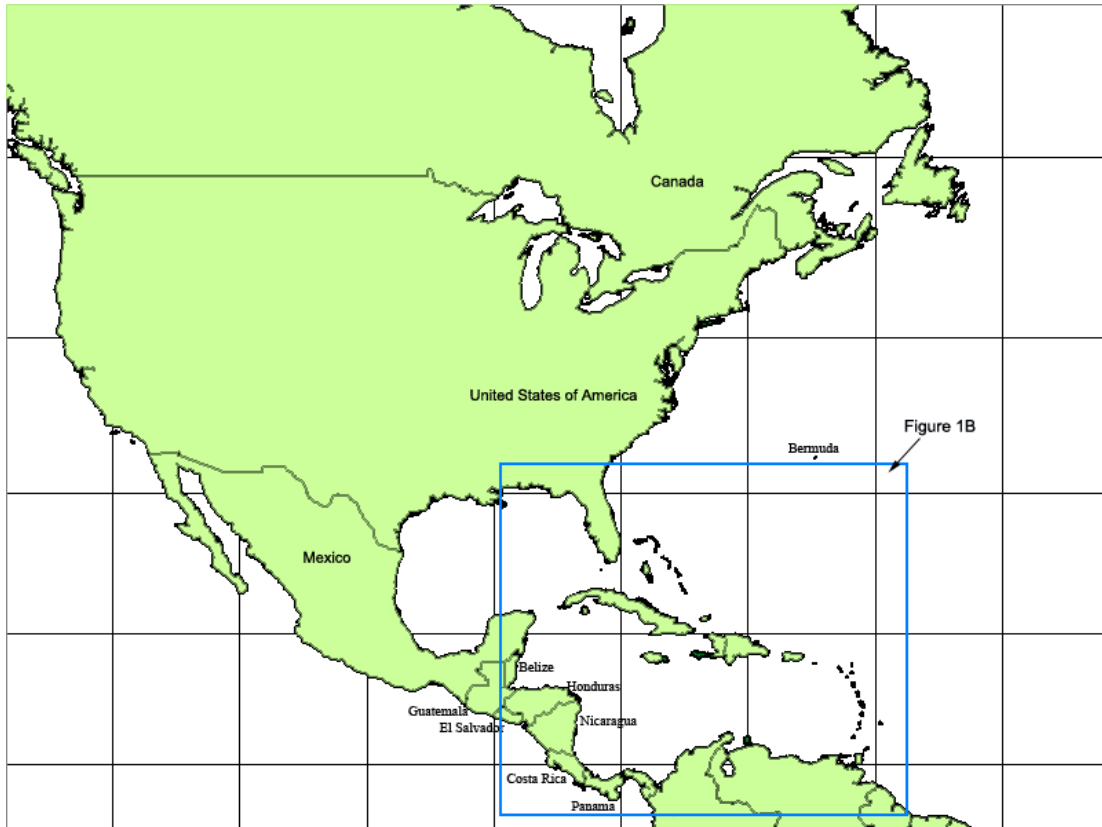


Figure 1-A: Tropical cyclone warning responsibility of RA IV countries described in paragraph 2.1



Figure 1-B: Tropical cyclone warning responsibility of RA IV countries described in paragraph 2.1

2.2 Forecasts and warnings for the open sea and civil aviation

2.2.1 The IMO/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) is the internationally coordinated service for the promulgation of meteorological warnings and forecasts. The WWMIWS guidance and coordination for marine meteorological maritime safety information messages issued on EGC (SafetyNET), NAVTEX and HF NBDP communication systems covering the following areas:

- warnings and forecasts for the High Seas;
- warnings and forecasts for coastal, offshore and local waters (including ports, lakes and harbour areas).

Operational guidance for handling and formatting meteorological information is given in detail in the Annex IV of the WMO Technical Regulations (Manual on Marine Meteorological Services – WMO-No. 558). The provision of warnings for weather systems that produce average wind speeds of 34 knots and greater are a mandatory requirement of the WWMIWS.

2.2.2 In accordance with the WMO Manual on Marine Meteorological Services (WMO No. 558), the USA is responsible for preparing marine tropical cyclone forecasts and warnings for the Caribbean Sea, Gulf of Mexico and the North Atlantic Ocean. These forecasts and warnings are available as part of a tropical cyclone forecast/advisory bulletin (reference chapter 3, section 3.1.2).

2.2.3 In accordance with the International Civil Aviation Organization (ICAO) Air Navigation Plans (ANPs) for the Caribbean (CAR), North Atlantic (NAT) and South American (SAM) Regions, warnings of tropical cyclones for international air navigation are issued as SIGMET messages by designated meteorological watch offices (MWOs), each of which provides information for one or more specified flight information regions (FIRs) or upper information regions (UIRs). The boundaries of the FIRs/UIRs are defined in ICAO ANPs for the CAR, NAT and SAM Regions.

2.2.4 SIGMET information is provided in accordance with WMO-No. 49 - Technical Regulations, Volume II (Meteorological Services for International Air Navigation). SIGMETs for tropical cyclones are issued for those tropical cyclones having a 10-minute mean surface wind speed of 63 km/h (34 kt) or more, **except in Regional Association IV where the mean surface wind will be averaged over a one-minute period**. While ICAO wished to standardize the practice of averaging globally, it recognized that the RA IV practice does not constitute a safety problem for aviation; it simply implies that some additional SIGMET messages would be issued for those tropical cyclones in which the ten-minute average would remain below the specified 63 km/h (34 kt) threshold.

2.2.5 The RSMC Miami - Hurricane Center disseminates advisory information on positions of the centre of the tropical cyclones to MWOs as appropriate for use in the preparation of SIGMETs for tropical cyclones. To facilitate automated pre-flight planning services, the responsible MWO in RA IV, located in the USA, will issue tropical cyclone advisory messages in accordance with amendment 72 to Annex 3.

2.3 Satellite rainfall estimates

The USA will provide satellite rainfall estimates when a tropical system is within 36 hours of making landfall within the region.

2.4 Observations

- (a) Radar: All nations in RA IV with radars will ensure the distribution of radar data and/or imagery whenever a tropical disturbance is within radar range. Content of the data and/or imagery will be in accordance with chapter 4 of this document.

- (b) Reconnaissance: The USA will make available all operational weather reconnaissance observations obtained in connection with tropical disturbances;
- (c) Satellite: Near-polar-orbiting and geostationary satellite products will be made available to countries having the necessary receiving equipment (see WMO-No. 411);
- (d) Surface: In addition to routine observations, additional observations will be taken by Members when requested by RSMC Miami - Hurricane Center;
- (e) Upper-air: Besides routine observations, additional rawinsonde observations will be taken by Members when requested by RSMC Miami - Hurricane Center.

2.5 Communications

Members will disseminate forecasts, warnings and observations in accordance with established communications headings presented in the Manual on the Global Telecommunication System (WMO-No. 386).

2.6 Information

RSMC Miami - Hurricane Center will serve as a regional information centre on tropical meteorology including tropical cyclones. This function is performed both during active tropical cyclone periods and as a source of information on past tropical cyclone activity.

In relation to international marine requirements, the WWMIWS coordinates the broadcast of forecasts and warnings to vessels at sea through the Global Maritime Distress and Safety System (GMDSS), which includes SafetyNET satellite communications.

As part of the WWMIWS coordination, there are the following types of Centres:

Issuing service means a National Meteorological Service which has accepted responsibility for ensuring that meteorological warnings and forecasts for shipping are disseminated through the Inmarsat SafetyNET service to the designated area (METAREA) for which the Service has accepted responsibility under the WWMIWS.

Preparation service means a National Meteorological Service which has accepted responsibility for the preparation of warnings and forecasts for parts of or an entire designated area (METAREA) in the WMO system for the dissemination of meteorological forecasts and warning to shipping under the WWMIWS and for their transfer to the relevant Issuing Service for broadcast.

Under the responsibilities section 3.2 for each centre, the above definitions have been applied to outline the coordination responsibilities in relation to issuing broadcasts on SafetyNET.

Under the IMO/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS), the provision of products on marine communication systems is coordinated by a METAREA Coordinator. In order to coordinate the required meteorological Maritime Safety Information or in the event of an inability to disseminate products with the Issuing Service, the RSMC should advise the relevant METAREA Coordinator for areas IV and XII (United States of America); area I (United Kingdom); area II (France) and on the rare occasion when tropical events warrant, areas V (Brazil) or XVI (Peru).

http://www.wmo.int/pages/prog/www/ois/Operational_Information/VolumeD/GMDSS/Focal_Points/GMDSS/fp.pdf

CHAPTER 3

TROPICAL CYCLONE PRODUCTS OF THE RSMC MIAMI

RSMC Miami has taken on additional responsibilities and now covers certain weather systems that are not tropical cyclones. In 2013, for example, the program was extended to cover certain post-tropical cyclones and, in 2017, certain disturbances that pose the threat of becoming tropical cyclones. Every attempt has been made to be careful about the use of the term *tropical cyclone* whenever policy indicates a different treatment among the various system types covered by this plan. However, it should be understood that in some contexts, such as in the title of this section (Tropical Cyclone Products of the RSMC Miami), the expression is meant to refer to *all* the system types covered by this plan - that is, systems that could become, actually are, or used to be, tropical cyclones. Note that all references to tropical cyclones apply to subtropical cyclones.

3.1 Tropical Cyclone Forecast and Advisory Products

3.1.1 Tropical Cyclone Public Advisories (TCP) are the primary tropical cyclone information products issued to the public. The RSMC Miami will issue these products on the criteria set in section 3.1.1.1.

3.1.1.1 Issuance Criteria. In the Atlantic and east Pacific, RSMC Miami will issue TCPs for all tropical cyclones (except for certain tropical depressions over land, for which the NOAA Weather Prediction Center (WPC) issues a similar product under the TCP header. In addition, TCPs will be issued by NHC for certain post-tropical cyclones and for certain disturbances that could become tropical cyclones (i.e., potential tropical cyclones), as described below.

The initial advisory will be issued when data confirm a tropical cyclone has developed, or, for potential tropical cyclones threatening the United States, upon the first issuance of U.S. coastal tropical cyclone wind or storm surge watches/warnings. When potential tropical cyclones threaten land areas outside of the United States, the initial advisory may be issued when there is a risk of tropical storm or hurricane conditions over international land areas within 48 hours. Advisories on potential tropical cyclones will not be issued for systems that only pose a threat of tropical storm or hurricane conditions to marine areas.

The title of the advisory will depend upon the intensity or status of the tropical cyclone as listed below.

- a. A tropical depression advisory refers to a tropical cyclone with 1-minute sustained winds up to 62 km/h or 38 mph.
- b. A tropical storm advisory will refer to tropical cyclones with 1-minute sustained surface winds 63-118 km/h or 39 to 73 mph.
- c. A hurricane advisory will refer to tropical cyclones with winds 119 km/h or 74 mph or greater.
- d. A post-tropical cyclone advisory will be issued on former tropical cyclones that pose a significant threat to life and property, and when the transfer of responsibility to another office would result in an unacceptable discontinuity of service.
- e. A potential tropical cyclone advisory will be issued for systems that have the potential to become a tropical cyclone and which pose the threat of bringing tropical-storm-force winds to land areas within the watch or warning lead time.

Public advisories will discontinue when either:

- a. The tropical cyclone becomes post-tropical and the system does not pose a significant threat to life and property or the system can be transferred to another office without an unacceptable discontinuity of service.

b. The tropical cyclone drops below depression stage (dissipates or becomes a remnant low). However, advisories may continue if the remnants of a tropical cyclone pose a threat of regeneration and of bringing tropical storm or hurricane conditions to land areas within 48 hours. In this case, the system type in advisory products will not be "Potential Tropical Cyclone", but would instead be "Remnants of".

c. Moves inland and watches and warnings are no longer required.

When RSMC Miami writes the last advisory on a system, the cyclone type that appears in the product type line will reflect the current status of the system (i.e., Post-Tropical Cyclone or Remnants of).

3.1.1.2 Issuance Times. RSMC Miami will issue public advisories at 0300, 0900, 1500, and 2100 Universal Time Coordinated (UTC) with valid position times corresponding to the advisory time.

3.1.1.3 Format and Content. The TCP comprises five sections: Summary, Watches and Warnings, Discussion and Outlook, Hazards, and Next Advisory. Each section of the TCP begins with a specific header text string. Advisories can begin with a lead statement or headline to emphasize significant aspects of the tropical cyclone. The Summary section contains the cyclone position in latitude and longitude coordinates, its distance from a well-known reference point, the maximum sustained winds, the cyclone's current direction and speed of motion, and the estimated or measured minimum central pressure. Advisories will list watches and warnings for hurricane and tropical storm conditions with recent changes highlighted at the top of the section. The Discussion and Outlook section will discuss the cyclone's current characteristics, including location, motion, intensity, and pressure and a general description of the predicted track and intensity of the cyclone over the next 72 hours. Any pertinent weather observations will also be included in this section. The Hazards section includes information on hazards to land such as storm surge/tide, wind, rainfall, tornadoes, and rip currents associated with the cyclone. The Next Advisory section indicates the time and office responsible for the next advisory will be provided along with new message headers if the tropical cyclone is passed to another Center. The forecaster's name will be included at the end of the message.

3.1.1.3.1 Units. Times in advisories should be local time of the affected area; however, local time and UTC should be used when noting the storm's location. The notation "Z" will not be used. All advisories will use statute miles and statute miles per hour, followed by the metric units of kilometers and kilometers per hour.

3.1.1.3.2 Tropical Storm/Hurricane Watches and Warnings. RSMC Miami will assist in coordination of tropical storm/hurricane watches and warnings if tropical storm/hurricane conditions are possible over land areas.

RSMC Miami will make every effort to list all tropical cyclone watches and warnings in effect. The first advisory in which watches or warnings are mentioned should give the effective time of the watch or warning, except when it is being issued by other countries and the time is not known.

Except for tropical storms and hurricanes forming close to land, it is recommended that a watch should precede a warning. Once a watch is in effect, it should either be replaced by a warning or remain in effect until the threat of the tropical cyclone conditions has passed. A hurricane watch and a tropical storm warning can be in effect for the same section of coast at the same time. It is not advantageous to step down warnings for tropical cyclones. This approach would cause confusion for the media and public, and this is especially true for tropical cyclones whose tracks parallel the coast.

3.1.1.3.3 Location and Movement. All advisories will include the location of the centre of the tropical cyclone by its latitude and longitude, and distance and direction from a well-known point, preferably downstream from the tropical cyclone. If the forecaster is unsure of the exact location of a depression, the position may be given as within 50, 75, etc., miles/km of a map coordinate. When the centre of the tropical cyclone is over land, give its position referencing the state or country in which it is located and in respect to some well known city, if appropriate.

In order to avoid confusion for the media and public or the interests of the nation involved, it is recommended that RSMC Miami coordinates and acts in agreement with any NMHS in RAIV, before the issuance of any new advisory, in cases when changes in the classification of the tropical cyclone is intended to occur near or into the territorial waters, or into the territory of the Country itself, of any RAIV Member.

Movement forecasts apply to the tropical cyclone's centre. The present movement is given to 16 points of the compass if possible. A 72-hour forecast of movement is included in terms of a continuance or departure from the present movement and speed. Uncertainties in either the tropical cyclone's location or movement should be explained in the advisory. An outlook beyond 72 hours (out to 120 hours when appropriate) may be included in the text of the advisory.

Landfall forecasts of the centre will be made with caution to avoid giving the public any false sense of security. Other forecast parameters can be used to describe the centre's landfall. When a threat to land exists, It is important to stress the tropical cyclone's effects extend well beyond the small area near the tropical cyclone's centre.

3.1.1.3.4 Wind and Intensity. Maximum observed 1-minute sustained surface wind speed will be given. During landfall threats, specific gust values and phrases like "briefly higher in squalls" may be used. Also included is the area (or radius) of both tropical and hurricane force winds. When warnings are in effect, the expected times of onset of tropical storm and hurricane force winds along the coast in general terms will be given, such as "this afternoon" or "tonight." Intensity forecasts for 72 hours only will be stated as an "increase," "decrease," or "no change" from the present intensity.

3.1.1.3.5 Pressure. Central pressure values in millibars and inches as determined by available data will be provided.

3.1.1.3.6 Storm Surge. Storm surge forecasts should highlight areas along the coast and within bays that are likely to experience dangerous flooding from storm surge. When possible, timing should be estimated or should be referenced to storm position, e.g. "as the hurricane is making landfall", or "as strong winds turn to the southwest". Wave information should be included for the outer coastline when possible. Storm surge heights should be indicated as values above the normal, predicted astronomical tide level, except for the continental United States, for which inundation above ground shall be provided. Note should be made of abnormally high or low astronomical tides, and their times of occurrence.

3.1.1.3.7 Inland Impacts. The inland impacts of tropical cyclones in advisories will be highlighted. This includes the threat of strong winds, heavy rainfall, flooding, and tornadoes. The extent and magnitude of inland winds as well as anticipated rainfall amounts and potential for flooding and tornadoes will be included. Tornado and flood watches will be mentioned as appropriate and actual occurrences of tornadoes, floods, and high winds with a note of urgency and supporting warnings and statements from local weather offices

To further publicize local products, when a tropical cyclone threatens a land area, the following statement in the TCP will be included: "For storm information specific to your area in the United States...please monitor products issued by your local National Weather Service Forecast Office. For storm information specific to your area outside of the United States...please monitor products issued by your National Meteorological Service."

3.1.1.4 Intermediate Public Advisories. These products are issued on a 3-hourly interval between scheduled advisories (see times of issuance below). 3-hourly intermediate advisories are issued whenever; 1) a coastal tropical storm or hurricane watch/warning is in effect, or 2) a tropical cyclone is over land at tropical storm strength or greater.

Intermediate advisories can be used to clear all, or parts of, a watch or warning area. Content should be similar to the scheduled advisory.

a. Three hourly issuances... Scheduled advisories at 0300, 0900, 1500, and 2100 UTC. Intermediates at 0000, 0600, 1200, and 1800 UTC.

3.1.1.5 Special Public Advisories. Special public advisories are unscheduled products issued whenever an unexpected change has occurred requiring a revised forecast or a tropical storm/hurricane watch or warning for any part of the United States or its territories.

3.1.2 Tropical Cyclone Forecasts/Advisories (TCM). RSMC Miami will prepare these products for all tropical cyclones within their area of responsibility. They will be issued and cease under the criteria given in section 3.1.1.1.

3.1.2.1 Issuance Times. Issue advisories at 0300, 0900, 1500, and 2100 UTC.

3.1.2.2 Format and Content. Tropical cyclone forecasts/advisories will contain appropriate information as shown in Attachment A in a standard consistent format. All forecast advisories will contain 12-, 24-, 36-, 48-, 72-, 96-, and 120-hour forecast positions, and 1-minute surface wind speeds (intensity). The 34- and 50-knot (four-quadrant) wind speed radii will be defined for 12-, 24-, 36-, 48-, and 72-hours. It will also contain forecast 64-knot wind speed radii at 12-, 24-, 36-, and 48-hours. No position or wind speed will accompany the forecast of "dissipated." A standard statement indicating the uncertainty associated with the 96- and 120-hour forecast positions will precede those two forecasts.

NOTE: As part of the header, append a code string at the end of the line "NWS NATIONAL HURRICANE CENTER MIAMI FL."

Format: NWSNATIONALHURRICANECENTERMIAMI FL BSNOYR
 where: (BS) is the basin (AL, EP or CP)
 where: (NO) is the tropical cyclone number (01, 02, 03,...99)
 where: (YR) is the last two digits of the year.

A special tropical cyclone forecast/advisory updates a scheduled advisory if unexpected changes have occurred in a tropical cyclone. Content of the special advisory will reflect significant changes requiring the special advisory to be issued. Issue special tropical cyclone forecast/advisories in conjunction with the issuance of a special public advisory.

3.1.3 Tropical Cyclone Discussion (TCD). RSMC Miami issues this product to explain forecasters' reasoning behind analysis and forecast of the tropical cyclone. The issuance time zone for the TCD will be consistent with the companion Public Advisory, so that they will be issued and cease under the criteria given in section 3.1.1.1.

3.1.3.1 Issuance Times. RSMC Miami will issue tropical cyclone discussions at 0300, 0900, 1500, and 2100 UTC and with all special advisories.

3.1.3.2 Format and Content. Discussions include prognostic reasoning; objective techniques employed; guidance used; coordinated 12-, 24-, 36-, 48-, 72-, 96-, and 120-hour tropical cyclone forecast points; maximum sustained wind speed forecasts for each forecast point; other meteorological decisions; plans for watches and warnings; and when appropriate, key messages to users are also provided. No position or wind speed will accompany the forecast of "dissipated".

3.1.4 Tropical Cyclone Updates (TCU). These products are issued to inform users of significant changes in a tropical cyclone in between regularly scheduled public advisories. Such uses include, but are not limited to the following:

- To provide timely information of an unusual nature, such as the time and location of landfall, or to announce an expected change in intensity that results in an upgrade or downgrade of status (e.g., from a tropical storm to a hurricane).
- To provide a continuous flow of information regarding the center location of a tropical cyclone when watches or warnings are in effect and the center can be easily tracked with land-based radar.
- To provide advance notice that significant changes to storm information will be conveyed shortly, either through a subsequent TCU or through a Special Advisory.
- To announce changes to international watches or warnings made by other countries, or to cancel U.S. watches or warnings
- To issue a U.S. watch or warning, but only if the TCU precedes a special advisory that will contain the same watch/warning information, and indicates the special advisory will be issued shortly.

3.1.5 Tropical Cyclone Surface Wind Speed Probabilities. This product will be issued for all tropical and subtropical cyclones in the Atlantic, East Pacific and Central Pacific basins and will be available no earlier than 15 minutes following the issuance deadlines for routine advisories (03, 09, 15, and 21 UTC) and after special advisories. Probabilities are statistically based on track, intensity, and wind structure uncertainties during recent years in the official tropical cyclone forecasts. They are computed for coastal and inland cities as well as some offshore locations (e.g., buoys). The product provides probabilities for sustained wind speeds equal to or exceeding three wind speed thresholds: 34, 50 and 64 knots. Two types of probability values are produced: onset and cumulative. Onset period probabilities are provided for each of the following time intervals: 0-12 hours, 12-24 hours, 24-36 hours, 36-48 hours, 48-72 hours, 72-96 hours, and 96-120 hours. These onset probabilities indicate the chance the particular wind speed will start during each interval at each location. Cumulative probabilities are also produced for the following time periods: 0-12 hours, 0-24 hours, 0-36 hours, 0-48 hours, 0-72 hours, 0-96 hours, and 0-120 hours. These cumulative probabilities indicate the overall chance the particular wind speed will occur at each location during the period between hour 0 and the forecast hour. The tropical cyclone wind speed probability text products are found under header FONT1 (01-05) for the Atlantic basin and FOPZ1 (01-05) for the eastern North Pacific basin.

Companion graphical wind speed probabilities products are also issued. These graphics depict the probability (likelihood, expressed as a percentage) that sustained (1-min average) winds meeting or exceeding specific thresholds will occur at particular locations over particular intervals of time. Separate graphics are provided for the 34 kt (tropical storm force), 50 kt, and 64 kt (hurricane force) wind thresholds.

The graphics provide location-specific *cumulative occurrence probabilities* - these values tell you the probability the wind event will occur sometime during the specified cumulative forecast period (0-12, 0-24, 0-36 hours, etc., out to 0-120 h) at each specific point. The images can be looped to show how the threat evolves over the five-day period of the forecast.

3.1.6 Tropical Cyclone Track and Watch / Warning Graphic. The Tropical Cyclone Track and Watch / Warning graphic contains the storm's forecast track, a cone along the track based upon the average area of uncertainty, and watches / warnings. The cone (solid white and hatched area) represents the probable track of the center of a tropical cyclone, and is formed by enclosing the area swept out by a set of circles along the forecast track (at 12, 24, 36 hours, etc.). The size of each circle is set so that two-thirds of historical official forecast errors over a 5-year sample fall within the circle.

The coastal watches and warnings display shows an approximate representation of coastal areas under a hurricane warning (red), hurricane watch (pink), tropical storm warning (blue) and tropical storm watch (yellow). The orange circle indicates the current position of the center of the tropical cyclone. A version of this graphic also shows the initial tropical-storm-force wind field of the tropical cyclone and another version includes a black line and dots to depict the RSMC Miami forecast track of the center at the times indicated.

3.1.6.1 Issuance Times. RSMC Miami will issue the tropical cyclone track and watch / warning graphics with each issuance of a public advisory or intermediate public advisory and with all special advisories.

3.1.7 Tropical-Storm-Force-Winds Arrival Timing Graphics. These graphics provide tropical-storm wind arrival time information for individual locations to help users understand when preparations should be complete when a tropical storm or hurricane threatens.

The graphics are created using the same Monte Carlo wind speed probability model that is used to determine the risk of tropical-storm- and hurricane-force winds at individual locations – a model in which 1000 plausible scenarios are constructed using the official NHC tropical cyclone forecast and its historical errors.

There are two versions of the graphic:

1. **Earliest Reasonable Arrival Time** - This is the primary arrival timing graphic. It identifies the time window that users at individual locations can safely assume will be free from tropical-storm-force winds. Specifically, this is the time before which there is no more than a 1-in-10 (10 percent) chance of seeing the onset of sustained tropical-storm-force winds. This is the period during which preparations should ideally be completed for those with a low tolerance for risk.
2. **Most Likely Arrival Time** – This graphic identifies the time before or after which the onset of tropical-storm-force winds is equally likely. This graphic is more appropriate for users who are willing to risk not having completed all their preparations before the arrival of tropical-storm-force winds.

Timing information is only available for locations that have at least a 5% chance of experiencing sustained tropical-storm-force winds during the next 5 days.

Each of these graphics is also available overlaid on top of the cumulative 5-day probability of tropical-storm-force winds, providing a single combined depiction of the likelihood of tropical-storm-force winds at individual locations, along with their possible or likely arrival times.

Arrival times are depicted with higher temporal resolution (i.e., in 6-hour intervals) during the first day of the 5-day forecast, increasing to lower temporal resolution (i.e., in 12-hour intervals) after the first day of the 5-day forecast period. Arrival times are referenced to 8 AM and 8 PM local time, using a constant time zone that corresponds to where the cyclone is located at the time of the advisory. For example, if a cyclone is located in the Eastern Time Zone at the time of an advisory but is forecast to move into the Central Time Zone during the 5-day forecast period, all times on the graphic will be referenced to the Eastern Time Zone.

3.1.7.1 Issuance Times. These graphics are available on the internet at 0300, 0900, 1500, and 2100 UTC. They are also produced for special advisories.

3.1.8 Cumulative Wind Distribution Graphic. This product is a graphical representation of the past track and size of the tropical cyclone. This information can be used to provide areas impacted by the past track of the storm.

This graphic shows how the size of the storm has changed, and the areas

potentially affected so far by sustained winds of tropical storm force (in orange) and hurricane force (in red). The display is based on the wind radii contained in the set of Forecast / Advisories indicated at the top of the figure. Users are reminded the Forecast / Advisory wind radii represent the maximum possible extent of a given wind speed within particular quadrants around the tropical cyclone. As a result, not all locations falling within the orange or red swaths will have experienced sustained tropical storm- or hurricane-force winds, respectively.

3.1.8.1 Issuance Times. RSMC Miami will issue the cumulate wind distribution graphic at 0300, 0900, 1500, and 2100 UTC and with all special advisories.

3.1.9 Tropical Cyclone Surface Wind Field Graphic. This graphic illustrates the area potentially affect by the tropical cyclone's sustained tropical storm and hurricane force winds at the initial advisory time. In addition to the wind field, the graphic provides an approximate representation of coastal areas under tropical storm / hurricane watches / warning.

Tropical storm-force winds are shown in orange and hurricane-force winds are shown in red. The display is based on the wind radii contained in the latest Forecast / Advisory. Users are reminded that the Forecast / Advisory wind radii represent the maximum possible extent of a given wind speed within particular quadrants around the tropical cyclone. As a result, not all locations falling within the orange or red shaded areas will be experiencing sustained tropical storm- or hurricane-force winds, respectively. In addition to the wind field, this graphic shows an approximate representation of coastal areas under a hurricane warning (red), hurricane watch (pink), tropical storm warning (blue) and tropical storm watch (yellow). The white dot indicates the current position of the center of the tropical cyclone, and the dashed black line shows the history of the center of the tropical cyclone.

3.1.9.1 Issuance Times. RSMC Miami will issue the tropical cyclone surface wind field graphic at 0300, 0900, 1500, and 2100 UTC and with all special advisories.

3.2 Subtropical Cyclone Forecast and Advisory Products

3.2.1 Subtropical Cyclone Public Advisories (TCP). RSMC Miami will issue subtropical cyclone advisories. However, due to the lack of well-defined criteria for distinguishing subtropical from non-tropical lows, marginally-subtropical systems may be handled as non-tropical gale or storm centres in High Seas forecast products. Format and content of these products are similar to the public tropical cyclone advisory. (See Attachment 3A for an example). The advisories are titled "SUBTROPICAL DEPRESSION ##" and in the message body is referred to as "SUBTROPICAL DEPRESSION ##." If winds reach subtropical storm strength, the storm receives the next available name. The advisories are titled "SUBTROPICAL STORM (name)" and in the body of the message the storm is referred to as "SUBTROPICAL STORM (name)." Information is listed in order of importance with a lead statement, when appropriate, followed by a summary of all coastal warnings. Latitude and longitude coordinates are used to identify the centre of the storm. These advisories are issued at the same scheduled times as public tropical cyclone advisories.

Special Subtropical Public Cyclone Advisories will be issued to (1) update previously scheduled advisories whenever an unexpected significant change has occurred in the cyclone or (2) to issue warnings.

3.2.2 Subtropical Cyclone Forecast/Advisory (TCM). These advisories are issued for all subtropical cyclones within RSMC Miami area of responsibility. The advisory is written in the same format and content as the tropical cyclone forecast/advisories. The advisories are titled "SUBTROPICAL DEPRESSION ##" and in the body of the message the depression is referred to as "SUBTROPICAL DEPRESSION ##." If winds reach subtropical storm strength, the storm receives the next available name. Advisories will be titled "SUBTROPICAL STORM (name)" and refer to in the body of the message as "SUBTROPICAL STORM (name)." These are issued at the same times as scheduled tropical cyclone forecast/advisories.

Special Subtropical Cyclone Forecast/Advisories are issued to update any unexpected change which occurred with the subtropical cyclone. Format remains the same as the scheduled advisory being replaced. These will be issued with every special subtropical cyclone public advisory.

3.3 Numbering and Naming Tropical Cyclones

3.3.1 Numbering and Naming Tropical Cyclones. RSMC Miami will number all depressions (whether tropical or subtropical) forming within a basin in a given year, as well as any potential tropical cyclone requiring the issuance of advisories, from a single list for that basin.

These numerical designations are always fully spelled out in advisory products (e.g., "One", "Two", "Three", ..., "Twenty-Three", etc.). The numerical designations will be assigned such that they match the total number of systems having formed within that basin during the season. For example, if three systems requiring advisories have already formed within a basin, the next potential tropical cyclone or depression of the season will be designated "Four".

As can be inferred from the above instruction, when advisories are initiated directly on a named tropical or subtropical storm (that is, the system never had advisories issued as a tropical depression or potential tropical cyclone), the corresponding numerical designation is skipped for that year. For example, if the first system of the season forms directly as Tropical Storm Ana without the issuance of depression or potential tropical cyclone advisories, then the designation "One" is skipped for that season in that basin.

When a potential tropical cyclone becomes a tropical depression, its numerical designation remains the same (i.e., Potential Tropical Cyclone Two becomes Tropical Depression Two).

" In the Pacific, for ease in differentiation, tropical depression numbers, assigned by RSMC Miami or RSMC Honolulu, will include the suffix "E" (for eastern) or "C," (for central) respectively, after the number. In both the Atlantic and Pacific, once the depression reaches tropical storm intensity, it will be given a name and the depression number dropped. The depression number will not be used again until the following year. Tropical cyclones will be given a name in the first advisory after intensifying to 34 knots (63 km/h, 39 mph) or greater.

The following rules apply for tropical cyclones passing from basin to another: the name will be retained if a tropical cyclone passes from one basin into another basin as a tropical cyclone, i.e. advisories are continuous. An unnamed tropical depression will also retain its number (e.g. Tropical Depression Six-E remains Tropical Depression Six-E) if it crosses into another basin.

Within a basin, if the remnant of a tropical cyclone redevelops into a tropical cyclone, it is assigned its original number or name. If the remnants of a former tropical cyclone regenerate in a new basin, the regenerated tropical cyclone will be given a new designation.

Post-Tropical cyclones will retain the name or number they were designated while a tropical cyclone. A post-tropical cyclone that regains tropical cyclone status also retains its original number or name. A numbered post-tropical cyclone that intensifies to 34 kt or higher as a post-tropical cyclone will not be given a name, but instead will retain its number.

If NHC uses all of the names for a given year and additional names are required, the Greek alphabet will be used (Alpha, Beta, etc.).

3.4 Numbering Advisories and Tropical Discussions

Scheduled and special advisories will be numbered consecutively beginning with the number 1 (not spelled out) for each new tropical or subtropical cyclone, and continue through the duration of the cyclone. In both the Atlantic and the Pacific, intermediate advisories and TCDs will retain the advisory number of the scheduled or special advisory they update and append an alphabetic designator (i.e., "HURRICANE ALLISON INTERMEDIATE ADVISORY NUMBER 20A").

3.5 Other Products

3.5.1 Tropical Weather Discussion (TWD). RSMC Miami will issue these discussions to describe major synoptic weather features and significant areas of disturbed weather in the tropics. One discussion will cover the Gulf of Mexico, the Caribbean, and the Atlantic between the equator and 32° north latitude and be transmitted at 0605, 1205, 1805, 0005 UTC. The discussion on the Caribbean will contain specific information for the island of Hispaniola. A second message for the eastern Pacific between the equator and 32° north and east of 140° west will be transmitted at 0405, 1005, 1605, and 2205 UTC.

3.5.2 Tropical Weather Outlook (TWO). RSMC Miami will prepare the TWO during the tropical cyclone seasons. The outlook covers tropical and subtropical waters and discusses areas of disturbed weather and the potential for tropical cyclone development during the next 5 days, including a categorical forecast of the probability of tropical cyclone formation during the first 48 hours, and during the entire 5-day forecast period. The 48 h and 5-day probabilities of genesis for each disturbance are given to the nearest 10 percent, and expressed in terms of one of the following categories: low probability of development (<40%), medium probability (40-60%), and high probability of development (>60%).

In addition to the discussion of areas of disturbed weather, the outlook will mention all systems on which advisories are being issued by the respective tropical cyclone forecast center, including the system's location in either general terms, status, and change in status. When advisories are being issued on potential tropical cyclones, a probabilistic genesis forecast will be provided in the same bulleted format normally used for disturbances.

If advisories are being issued by WPC or NHC on a post-tropical cyclone, and the post-tropical cyclone poses a threat to regenerate into a tropical cyclone, genesis probabilities will be provided in the same format as for potential tropical cyclones.

For the first 24 hours after advisories are initiated, the outlook will include a statement identifying the NWS product header and WMO headers for the advisory.

Transmission times for both the Atlantic and eastern Pacific TWOs are 0000, 0600, 1200, and 1800 UTC.

The 48-h and 5-day Graphical Tropical Weather Outlooks (GTWO) are companion products to the text Tropical Weather Outlook. The 48-h GTWO shows the locations of systems that NHC is issuing advisories on. The location of areas of disturbed weather on the graphic are denoted by an X and numbered, with text discussions for each disturbance given beneath the graphic.

The 5-day Graphical Tropical Weather Outlook provides formation potential for

individual disturbances during the next 5-day period. The areas enclosed on the graph represent the potential formation area during the forecast period. The areas are color-coded based on the potential for tropical cyclone formation during the next 5-days. The location of existing disturbances is indicated by an X. If the formation potential of an existing disturbance does not include the area in which the disturbance is currently location, an arrow will connect the current location of the disturbance to its area of potential formation. Areas without an X or connected by an arrow to an X indicate that the disturbance does not currently exist, but is expected to develop during the 5-day period.

On both graphical outlooks, the Xs or potential formation areas are color-coded based on the potential for tropical cyclone formation. Areas in yellow indicate a low probability of development (<40%), orange indicates medium likelihood (40-60%), and red indicates a high likelihood of development (>60%).

Potential formation areas will not be provided for potential tropical cyclones while regular advisory products are being issued.

3.5.3 Special Tropical Weather Outlook (Special TWO). RSMC Miami will issue a Special TWO for situations when important changes with areas of disturbed weather over tropical or subtropical waters need to be conveyed before the next scheduled release of the TWO, and when needed outside of the hurricane season. The Graphical Tropical Weather Outlooks will be updated when a Special TWO is issued.

3.5.4 Tropical Weather Summary (TWS) and Seasonal Track Maps. RSMC Miami will prepare this product each month summarizing the previous month's tropical cyclone activity. The TWS content will consist only of a table of basic statistics for each cyclone and a short narrative of records of interest, if any. Summaries for each month are due the first day of the next month. RSMC Miami also prepares a preliminary seasonal track map that is typically available on the NHC web page near the beginning of each month from July through December. The maps show the tracks of all of the season's tropical cyclones. The data for each tropical cyclone are considered preliminary until the Tropical Cyclone Report is issued. The last TWS of the season will summarize November's activity plus the activity for the whole tropical cyclone season. A final seasonal track map will be issued after the completion of all Tropical Cyclone Reports.

3.5.5 Tropical Cyclone Reports (TCR). RSMC Miami will prepare a final track chart and summary of each tropical cyclone occurring in its area of responsibility. The time to prepare a TCR after the tropical cyclone has ended can vary from a couple of weeks to several months depending on the longevity of the cyclone, available data, and the extent of the cyclone's impacts. When complete, reports will be posted on the Internet at www.nhc.noaa.gov.

3.6 Correction Procedures

If a correction needs to be issued for any tropical cyclone product, the reason for the correction will be indicated immediately after the header of the corrected product.

EXAMPLES OF TROPICAL WEATHER PRODUCTS

Example: Tropical Weather Outlook

(Any references to specific product headers in the NHC Tropical Weather Outlook will occur at the bottom of the product, not within the paragraph(s) describing a disturbance or its forecast hazards.)

ABNT20 KNHC 141731
TWOAT

TROPICAL WEATHER OUTLOOK
NWS NATIONAL HURRICANE CENTER MIAMI FL
200 PM EDT MON OCT 14 2016

FOR THE NORTH ATLANTIC, CARIBBEAN SEA AND THE GULF OF MEXICO:

THE NATIONAL HURRICANE CENTER IS ISSUING ADVISORIES ON NEWLY FORMED TROPICAL DEPRESSION ELEVEN, LOCATED IN THE CENTRAL GULF OF MEXICO, AND ON POST-TROPICAL CYCLONE JULIA, LOCATED JUST OFFSHORE OF CAPE COD, MASSACHUSETTS.

THE NATIONAL HURRICANE CENTER IS ISSUING ADVISORIES ON POTENTIAL TROPICAL CYCLONE TWELVE, LOCATED ABOUT 100 MILES SOUTH OF SAN JUAN, PUERTO RICO.

- * FORMATION CHANCE THROUGH 48 HOURS...HIGH...70 PERCENT
- * FORMATION CHANCE THROUGH 5 DAYS...HIGH...90 PERCENT

A BROAD AREA OF LOW PRESSURE LOCATED A COUPLE OF HUNDRED MILES SOUTH-SOUTHWEST OF JAMAICA IS ACCOMPANIED BY SHOWERS AND THUNDERSTORMS. THIS DISTURBANCE REMAINS DISORGANIZED, AND DEVELOPMENT, IF ANY, SHOULD BE SLOW TO OCCUR OVER THE NEXT COUPLE OF DAYS WHILE IT MOVES SLOWLY NORTHWESTWARD. ENVIRONMENTAL CONDITIONS ARE EXPECTED TO BE marginally conducive for some development when the system moves over the northwestern Caribbean Sea and the southern Gulf of Mexico later this week. Locally heavy rainfall is possible over portions of Haiti and Jamaica today, and will likely spread across the Cayman Islands and eastern Cuba on Tuesday.

- * FORMATION CHANCE THROUGH 48 HOURS...LOW...10 PERCENT
- * FORMATION CHANCE THROUGH 5 DAYS...LOW...30 PERCENT

A WESTWARD-MOVING TROPICAL WAVE IS PRODUCING SHOWERS AND THUNDERSTORMS ACROSS THE WINDWARD ISLANDS. HOWEVER, UPPER-LEVEL WINDS ARE BECOMING UNFAVORABLE FOR FURTHER DEVELOPMENT OF THIS SYSTEM.

- * FORMATION CHANCE THROUGH 48 HOURS...LOW...10 PERCENT
- * FORMATION CHANCE THROUGH 5 DAYS...LOW...10 PERCENT

A NON-TROPICAL AREA OF LOW PRESSURE COULD DEVELOP OVER THE NEXT COUPLE OF DAYS A FEW HUNDRED MILES EAST OF BERMUDA, AND THIS LOW WILL HAVE SOME POTENTIAL TO GRADUALLY ACQUIRE TROPICAL CHARACTERISTICS AS IT MOVES SLOWLY SOUTHWARD.

- * FORMATION CHANCE THROUGH 48 HOURS...LOW...NEAR 0 PERCENT
- * FORMATION CHANCE THROUGH 5 DAYS...LOW...20 PERCENT

&&

PUBLIC ADVISORIES ON TROPICAL DEPRESSION ELEVEN ARE ISSUED UNDER WMO HEADER WTNT31 KNHC AND UNDER AWIPS HEADER MIATCPNT1. FORECAST/ADVISORIES ARE ISSUED UNDER WMO HEADER WTNT21 KNHC AND UNDER AWIPS HEADER MIATCMNT1.

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NNNN

Example: Special Tropical Weather Outlook

ABNT20 KNHC 01155
TWOAT

SPECIAL TROPICAL WEATHER OUTLOOK

NWS NATIONAL HURRICANE CENTER MIAMI FL

400 PM EDT MON OCT 14 2017

FOR THE NORTH ATLANTIC, CARIBBEAN SEA AND THE GULF OF MEXICO:

SPECIAL TROPICAL WEATHER OUTLOOK ISSUED TO UPDATE THE DISCUSSION OF THE LOW-PRESSURE SYSTEM NEAR JAMAICA.

UPDATED: THE BROAD AREA OF LOW PRESSURE LOCATED A COUPLE OF HUNDRED MILES SOUTH-SOUTHWEST OF JAMAICA HAS BECOME SIGNIFICANTLY BETTER ORGANIZED OVER THE PAST FEW HOURS, AND ITS CHANCES OF BECOMING A TROPICAL CYCLONE HAVE INCREASED. ENVIRONMENTAL CONDITIONS ARE EXPECTED TO REMAIN FAVORABLE AS THE SYSTEM MOVES SLOWLY NORTHWESTWARD OVER THE NEXT COUPLE OF DAYS. LOCALLY HEAVY RAINFALL AND STRONG GUSTY WINDS ARE POSSIBLE OVER PORTIONS OF HAITI AND JAMAICA TODAY, AND WILL LIKELY SPREAD ACROSS THE CAYMAN ISLANDS AND EASTERN CUBA ON TUESDAY.

- * FORMATION CHANCE THROUGH 48 HOURS...MEDIUM...60 PERCENT
- * FORMATION CHANCE THROUGH 5 DAYS...HIGH...80 PERCENT

A WESTWARD-MOVING TROPICAL WAVE IS PRODUCING SHOWERS AND THUNDERSTORMS ACROSS THE WINDWARD ISLANDS. HOWEVER, UPPER-LEVEL WINDS ARE BECOMING UNFAVORABLE FOR FURTHER DEVELOPMENT OF THIS SYSTEM.

- * FORMATION CHANCE THROUGH 48 HOURS...LOW...10 PERCENT
- * FORMATION CHANCE THROUGH 5 DAYS...LOW...10 PERCENT

A NON-TROPICAL AREA OF LOW PRESSURE COULD DEVELOP OVER THE NEXT COUPLE OF DAYS A FEW HUNDRED MILES EAST OF BERMUDA, AND THIS LOW WILL HAVE SOME POTENTIAL TO GRADUALLY ACQUIRE TROPICAL CHARACTERISTICS AS IT MOVES SLOWLY SOUTHWARD.

- * FORMATION CHANCE THROUGH 48 HOURS...LOW...NEAR 0 PERCENT
- * FORMATION CHANCE THROUGH 5 DAYS...LOW...20 PERCENT

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Examples: Mass News Disseminator Headers

POTENTIAL TROPICAL CYCLONE THREE ADVISORY NUMBER 2
TROPICAL DEPRESSION TWENTY-ONE-E ADVISORY NUMBER 1
TROPICAL STORM ALEX ADVISORY NUMBER 3
HURRICANE ALEX ADVISORY NUMBER 4
SUBTROPICAL STORM GABRIELLE ADVISORY NUMBER 1
SUBTROPICAL DEPRESSION TWO ADVISORY NUMBER 1
TYPHOON PARMA (19W) ADVISORY NUMBER 10
POST-TROPICAL CYCLONE IRENE ADVISORY NUMBER 35
REMNANTS OF JOSE ADVISORY NUMBER 6

Example: Hurricane Public Advisory

ZCZC MIATCPAT4 ALL
TTAA00 KNHC DDHHMM

BULLETIN

Hurricane Michael Advisory Number 16
NWS National Hurricane Center Miami FL AL142018
1000 AM CDT Wed Oct 10 2018

...CORE OF EXTREMELY DANGEROUS HURRICANE MICHAEL CLOSING IN ON THE COAST OF THE FLORIDA PANHANDLE...
...LIFE-THREATENING STORM SURGE...HURRICANE FORCE WINDS...AND HEAVY RAINFALL IMMINENT...

SUMMARY OF 1000 AM CDT...1500 UTC...INFORMATION

LOCATION...29.4N 86.0W
ABOUT 60 MI...95 KM SSW OF PANAMA CITY FLORIDA
ABOUT 65 MI...100 KM WSW OF APALACHICOLA FLORIDA
MAXIMUM SUSTAINED WINDS...145 MPH...230 KM/H
PRESENT MOVEMENT...NNE OR 15 DEGREES AT 14 MPH...22 KM/H
MINIMUM CENTRAL PRESSURE...928 MB...27.41 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY:

A Tropical Storm Warning has been issued for the coast of North Carolina from Surf City to Duck including the Pamlico and Albemarle Sounds.

A Storm Surge Watch has been issued for the coast of North Carolina from Ocracoke Inlet to Duck.

The Tropical Storm Watch for the Gulf coast west of the Mississippi/ Alabama border has been discontinued.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT:

A Storm Surge Warning is in effect for...

* Okaloosa/Walton County Line Florida to Anclote River Florida

ATTACHMENT 3 A, p.4

A Storm Surge Watch is in effect for...

- * Anclote River Florida to Anna Maria Island Florida, including Tampa Bay
- * Ocracoke Inlet North Carolina to Duck North Carolina

A Hurricane Warning is in effect for...

- * Alabama/Florida border to Suwannee River Florida

A Tropical Storm Warning is in effect for...

- * Alabama/Florida border to the Mississippi/Alabama border
- * Suwannee River Florida to Chassahowitzka Florida
- * North of Fernandina Beach Florida to Duck North Carolina
- * Pamlico and Albemarle Sounds

A Tropical Storm Watch is in effect for...

- * Chassahowitzka to Anna Maria Island Florida, including Tampa Bay

A Storm Surge Warning means there is a danger of life-threatening inundation, from rising water moving inland from the coastline. For a depiction of areas at risk, please see the National Weather Service Storm Surge Watch/Warning Graphic, available at hurricanes.gov.

A Hurricane Warning means that hurricane conditions are expected somewhere within the warning area.

A Tropical Storm Warning means that tropical storm conditions are expected somewhere within the warning area.

A Storm Surge Watch means there is a possibility of life-threatening inundation, from rising water moving inland from the coastline.

A Tropical Storm Watch means that tropical storm conditions are possible within the watch area.

Interests elsewhere across the southeastern United States should monitor the progress of Michael.

For storm information specific to your area, including possible inland watches and warnings, please monitor products issued by your local National Weather Service forecast office.

DISCUSSION AND OUTLOOK

At 1000 AM CDT (1500 UTC), the eye of Hurricane Michael was located near latitude 29.4 North, longitude 86.0 West. Michael is moving toward the north-northeast near 14 mph (22 km/h). A turn toward the northeast is expected this afternoon or tonight. A motion toward the northeast at a faster forward speed is forecast on Thursday through Friday night. On the forecast track, the core of Michael is expected to move ashore along the Florida Panhandle early this afternoon, move northeastward across the southeastern United States tonight and Thursday, and then move off the Mid-Atlantic coast away from the United States on Friday.

Data from NOAA and Air Force Reserve Hurricane Hunter aircraft indicate that maximum sustained winds are near 145 mph (230 km/h) with higher gusts. Michael is an extremely dangerous category 4 hurricane on the Saffir-Simpson Hurricane Wind Scale. Some strengthening is still possible before landfall. After landfall, Michael should weaken as it crosses the southeastern United

States. Michael is forecast to become a post-tropical cyclone on Friday, and strengthening is forecast as the system moves over the western Atlantic. Hurricane-force winds extend outward up to 45 miles (75 km) from the center and tropical-storm-force winds extend outward up to 175 miles (280 km). A private weather station at Bald Point, Florida, recently reported a sustained wind of 54 mph (87 km/h) with a gust to 61 mph (98 km/h). A wind gust to 46 mph (74 km/h) was recently reported inland at Tallahassee, Florida.

The latest minimum central pressure based on data from the reconnaissance aircraft is 928 mb (27.41 inches).

HAZARDS AFFECTING LAND

STORM SURGE: The combination of a dangerous storm surge and the tide will cause normally dry areas near the coast to be flooded by rising waters moving inland from the shoreline. The water has the potential to reach the following heights above ground if peak surge occurs at the time of high tide...

Tyndall Air Force Base FL to Aucilla River FL...9-14 ft
Okaloosa/Walton County Line FL to Tyndall Air Force Base FL...6-9 ft
Aucilla River FL to Cedar Key FL...6-9 ft Cedar Key FL to Chassahowitzka FL...4-6 ft
Chassahowitzka to Anna Maria Island FL including Tampa Bay...2-4 ft
Sound side of the North Carolina Outer Banks from Ocracoke Inlet to Duck...2-4 ft

WIND: Tropical storm and hurricane conditions are spreading onshore along the U.S. Gulf Coast within the warning areas. Hurricane conditions will also spread well inland across portions of the Florida Panhandle, southeastern Alabama and southwestern Georgia later today and tonight.

Tropical storm conditions are expected to spread northward within the warning area along the southeast U.S. coast beginning tonight through Friday.

RAINFALL: Michael is expected to produce the following rainfall amounts through Friday...

Florida Panhandle and Big Bend, southeast Alabama, and portions of southwest and central Georgia...4 to 8 inches, with isolated maximum amounts of 12 inches. This rainfall could lead to life-threatening flash floods.

The remainder of Georgia, the Carolinas, and southern Virginia...3 to 6 inches, with isolated maximum amounts of 8 inches. This rainfall could lead to life-threatening flash floods.

Florida Peninsula, eastern Mid Atlantic, southern New England coast...1-3 inches.

SURF: Swells generated by Michael will affect the coasts of the eastern, northern, and western Gulf of Mexico during the next day or so. These swells are likely to cause life-threatening surf and rip current conditions. Please consult products from your local weather office.

TORNADOES: Tornadoes are possible across parts of the Florida Panhandle and the northern Florida Peninsula through this afternoon. This risk will spread

ATTACHMENT 3 A, p.6

northward into parts of Georgia and southern South Carolina this afternoon and tonight.

NEXT ADVISORY

Next intermediate advisory at 100 PM CDT.

Next complete advisory at 400 PM CDT.

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Forecaster Brown

NNNN

Example: Potential Tropical Cyclone Public Advisory (TCP)

WTNT32 KNHC 190240
TCPAT2

BULLETIN

Potential Tropical Cyclone Two Advisory Number 2
NWS National Hurricane Center Miami FL AL022017
1100 PM AST Sun Jun 18 2017

...TROPICAL STORM CONDITIONS EXPECTED TO REACH THE SOUTHERN WINDWARD ISLANDS BY MONDAY NIGHT...

SUMMARY OF 1100 PM AST...0300 UTC...INFORMATION

LOCATION...7.9N 52.4W
ABOUT 630 MI...1015 KM ESE OF TRINIDAD
ABOUT 695 MI...1120 KM ESE OF GRENADA
MAXIMUM SUSTAINED WINDS...40 MPH...65 KM/H
PRESENT MOVEMENT...W OR 280 DEGREES AT 23 MPH...37 KM/H
MINIMUM CENTRAL PRESSURE...1005 MB...29.68 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY:

None.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT:

A Tropical Storm Warning is in effect for...
* Barbados
* St. Vincent and the Grenadines
* Trinidad
* Tobago
* Grenada

A Tropical Storm Warning means that tropical storm conditions are expected somewhere within the warning area within 36 hours.

For storm information specific to your area, please monitor products issued by your national meteorological service.

DISCUSSION AND OUTLOOK

At 1100 PM AST (0300 UTC), the disturbance was centered near latitude 7.9 North, longitude 52.4 West. A fast motion toward the west-northwest is expected for the next 48 hours. On the forecast track, the disturbance is expected to move through the Windward Islands Monday night and Tuesday.

Maximum sustained winds have increased to near 40 mph (65 km/h) with higher gusts. Some additional strengthening is expected during the next 48 hours, and the disturbance is forecast to be a tropical storm when it moves through the Windward Islands Monday night and Tuesday.

ATTACHMENT 3 A, p.8

Thunderstorm activity associated with the disturbance continues to become better organized, and additional development is likely during the next day or two.

* Formation chance through 48 hours...high...90 percent

* Formation chance through 5 days...high...90 percent

Tropical-storm-force winds extend outward up to 60 miles (95 km), mainly northwest through northeast of the center.

The estimated minimum central pressure is 1005 mb (29.68 inches).

HAZARDS AFFECTING LAND

WIND: Tropical storm conditions are expected to first reach the warning area overnight Monday and Tuesday morning, making outside preparations difficult or dangerous.

RAINFALL: The disturbance is expected to produce total rain accumulations of 2 to 4 inches over the Windward Islands Monday night and Tuesday.

NEXT ADVISORY

Next intermediate advisory at 200 AM AST.

Next complete advisory at 500 AM AST.

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Forecaster Stewart

Example: Post-Tropical Cyclone Public Advisory (TCP)

WTNT34 KNHC 091754
TCPAT4

BULLETIN

POST-TROPICAL CYCLONE MATTHEW INTERMEDIATE ADVISORY NUMBER 46A
NWS NATIONAL HURRICANE CENTER MIAMI FL AL142016
200 PM EDT SUN OCT 09 2016

...STORM SURGE AND INLAND FLOODING CONTINUES OVER EASTERN NORTH CAROLINA...

SUMMARY OF 200 PM EDT...1800 UTC...INFORMATION

LOCATION...35.2N 72.9W
ABOUT 150 MI...240 KM E OF CAPE HATTERAS NORTH CAROLINA
MAXIMUM SUSTAINED WINDS...75 MPH...120 KM/H
PRESENT MOVEMENT...E OR 80 DEGREES AT 15 MPH...24 KM/H
MINIMUM CENTRAL PRESSURE...988 MB...29.18 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY:

THE TROPICAL STORM WARNING HAS BEEN DISCONTINUED SOUTH OF SURF CITY.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT:

A TROPICAL STORM WARNING IS IN EFFECT FOR...

- * SURF CITY TO DUCK
- * PAMLICO AND ALBEMARLE SOUNDS

FOR STORM INFORMATION SPECIFIC TO YOUR AREA, INCLUDING POSSIBLE INLAND WATCHES AND WARNINGS, PLEASE MONITOR PRODUCTS ISSUED BY YOUR LOCAL NATIONAL WEATHER SERVICE FORECAST OFFICE.

DISCUSSION AND OUTLOOK

AT 200 PM EDT (1800 UTC), THE CENTER OF POST-TROPICAL CYCLONE MATTHEW WAS LOCATED NEAR LATITUDE 35.2 NORTH, LONGITUDE 72.9 WEST.

THE POST-TROPICAL CYCLONE IS MOVING TOWARD THE EAST NEAR 15 MPH (24 KM/H), AND THIS GENERAL MOTION IS EXPECTED TO CONTINUE DURING THE NEXT DAY OR SO. ON THE FORECAST TRACK, THE CENTER OF MATTHEW WILL MOVE FARTHER OFFSHORE OF THE COAST OF THE NORTH CAROLINA OUTER BANKS THIS AFTERNOON AND TONIGHT.

MAXIMUM SUSTAINED WINDS ARE NEAR 75 MPH (120 KM/H) WITH HIGHER GUSTS. GRADUAL WEAKENING IS FORECAST DURING THE NEXT DAY OR SO, AND THE LOW IS EXPECTED TO BE ABSORBED WITHIN A FRONTAL BOUNDARY MONDAY NIGHT.

HURRICANE-FORCE WINDS EXTEND OUTWARD UP TO 70 MILES (110 KM), MAINLY TO THE SOUTHWEST OF THE CENTER, AND TROPICAL-STORM-FORCE WINDS EXTEND OUTWARD UP TO 240 MILES (390 KM).

THE ESTIMATED MINIMUM CENTRAL PRESSURE IS 988 MB (29.18 INCHES).

HAZARDS AFFECTING LAND

WIND: TROPICAL STORM CONDITIONS ARE EXPECTED TO CONTINUE OVER THE WARNING AREA THIS AFTERNOON, AND THEN GRADUALLY DIMINISH BY THIS EVENING.

STORM SURGE: THERE IS A DANGER OF LIFE-THREATENING INUNDATION THROUGH THIS AFTERNOON ALONG THE COAST FROM CAPE LOOKOUT TO DUCK, NORTH CAROLINA, INCLUDING PORTIONS OF THE PAMLICO AND ALBEMARLE SOUNDS. WATER LEVELS SHOULD SUBSIDE BY THIS EVENING. FOR A DEPICTION OF AREAS AT RISK, PLEASE SEE THE PROTOTYPE NATIONAL WEATHER SERVICE STORM SURGE WATCH/WARNING GRAPHIC. FOR INFORMATION SPECIFIC TO YOUR AREA, PLEASE SEE PRODUCTS ISSUED BY YOUR LOCAL NATIONAL WEATHER SERVICE FORECAST OFFICE.

THE PROTOTYPE STORM SURGE WATCH/WARNING GRAPHIC IS A DEPICTION OF AREAS THAT WOULD QUALIFY FOR INCLUSION UNDER A STORM SURGE WATCH OR WARNING CURRENTLY UNDER DEVELOPMENT BY THE NATIONAL WEATHER SERVICE AND PLANNED FOR OPERATIONAL USE IN 2017. THE PROTOTYPE GRAPHIC IS AVAILABLE AT HURRICANES.GOV.

RAINFALL: LIFE-THREATENING FLOODING WILL CONTINUE OVER PORTIONS OF EASTERN NORTH CAROLINA THAT HAVE RECEIVED RECORD RAINS FROM MATTHEW. CONSULT PRODUCTS ISSUED BY YOUR LOCAL NATIONAL WEATHER SERVICE FORECAST OFFICE FOR ADDITIONAL INFORMATION AND WARNINGS.

SURF: SWELLS GENERATED BY MATTHEW WILL CONTINUE TO AFFECT MUCH OF THE SOUTHEASTERN AND MID-ATLANTIC COASTS OF THE UNITED STATES DURING THE NEXT COUPLE OF DAYS. THESE SWELLS WILL LIKELY CAUSE LIFE-THREATENING SURF AND RIP CURRENT CONDITIONS. PLEASE CONSULT PRODUCTS FROM YOUR LOCAL WEATHER OFFICE.

NEXT ADVISORY

NEXT COMPLETE ADVISORY AT 500 PM EDT.

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FORECASTER BROWN

Example: Intermediate Public Advisory

WTNT31 KNHC 140551
TCPAT1

BULLETIN

TROPICAL STORM JULIA INTERMEDIATE ADVISORY NUMBER 1A
NWS NATIONAL HURRICANE CENTER MIAMI FL AL112016
200 AM EDT SEP 2016

...RAINS FROM JULIA CONTINUE TO SPREAD ONSHORE ALONG THE NORTHEAST FLORIDA AND GEORGIA COASTS...

SUMMARY OF 200 AM EDT...0600 UTC...INFORMATION

LOCATION...30.5N 81.8W
ABOUT 15 MI...25 KM NNW OF JACKSONVILLE FLORIDA
ABOUT 50 MI...85 KM SSW OF BRUNSWICK GEORGIA
MAXIMUM SUSTAINED WINDS...40 MPH...65 KM/H
PRESENT MOVEMENT...NNW OR 340 DEGREES AT 8 MPH...13 KM/H
MINIMUM CENTRAL PRESSURE...1011 MB...29.85 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY:
NONE.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT:

A TROPICAL STORM WARNING IS IN EFFECT FOR...
* PONTE VEDRA BEACH TO ALTAMAHA SOUND

FOR STORM INFORMATION SPECIFIC TO YOUR AREA, INCLUDING POSSIBLE INLAND WATCHES AND WARNINGS, PLEASE MONITOR PRODUCTS ISSUED BY YOUR LOCAL NATIONAL WEATHER SERVICE FORECAST OFFICE.

DISCUSSION AND OUTLOOK

AT 200 AM EDT (0600 UTC), THE CENTER OF TROPICAL STORM JULIA WAS LOCATED NEAR LATITUDE 30.5 NORTH, LONGITUDE 81.8 WEST. JULIA IS MOVING TOWARD THE NORTH-NORTHWEST NEAR 8 MPH (13 KM/H) AND THIS MOTION IS EXPECTED TO CONTINUE OVERNIGHT WITH A REDUCTION IN FORWARD SPEED LATER TODAY.

MAXIMUM SUSTAINED WINDS ARE NEAR 40 MPH (65 KM/H) WITH HIGHER GUSTS. LITTLE CHANGE IN STRENGTH IS EXPECTED OVERNIGHT. JULIA IS FORECAST TO WEAKEN TO A TROPICAL DEPRESSION BY LATE WEDNESDAY.

TROPICAL-STORM-FORCE WINDS EXTEND OUTWARD UP TO 45 MILES (75 KM), MAINLY OVER WATER TO THE NORTHEAST OF THE CENTER.

THE ESTIMATED MINIMUM CENTRAL PRESSURE IS 1011 MB (29.85 INCHES).

HAZARDS AFFECTING LAND

WIND: TROPICAL-STORM-FORCE WINDS ARE ALREADY OCCURRING WITHIN PORTIONS OF THE TROPICAL STORM WARNING AREA.

RAINFALL: JULIA IS EXPECTED TO PRODUCE 3 TO 6 INCHES OF RAIN NEAR THE NORTHEAST FLORIDA, GEORGIA, AND SOUTH CAROLINA COASTLINES THROUGH FRIDAY AFTERNOON. ISOLATED TOTALS OF 10 INCHES ARE POSSIBLE. THIS RAINFALL COULD LEAD TO FLASH FLOODING. FLOODING MAY BE FURTHER COMPOUNDED WITH PERSISTENT STRONG ONSHORE FLOW REDUCING RIVER AND STREAM DISCHARGES.

TORNADOES: AN ISOLATED TORNADO OR TWO WILL BE POSSIBLE THROUGH THIS MORNING ACROSS PARTS OF NORTHEASTERN FLORIDA AND SOUTHEASTERN GEORGIA.

NEXT ADVISORY

NEXT COMPLETE ADVISORY AT 500 AM EDT.

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FORECASTER BROWN/CANGIALOSI

Example: Special Public Advisory

WTNT35 KNHC 190002
TCPAT5

BULLETIN

Hurricane Maria Special Advisory Number 11
NWS National Hurricane Center Miami FL AL152017
800 PM AST Mon Sep 18 2017

...MARIA BECOMES A POTENTIALLY CATASTROPHIC CATEGORY 5 HURRICANE...
...THE EYE AND THE INTENSE INNER CORE IS NEARING DOMINICA...

SUMMARY OF 800 PM AST...0000 UTC...INFORMATION

LOCATION...15.3N 61.1W
ABOUT 15 MI...25 KM ESE OF DOMINICA
ABOUT 40 MI...70 KM N OF MARTINIQUE
MAXIMUM SUSTAINED WINDS...160 MPH...260 KM/H
PRESENT MOVEMENT...WNW OR 300 DEGREES AT 9 MPH...15 KM/H
MINIMUM CENTRAL PRESSURE...925 MB...27.32 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY:

The government of France has changed the Hurricane Warning to a Tropical Storm Warning for Martique.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT:

A Hurricane Warning is in effect for...

- * Guadeloupe
- * Dominica
- * St. Kitts, Nevis, and Montserrat
- * U.S. Virgin Islands
- * British Virgin Islands
- * Puerto Rico, Culebra, and Vieques

A Tropical Storm Warning is in effect for...

- * Antigua and Barbuda
- * Saba and St. Eustatius
- * St. Maarten

- * Anguilla
- * St. Lucia
- * Martinique

A Hurricane Watch is in effect for...

- * Saba and St. Eustatius
- * St. Maarten
- * St. Martin and St. Barthelemy
- * Anguilla
- * Isla Saona to Puerto Plata

A Tropical Storm Watch is in effect for...

- * St. Vincent and the Grenadines
- * West of Puerto Plata to the northern Dominican Republic-Haiti border

A Hurricane Warning means that hurricane conditions are expected somewhere within the warning area. Preparations to protect life and property should be rushed to completion.

A Tropical Storm Warning means that tropical storm conditions are expected somewhere within the warning area.

A Hurricane Watch means that hurricane conditions are possible within the watch area. A watch is typically issued 48 hours before the anticipated first occurrence of tropical-storm-force winds, conditions that make outside preparations difficult or dangerous.

A Tropical Storm Watch means that tropical storm conditions are possible within the watch area, generally within 48 hours.

Interests elsewhere in Hispaniola should monitor the progress of this system. Additional watches and warnings may be required later tonight or on Tuesday.

For storm information specific to your area in the United States, including possible inland watches and warnings, please monitor products issued by your local National Weather Service forecast office. For storm information specific to your area outside the United States, please monitor products issued by your national meteorological service.

DISCUSSION AND OUTLOOK

At 800 PM AST (0000 UTC), the eye of Hurricane Maria was located near latitude 15.3 North, longitude 61.1 West. Maria is moving toward the west-northwest near 9 mph (15 km/h), and this general motion is expected to continue through Wednesday. On the forecast track, the core of Maria will move near Dominica and the adjacent Leeward Islands during the next few hours, over the extreme northeastern Caribbean Sea the remainder of tonight and Tuesday, and approach Puerto Rico and the Virgin Islands Tuesday night and Wednesday.

Maximum sustained winds are near 160 mph (260 km/h) with higher gusts. Maria is a category 5 hurricane on the Saffir-Simpson Hurricane Wind Scale. Some additional strengthening is possible tonight, but some fluctuations in intensity are likely during the

next day or two.

Hurricane-force winds extend outward up to 25 miles (35 km) from the center and tropical-storm-force winds extend outward up to 125 miles (205 km).

The estimated minimum central pressure based on Air Force Hurricane Hunter data is 925 mb (27.32 inches).

HAZARDS AFFECTING LAND

WIND: Hurricane conditions should be spreading across Dominica, Guadeloupe, and Martinique during the next few hours, with tropical storm conditions already occurring over portions of the Leeward Islands. Hurricane conditions should spread through the remainder of the hurricane warning area tonight through Wednesday. Hurricane conditions are possible within the hurricane watch area Tuesday through Wednesday, with tropical storm conditions possible tonight. Tropical storm conditions are possible in the tropical storm watch area in St. Vincent and the Grenadines through tonight, and are possible in the tropical storm watch area in the Dominican Republic on Wednesday.

Wind speeds atop and on the windward sides of hills and mountains are often up to 30 percent stronger than the near-surface winds indicated in this advisory, and in some elevated locations could be even greater.

STORM SURGE: A dangerous storm surge accompanied by large and destructive waves will raise water levels by as much as 6 to 9 feet above normal tide levels in the hurricane warning area near where the center of Maria moves across the Leeward Islands and the British Virgin Islands.

The combination of a dangerous storm surge and the tide will cause normally dry areas near the coast to be flooded by rising waters moving inland from the shoreline. The water is expected to reach the following heights above ground if the peak surge occurs at the time of high tide...

Puerto Rico and the U.S. Virgin Islands...6 to 9 ft

The deepest water will occur along the immediate coast near and to the north and east of the landfall location, where the surge will be accompanied by large and destructive waves. Surge-related flooding depends on the relative timing of the surge and the tidal cycle, and can vary greatly over short distances. For information specific to your area, please see products issued by your local National Weather Service forecast office.

RAINFALL: Maria is expected to produce the following rain accumulations through Thursday:

Central and southern Leeward Islands...10 to 15 inches, isolated 20 inches.

U.S. and British Virgin Islands...10 to 15 inches, isolated 20 inches.

Puerto Rico...12 to 18 inches, isolated 25 inches.

Northern Leeward Islands from Barbuda to Anguilla...4 to 8 inches,

ATTACHMENT 3 A, p.15

isolated 10 inches.

Windward Islands and Barbados...2 to 4 inches, isolated 6 inches.

Eastern Dominican Republic...4 to 8 inches, isolated 12 inches.

Rainfall on all of these islands could cause life-threatening flash floods and mudslides.

SURF: Swells generated by Maria are affecting the Lesser Antilles. These swells are likely to cause life-threatening surf and rip current conditions. Please consult products from your local weather office.

NEXT ADVISORY

Next intermediate advisory at 800 PM AST.

Next complete advisory at 1100 PM AST.

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Forecaster Brown

Example: Public Advisory Correction

WTNT31 KNHC 240855 CCA
TCPAT3

HURRICANE ANDREW ADVISORY NUMBER 25...CORRECTED
NWS NATIONAL HURRICANE CENTER MIAMI FL AL011992
500 AM EDT MON AUG 24 1992
CORRECTED FOR CENTRAL PRESSURE.

BODY OF TEXT...

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Example: Subtropical Cyclone Public Advisory

WTNT32 KNHC 260845
TCPAT2

BULLETIN

Subtropical Storm Beryl Advisory Number 2
NWS National Hurricane Center Miami FL AL022012
500 AM EDT Sat May 26 2012

...BERYL MOVING WEST-SOUTHWESTWARD...
...TROPICAL STORM CONDITIONS EXPECTED IN THE WARNING AREA ON SUNDAY...

SUMMARY OF 500 AM EDT...0900 UTC...INFORMATION

LOCATION...32.3N 75.6W
ABOUT 180 MI...285 KM SE OF CAPE FEAR NORTH CAROLINA
ABOUT 260 MI...415 KM E OF CHARLESTON SOUTH CAROLINA
MAXIMUM SUSTAINED WINDS...45 MPH...75 KM/H
PRESENT MOVEMENT...WSW OR 255 DEGREES AT 5 MPH...7 KM/H
MINIMUM CENTRAL PRESSURE...1001 MB...29.56 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY:
NONE.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT...

A TROPICAL STORM WARNING IS IN EFFECT FOR...
* VOLUSIA/BREVARD COUNTY LINE FLORIDA TO EDISTO BEACH SOUTH CAROLINA

A TROPICAL STORM WATCH IS IN EFFECT FOR...
* NORTH OF EDISTO BEACH TO SOUTH SANTEE RIVER SOUTH CAROLINA

A TROPICAL STORM WARNING MEANS THAT TROPICAL STORM CONDITIONS ARE EXPECTED SOMEWHERE WITHIN THE WARNING AREA WITHIN 36 HOURS.

A TROPICAL STORM WATCH MEANS THAT TROPICAL STORM CONDITIONS ARE POSSIBLE WITHIN THE WATCH AREA, GENERALLY WITHIN 48 HOURS.

FOR STORM INFORMATION SPECIFIC TO YOUR AREA IN THE UNITED STATES, INCLUDING POSSIBLE INLAND WATCHES AND WARNINGS, PLEASE MONITOR PRODUCTS ISSUED BY YOUR LOCAL NATIONAL WEATHER SERVICE FORECAST OFFICE.

DISCUSSION AND OUTLOOK

AT 500 AM EDT (0900 UTC), THE CENTER OF SUBTROPICAL STORM BERYL WAS LOCATED NEAR LATITUDE 32.3 NORTH, LONGITUDE 75.6 WEST. BERYL IS MOVING TOWARD THE WEST-SOUTHWEST NEAR 5 MPH (7 KM/H). A WEST-SOUTHWEST OR SOUTHWEST MOTION WITH AN INCREASE IN FORWARD SPEED IS EXPECTED THROUGH SUNDAY, WITH A TURN TOWARD THE WEST EXPECTED ON SUNDAY NIGHT. ON THE FORECAST TRACK THE CENTER OF BERYL WILL APPROACH THE COAST IN THE WARNING AREA ON SUNDAY.

MAXIMUM SUSTAINED WINDS REMAIN NEAR 45 MPH (75 KM/H) WITH HIGHER GUSTS. A LITTLE STRENGTHENING IS POSSIBLE DURING THE NEXT DAY OR SO.

TROPICAL STORM FORCE WINDS EXTEND OUTWARD UP TO 115 MILES (185 KM) FROM THE CENTER.

THE ESTIMATED MINIMUM CENTRAL PRESSURE IS 1001 MB (29.56 INCHES).

HAZARDS AFFECTING LAND

WIND: TROPICAL STORM CONDITIONS ARE EXPECTED TO REACH THE COAST WITHIN THE WARNING AREA FROM NORTHEAST FLORIDA TO SOUTH CAROLINA ON SUNDAY. TROPICAL STORM CONDITIONS ARE POSSIBLE IN THE WATCH AREA ALONG THE CENTRAL SOUTH CAROLINA COAST LATE TONIGHT OR SUNDAY.

STORM SURGE: THE COMBINATION OF A STORM SURGE AND THE TIDE WILL CAUSE NORMALLY DRY AREAS NEAR THE COAST TO BE FLOODED BY RISING WATERS. THE WATER COULD REACH THE FOLLOWING HEIGHTS ABOVE GROUND IF THE PEAK SURGE OCCURS AT THE TIME OF HIGH TIDE...

COASTAL PORTIONS OF SOUTH CAROLINA...GEORGIA...AND NORTH FLORIDA...1 TO 3 FT.

THE DEEPEST WATER WILL OCCUR ALONG THE IMMEDIATE COAST NEAR AND TO THE NORTH OF THE LANDFALL LOCATION, WHERE THE SURGE WILL BE ACCOMPANIED BY LARGE WAVES. SURGE-RELATED FLOODING DEPENDS ON THE RELATIVE TIMING OF THE SURGE AND THE TIDAL CYCLE, AND CAN VARY GREATLY OVER SHORT DISTANCES. FOR INFORMATION SPECIFIC TO YOUR AREA, PLEASE SEE PRODUCTS ISSUED BY YOUR LOCAL NATIONAL WEATHER SERVICE OFFICE.

RAINFALL: BERYL IS EXPECTED TO PRODUCE TOTAL RAIN ACCUMULATIONS OF 2 TO 4 INCHES ALONG THE SOUTHEASTERN COAST OF THE UNITED STATES FROM NORTHEASTERN FLORIDA THROUGH SOUTHEASTERN NORTH CAROLINA.

SURF: DANGEROUS SURF CONDITIONS ARE POSSIBLE ALONG THE NORTHEAST FLORIDA, GEORGIA, SOUTH CAROLINA, AND CENTRAL AND SOUTHERN NORTH CAROLINA COASTS OVER THE MEMORIAL DAY WEEKEND. PLEASE SEE STATEMENTS ISSUED BY YOUR LOCAL NATIONAL WEATHER SERVICE OFFICE FOR INFORMATION SPECIFIC TO YOUR AREA.

NEXT ADVISORY

NEXT INTERMEDIATE ADVISORY AT 800 AM EDT.
NEXT COMPLETE ADVISORY AT 1100 AM EDT.

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FORECASTER BRENNAN

Example: WPC Public Advisory

WTPZ35 KWNH 080250

TCPEP5

POST-TROPICAL CYCLONE NEWTON ADVISORY NUMBER 14
NWS WEATHER PREDICTION CENTER COLLEGE PARK MD EP152016
800 PM MST WED SEP 07 2016

...NEWTON CONTINUES TO WEAKEN OVER SOUTHEASTERN ARIZONA AS IT
MOVES SLOWLY TOWARDS THE NORTHEAST...

SUMMARY OF 800 PM MST...0300 UTC...INFORMATION

LOCATION...33.5N 111.1W
ABOUT 48 MILES...77 KM...E OF PHOENIX...ARIZONA.
MAXIMUM SUSTAINED WINDS...25 MPH...40 KM/H
PRESENT MOVEMENT...NNE OR 025 DEGREES AT 15 MPH...24 KM/H
MINIMUM CENTRAL PRESSURE...1009 MB...29.80 INCHES

WATCHES AND WARNINGS

THERE ARE NO WATCHES AND WARNINGS IN EFFECT ASSOCIATED WITH NEWTON.

FOR INFORMATION, SPECIFIC TO YOUR AREA...INCLUDING POSSIBLE WATCHES
AND WARNINGS...PLEASE MONITOR PRODUCTS ISSUED BY YOUR LOCAL
NATIONAL WEATHER SERVICE OFFICE AT WWW.WEATHER.GOV.

DISCUSSION AND OUTLOOK

AT 800 PM MST...0300 UTC...THE CENTER OF NEWTON WAS LOCATED NEAR
LATITUDE 33.5 NORTH...AND LONGITUDE 111.1 WEST. NEWTON WAS LOCATED
IN SOUTHEASTERN ARIZONA AND MOVING TOWARDS THE NORTH-NORTHEAST.
THE STORM IS EXPECTED TO SLOW IN MOTION OVERNIGHT BEFORE
DISSIPATING BY THURSDAY MORNING.

MAXIMUM SUSTAINED WINDS ARE NEAR 25 MPH...40 KM/H...WITH HIGHER
GUSTS.

MINIMUM CENTRAL PRESSURE IS 1009 MB...29.80 INCHES.

HAZARDS

RAINFALL...NEWTON IS EXPECTED TO PRODUCE ADDITIONAL RAINFALL

AMOUNTS OF GENERALLY UP TO AN INCH ACROSS PORTIONS OF SOUTHEAST ARIZONA AND SOUTHWEST NEW MEXICO OVERNIGHT AND INTO THURSDAY. LOCALLY HIGHER AMOUNTS UP TO 2 INCHES ARE POSSIBLE IN THE HIGHER TERRAIN.

NEXT ADVISORY

NEXT ADVISORY ISSUED AT 200 AM MST. PLEASE REFER TO YOUR LOCAL NATIONAL WEATHER SERVICE OFFICE FOR FURTHER INFORMATION ON THIS STORM.

FORECASTER SANTORELLI

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Example: Tropical Cyclone Forecast/Advisory

ZCZC MIATCMAT2 ALL
TTAA00 KNHC DDHHMM

TROPICAL STORM EARL FORECAST/ADVISORY NUMBER 16
NWSNATIONAL HURRICANE CENTER MIAMI FL AL072010
0900 UTC SUN AUG 29 2010

CHANGES IN WATCHES AND WARNINGS WITH THIS ADVISORY...

THE GOVERNMENT OF THE NETHERLANDS ANTILLES HAS ISSUED A HURRICANE WARNING FOR THE ISLANDS OF St. MAARTEN...SABA AND St. EUSTATIUS.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT...

A HURRICANE WARNING IS IN EFFECT FOR...

- * ANTIGUA...BARBUDA...MONTserrat...ST.KITTS...NEVIS...AND ANGUILLA
- * SAINT MARTIN AND SAINT BARTHELEMY
- * St. MAARTEN...SABA AND St. EUSTATIUS

A HURRICANE WATCH IS IN EFFECT FOR...

- * BRITISH VIRGIN ISLANDS
- * U.S.VIRGINISLANDS
- * PUERTO RICO INCLUDING THE ISLANDS OF CULEBRA AND VIEQUES

HURRICANE CONDITIONS ARE EXPECTED WITHIN THE WARNING AREA BEGINNING WITHIN 24 HOURS. PREPARATIONS TO PROTECT LIFE AND PROPERTY SHOULD BE RUSHED TO COMPLETION.

HURRICANE CONDITIONS ARE POSSIBLE WITHIN THE WATCH AREA WITHIN THE NEXT 36 HOURS.

TROPICAL STORM CENTER LOCATED NEAR 16.9N 56.9W AT 29/0900Z
POSITION ACCURATE WITHIN 30 NM

PRESENT MOVEMENT TOWARD THE WEST OR 280 DEGREES AT 16 KT

ESTIMATED MINIMUM CENTRAL PRESSURE 989 MB
MAX SUSTAINED WINDS 55 KT WITH GUSTS TO 65 KT.
50 KT..... 35NE 0SE 0SW 30NW.
34 KT.....140NE 80SE 15SW 90NW.
12 FT SEAS..170NE 80SE 30SW 90NW.

WINDS AND SEAS VARY GREATLY IN EACH QUADRANT. RADII IN NAUTICAL MILES ARE THE LARGEST RADII EXPECTED ANYWHERE IN THAT QUADRANT.

REPEAT...CENTER LOCATED NEAR 16.9N 56.9W AT 29/0900Z
AT 29/0600Z CENTER WAS LOCATED NEAR 16.7N 56.2W

FORECAST VALID 29/1800Z 17.3N 59.1W
MAX WIND 65 KT...GUSTS 80 KT.
64 KT... 15NE 0SE 0SW 15NW.
50 KT... 40NE 25SE 15SW 35NW.
34 KT...140NE 90SE 30SW 90NW.

FORECAST VALID 30/0600Z 17.9N 61.4W
MAX WIND 70 KT...GUSTS 85 KT.
64 KT... 25NE 15SE 0SW 25NW.
50 KT... 50NE 30SE 30SW 40NW.
34 KT...140NE 90SE 50SW 100NW.

FORECAST VALID 30/1800Z 18.7N 63.6W
MAX WIND 80 KT...GUSTS 100 KT.
64 KT... 35NE 25SE 20SW 35NW.
50 KT... 60NE 40SE 40SW 50NW.
34 KT...140NE 100SE 60SW 110NW.

FORECAST VALID 31/0600Z 19.9N 65.4W
MAX WIND 90 KT...GUSTS 110 KT.
64 KT... 35NE 25SE 20SW 35NW.
50 KT...75NE 50SE 50SW 75NW.
34 KT...150NE 110SE 75SW 120NW.

FORECAST VALID 01/0600Z 23.5N 69.0W
MAX WIND 100 KT...GUSTS 120 KT.
50 KT... 90NE 60SE 50SW 80NW.
34 KT...160NE 120SE 90SW 130NW.

EXTENDED OUTLOOK. NOTE...ERRORS FOR TRACK HAVE AVERAGED NEAR 200 NM ON DAY 4 AND 250 NM ON DAY 5...AND FOR INTENSITY NEAR 20 KT EACH DAY

OUTLOOK VALID 02/0600Z 29.0N 72.0W
MAX WIND 105 KT...GUSTS 130 KT.

OUTLOOK VALID 03/0600Z 34.5N 72.0W
MAX WIND 105 KT...GUSTS 130 KT.

REQUEST FOR 3 HOURLY SHIP REPORTS WITHIN 300 MILES OF 16.9N 56.9W

NEXT ADVISORY AT 29/1500Z

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FORECASTER BRENNAN

NNNN

Example: Tropical Cyclone Discussion (TCD)

ZCZC MIATCDAT1 ALL
TTAA00 KNHC DDHHMM

Hurricane Irma Discussion Number 21
NWS National Hurricane Center Miami FL AL112017
1100 AM AST Mon Sep 04 2017

The satellite presentation of Irma has improved markedly over the past 24 hours, with the eye becoming larger and much more distinct. A NOAA Hurricane Hunter aircraft has reported peak 700-mb flight level winds of 117 kt, SFMR winds of 107 kt, and dropsonde data that support a minimum pressure of around 944 mb. These data support an initial intensity of 105 kt. The aircraft also reported concentric eyewalls and a double wind maximum during the last couple of passes through the center, indicating that an eyewall replacement cycle has likely begun.

Irma is expected to remain within a very favorable environment for strengthening during the next several days and additional intensification appears likely. However, eyewall replacement cycles are likely to cause some fluctuations in intensity during that time. The NHC forecast brings the hurricane to category 4 strength within the next 24 hours, and then maintains Irma as a powerful hurricane during the next 5 days, assuming that the core of the cyclone does not move over any of the Greater Antilles.

Irma has been moving west-southwestward or 255/11 kt to the south of a strong mid-level ridge over the central Atlantic. The hurricane should turn westward later today or tonight, then west-northwestward Tuesday as it reaches the southwestern portion of the ridge. As mentioned in the previous NHC discussion, a large mid-latitude trough is expected to amplify over the eastern United States during the next few days. The global models are unanimous in lifting the trough out to the northeast by late in the week, allowing the Atlantic ridge to build westward on days 3 through 5. The track guidance has again shifted westward and southwestward at days 4 and 5, but the models remain in very good agreement through the forecast period. The updated NHC track forecast has been adjusted southwestward late in the period, and lies very near the consensus of the ECMWF, GFS, and HWRP models.

Six hourly upper-air soundings will begin at 1800 UTC today over the central United States to better sample the upstream mid-latitude trough. In addition, the NOAA G-IV aircraft will begin sampling the environment around Irma this afternoon and evening, and these data will be included in tonight's 0000 UTC model runs.

Users are reminded to not focus on the exact forecast track since strong winds and heavy rainfall extend well away from the center. In addition, average NHC track errors are about 175 and 225 statute miles at days 4 and 5, respectively.

KEY MESSAGES:

1. Irma is expected to affect the northeastern Leeward Islands as a dangerous major hurricane, accompanied by life-threatening wind, storm surge, and rainfall impacts, along with rough surf and rip currents. Hurricane warnings have been issued for portions of the Leeward Islands. Preparations should be rushed to completion, as tropical-storm force winds are expected to first arrive in the hurricane warning area by late Tuesday.
2. Irma could directly affect the British and U.S. Virgin Islands and Puerto Rico as a dangerous major hurricane later this week. Hurricane watches have been issued for these areas, and tropical-storm-force winds could arrive in these areas by early Wednesday.
3. Irma could directly affect Hispaniola, the Turks and Caicos, the Bahamas, and Cuba as a dangerous major hurricane later this week. Residents in these areas should monitor the progress of Irma and listen to advice given by officials.
4. There is an increasing chance of seeing some impacts from Irma in the Florida Peninsula and the Florida Keys later this week and this weekend. In addition, rough surf and dangerous marine conditions will begin to affect the southeastern U.S. coast by later this week. Otherwise, it is still too early to determine what direct impacts Irma might have on the continental United States. However, everyone in hurricane-prone areas should ensure that they have their hurricane plan in place, as we are now near the peak of the season.

FORECAST POSITIONS AND MAX WINDS

INIT 04/1500Z 16.8N 53.3W 105 KT 120 MPH
12H 05/0000Z 16.5N 54.8W 115 KT 130 MPH
24H 05/1200Z 16.7N 57.1W 120 KT 140 MPH
36H 06/0000Z 17.3N 59.6W 120 KT 140 MPH
48H 06/1200Z 18.2N 62.4W 125 KT 145 MPH
72H 07/1200Z 19.9N 68.0W 120 KT 140 MPH
96H 08/1200Z 21.2N 73.3W 115 KT 130 MPH
120H 09/1200Z 22.0N 77.8W 115 KT 130 MPH...NEAR THE COAST OF CUBA

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Forecaster Brown

Example: Tropical Cyclone Update from - NHC

Example 1 - TCU to convey changes in storm information (with summary section)

WTNT63 KNHC 052135
TCUAT3

Tropical Storm Colin Tropical Cyclone Update

NWS National Hurricane Center Miami FL AL032016
430 PM CDT Sun Jun 05 2016

...DEPRESSION STRENGTHENS TO A TROPICAL STORM...

Reports from an Air Force Reserve Unit Hurricane Hunter aircraft indicate that Tropical Depression Three is now a tropical storm with maximum sustained winds of 40 mph (65 km/h).

SUMMARY OF 430 PM CDT...2130 UTC...INFORMATION

LOCATION...23.3N 87.9W
ABOUT 465 MI...750 KM SW OF TAMPA FLORIDA
ABOUT 475 MI...765 KM SSW OF APALACHICOLA FLORIDA
MAXIMUM SUSTAINED WINDS...40 MPH...65 KM/H
PRESENT MOVEMENT...N OR 360 DEGREES AT 12 MPH...19 KM/H
MINIMUM CENTRAL PRESSURE...1005 MB...29.68 INCHES

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Forecaster Pasch

Example 2 - TCU to provide hourly position updates

Hurricane Isaac Tropical Cyclone Update
NWS National Hurricane Center Miami FL AL092012
1100 AM CDT Wed Aug 29 2012

...11 AM POSITION UPDATE...

A gust to 67 mph was recently reported at Shell Beach Louisiana. Tropical storm conditions are continuing along the Mississippi and Alabama coasts.

SUMMARY OF 1100 AM CDT...1600 UTC...INFORMATION

LOCATION...29.6N 90.7W
ABOUT 1 MI...2 KM W OF HOUMA LOUISIANA
ABOUT 45 MI...75 KM SW OF NEW ORLEANS LOUISIANA
MAXIMUM SUSTAINED WINDS...75 MPH...120 KM/H
PRESENT MOVEMENT...NW OR 310 DEGREES AT 6 MPH...9 KM/H
MINIMUM CENTRAL PRESSURE...972 MB...28.70 INCHES

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Forecaster Stewart

Example 3 - TCU to notify users that change in status is forthcoming (no summary section)

WTNT62 KNHC 251800
TCUAT2

Tropical Depression Seven Tropical Cyclone Update
NWS National Hurricane Center Miami FL AL072008
200 PM EDT Mon Aug 25 2008

Preliminary reports from an air force hurricane hunter aircraft indicate that Tropical Depression Seven has strengthened. A special advisory will be issued within the next 30 minutes to upgrade the depression to a tropical storm, to update the intensity forecast, and to issue new watches and warnings for Hispaniola.

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Forecaster Pasch

NNNN

Example 4 - TCU to update watches or warnings (no change in storm summary information)

WTNT62 KNHC 251800
TCUAT2

Tropical Depression Seven Tropical Cyclone Update
NWS National Hurricane Center Miami FL AL072008
200 PM EDT Mon Aug 25 2008

ZCZC MIATCUAT4 ALL
TTAA00 KNHC DDHHMM

Hurricane Ike Tropical Cyclone Update
NWS National Hurricane Center Miami FL AL092008
600 PM AST Fri Sep 05 2008

At 600 PM AST, 2200 UTC, the Government of the Bahamas has issued a Hurricane Watch for the Southeastern Bahamas, including the Acklins, Crooked Island, the Inaguas, Mayaguana, and the Ragged Islands, as well as for the Turks and Caicos Islands.

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Forecaster Blake

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Example: Wind Speed Probabilities

TROPICAL STORM ISAAC WIND SPEED PROBABILITIES NUMBER 23
NWS NATIONAL HURRICANE CENTER MIAMI FL AL092012
2100 UTC SUN AUG 26 2012

AT 2100Z THE CENTER OF TROPICAL STORM ISAAC WAS LOCATED NEAR
LATITUDE 24.2 NORTH...LONGITUDE 82.3 WEST WITH MAXIMUM SUSTAINED
WINDS NEAR 50 KTS...60 MPH...95 KM/H.

Z INDICATES COORDINATED UNIVERSAL TIME (GREENWICH)
ATLANTIC STANDARD TIME (AST)...SUBTRACT 4 HOURS FROM Z TIME

EASTERN DAYLIGHT TIME (EDT)...SUBTRACT 4 HOURS FROM Z TIME
CENTRAL DAYLIGHT TIME (CDT)...SUBTRACT 5 HOURS FROM Z TIME

WIND SPEED PROBABILITY TABLE FOR SPECIFIC LOCATIONS

CHANCES OF SUSTAINED (1-MINUTE AVERAGE) WIND SPEEDS OF AT LEAST

...34 KT (39 MPH... 63 KPH)...

...50 KT (58 MPH... 93 KPH)...

...64 KT (74 MPH...119 KPH)...

FOR LOCATIONS AND TIME PERIODS DURING THE NEXT 5 DAYS

PROBABILITIES FOR LOCATIONS ARE GIVEN AS OP (CP) WHERE

OP IS THE PROBABILITY OF THE EVENT BEGINNING DURING
AN INDIVIDUAL TIME PERIOD (ONSET PROBABILITY)

(CP) IS THE PROBABILITY OF THE EVENT OCCURRING BETWEEN
18Z SUN AND THE FORECAST HOUR (CUMULATIVE PROBABILITY)

PROBABILITIES ARE GIVEN IN PERCENT

X INDICATES PROBABILITIES LESS THAN 1 PERCENT

PROBABILITIES FOR 34 KT AND 50 KT ARE SHOWN AT A GIVEN LOCATION WHEN
THE 5-DAY CUMULATIVE PROBABILITY IS AT LEAST 3 PERCENT.

PROBABILITIES FOR 64 KT ARE SHOWN WHEN THE 5-DAY CUMULATIVE
PROBABILITY IS AT LEAST 1 PERCENT.

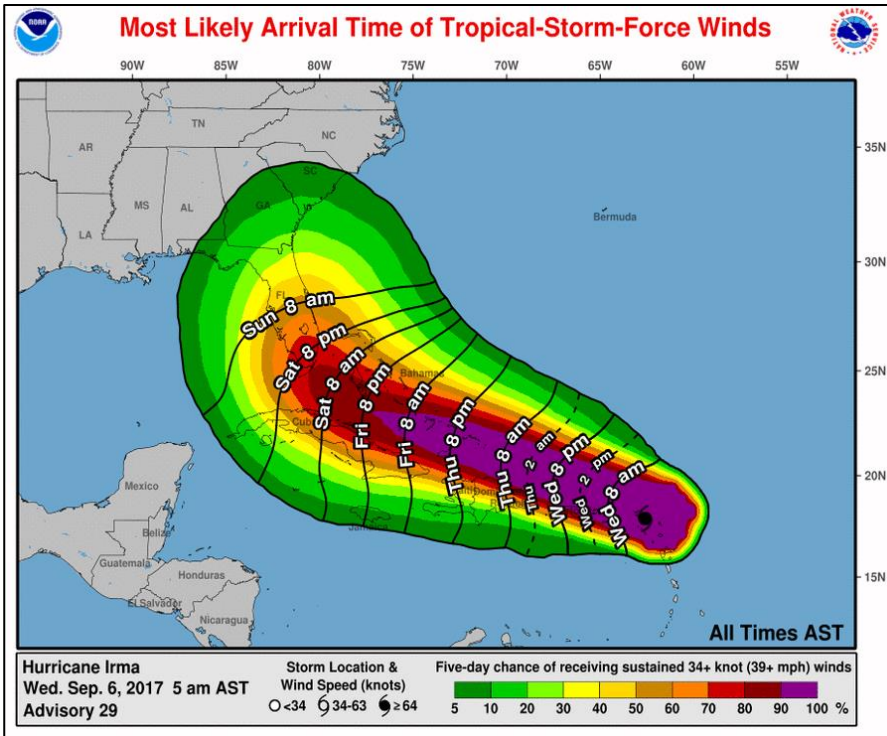
ATTACHMENT 3 A, p.26

- - - - WIND SPEED PROBABILITIES FOR SELECTED LOCATIONS - - - -

TIME PERIODS	FROM 18Z SUN		FROM 06Z MON		FROM 18Z MON		FROM 06Z TUE		FROM 18Z TUE		FROM 18Z WED		FROM 18Z THU		FROM 18Z FRI	
	TO 06Z MON	18Z MON	TO 18Z MON	06Z TUE	TO 18Z MON	06Z TUE	TO 18Z TUE	18Z TUE	TO 18Z TUE	18Z WED	TO 18Z WED	18Z THU	TO 18Z THU	18Z THU	TO 18Z THU	18Z FRI
FORECAST HOUR	(12)	(24)	X(36)	(48)	(72)	(96)	(120)									
W PALM BEACH	34 14	2 (16)	X(16)	X(16)	X(16)	X(16)	X(16)									
MIAMI FL	34 99	X(99)	X(99)	X(99)	X(99)	X(99)	X(99)									
MARATHON FL	34 99	X(99)	X(99)	X(99)	X(99)	X(99)	X(99)									
MARATHON FL	50 14	X(14)	X(14)	X(14)	X(14)	X(14)	X(14)									
KEY WEST FL	34 99	X(99)	X(99)	X(99)	X(99)	X(99)	X(99)									
KEY WEST FL	50 99	X(99)	X(99)	X(99)	X(99)	X(99)	X(99)									
MARCO ISLAND	34 99	X(99)	X(99)	X(99)	X(99)	X(99)	X(99)									
FT MYERS FL	34 48	1 (49)	2 (51)	X(51)	X(51)	X(51)	X(51)									
VENICE FL	34 37	5 (42)	2 (44)	1 (45)	X(45)	1 (46)	X(46)									
TAMPA FL	34 18	8 (26)	3 (29)	2 (31)	X(31)	1 (32)	X(32)									
TALLAHASSEE FL	34 X	7 (7)	10 (17)	6 (23)	6 (29)	1 (30)	X(30)									
ST MARKS FL	34 1	9 (10)	9 (19)	6 (25)	5 (30)	1 (31)	1 (32)									
APALACHICOLA	34 3	11 (14)	16 (30)	9 (39)	7 (46)	1 (47)	X(47)									
APALACHICOLA	50 X	XX(X)	2 (2)	2 (4)	1 (5)	1 (6)	X(6)									
APALACHICOLA	64 X	XX(X)	X(X)	1 (1)	X(1)	X(1)	X(1)									
PANAMA CITY FL	34 1	11 (12)	20 (32)	13 (45)	7 (52)	1 (53)	1 (54)									
PANAMA CITY FL	50 X	XX(X)	3 (3)	4 (7)	3 (10)	1 (11)	X(11)									
PANAMA CITY FL	64 X	XX(X)	X(X)	1 (1)	1 (2)	X(2)	X(2)									
COLUMBUS GA	34 X	XX(X)	3 (3)	6 (9)	11 (20)	2 (22)	1 (23)									
MONTGOMERY AL	34 X	X(X)	7 (7)	10 (17)	18 (35)	3 (38)	1 (39)									
MONTGOMERY AL	50 X	X(X)	X(X)	X(X)	5 (5)	2 (7)	X(7)									
MONTGOMERY AL	64 X	X(X)	X(X)	X(X)	1 (1)	1 (2)	X(2)									
PENSACOLA FL	34 X	6 (6)	24 (30)	25 (55)	14 (69)	2 (71)	X(71)									
PENSACOLA FL	50 X	XX(X)	2 (2)	14 (16)	12 (28)	1 (29)	1 (30)									
PENSACOLA FL	64 X	XX(X)	X(X)	4 (4)	5 (9)	2 (11)	X(11)									
MOBILE AL	34 X	3 (3)	22 (25)	31 (56)	20 (76)	2 (78)	X(78)									
MOBILE AL	50 X	XX(X)	2 (2)	15 (17)	21 (38)	2 (40)	X(40)									
MOBILE AL	64 X	XX(X)	X(X)	3 (3)	12 (15)	1 (16)	X(16)									
GULFPORT MS	34 X	3 (3)	22 (25)	33 (58)	21 (79)	2 (81)	X(81)									
GULFPORT MS	50 X	XX(X)	2 (2)	19 (21)	22 (43)	2 (45)	X(45)									
GULFPORT MS	64 X	XX(X)	X(X)	5 (5)	13 (18)	2 (20)	X(20)									
STENNIS SC	34 X	2 (2)	19 (21)	32 (53)	23 (76)	3 (79)	1 (80)									
STENNIS SC	50 X	XX(X)	1 (1)	15 (16)	22 (38)	2 (40)	X(40)									
STENNIS SC	64 X	XX(X)	X(X)	4 (4)	12 (16)	1 (17)	X(17)									
BURAS LA	34 X	5 (5)	29 (34)	33 (67)	14 (81)	2 (83)	1 (84)									
BURAS LA	50 X	XX(X)	5 (5)	25 (30)	15 (45)	2 (47)	X(47)									
BURAS LA	64 X	XX(X)	1 (1)	8 (9)	11 (20)	1 (21)	X(21)									
NEW ORLEANS LA	34 X	1 (1)	16 (17)	29 (46)	23 (69)	3 (72)	1 (73)									
NEW ORLEANS LA	50 X	XX(X)	1 (1)	10 (11)	18 (29)	3 (32)	1 (33)									
NEW ORLEANS LA	64 X	XX(X)	X(X)	1 (1)	9 (10)	1 (11)	X(11)									
BATON ROUGE LA	34 X	XX(X)	9 (9)	18 (27)	24 (51)	6 (57)	X(57)									
BATON ROUGE LA	50 X	XX(X)	X(X)	2 (2)	14 (16)	3 (19)	X(19)									
BATON ROUGE LA	64 X	XX(X)	X(X)	X(X)	5 (5)	2 (7)	X(7)									
NEW IBERIA LA	34 X	X(X)	7 (7)	12 (19)	20 (39)	7 (46)	X(46)									
BATON ROUGE LA	50 X	X(X)	X(X)	1 (1)	9 (10)	2 (12)	1 (13)									
BATON ROUGE LA	64 X	XX(X)	X(X)	X(X)	5 (5)	2 (7)	X(7)									

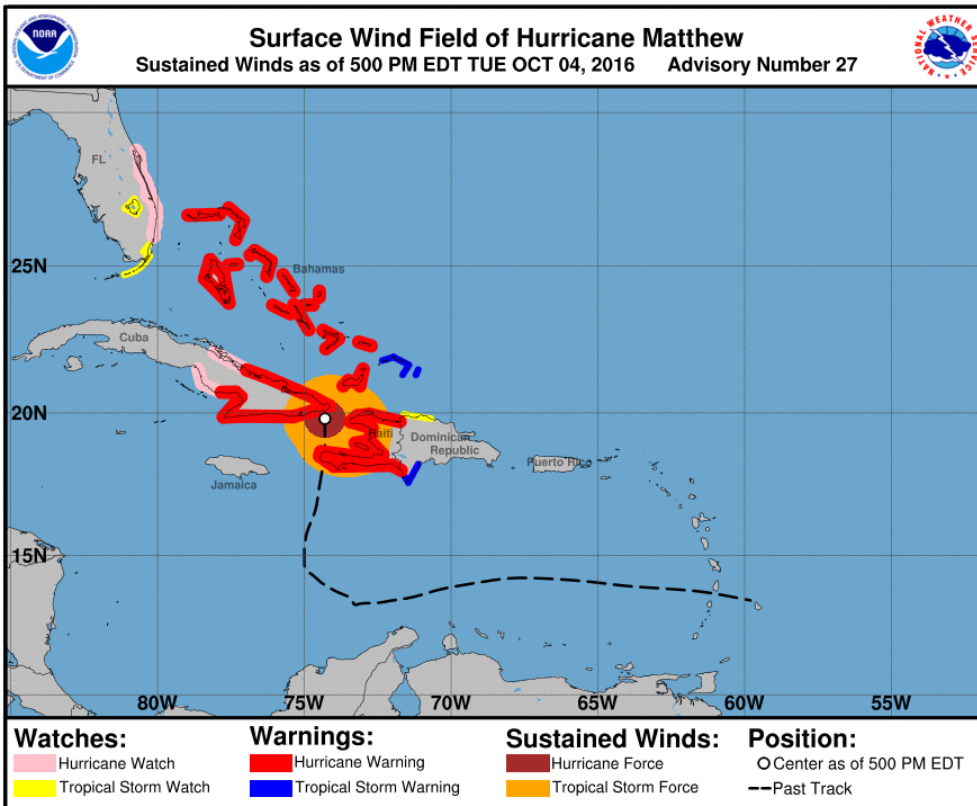
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FORECASTER PASCH
NNN

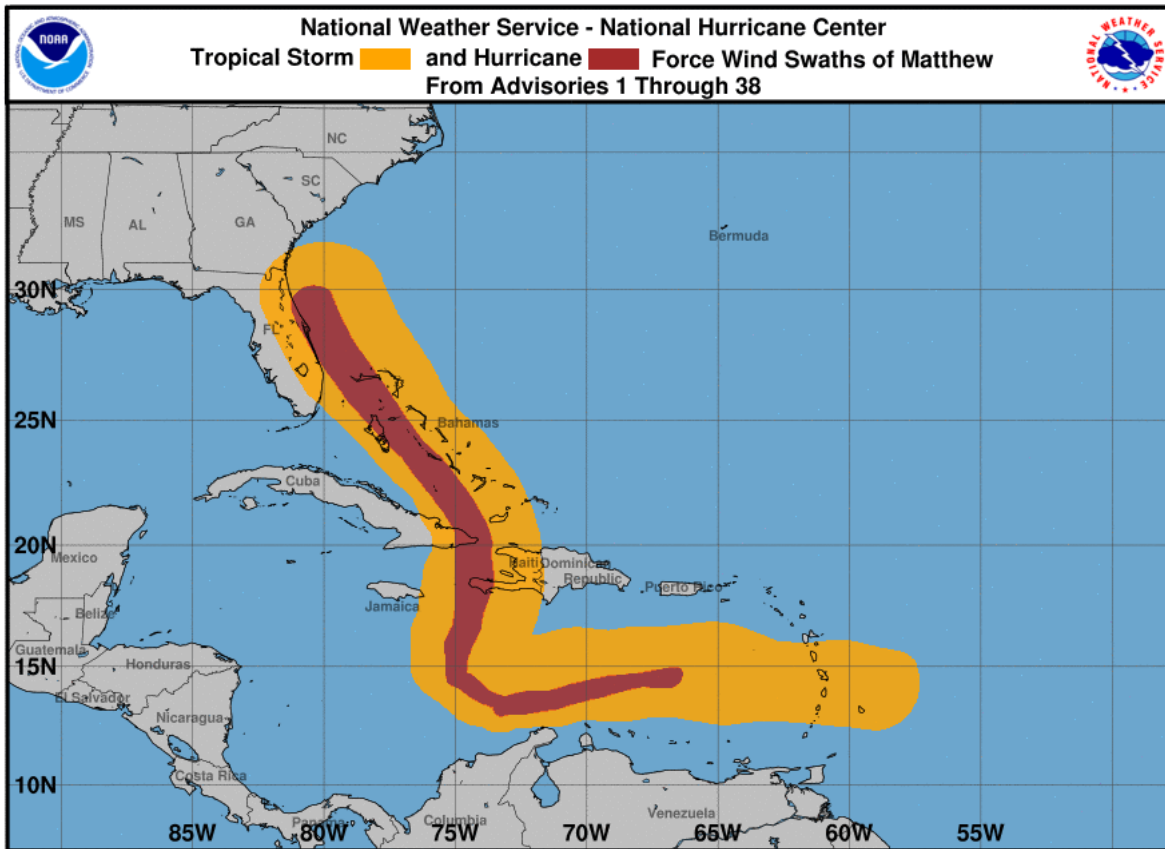


Note: There are versions of these graphics without the probability of tropical-storm-force winds included.

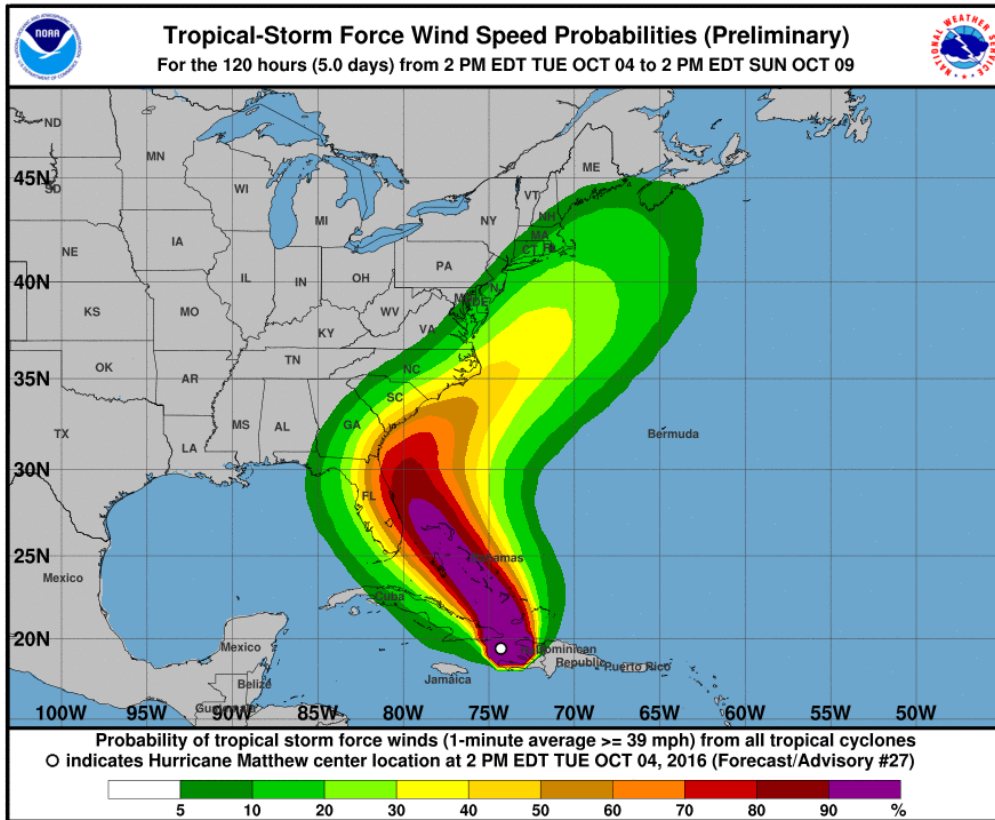
Example: Tropical Cyclone Surface Wind Field Graphic



Example: Cumulative Wind History Graphic



Example: Wind Speed Probability Graphic



Note: Graphics showing the chance of 34-kt, 50-kt, and 64-kt winds at individual locations are available. This is an example of the 34-kt wind probability graphic.

CHAPTER 4

GROUND RADAR OBSERVATIONS

4.1 General

Weather radars are used to locate precipitation, calculate its motion, estimate its type (rain, hail, etc) and amount and to forecast future positions and intensity. Most modern weather radars are Doppler radars, capable of detecting the motion of rain droplets in addition to intensity of the precipitation. Both types of data can be analyzed to determine the structure of approaching storms and hurricanes.

Since radar data is mostly digital and available through meteorological circuits and the Internet, individual and network mosaic radar images from all available sources should be distributed to all warning offices and the RSMC-Miami via meteorological circuits and FTP servers. Provision of meteorological data to other users and the general public via the Internet should be separated, if possible, from data intended for operational use.

4.1.1 Observations

Radar imagery during tropical cyclones are among the most important and useful observations available to the hurricane forecaster and to those whose responsibility it is to issue warnings. It is essential that continuous radar observations be available whenever a tropical cyclone is under surveillance by a particular radar, and that all responsible officials cooperate to ensure that the observations are distributed to the RSMC-Miami and other concerned meteorological offices.

While it might be a practice to provide only base reflectivity radar data (data from at a single elevation scan of the radar) outside of the hurricane season or when no weather systems are present, it is recommended that full volume scans (composite reflectivity) of each radar, showing the strongest reflected energy at all elevation scans, be made available as a routine on any weather system during the hurricane season. It may also be useful to provide rainfall accumulation products, if available.

Radar data which is intended to be included in the Caribbean radar mosaic should be transmitted to the Global Telecommunications System (GTS) Internet File Service (GIFS) server at <https://ra4-gifs.weather.gov/data/RMTN/RADAR/>. Météo-France Martinique, has the responsibility for the generation of the composite product.

4.1.2 Special Observations

(a) ***Information on the hurricane or storm eye or centre***

Any radar image containing an eye or centre position is considered as a special observation. Observance of the eye of tropical storms and hurricanes is vital. The eye position is best determined from a continuous set of observations. Ideally, the radar-observed eye is readily apparent as a circular echo-free area surrounded by the wall cloud. Once an eye is located within a radar's range, it is recommended that as many detailed images as possible be made available to the RSMC and the Warning Offices under threat. Information should be available on the imagery to enable the latitude and longitude of the eye or centre to be determined.

(b) ***Doppler observations***

Availability of Doppler information on the wind field of the storm or hurricane should also be increased. It is recommended that a Doppler scan with radial velocity measurements up to 100-120 km should be made available every 15 minutes.

(c) **Rainfall observations**

Radar observations are necessary to provide quantitative estimate of precipitation during a storm or hurricane. Imagery in rainfall rates (in addition to intensities - dBZ) should be provided at intervals, as well as imagery to indicate precipitation intensities in the major rain bands.

4.1.3 Radar availability

It is highly recommended that interruptions of radar operations for preventive maintenance should be minimized during periods of inclement weather. In particular, interruptions of an individual radar's operations should not be carried out when a tropical cyclone is within at least forty-eight (48) hours of surveillance by that radar. Where possible, radar outages should be made known to RSMC Miami, along with the estimated time to their return to service.

4.2 USA coastal radars

These are operated by the US National Weather Service at the following sites:

Location	Radar type	Latitude	Longitude	Id.	Max range (Nau/St mi/km)
Boston, MA	WSR-88D	41°57'N	71°08'W	BOX	248/ - /46 0
Brownsville, TX	WSR-88D	25°55'N	97°29'W	BRO	"
Caribou, ME	WSR-88D	46°02'N	67°48'W	CBW	"
Charleston, SC	WSR-88D	32°39'N	80°03'W	CLX	"
Corpus Christi, TX	WSR-88D	27°46'N	97°30'W	CRP	"
Houston, TX	WSR-88D	29°28'N	95°05'W	HGX	"
Jacksonville, FL	WSR-88D	30°29'N	81°42'W	JAX	"
Key West, FL	WSR-88D	24°36'N	81°42'W	BYX	"
Lake Charles, LA	WSR-88D	30°07'N	93°13'W	LCH	"
Miami, FL	WSR-88D	25°37'N	80°25'W	AMX	"
Melbourne, FL	WSR-88D	28°07'N	80°39'W	MLB	"
Mobile, AL	WSR-88D	30°41'N	88°14'W	MOB	"
Morehead City, NC	WSR-88D	34°47'N	76°53'W	MHX	"
New York City, NY	WSR-88D	40°52'N	72°52'W	OKX	"
Norfolk, VA	WSR-88D	36°59'N	77°00'W	AKQ	"
Philadelphia, PA	WSR-88D	39°57'N	74°27'W	DIX	"
Portland, ME	WSR-88D	43°53'N	70°15'W	GYX	"
San Juan, PR	WSR-88D	18°07'N	66°05'W	TJUA	"
Slidell, LA	WSR-88D	30°20'N	89°49'W	LIX	"
State College, PA	WSR-88D	40°55'N	78°00'W	CCX	"
Sterling, VA	WSR-88D	38°58'N	77°29'W	LWX	"
Tampa, FL	WSR-88D	27°42'N	82°24'W	TBW	"
Tallahassee, FL	WSR-88D	30°24'N	84°20'W	TLH	"
Wilmington, NC	WSR-88D	33°59' N	78°26'W	LTX	"

Coastal Department of Defence sites, NHC access:

Dover AFB, DE	WSR-88D	38°50'N	75°26'W	DOX	248/ - /460
Eglin AFB, FL	WSR-88D	30°34'N	85°55'W	EVX	"
Fort Hood, TX	WSR-88D	30°43'N	97°23'W	GRK	"
Fort Rucker, AL	WSR-88D	31°28'N	85°28'W	EOX	"
Maxwell AFB, AL	WSR-88D	32°32'N	85°47'W	MXX	"
Robins AFB, GA	WSR-88D	32°40'N	83°21'W	JGX	"

4.3 Panama radar

Engineering Hill	DWSR-8501S	08°58'N	79°33'W		260/300/480
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4.4 Bahamian radar

Nassau	EEC	25°03'N	77°28'W	MYNN	- /300/480
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4.5 Canadian radars

Halifax – Gore, NS		45°5'N	63°42'W	XGO	- /155/250
Holyrood, NL		47°19'N	53°10'W	WTP	"
Marion Bridge, NS		45°56'N	60°12'W	XMB	"
Chipman, NB		46°13'N	65°41'W	XNC	"
Marble Mtn., NL		48°55'N	57°50'W	XME	"
Val d'Îrène, QC		48°28'N	67°36'W	XAM	"
Lac Castor, QC		48°34'N	70°39'W	WMB	"

4.6 Caribbean Meteorological Organization network of Doppler radars

Location	Radar type	Latitude	Longitude	Id.	Max range (Nau/St mi/km)
Aruba Vaisala	WRM 200	12°50'N	70°01'W	TNCA	- /250/400
Barbados	Gematronik 10cm	13°11'N	59°33'W	TBPB	- /250/400
Belize	Gematronik 10cm	17°32'N	88°18'W	MZBZ	- /250/400
Grand Cayman	Gematronik 10cm	19°09'N	81°08'W	MWCR	- /250/400
Kingston, Jamaica	EEC 10cm	18°04'N	76°51'W	MKJP	- /300/480
Trinidad	Gematronik 10cm	10°25'N	61°17'W	TTTP	- /250/400
Guyana (RAIII)	Gematronik 10cm	06°29'N	58°15'W	SYCJ	- /250/400

4.7 Cuban radars

Casablanca	MRL-5(M)	23°09'N	82°21'W	CSB	- /280/450
Camaguey	MRL-5(M)	21°23'N	77°51'W	CMW	- /280/450
La Bajada	RC-32B(M)	21°51'N	84°29'W	LBJ	- /280/450
Punta del Este	RC-32B(M)	21°33'N	82°32'W	PDE	- /280/450
Gran Piedra	RC-32B(M)	20°01'N	75°38'W	GPD	- /310/500
Pico San Juan	MRL-5(M)	21°59'N	80°09'W	PSJ	- /310/500
Pilón	MRL-5(M)	19°56'N	77°24'W	PLN	- /280/450
Holguín	Meteor 1500 S	20°56'N	76°12'W	HLG	- /280/450

4.8 El Salvador radars

Santa Ana	FURUNO BANDA X 3 cm	13°58'42.83"N	89°33' 52.76"W		- /- /60
San Salvador	FURUNO BANDA X 3 cm	13°41'15.39"N	89°13'43.38"W		- /- /60
San Miguel	FURUNO BANDA X 3 cm	13°29'55.40"N	88°9'45.50"W		- /- /60
Sonsonate	FURUNO BANDA X 3 cm	13°42'32.92"N	89°43' 52.62"W		- /- /60
Chalatenango	FURUNO BANDA X 3 cm	14°9'45.74"N	88°56'40.51"W		- /- /60
Zacatecoluca	FURUNO BANDA X 3 cm	13°30'18.81"N	88°52'32.57"W		- /- /60
Radar Cabañas (Victoria)	FURUNO BANDA X 3 cm	13°960"N	88°638"W		- /- /60
Usulután (Puerto Parada)	FURUNO BANDA X 3 cm	13°251"N	88°440"W		- /- /60

4.9 French radars

Le Moule, Guadeloupe	Gematronik 10cm	16°19'N	61°20'W	TFFR	- /250/400
Diamant, Martinique	Gematronik 10cm	14°30'N	61°01'W	TFFF	- /250/400
Kourou, French Guiana	Doppler EEC 5.6 cm Doppler	04°50'N	52°22'W	SOCA	- /250/400

4.10 Mexican radars

Location	Radar type	Latitude	Longitude	Id.	Max range (Nau/St mi/km)
Altamira, Tamaulipas	EEC	22°23'N	97°56'W	TAM	-/-/480
Guasave, Sinaloa	EEC	25°34'N	108°28'W	SIN	-/-/480
Los Cabos, Baja California Sur	EEC	22°53'N	109°56'W	BCS	-/-/480
El Palmito, Durango*	EEC	25°46'N	104°54'W	DGO	-/-/480
Acapulco, Guerrero	EEC	16°46'N	99°45'W	GRO	-/-/480
Sabancuy, Campeche	EEC*	18°57'N	91°10'W	CMP	-/-/480
Cancún, Quintana Roo	EEC*	21°01'N	86°51'W	QRO	-/-/480
Cerro de la Catedral, Estado de México	Ericsson	19°33'N	99°31'W	MEX	-/-/500
Cuyutlán, Colima	Ericsson	18°57'N	104°08'W	COL	-/-/500
Puerto Angel, Oaxaca	Ericsson	15°39'N	96°30'W	OAX	-/-/500
Alvarado, Veracruz	Ericsson	18°43'N	95°37'W	VER	-/-/480
Obregón, Sonora	Ericsson	27°28'N	109°55'W		-/-/500
Mozotal, Chiapas	Gematronik	15°26'N	92°21'W		-/-/480

4.11 Curaçao and Sint Maarten radars

Hato Airport, Curaçao	WSR-74S 10 cm	12°10'N	68°56'W	TNCC	- /250/400
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4.12 Bermuda Radar

LF Wade Intl. Airport	Gematronik 10cm	32°18'N	64°42'W	TXKF	- /310/500
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4.13 Venezuela – Coastal Radars

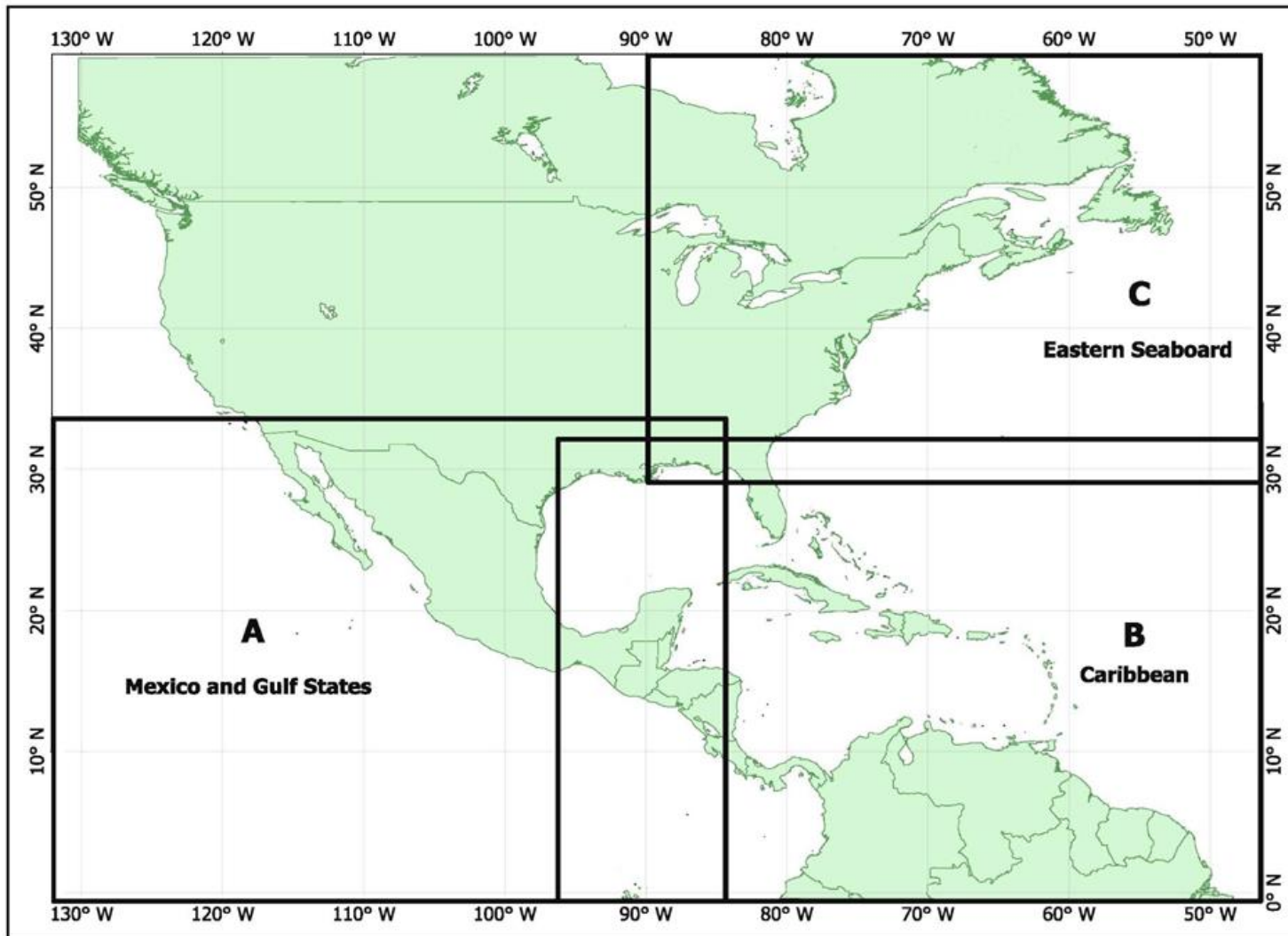
Maracaibo	Gematronik 10cm	10°25'N	67°13'W		-/-/400
Jeremba	Gematronik 10cm	10°34'N	71°43'W		-/-/400
Capuchino	Gematronik 10cm	10°33'N	63°21'W		-/-/400

4.14 Honduras radars

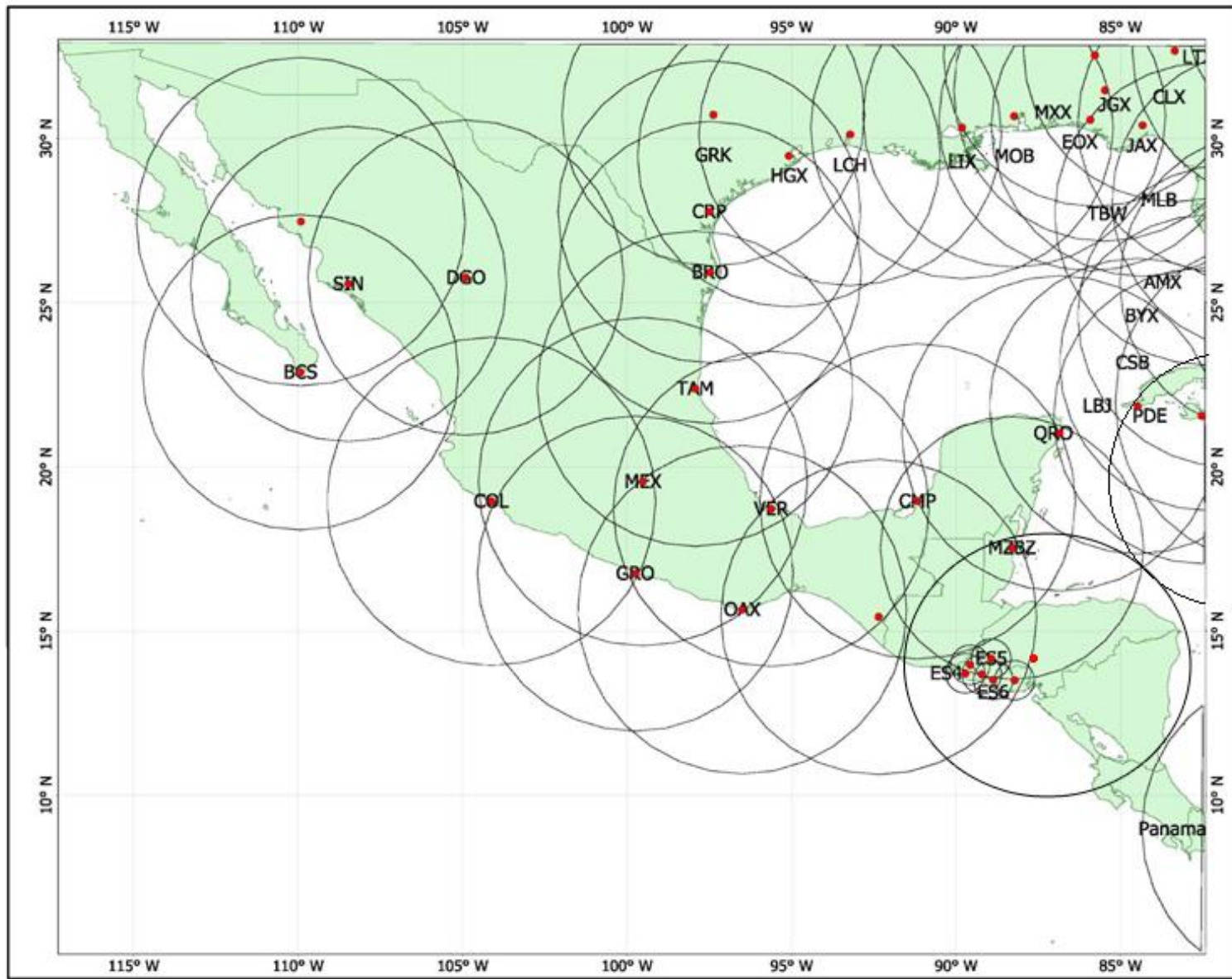
Radar Doppler Banda S	Gematronik	10 cm	13°54' 28.26"N	87°7' 51.83"W
Radar Banda X	Selex	8m	15°46' 19.02"N	86°48' 11.62"W

* The equipment of calculation and controller are manufactured by Enterprise; the antenna and the pedestal are manufactured by Ericsson.

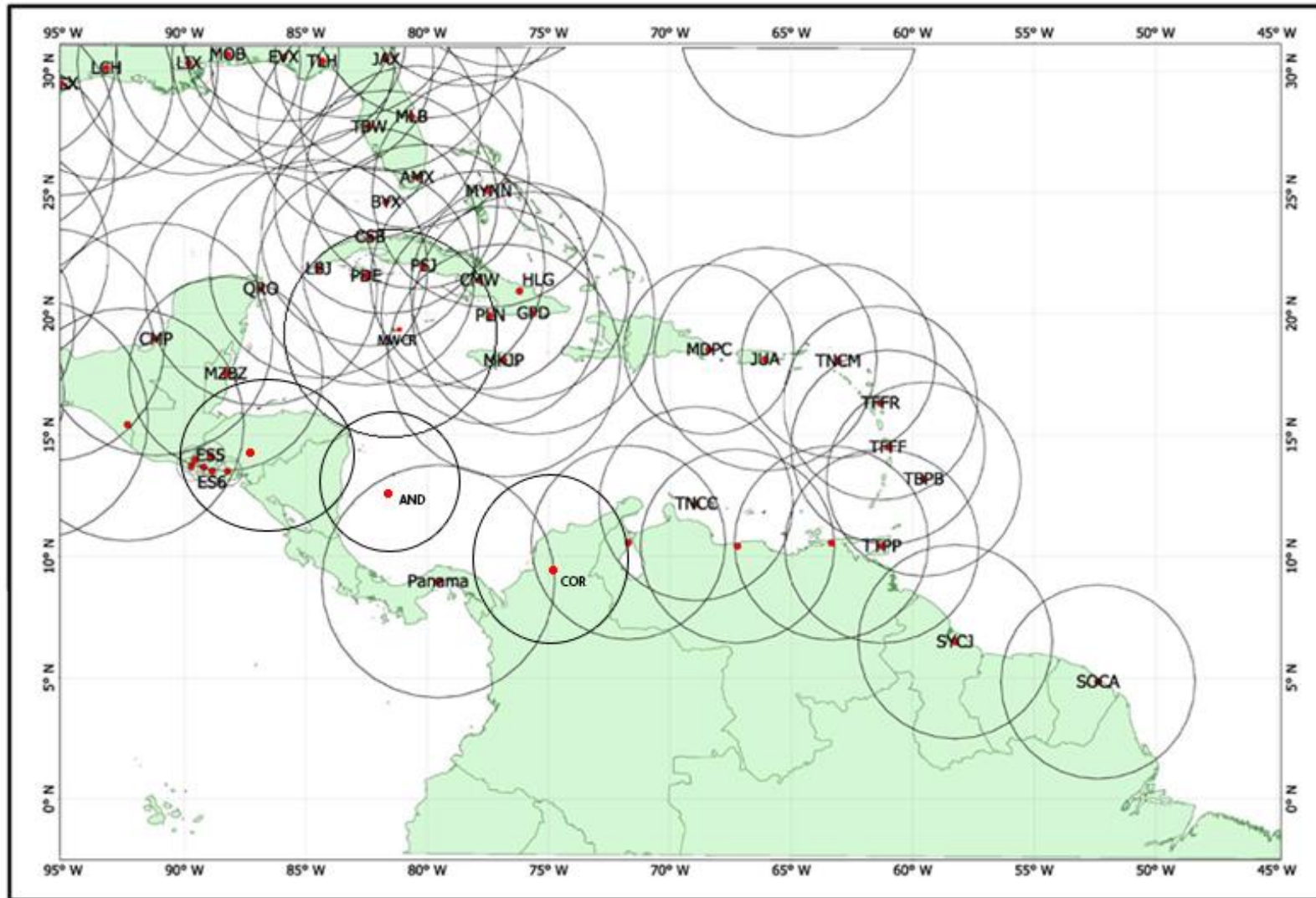
4.15 Section map for the coastal radar coverage in RA IV



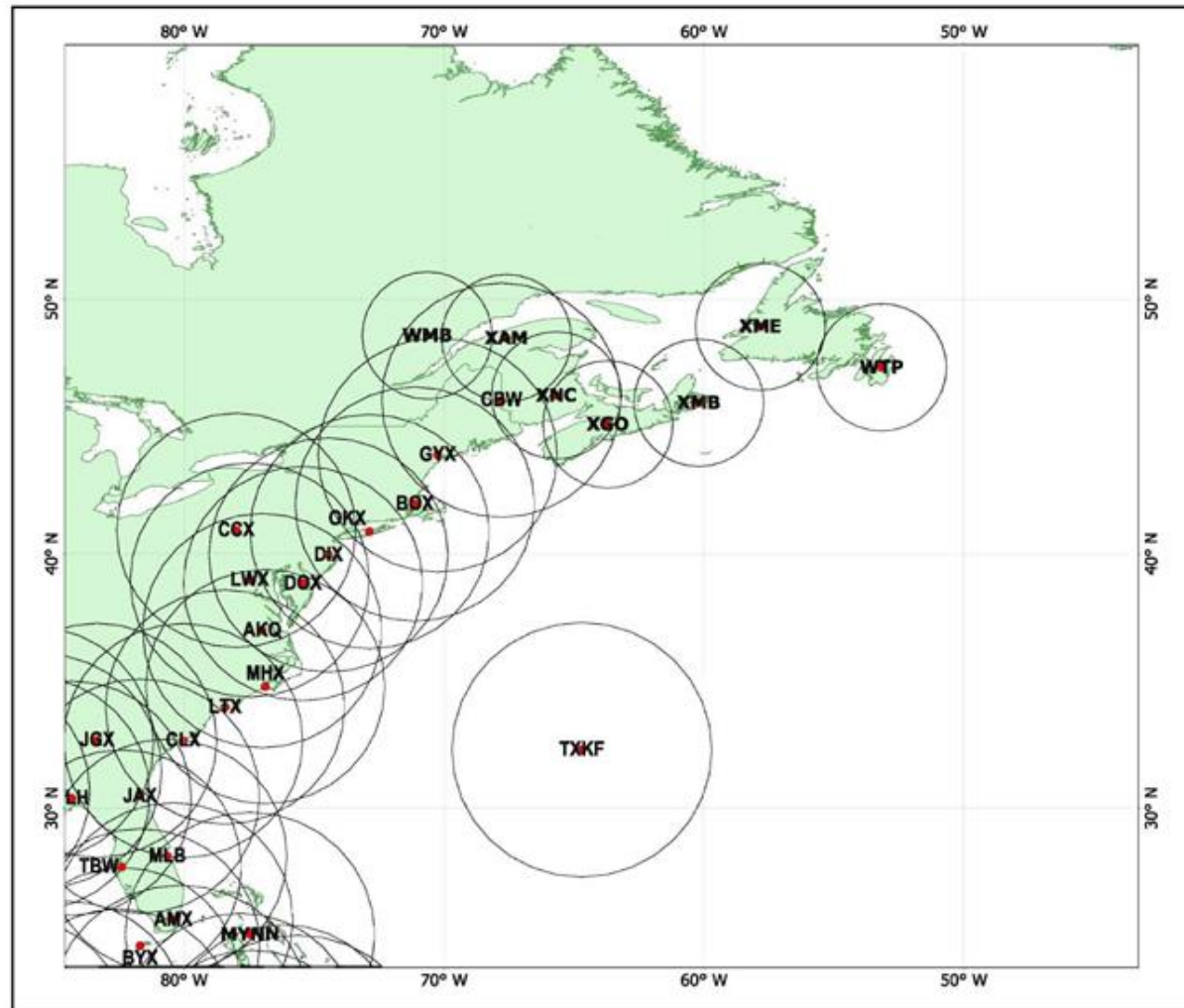
4.15.1 Coastal radar coverage (Doppler) - map A



4.15.2 Coastal radar coverage - map B



4.15.3 Coastal radar coverage - map C



CHAPTER 5

SATELLITE SURVEILLANCE

5.1 Operational Meteorological Satellites

Summary information on the status of operational meteorological satellites is available from <http://www.wmo.int/pages/prog/sat/satellitestatus.php> and more detailed technical information is available in the WMO OSCAR database: <http://www.wmo-sat.info/oscar/spacecapabilities>. [These resources include information on the operational GOES satellites. The WMO Satellite User Readiness Portal \(SATURN, https://www.wmo-sat.info/satellite-user-readiness\) contains specific information assisting users in utilizing data from the new generation GOES-R \(GOES-16\)/GOES-S \(GOES-17\) satellites.](#)

5.2 Tropical Analysis and Forecast Branch Products

(a) Support concept

GOES imagery in support of the hurricane warning services provided by direct downlink to RSMC Miami is distributed by the Central Data Distribution Facility at Marlow Heights, Maryland, to Honolulu and Washington.

(b) Station contact

NHC satellite meteorologists can be contacted as follows:

(i) Miami - 24 hours a day at (305) 229-4425.

(c) Satellite Products: Issuance Times and Geographic Areas

Tropical Weather Discussion

<u>Heading</u>	<u>Issuance times</u>	<u>Oceanic area</u>
AXNT20 KNHC	0005Z, 0605Z, 1205Z, 1805Z	Gulf of Mexico, Caribbean Sea, and Atlantic South of 32°N to equator
AXPZ20 KNHC	0405Z, 1005Z, 1605Z, 2205Z	Pacific South of 32°N to equator and east of 140°W

Tropical Disturbance Rainfall Estimate

<u>Heading</u>	<u>Issuance times</u>	<u>Oceanic area</u>
TCCA21 KNHC	6 Hourly as needed	Caribbean East of 67°W
TCCA22 KNHC	6 Hourly as needed	Caribbean between 67°W and a 22°N 81°W - 9°N 77°W line
TCCA23 KNHC	6 Hourly as needed	Caribbean West of 22°N 81°W - 9°N 77°W line and Mexico (Atlantic and Pacific Coasts)

For numbered tropical cyclones, the text products will be issued under the following AWIPS/WMO headers:

STDAT(1-5)/TCNT21-25 KNHC for numbered systems in the Atlantic basin

STDEP(1-5)/TCPZ21-25 KNHC for numbered systems in the East Pacific basin

5.3 Tropical Numerical Guidance Interpretation Message

The National Centers for Environmental Prediction Tropical Desk (NCEP) in Washington issues a Tropical Numerical Guidance Interpretation Message once a day about 1900 UTC under the header FXCA20 KWBC. The message includes a description of the initial model analysis, model comparison and a prognostic discussion.

5.4 NESDIS Office of Satellite and Product Operations (OSPO)

The NESDIS OSPO operates 24 hours a day to provide GOES and NOAA satellite data support to the National Weather Service forecast offices, to the National Centers for Environmental Prediction and all users of NESDIS satellite data services (WWW: <http://www.ospo.noaa.gov/Organization/About/contact.html>, email: ESPCOperations@noaa.gov or telephone + 301 817-3880).

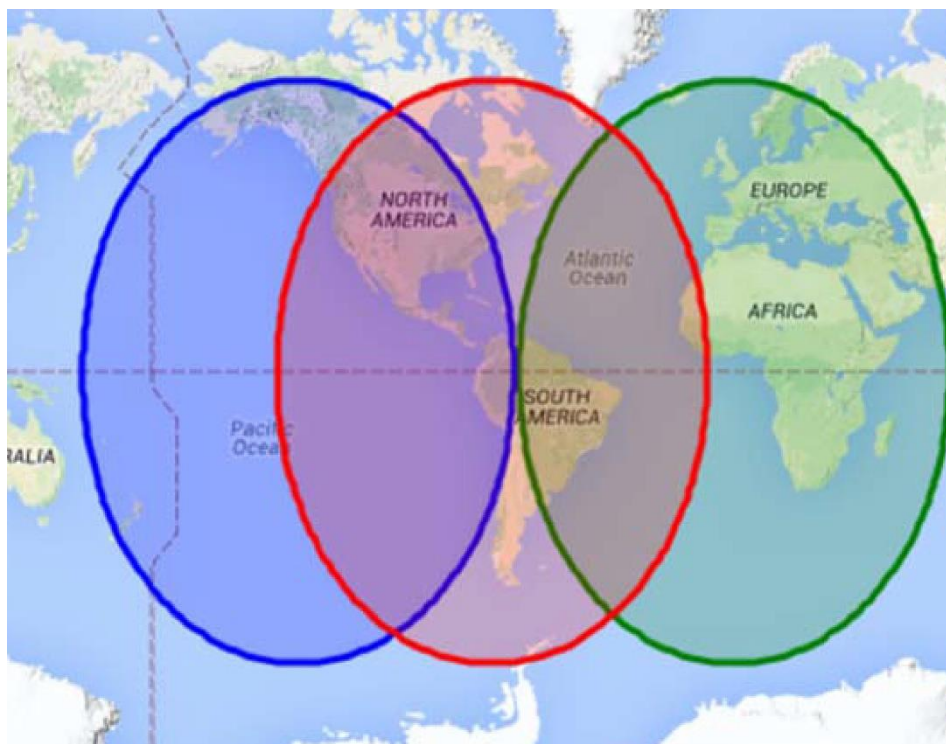


Figure 1: Regional coverage by geostationary satellites GOES-West (left circle, centered over 137.2°W), GOES-East (middle circle, centered over 75.2°W) and the European Meteosat-0° service (right circle).

ATTACHMENT 5 A

OPERATIONAL METEOROLOGICAL SATELLITE INFORMATION FOR RA IV

The space-based component of the GOS is comprised of operational meteorological satellites in polar-orbit and in geostationary orbit, oceanographic satellites in low-Earth orbit, and other environmental satellite missions often provided by Members in the context of scientific research or demonstration programmes.

NOTES:

- Detailed technical information on satellites is available in the WMO OSCAR database: <http://www.wmo-sat.info/oscar/spacecapabilities>
- [The WMO Satellite User Readiness Portal \(SATURN, https://www.wmo-sat.info/satellite-user-readiness\)](https://www.wmo-sat.info/satellite-user-readiness) contains specific information assisting users in utilizing data from the new generation GOES-R/S satellites.

Details for the status of operational space segment available in RA IV are given below.

GEOSTATIONARY SATELLITES

GOES-16 and 17, operated by NOAA (USA)

1. The GOES-R Series (GOES R, S, T, U) is the follow-on geostationary replacement block of satellites providing continuity for yet another generation of users through 2036 and offers the first significant upgrade in instrument capability in decades. Six new and improved instruments were developed for each of the four satellites in the GOES-R Series. The first satellite in the GOES-R Series, GOES-16, was launched in November 2016. Following post-launch checkout, the satellite was moved from its in-orbit test position at 89.5 W to its operational location.

GOES-16 is located at 75.2 W, GOES-17 is located at 137.2 W, and GOES-T (GOES-18) will become an on-orbit spare at 105 W when it is launched in the coming years.

GOES-16 and GOES-17 are now operational following post-launch testing that included instrument performance and product validation reviews (available at the NOAA National Centers for Environmental Information (NCEI) website <https://www.ncdc.noaa.gov/data-access/satellite-data/goes-r-series-satellites>).

The GOES-R Series Data Book (2018) and the Product Definition and Users Guide (2017) provide additional information on the instruments and the data products (L1b, L2).

The GOES-15 (launched March 2010 and located at 135°W) will be operated for six months in conjunction with the new GOES-17. These satellites with GOES-16 are used to provide simultaneous images and soundings of the Western Hemisphere.

More details on GOES-16/17 are available on WMO OSCAR database⁴, WMO SATURN portal⁵, and related NOAA web resources.

Himawari, operated by Japan

2. Himawari-8 – launched in October 2014, has replaced MTSAT-2 as operational satellite on 7 July 2015 at 141°E. Regarding data access information; near-real time availability of AHI images and DCP messages through Internet Cloud service and dissemination of reduced resolution AHI data on HimawariCast. In addition to the direct broadcast in High and Low Rate Information Transmission (HRIT/LRIT), high and low resolution data are made available in near-real time by JMA via Internet.

3. Himawari-9 – launched in November 2016 and started backup operation on 10 March 2017. Himawari-8 and 9 are located in the same orbit at around 141°E, and will observe the East Asia and Western Pacific regions for a period of 15 years.

Meteosat, operated by EUMETSAT

4. Meteosat-11, launched in July 2015, is the prime operational spacecraft providing imagery and product services every 15-mins at the 0° position. Meteosat-10 at 9.5°E provides rapid-scanning services every 5 minutes over approximately the top third of the nominal repeat cycle, i.e. over a latitude range from 15°N to 70°N.

POLAR-ORBITING SATELLITES

FY-3B and FY-3C, operated by China

5. The FY-3B and FY-3C polar orbiting satellites were launched respectively on 4 November 2010 and 23 September 2013 on an afternoon orbit and a morning orbit. They carry a comprehensive payload with visible, infrared and microwave imagery and infrared and microwave sounding. Direct Broadcast is available. FY-3D has been launched on 14 November 2017 and is operational.

NOAA-19 and SNPP, operated by the United States

6. NOAA-19 was launched on 6 February 2009. It serves as the primary spacecraft on an afternoon orbit with a descending node at approx. 2 p.m. Its payload includes the heritage imager (AVHRR/3) and ATOVS sounding instruments (HIRS, AMSU-A, MHS). Continuity of the NOAA-19 mission and new capabilities is provided by the operational Suomi National Polar-orbiting Partnership (NPP) launched on 27 October 2011. NOAA-20, first flight unit of the JPSS programme, was launched on 18 November 2017 and is operational.

MetOp, operated by EUMETSAT

7. The European Polar System programme consists of a series of three polar orbiting Metop satellites, being flown successively for more than 14 years, from 2006, operated together with the relevant ground facilities. Metop-A (launched on 19 October 2006), Metop-B, currently the prime Metop satellite launched on 17 September 2012, and Metop-C (launched 7 November 2018) are in a lower polar orbit, at an altitude of 817 kilometres, to provide detailed observations of the global atmosphere, oceans and continents. The three satellites operate in unison (a tri-star constellation) for as long as Metop-A's available capacities bring benefits to users. Metop carries a set of 'heritage' instruments provided by the United States and a new generation of European instruments that offer improved remote sensing capabilities to both meteorologists and climatologists: AVHRR for imaging, AMSU-A, MHS and HIRS for atmospheric sounding, IASI for hyperspectral sounding, the ASCAT scatterometer for monitoring ocean surface winds and soil moisture, GOME-2 for atmospheric composition monitoring, and the GRAS GNSS sounding instrument.

Ocean surface topography missions

8. The Jason-3 altimetry satellite, a joint ocean mission of CNES, EUMETSAT, NASA, and NOAA, launched in January 2016 on a 1336 km orbit with an inclination of 66°, is an operational follow-on to the Jason-2 mission. It provides high-precision ocean surface topography measurements.

PRODUCTS

9. Satellite-derived products provided by NOAA most relevant to the Committee are available here:

- <http://www.ospo.noaa.gov/Products/atmosphere/wind.html> (Atmosphere and Ocean winds)
- <http://www.ospo.noaa.gov/Products/ocean/tropical.html> (Tropical systems products including use of advanced Dvorak

- <http://www.ssd.noaa.gov/PS/TROP/> technique)
(Tropical cyclones products)

Satellite imagery and products provided by EUMETSAT (including Third-Party data) are available here:

<https://navigator.eumetsat.int/start> (products)

<https://www.eumetsat.int/website/home/Images/RealTimeImages/index.html> (NRT imagery)

COORDINATION GROUP ON SATELLITE DATA REQUIREMENTS

10. The Coordination Group on Satellite Data Requirements for Region III and Region IV (<http://satellite.cptec.inpe.br/geonetcast/es/datareq.html>) is the main interface between satellite users in the Region, and satellite operators (NOAA and EUMETSAT). The main scope of this user group is to review and document the needs of RA III and RA IV Members to access existing satellite data and products in support of all WMO application areas, including hurricane tracking and forecasting. The Group has been instrumental in preparing users to the new-generation GOES-16, GOES-17 and NOAA-20 satellites. The Group also gave guidance to NOAA on the priority datasets and products to be disseminated via GEONETCast-Americas. Aruba, Belize, the British Caribbean Territories, Canada, Colombia, Dominica, Saint Lucia, Trinidad and Tobago and Venezuela, have nominated representatives to the Group, in addition to the RA III Members of Argentina, Brazil, Chile, Ecuador, and Peru.

GOES SATELLITE FRAMES

11. Regarding GOES-East, the Advanced Baseline Imager (ABI) primary scanning strategy is Flex Mode which consists of a full disk image every 15 minutes, a CONUS every 5 minutes, and two mesoscale sectors scanning every minute that can be moved anywhere in the field of view. The focused mesoscale scans are moved over areas of weather concern where 1-minute imagery is beneficial.

12. Information on the ABI on the GOES-R website: <https://www.goes-r.gov/spacesegment/abi.html>.

13. Details on scanning schedules are provided here: <https://www.ospo.noaa.gov/Operations/GOES/schedules.html>

14. The latest public information on the GOES-17 transition plan and scanning schedules will be provided here, if available: <https://www.goes-r.gov/users/transitionToOperations17.html>

TRAINING

15. Within the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) (<https://www.wmo-sat.info/vlab/>), two Centres of Excellence for training in satellite meteorology exist in RA IV, the University of Costa Rica, in Costa Rica, and CIMH in Barbados. These centres run training events and support two Regional Focus Groups that are holding regular on-line sessions that play an important role for capacity building and exchange of technical information, such as discussions among forecasters of weather events of current interest (<https://www.wmo-sat.info/vlab/regional-focus-groups-2/>)

REFERENCES

GOES-R Algorithm Working Group and GOES-R Series Program (2017), Product Definition and User's Guide. Volume 3: Level 1b Products, 29 November 2017 DCN 7035538, Revision F.1, available at <https://www.goes-r.gov/users/docs/PUG-L1b-vol3.pdf>

GOES-R Series Data Book (2018), CDRL PM-14 Rev. September 2018, NASA, available at <https://www.goes-r.gov/downloads/resources/documents/GOES-RSeriesDataBook.pdf>.

CHAPTER 6

AIRCRAFT RECONNAISSANCE

6.1 General

The tropical cyclone reconnaissance system of the USA will normally be prepared to generate up to five reconnaissance aircraft sorties per day in the Atlantic when a storm is within 500 nm of landfall and west of 52.5°W. Notification of requirements must generally be levied by RSMC Miami early enough to allow 16 hours plus en route flying time to ensure that the aircraft will reach the area on time. In the Eastern Pacific, reconnaissance missions may be tasked when necessary to carry out warning responsibilities.

The USA has a Gulfstream jet aircraft for determining the environmental conditions on the periphery of tropical cyclones that threaten landfall. The environmental conditions will be determined with GPS dropwindsondes. The flight pattern will be tailored to the storm situation on a case-by-case basis.

To assure the uninterrupted flow of operational reconnaissance data, all Member countries hosting or conducting research or operational flights into tropical cyclones in the RA IV Region will coordinate such activities. The RSMC Miami will serve as the focus for this coordination. Whenever possible, this co-ordination will be accomplished in advance by telephone. All other means of contact will be utilized, including in-flight aircraft to aircraft radio/voice contacts, to assure proper co-ordination.

6.2 Aircraft reconnaissance data

6.2.1 Parameter requirements

Data needs in order of priority are:

- (a) Geographical position of the flight level vortex centre (vortex fix) and relative position of the surface centre, if known);
- (b) Wind data (continuous observations along the flight track) for surface and flight level.
- (c) Central sea-level pressure determined by dropsonde or extrapolation from within 1,500 ft. of sea surface or from the computed 925, 850, or 700 hPa height
- (d) Minimum 700, 850, or 925 hPa height, if available;
- (e) SFMR surface wind and rain rate;
- (f) Radar reflectivity imagery
- (g) High density three-dimensional Doppler radial velocities of the tropical cyclone core circulation
- (h) Temperature at flight level;
- (i) Sea-surface temperature;
- (j) Dewpoint temperature at flight level;

6.2.2 Meteorological instrument capabilities

Required aircraft reconnaissance data instrument capabilities are as follows:

Geographic Position.

- Aircraft position: within 3 nm.
- Storm surface center (wind/pressure): within 6 nm.
- Flight level storm center (wind/pressure): within 6 nm.

Wind Direction.

- Surface: within 10 deg.
- Flight level for winds greater than 20 kt: within 5 deg.

Wind Speed.

- Surface: within 10 kt.
- Flight level: within 4 kt.

Pressure Height.

- Surface: within 2 mb.
- Flight level at or below 500 mb: within 10 m.
- Flight level above 500 mb: within 20 m.

Temperature.

- Sea surface: within 1°C.
- Flight level: within 1°C.

Dew-Point Temperature.

- From 20°C to +40°C: within 1°C.
- Less than 20°C: within 3°C.

Absolute Altitude:

Within 10 m.

Vertical Sounding.

- Pressure: within 2 mb.
- Temperature: within 1°C.
- Dew-point temperature:
 - From 20°C to +40°C: within 1°C.
 - Less than 20°C: within 3°C.
- Wind direction: within 10 deg.
- Wind speed: within 5 kt.

Core Doppler Radar

- Horizontal resolution along aircraft track: 1.5 km
- Radar beam width: 3 degrees.
- Radar radial resolution (gate length): 150 m.
- Error in radar radial velocity: 1 m/s.
- Range: 50 km.

6.3

Mission identifier

Each reconnaissance report will include the mission identifier as the opening text of

the message. Regular weather and hurricane reconnaissance messages will include the five digit agency/aircraft indicator followed by the 5 digit assigned mission-system indicator. Elements of the mission identifier are:

Agency - aircraft indicator - mission indicator

Agency - aircraft number	# of missions this system (two digits)	TD # or XX if not at least a TD (two digits)	Alpha letter showing area A-Atlantic E-East Pacific C-Central Pacific	Storm name or words CYCLONE or DISTURB
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AF plus last three digits of tail #

NOAA plus last digit of registration #

Examples:

AF985 01XXA DISTURB (1st mission on a disturbance in the Atlantic) AF987 0503E CYCLONE (5th mission, depression #3, in the Eastern Pacific) NOAA2 0701C Agnes (7th mission on TD #1 which was named Agnes, Central Pacific)

6.4 Observation numbering and content

- (a) The first weather observation will have appended as remarks the ICAO four-letter departure station identifier, time of departure and estimated time of arrival (ETA) at the co-ordinates or storm. It will be transmitted as soon as possible after take-off.

AF966 0308 EMMY OB I

97779 TEXT...DPTD KBIX AT 102100Z ETA

31.5N 75.0W AT 110015Z;

- (b) All observations on tropical cyclone missions requested by Hurricane Centres will be numbered sequentially from the first to the last.

6.5 Aerial reconnaissance weather encoding and reporting

6.5.1 Horizontal and vertical observations

Horizontal meteorological observations and vertical observations will be coded and transmitted in RECCO code and TEMP DROP code, respectively. Enroute RECCO observations will be taken and transmitted at least hourly until the aircraft is within 370 km (200 naut. mls.) of the centre of the storm at which time observation frequency will become at least every 30 minutes.

6.5.2 Vortex data

All observed vortex fix information will be included in the detailed vortex data message (see Attachment 6A) prepared and transmitted for all scheduled fixes and in all detailed vortex data messages prepared and transmitted on an "as required" basis for intermediate non-scheduled fixes. An abbreviated vortex data message (Attachment 6A, items A-H) may be sent in lieu of the detailed message for intermediate fixes. These messages should be transmitted as soon as possible.

6.5.3 Coded reports

Other than vortex data and supplementary vortex data messages, aerial reconnaissance observation messages will have the following format:

9xxx9 GGggi_d YQL_aL_aL_a L_oL_oL_oBf_c h_ah_ah_ad_td_a d_dfff TTT_dT_dw m_wjHHH 4d_dff and

9ViT_wT_wT_w 95559 GGggi_d YQL_aL_aL_a L_oL_oL_oBf_c d_dfff TTT_dT_dw m_wjHHH 4d_dff plus

9V_iT_wT_wT_wSymbol identification . . .

9xxx9 - RECCO indicator group specifying type of observation xxx =

222 - Basic observation without radar data

555 - Intermediate observation

777 - Basic observation with radar data

GGgg - Time of observation (hours and minutes -UTC)

i_d - Humidity indicator (0-no humidity; 4-°C dewpoint) Y

- Day of week (Sun-1)

Q - Octant of the globe (0- 0° - 90°W N.H.)
(1-90° - 180°W N.H.)L_aL_aL_a - Latitude degrees and tenths L_oL_oL_o
- Longitude degrees and tenths

B - Turbulence (range 0 (none) to 9 (frequent, severe))

fc - Cloud amount (range 0 (less than 1/8) to 9 (in clouds all the time)) h_ah_ah_a -

Absolute altitude of aircraft (decametres)

d_t - Type of wind (range 0 (spot wind) to 9 (averaged over more than 740 km
(400 naut. mls.))d_a - Reliability of wind (range 0 (90 % to 100 % reliable) to 7 (no reliability) and 8 (no wind))

dd - Wind direction at flight level (tens of degrees true) fff

- Wind speed at flight level (knots)

TT - Temperature (whole degrees C; 50 added to temperature for negative temperatures)

T_dT_d - Dewpoint temperature (whole degrees C), (when // with i_d;=;4 indicates relative humidity
less than 10 %)w - Present weather (0 (clear), 4 (thick dust or haze), 5 (drizzle), 6 (rain), 8 (showers), 9
(thunderstorms))m_w - Remarks on weather (range 0 (light intermittent) to 5 (heavy continuous) and 6 (with rain))j - Index to level ((0 (sea-level pressure in whole hectopascals (hPa), thousands omitted: 1 -
1,000 hPa surface height in geopotential metres, 500 added to HHH if negative; 2 - 850 hPa
and 3 - 700 hPa height in gpm, thousands omitted; 4 - 500 hPa,
5 - 400 hPa and 6 - 300 hPa height in geopotential decametres; 7 - 250 hPa height in
geopotential decametres, tens of thousands omitted; 8 - D - value in geopotential
decametres, 500 added to HHH if negative; 9 - no absolute altitude available)

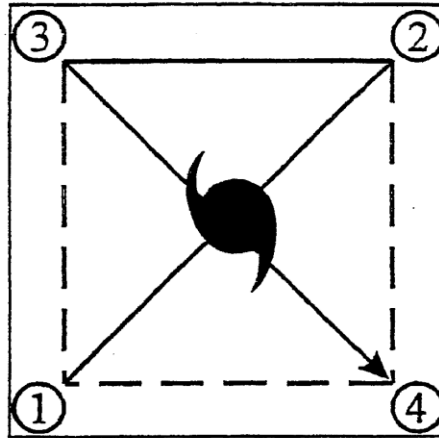
4 - Group indicator for surface wind direction and speed

V_i - In-flight visibility (1 (0 to 1.8 km) (0 to 1 naut. ml.); 2 (greater than 1.8 km) (1 naut. ml.), but not
exceeding 5.5 km (3 naut. mls.); 3 (greater than 5.5 km (3 naut. mls.))T_wT_wT_w - Sea-surface temperature (degrees and tenths °C)

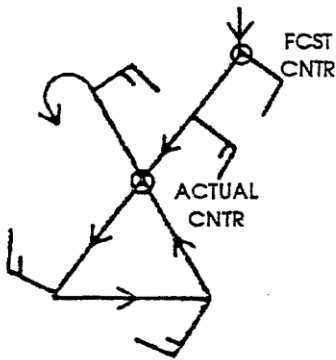
ABBREVIATED/DETAILED VORTEX DATA MESSAGE

VORTEX DATA MESSAGE		ATCF STORM ID	ARWO/FD
A	Z	DATE AND TIME OF FIX	
B	DEG N S DEG E W	LATITUDE AND LONGITUDE OF VORTEX FIX (DECIMAL DEGREES)	
C	MB M	MINIMUM HEIGHT AT STANDARD ATMOSPHERIC LEVEL	
D	MB	MINIMUM SEA LEVEL PRESSURE COMPUTED FROM DROPSONDE OR EXTRAPOLATED FROM FLIGHT LEVEL. IF EXTRAPOLATED, CLARIFY IN REMARKS.	
E	DEG KT	CENTER DROPSONDE SURFACE WIND	
F		CENTER CHARACTER: Closed wall, poorly defined, open SW, etc.	
G		CENTER SHAPE/ORIENTATION/DIAMETER. CODE CENTER SHAPE AS: C - Circular; CO - Concentric; E- Elliptical. TRANSMIT DIAMETER IN NAUTICAL MILES. IF ELLIPTICAL, TRANSMIT ORIENTATION OF MAJOR AXIS IN TENS OF DEGREES (i.e., 01-010 to 190; 17-170 to 350). Examples: C8 - Circular center of 8 NM diameter. E09/15/5 - Elliptical center, major axis 090-270, length of major axis 15 NM, length of minor axis 5 NM. CO8-14 - Concentric eyewalls, diameter inner eyewall 8 NM, outer eyewall 14 NM.	
H	KT	ESTIMATE OF INBOUND MAXIMUM SURFACE WIND OBSERVED	
I	DEG NM Z	BEARING AND RANGE FROM CENTER AND TIME OF INBOUND MAXIMUM SURFACE WIND	
J	DEG KT	MAXIMUM INBOUND FLIGHT LEVEL WIND NEAR CENTER	
K	DEG NM Z	BEARING AND RANGE FROM CENTER AND TIME OF INBOUND MAXIMUM FLIGHT LEVEL WIND	
L	KT	ESTIMATE OF OUTBOUND MAXIMUM SURFACE WIND OBSERVED	
M	DEG NM Z	BEARING AND RANGE FROM CENTER AND TIME OF OUTBOUND MAXIMUM SURFACE WIND	
N	DEG KT	MAXIMUM OUTBOUND FLIGHT LEVEL WIND NEAR CENTER	
O	DEG NM Z	BEARING AND RANGE FROM CENTER AND TIME OF OUTBOUND MAXIMUM FLIGHT LEVEL WIND	
P	C/ M	MAXIMUM FLIGHT LEVEL TEMP/PRESSURE ALTITUDE OUTSIDE CENTER	
Q	C/ M	MAXIMUM FLIGHT LEVEL TEMP/PRESSURE ALTITUDE INSIDE CENTER	
R	C/ C	DEW POINT TEMP/SEA SURFACE TEMP INSIDE CENTER	
S	/	FIX DETERMINED BY/FIX LEVEL. FIX DETERMINED BY: 1 - Penetration; 2 - Radar; 3 - Wind; 4 - Pressure; 5 - Temperature. FIX LEVEL: Indicate surface center if visible; indicate both surface and flight level centers only when they are within 5 NM of each other: 0 - Surface; 1 - 1500 ft; 9 - 925 mb; 8 - 850 mb; 7 - 700 mb; 5 - 500 mb; 4 - 400 mb; 3 - 300 mb; 2 - 200 mb; NA - Other.	
T	/ NM	NAVIGATION FIX ACCURACY/METEOROLOGICAL ACCURACY	
U	REMARKS: _____ AGENCY/AIRCRAFT NUMBER _____ WX MISSION ID _____ SYSTEM NAME OB _____ MAX FL WIND _____ KT BEARING / RANGE NM _____ Z SLP EXTRAP FROM (BELOW 1500 FT/ 925 MB/ 850 MB/ 700 MB/ _____ FT/ DROPSONDE) SFC CNTR _____ / _____ NM FROM FL CNTR MAX FL TEMP _____ C _____ / _____ NM FROM FL CNTR INBOUND [AND] OUTBOUND SURFACE WIND[S] OBSERVED VISUALLY SECONDARY INBOUND MAX FL WIND _____ KT BEARING / RANGE NM _____ Z SECONDARY OUTBOUND MAX FL WIND _____ KT BEARING / RANGE NM _____ Z		
INSTRUCTIONS: Items A through C (and D when extrapolated) and H through K are transmitted from the aircraft immediately following the fix. The remainder of the message is transmitted as soon as available.			

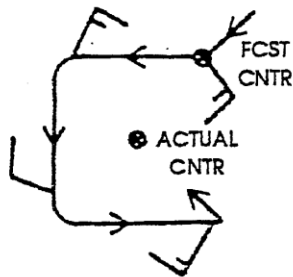
OPERATIONAL HURRICANE RECONNAISSANCE FLIGHT PATTERN



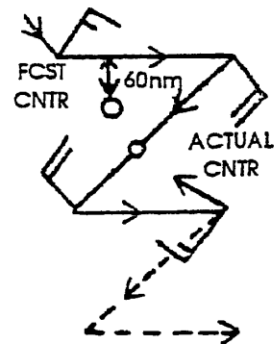
Flight pattern ALPHA



X-PATTERN



BOX PATTERN



DELTA PATTERN

CHAPTER 7

SURFACE AND UPPER-AIR OBSERVATIONS

7.1 General

In addition to regularly scheduled surface and upper-air observations, additional observations are required at key locations when a tropical cyclone is an imminent threat to Members. These requests for additional observations are normally initiated by the RSMC Miami. The frequency of special observations depends on the individual tropical cyclone situation. Additional observations may require 24-hour staffing of a station. Requests will normally be made by telephone to the relevant NMC.

7.2 Surface observations

Additional surface observations at one- three- or six-hourly intervals may be requested from implemented stations in Region IV. A list of key stations is given in Attachment 7 A.

7.3 Upper-air observations

Additional upper-air observations may be requested from implemented stations in Region IV. A list of key stations is given in Attachment 7 B.

7.4 Moored buoys

Information on the operational status of moored buoys may be required. This information is provided for those located in the North Atlantic Ocean, Caribbean Sea and Gulf of Mexico in Attachment 7 C.

7.5 Ship Observations

Observations from ships at sea augment the traditional national networks and private sources. These observations can be provided in a manual sense (VOS - Voluntary Ship Observations) or through automated systems (AVOS - Automated Voluntary Observing Systems). While ships aren't expected to put themselves in harms ways in the storm environment, the observations in the pre-storm environment and the environment away from the storm are important for a complete analysis. The Committee encourages nations to ensure the communication of the ship met/ocean data (with its metadata) through GTS to enhance observation availability.

7.6 Post-storm country reports

A post-storm country report should be issued by National Meteorological Services in RA IV, based on the format as given in Attachment 7 D and sent to the RSMC Miami (ncep.nhc.hsu@noaa.gov, lixion.a.avila@noaa.gov) preferably within 15 days after being affected, directly or indirectly, by any tropical depression, tropical storm or hurricane. Countries can also submit rainfall accumulation maps or other graphics that would be useful for RSMC Miami's post-storm analysis and Tropical Cyclone Reports.

**STATIONS FROM WHICH ADDITIONAL SURFACE OBSERVATIONS
MAY BE REQUESTED DURING TROPICAL CYCLONES**

Country	Station name	Block and Station number	Int. location indicators for addressed messages
Antigua & Barbuda	V.C. Bird Airport	78862	TAPA
Bahamas	Freeport, Grand Bahama	78062	MYGF
	Green Turtle Cay, Abaco	78066	
	Alice Town, Bimini	78070	MYBS
	Nassau, New Providence	78073	MYNN
	Dunmore Town,	78077	MYER
	Harbour Island, Eleuthera		
	Kemps Bay, Andros	78086	
	The Bight, Cat Island	78087	
	Cockburn Town, San Salvador	78088	MYSM
	George Town, Exuma	78092	MYEG
	Clarence Town, Long Island	78095	
	Duncan Town, Ragged Island	78101	
	Church Grove, Crooked Island	78104	
	Abraham Bay, Mayaguana	78109	MYMM
Matthew Town, Inagua	78121	MYIG	
Barbados	Grantley Adams	78954	TBPB
Belize	Philip Goldson Int'l Airport	78583	MZBZ
Bermuda	LF Wade International Airport	78016	TXKF
Canada	Halifax International, NS	71395	CYHZ
	Sable Island, NS	71600	CWSA
	Shearwater, NS	71601	CYAW
	Sydney, NS	71707	CYQY
	Yarmouth, NS	71603	CYQI
	Fredericton, NB	71700	CYFC
	Gagetown, NB	71701	CYCX
	Moncton, NB	71705	CYQM
Saint John, NB	71609	CYSJ	

Country	Station name	Block and Station number	Int. location indicators for addressed messages
Canada (continued)	Charlottetown, PEI	71706	CYYG
	Mt. Pearl, Nfld	71802	CAYT
	Stephenville, Nfld	71815	CYJT
Cayman Islands	Grand Cayman	78384	MWCR
	Owen Roberts Intl.		
Colombia	Aerp. Sesquicentenario/ Isla San Andres	80001	SKSP
	Aerp. El Embrujo/Isla Providencia	80002	SKPV
	Aerp. Admirante Padilla/Río Hacha	80035	SKRH
Costa Rica	Aeropuerto Intn. Juan Santamaria/Alajuela	78762	MROC
	Puerto Limon	78767	MRLM
Cuba	Cabo de San Antonio	78310	
	Santa Lucia	78312	
	Isabel Rubio	78313	
	Pinar del Rio	78315	
	Paso Real de San Diego	78317	
	Bahía Honda	78318	
	Güira de Melena	78320	
	La Fé	78321	
	Batabano	78322	
	Punta del Este	78324	
	Casablanca	78325	
	Union de Reyes	78327	
	Varadero	78328	
	Colon	78332	
	Playa Giron	78333	
	Sagua la Grande	78338	
	Cayo Coco	78339	
	Bainoa	78340	
	Yabu	78343	
	Cantarrana	78344	
Jucaro	78345		
Ciego de Avila	78346		
Caibarién	78348		

Country	Station name	Block and station number	Int. location indicators for addressed messages
Cuba (continued)	Sancti Spiritus	78349	
	Sta. Cruz del Sur	78351	
	Nuevitas	78353	
	Camaguey	78355	
	Victoria de Las Tunas	78357	
	Puerto Padre	78358	
	Manzanillo	78359	
	Cabo Cruz	78360	
	Contramaestre	78363	
	Santiago de Cuba	78364	
	Punta Lucrecia	78365	
	Gran Piedra	78366	
	Guantánamo	78368	
Punta Maisi	78369		
Santiago de Las Vegas	78373		
Dominica	Douglas-Charles	78905	TDPD
	Canefield	78906	TDCF
Dominican Republic	Montecristi	78451	
	Puerto Plata Int'l Airport	78458	MDPP
	Santiago	78460	MDST
	Arroyo Barril	78466	MDAB
	Sabana de la Mar	78467	MDSM
	Bayaguana	78473	
	Punta Cana Int'l Airport	78479	MDPC
	Jimani	78480	
	Maria Montez Airport, Barahona	78482	MDBH
	Aeropuerto Int'l Joaquin Balaguer	78484	MDJB
Las Americas Int'l Airport	78485	MDLA	
Santo Domingo	78486	MDSM	
El Salvador	Puerto de Acajutla	78650	MSAC
	Aeropuerto de Ilopango	78663	MSSS
	Santa Ana UNICO	78655	MSSA
	San Miguel/UES	78670	MSSM
	La Unión/CPI	78672	MSLU
	El Salvador Int Airport	78666	MSLP

Country	Station name	Block and station number	Int. location indicators for addressed messages	
France..	Guadeloupe	Le Raizet	78897	TFFR
	Martinique	Le Lamentin	78925	TFFF
Grenada	Pt. Salines		78958	TGPY
Guatemala	Mundo Maya		78615	MGMM
	Puerto Barrios		78637	MGPB
	Guatemala		78641	MGGT
	San Jose		78647	MGSJ
	Huehuetenango		78627	MGHT
Haiti	Cap Haitien		78409	MTCH
	Port-au-Prince		78439	MTPP
	Cayes		78447	MTCH
Honduras	Amapala		78700	MHAM
	Guanaja		78701	MHNJ
	Roatan		78703	MHRO
	Trujillo		78704	MHTR
	La Ceiba/Goloson		78705	MHLC
	Tela		78706	MHTE
	Yoro		78707	MHYR
	La Mesa/San Pedro Sula		78708	MHLM
	Puerto Lempira		78711	MHPL
	Catacamas		78714	MHCA
	Santa Rosa de Copan		78717	MHSR
	Nueva Ocotepeque		78718	MHNO
	La Esperanza		78719	MHLE
	Tegucigalpa		78720	MHTG
Choluteca		78724	MHCH	
Jamaica	Montego Bay		78388	MKJS
	Kingston		78397	MKJP

Country	Station name	Block and station number	Int. location indicators for addressed messages
Mexico (on the Pacific)	San Felipe, B.C.	76055	
	Santa Rosalia, B.C.S.	76253	
	Loreto, B.C.S.	76305	
	Empalme, Son.	76256	
	La Paz, B.C.	76405	
	Mazatlan, Sin.	76458	
	Manzanillo, Col.	76654	
	Isla Socorro, Col.	76723	
	Acapulco, Gro.	76805	
	Salina Cruz, Oax.	76833	
Tapachula, Chis.	76904		
Mexico (on the Gulf of Mexico)	Tampico, Tamps.	76548	
	Tuxpan, Ver.	76640	
	Merida, Yuc.	76644	
	Veracruz, Ver.	76692	
	Campeche, Camp.	76695	
Mexico (on the Caribbean)	Cozumel, Q. Roo	76648	
	Chetumal, Q. Roo	76750	
(continental locations)	Monterrey, N.L.	76394	
	Felipe Carrillo Puerto, Q. Roo	76698	
	Mexico, D.F.	76679	
Curacao and Sint Maarten	Hato Airport, Curaçao	78988	TNCC
	Juliana Airport, St. Maarten	78866	TNCM
The Netherlands	Roosevelt Airport, St. Eustatius	78873	TNCE
	Flamingo Airport, Bonaire	78990	TNCB
Aruba	Queen Beatrix Airport, Aruba	78982	TNCA

Country	Station name	Block and station number	Int. location indicators for addressed messages
Nicaragua	Puerto Cabezas	78730	MNPC
	Bluefields	78745	MNBL
	Managua	78741	MNMG
	Rivas	78733	MNRS
	Jinotega	78734	MNJG
	Juigalpa	78735	MNJU
	Chinandega	78739	MNCH
Panama	Tocumen	78792	MPTO
	David	78793	MPDA
	Santiago	78795	MPSA
	Changuinola		MPCH
	Albrook		MPMG
St. Kitts/ Nevis	Robert Bradshaw Airport	78858	TKPK
Saint Lucia	George F. L. Charles	78947	TLPC
	Hewanorra International Airport	78948	TLPL
St Vincent	Arnos Vale	78951	TVSV
Trinidad and Tobago	A.N.R. Robinson International Airport, Scarborough, Tobago	78962	TTCP
	Piarco International Airport, Port-of-Sp; Trinidad	78970	TTPP
Turks and Caicos Islands	Grand Turk	78118	MBGT
	Providenciales	78114	MBPV
USA	Mainland coastal stations		
	Puerto Rico San Juan	78526	TJSJ
	Ponce		TJPS
	Mayaguez		TJMZ
	Aguadilla		TJBQ
Ceiba (Rossevelt Road/Navy)	78535	TJNR	
Cuba	Guantanamo	78367	
U.S. Virgin Islands	Saint Thomas		TIST
	Saint Croix		TISX
Venezuela	Aves Island	80400	

**STATIONS FROM WHICH ADDITIONAL UPPER-AIR OBSERVATIONS
MAY BE REQUESTED DURING TROPICAL CYCLONES**

Country	Station name	Block and station number	Int. location indicators for addressed messages
Bahamas	Nassau	78073	MYNN
Barbados	Grantley Adams	78954	TBPB
Belize	Philip Goldson Int'l Airport	78583	MZBZ
Bermuda	LF Wade International Airport	78016	TXKF
Canada	Sable Island, NS	71600	CWSA
	Gagetown, NB	71701	CYCX
	Mt. Pearl, Nfld.	71802	CAYT
	Stephenville, Nfld.	71815	CZJT
	Yarmouth, NS	71603	CYQI
Cayman Island	Georgetown, Grand Cayman	78384	MWCR
Colombia	San Andres (Isla)	80001	SKSP
	Riohacha/Admirante Padilla	80035	SKRH
Costa Rica	San Jose/Juan Santamaria	78762	MROC
Cuba	Camaguey	78355	
	Casa Blanca	78325	
Curacao and Sint Maarten	Hato Airport, Curacao	78988	TNCC
	Juliana Airport, St. Maarten	78866	TNCM
Dominican Republic	Santo Domingo	78486	MDSD
France: Guadeloupe	Le Raizet	78897	TFFR

Country	Station name	Block and station number	Int. location indicators for addressed messages
Honduras	Tegucigalpa	78720	MHTG
Jamaica	Kingston	78397	MKJP
Mexico	Acapulco, Gro.*	76805	
	Cancún, Q.R.	76695	
	Chihuahua, Chi.	76225	
	Empalme, Son.*	76256	
	Isla Socorro, Col.*	76723	
	La Paz, B.C.S.*	76405	
	Monterrey, N.L.	76394	
	Mazatlan, Sin.*	76458	
	Guadalajara, Jal.	76612	
	Merida, Yuc.	76644	
	Manzanillo, Col.*	76654	
	Mexico City, D.F.	76679	MMMX
Villahermosa, Tab.	76743	MMVA	
Veracruz, Ver.	76692		
Nicaragua	Puerto Cabezas**	78730	MNPC
Panama	Corozal	78808	MPCZ
Sint Maarten	Juliana Airport, St. Maarten	78866	TNCM
Trinidad and Tobago	Piarco International Airport, Port of Spain	78970	TTPP
USA	Rawinsonde stations within 300 miles of the coast		
Venezuela	San Antonio	80447	SVSA
	San Fernando	80450	SVSR
	Ciudad Bolivar	80444	SVCB
	Mariscal Sucre	80413	SVBS

* Stations on the Pacific coast

** Out of Service

**INFORMATION ON OPERATIONAL STATUS
OF AUTOMATIC MARINE STATIONS - MOORED BUOYS**

Legend - Observed or technical parameters

<u>Column</u>	<u>Parameters</u>	<u>Column</u>	<u>Parameters</u>
1	Wind direction and speed	5	Sea-surface temperature
2	Air temperature	6	Wave period and height
3	Air pressure	7	Wave spectra
4	Pressure tendency	8	Peak wind gust
		9	Wave direction

1. Canada

The data acquisition for the moored buoys is presently via the NESDIS GOES system. The messages are received by NESDIS and sent to the Canadian Meteorological Centre (CMC) for processing by the Weather Buoy System (WBS) which is installed in Vancouver, British Columbia and Gander, Newfoundland and Labrador. The WBS is the software that decodes, performs automated quality control, and generates the FM13 messages and sends the bulletins to the GTS. Meteorological reports from moored buoys using FM 13-IX SHIP code are distributed to the GTS via the Canadian Meteorological Centre (CMC) in Montreal.

North-west Atlantic Ocean:

WMO buoy Identifier	ARGOS Identifier	Position		Observed or technical parameters								
		Latitude	Longitude	1	2	3	4	5	6	7	8	9
44137		42°16'N	62°00'W	X	X	X	X	X	X	X	X	X
44139		44°16'N	57°05'W	X	X	X	X	X	X	X	X	X
44150		42°30'N	64°01'W	X	X	X	X	X	X	X	X	X
44258		44°30'N	63°24'W	X	X	X	X	X	X	X	X	X

2. France

Data from the moored buoys are available on the GTS in BUOY code. The wave spectra is not available in the BUOY code, but is available in WAVEOB code. Buoys 41096, 41098 and 41099 are sensitive to Atlantic swells while buoy 41097 on the west coast of Martinique in the bay of Fort de France is not directly sensitive to Atlantic swells but westerly or northerly swells. Note that the wave-rider information is concentrated by VHF and sent on the GTS right after. As a backup system, some wave-riders are still equipped with ARGOS transmitters, others with IRIDIUM but due to a rotation programme, the identifier changes annually for the same location.

WMO buoy Identifier	Location	Position		Observed or technical parameters								
		Latitude	Longitude	1	2	3	4	5	6	7	8	9
41096*	GD – La vigie	16.530N	61.410W					X	X	X		X
41097	MA - Fort de France	14.550N	61.095W					X	X	X		X
41098	MA- Basse Pointe	14.895N	61.115W					X	X	X		X
41099	Ste-Lucia Chanel	14.175N	60.940W					X	X	X		X
41300**		15.860N	57.610W	X	X	X	X	X	X	X	X	X

3. United States of America

Up-to-date list of U.S.A. Ocean Data Acquisition System (ODAS) is available at the web site of the National Data Buoy Centre of the National Oceanic and Atmospheric Administration (NOAA) www.ndbc.noaa.gov. Data from moored buoys and platforms are collected by geostationary meteorological satellites and reports are distributed on the GTS in SHIP code.

WMO buoy Identifier	ARGOS Identifier	Position:		Observed or technical parameters								
		Latitude	Longitude	1	2	3	4	5	6	7	8	9
41001		34.70N	72.73W	X	X	X	X	X	X	X		
41002		32.38N	75.41W	X	X	X	X	X	X	X		
41004		32.50N	79.10W	X	X	X	X	X	X	X		
41008		31.40N	80.87W	X	X	X	X	X	X	X		X
41009		28.52N	80.17W	X	X	X	X	X	X	X		
41010		28.91N	78.47W	X	X	X	X	X	X	X		
41012		30.04N	80.53W	X	X	X	X	X	X	X		X
41013		33.44N	77.74W	X	X	X	X	X	X	X		X
41025		35.01N	75.40W	X	X	X	X	X	X	X		
41035		34.48N	77.28W	X	X	X	X	X	X	X		X
41036		34.21N	76.95W	X	X	X	X	X	X	X		X
41040		14.48N	53.01W	X	X	X	X	X	X	X		
41041		14.36N	46.01W	X	X	X	X	X	X	X		X
41043		20.99N	65.01W	X	X	X	X	X	X	X		
41044		21.65N	58.70W	X	X	X	X	X	X	X		
41046		23.87N	70.87W	X	X	X	X	X	X	X		
41047		27.47N	71.49W	X	X	X	X	X	X	X		
41048		31.98N	69.65W	X	X	X	X	X	X	X		X
41049		27.50N	63.00W	X	X	X	X	X	X	X		
42001		25.90N	89.67W	X	X	X	X	X	X	X		X
42002		25.79N	93.67W	X	X	X	X	X	X	X		X
42003		25.97N	85.59W	X	X	X	X	X	X	X		X
42007		30.09N	88.77W	X	X	X	X	X	X	X		X

* Waverider - under repair/replacement. No timeline for the moment

** Moored buoy.- brand new buoy with full set of sensors, including precipitation

ATTACHMENT 7 C, p. 3

42012	30.07N	87.55W	X	X	X	X	X	X	X	X
42019	27.90N	95.39W	X	X	X	X	X	X	X	X
42020	26.97N	96.70W	X	X	X	X	X	X	X	X
42035	29.23N	94.41W	X	X	X	X	X	X	X	X
42036	28.50N	84.52W	X	X	X	X	X	X	X	X
42039	28.79N	86.01W	X	X	X	X	X	X	X	
42040	29.21N	88.21W	X	X	X	X	X	X	X	
42055	22.02N	94.05W	X	X	X	X	X	X	X	X
42056	19.87N	85.06W	X	X	X	X	X	X	X	X
42057	16.83N	81.50W	X	X	X	X	X	X	X	X
42058	15.09N	75.06W	X	X	X	X	X	X	X	X
42059	15.01N	67.50W	X	X	X	X	X	X	X	
42060	16.50N	63.50W	X	X	X	X	X	X	X	
44005	43.19N	69.14W	X	X	X	X	X	X	X	
44007	43.53N	70.14W	X	X	X	X	X	X	X	X
44008	40.50N	69.25W	X	X	X	X	X	X	X	X
44009	38.46N	74.70W	X	X	X	X	X	X	X	
44011	41.11N	66.58W	X	X	X	X	X	X	X	
44013	42.35N	70.65W	X	X	X	X	X	X	X	
44014	36.61N	74.84W	X	X	X	X	X	X	X	X
44017	40.69N	74.70W	X	X	X	X	X	X	X	X
44018	41.26N	69.31W	X	X	X	X	X	X	X	X
44020	41.44N	70.19W	X	X	X	X	X	X	X	X
44025	40.25N	73.17W	X	X	X	X	X	X	X	X
44027	44.27N	67.31W	X	X	X	X	X	X	X	X
44065	40.37N	73.70W	X	X	X	X	X	X	X	
44066	39.58N	72.60W	X	X	X	X	X	X	X	
51000	23.46N	154.00W	X	X	X	X	X	X	X	X
51001	23.45N	162.28W	X	X	X	X	X	X	X	X
51002	17.19N	157.78W	X	X	X	X	X	X	X	
51003	19.09N	160.66W	X	X	X	X	X	X	X	
51004	17.59N	152.46W	X	X	X	X	X	X	X	
51100	23.56N	153.90W	X	X	X	X	X	X	X	X
51101	24.32N	162.06W	X	X	X	X	X	X	X	X

POST STORM COUNTRY REPORTS

A Post-storm Country Report should be issued by National Meteorological Services in RA IV and sent to the RSMC Miami (ncep.nhc.hsu@noaa.gov, lixion.a.avila@noaa.gov), preferably within 15 days after being affected, directly or indirectly, by any Tropical Depression, Tropical Storm or Hurricane. This document will be of utmost importance to gather all relevant data necessary for the Hurricane Season Report.

This Report should have the following format:

- a) Document headings:
Post-Storm Country Report.
Country: _____
Tropical Cyclone name: _____
Date of data: _____; Date of issuance: _____
- b) Data for each meteorological station within the affected area:
- Maximum sustained wind reported (10-min wind/ 1-min wind):
(direction, velocity, date and time UTC)
 - Maximum wind gust reported (direction, velocity, date and time UTC)
 - Duration of Calm (Time UTC of onset and of end)
 - Total rainfall during the event
 - Minimum sea level pressure (date and time UTC)
- c) Remarks:
- Data concerning storm surge: height, instrument used, etc.
 - Data on type of instrument or observation methodology if different from WMO standards.
- Other relevant information.

Example:

POST-STORM COUNTRY REPORT

Country: CUBA

Tropical Cyclone: Hurricane MICHELLE

Date of data: November 4, 2001 Date of issuance: November 10, 2001

Station	Maximum Sustained Wind			Maximum Wind Gust			Calm	Total Rainfall	Minimum SL Pressure	
	Direction	Veloc. (km/h)10 min/1 min	Time UTC	Direction	Veloc (km/h)	Time UTC	Time UTC	(mm)	Pressure (hPa)	Time UTC
78325 Casablanca	NNE	112/xxx	21:00-22:00	NNE	134	21:15	-	44.4	993.4	21:10
78373 Stgo Las Vegas	NNE	90	20:00-22:45	NNE	138	20:55	-	57.6	997.8	20:40
78340 Bainoa	NE	90	20:00-21:00	NE	140	22:40	-	83.2	996.1	20:45
78374 Tapaste	NE	70	19:00-04:00 (5 th)	NNE	120	20:00	-	97.6	995.5	20:50
78323 Güines	NE	82	20:30-02:40 (5 th)	NNE	118	01:25 (5 th)	-	23.7	993.4	20:30
78375 Melena del Sur	N	80	20:00-02:30 (5 th)	N	135	22:53	-	60.8	994.8	20:00
78320 Güira de Melena	NNE	60	19:00-03:00 (5 th)	NNE	103	00:50 (5 th)	-	78.4	997.7	20:55
78376 Bauta	N	90	21:00-01:00 (5 th)	N	112	20:50	-	40.3	999.1	20:30
78322 Batabanó	NNE	84	21:00-01:00 (5 th)	NNE	100	23:10	-	64.3	995.3	19:00
78324 Punta del Este	N	128	16:45-17:00	N	160	03:55 (5 th)	-	304.0	981.4	17:00
78321 La Fe	N	100	18:35-19:00	N	112	19:00	-	118.9	991.6	15:00

Station	Maximum Sustained Wind			Maximum Wind Gust			Calm	Total Rainfall	Minimum SL Pressure	
	Direction	Veloc. (km/h) 10 min/1 min	Time UTC	Direction	Veloc (km/h)	Time UTC	Time UTC	(mm)	Pressure (hPa)	Time UTC
78309 Cuba-Francia	N	100	12:15-12:23	N	132	13:32	-	103.8	991.7	16:56
78221 Nueva Gerona	NNE	92	04:15-04:45	NNE	120	18:00	-		994.3	17:30
78331 Jagüey Grande	ENE	135	21:00- 00:00 (5 th)	-	210	-	-	234.3	992.8	00:00 (5 th)
78333 Playa Girón	ESE	101	18:00-21:00	W	194	23:00	16:30-17:30	129.5	960.5	23:00
78328 Varadero	NNE	85	00:00 (5 th)-03:00 (5 th)	N	151	00:40 (5 th)	-	101.1	-	-
78327 Unión de Reyes	N	85	00:30 (5 th)-03:00 (5 th)	NNE	150	01:15 (5 th)	-	116.0	986.6	00:00 (5 th)
78332 Colón	ENE	70	19:00-23:00	NE	147	22:45	-	86.2	980.9	23:00
78330 Jovellanos	N	68	23:00- 01:00 (5 th)	N	101	00:00 (5 th)	-	164.8	985.3	00:00 (5 th)
78344 Cienfuegos	SE	120	23:00- 02:00 (5 th)	S	168	00:00 (5 th)	-	-	958.9	01:00 (5 th)
78335 Aguada de Pasajeros	ESE	120	22:00-23:00	ESE	176	23:00	19:45-20:45	-	958.5	00:30 (5 th)
78338 Sagua La Grande	ESE	90	02:20 (5 th)-03:30 (5 th)	N	150	05:58 (5 th)	23:20 – 23:45	57.0	977.0	04:10 (5 th)
78326 Santo Domingo	SE	119	02:40 (5 th)	N	157	05:44 (5 th)	22:50 – 23:00	61.2	962.8	03:00 (5 th)
78343 Yabú	SE	112	03:00 (5 th)	SW	136	01:58 (5 th)	-	46.5	963.7	04:55 (5 th)
78349 Sancti Spíritus	S	90	04:25 (5 th)-04:55 (5 th)	S	120	04:30 (5 th)	-	75.4	990.1	06:00 (5 th)

Station	Maximum Sustained Wind			Maximum Wind Gust			Calm	Total Rainfall	Minimum SL Pressure	
	Direction	Veloc. (km/h)10 min/1 min	Time UTC	Direction	Veloc (km/h)	Time UTC	Time UTC	(mm)	Pressure (hPa)	Time UTC
78337 Trinidad	WNW	70	04:30 (5 th)-04:40 (5 th)	WNW	118	04:45 (5 th)	-	121.5	991.3	04:00 (5 th)
78341 Jíbaro	S	68	04:10 (5 th)-04:20 (5 th)	ESE	108	04:25 (5 th)	-	86.0	995.5	04:00 (5 th)
78342 T. de Collantes	W	100	05:00 (5 th)-05:10 (5 th)	W	120	04:50 (5 th)	-	193.0	-	04:00 (5 th)

Remarks:

1. A maximum Storm Surge 2.5 - 3 meters high was reported in Cayo Largo del Sur (observational). The coastline retreated up to 500 meters in Batabanó, some people walked through the exposed sea bottom. Large waves battered both coasts of western and central Cuba with waves up to 4 - 5 meters high, causing extensive coastal floodings.

CHAPTER 8

COMMUNICATIONS

8.1 General

Telecommunications within the region is a two part system.

The first is the Global Telecommunications System (GTS) Internet File Service (GIFS) is provided by the United States National Weather Service (NWS) for World Meteorological Organization (WMO) Regional Association IV (RA-IV) Member States, and other WMO Regions that are adjacent to RA-IV, as a highly reliable Internet source of meteorological products. The purpose of GIFS is to provide access to WMO RA-IV related weather information in BUFR, GRIB, alpha-numeric text, and T4-FAX data types to facilitate Members' access to information needed for operational and some research activities between the United States and nations in the Caribbean, North America, and Central America. This service is available to all authorized WMO RA-IV Member States as well as other WMO Regions adjacent to RA-IV. The GIFS is the primary service for GTS data within RA-IV.

The second portion is the WAFS Internet File Services (WIFS) which hosts WAFS products intended for flight planning and documentation in accordance with ICAO Annex 3, Meteorological Service for International Air Navigation. There are three types of products:

- (1) Gridded Binary (GRIB) Coded Data (produced by WAFC Washington and WAFC London), containing forecasts of upper wind and temperature data, tropopause height and temperature, and maximum wind (height, speed, direction), using GRIB2 encoding on a 1.25 x 1.25 degree global grid for flight planning.
- (2) Charts, consisting of upper-air wind and temperature forecasts at selected flight levels in PNG format (produced by WAFC Washington and WAFC London), significant weather (SIGWX) forecasts in BUFR and PNG formats (also produced by WAFC Washington and WAFC London), and volcanic ash dispersion advisories are provided in PNG format (produced by the nine Volcanic Ash Advisory Centers across the world).
- (3) Operational Meteorology (OPMET) alphanumeric messages, consisting of (a) routine aviation weather reports (METAR and SPECI), (b) terminal aerodrome forecasts (TAFs), (c) en-route hazardous weather warnings of significant meteorological information (SIGMETs), (e) volcanic ash advisory messages (VAA) messages, and (f) tropical cyclone advisory messages. Administrative messages are also provided. WIFS only provides those METAR, SPECI and TAFs listed in FASID Table MET 2A (which is listed in Annex 1 of the SADIS User's Guide), available at <http://www.icao.int/safety/meteorology>.

Additional communication systems are also in place and are an integral part of the RMTN. These include the Emergency Managers Weather Information Network (EMWIN), the GOES Satellite Data Collection Platform (DCP), and the ICAO Aeronautical Fixed telecommunication Network (AFTN). Several alternate mechanisms for data exchange exist which use the Internet and TCP/IP technologies have been implemented by RTH Washington, including HTTP and FTP servers, E-mail Data Ingest Systems, RTH Web-based Bulletin Input, FTP Input Service and Dial-up Data Input. These alternate mechanisms are available to all Members covered by this Plan.

All data and product providers covered by this plan are encouraged to have at a minimum two methods of transmission and to regularly exercise or test both of them.

A restricted distribution list containing telephone numbers of national Meteorological Service and homes of key officials is given in attachment 8A.

8.2 Procedures to be followed

WMO communications headings, station location identifiers, and international block and station index numbers will be used to send surface and upper-air observations.

8.3 Tropical cyclone warning headings

Tropical cyclone warning headings to be used by Members are listed in Attachment 8B. Headings to be used by the USA for tropical/subtropical cyclone releases are listed in Attachments 8C and 8D.

**LIST OF TELEPHONE NUMBERS OF NATIONAL METEOROLOGICAL SERVICES
AND KEY OFFICIALS / LISTA DE LOS NÚMEROS DE TELÉFONO
DE LOS SERVICIOS METEOROLÓGICOS**

NACIONALES Y DE LOS PRINCIPALES FUNCIONARIOS

(RESTRICTED DISTRIBUTION / DISTRIBUCIÓN RESTRICTIVA)

**TROPICAL CYCLONE WARNING HEADINGS/
ENCABEZAMIENTO DE LOS AVISOS DE CICLON**

Country/País	Tropical depression heading/ Encabezamiento de depresión tropical	Tropical storm or hurricane heading/ Encabezamiento de tormenta tropical o
Antigua & Barbuda	WOCA31 TAPA	WHCA31 TAPA
Bahamas	WOBA31 MYNN	WHBA31 MYNN
Barbados	WOCA31 TBPB	WHCA31 TBPB
Belize/Belice	WOCA31 MZBZ	WHCA31 MZBZ
Colombia	WOCO01 SKBO	WHCO01 SKBO
Costa Rica	WOCA31 MRSJ	WHCA31 MRSJ
Cuba	WOCA31 MUHV	WHCA31 MUHV
Dominican Republic/ República Dominicana	WOCA31 MDSD	WHCA31 MDSD
France (Martinique)/ Francia (Martinica)	WOMR31 TFFF	WHMR31 TFFF
France (Guadeloupe)/ Francia (Guadalupe)	WOMF31 TFFR	WHMF31 TFFR
Guatemala	WOCA31 MGGT	WHCA31 MGGT
Honduras	WOCA31 MHTG	WHCA31 MHTG
Jamaica	WOCA31 MKJP	WHCA31 MKJP
Mexico/México	WOMX01 MMMX	WHMX01 MMMX
	WOMX02 MMMX	WHMX02 MMMX

Country/País	Tropical depression heading/ Encabezamiento depresión tropical	Tropical storm or hurricane heading/ Encabezamiento de tormenta tropical o
Nicaragua	WOCA31 MNMG	WHCA31 MNMG
Panama	WOCA31 MPTO	WHCA31 MPTO
Trinidad and Tobago/ Trinidad y Tobago	WOCA31 TTPP	WHCA31 TTPP

CANADA HEADINGS FOR TROPICAL CYCLONE RELEASES

	Public Tropical Cyclone Information Statement	Watch/Warning Tropical Cyclone	Tropical Cyclone Technical Discussion
Canada	WOCN31-33 CWHX (E) WOCN41-43 CWHX (F)	W(W/T)CN31-33 CWHX (E) W(W/T)CN41-43 CWHX (F)	FXCN31-33 CWHX (E) FXCN41-43 CWHX (F)

USA HEADINGS FOR TROPICAL CYCLONE RELEASES

	Public Tropical Cyclone	Forecast/Advisory Tropical Cyclone	Tropical Cyclone Discussion
Miami, FL	WTNT31-35 KNHC (Atlantic, Caribbean, Gulf of Mexico)	WTNT21-25 KNHC	WTNT41-45 KNHC
Miami, FL	WTPZ31-35 KNHC (Eastern North Pacific)	WTPZ21-25 KNHC	WTPZ41-45 KNHC
Honolulu, HI	WTPA31-35 PHFO	WTPA21-25 PHFO	

Tropical Cyclone Surface Wind Speed Probabilities
World Meteorological Organization (WMO) headers:
FONT11-15 KNHC – Atlantic
FOPZ11-15 KNHC – Eastern Pacific
FOPA11-15 PHFO – Central Pacific (issued by CPHC)

NOTE: US advisory headings range from 1 to 5 and are recycled with the sixth, eleventh, and sixteenth tropical cyclone.

**USA HEADINGS FOR ADDITIONAL TROPICAL/
SUBTROPICAL METEOROLOGICAL RELEASES**

1. TROPICAL CYCLONES UPDATE
WTNT61-65KNHC (NORTH ATLANTIC)
WTPZ61-65KNHC (EASTERN NORTH PACIFIC)
 2. TROPICAL WEATHER OUTLOOK
ABNT20 KNHC (NORTH ATLANTIC)
ABPZ20 KNHC (EASTERN NORTH PACIFIC)
 3. TROPICAL WEATHER SUMMARY
ABNT30 KNHC (NORTH ATLANTIC)
ABPZ30 KNHC (EASTERN NORTH PACIFIC)
 4. TROPICAL WEATHER DISCUSSION
AXNT20 KNHC (NORTH ATLANTIC)
AXPZ20 KNHC (EASTERN NORTH PACIFIC)
 5. SATELLITE - DERIVED RAINFALL
TCCA21 KNHC (EASTERN CARIBBEAN)
TCCA22 KNHC (CENTRAL CARIBBEAN)
TCCA23 KNHC (WESTERN CARIBBEAN)
-

**LIST OF WEB SITES OF NATIONAL METEOROLOGICAL SERVICES/
LISTA DE WEB SITES DE LOS SERVICIOS METEOROLOGICOS -**

ANTIGUA AND BARBUDA / ANTIGUA Y BARBUDA

Meteorological Services www.antiguamet.com

ARUBA

Departamento Meteorologico Aruba www.meteo.aw

BAHAMAS/BAHAMAS

Meteorological Services www.bahamasweather.org.bs

BARBADOS

Meteorological Services www.barbadosweather.org

BELIZE / BELICE

Meteorological Services www.hydromet.gov.bz

Facebook <https://www.facebook.com/nms.belize/>

BERMUDA / BERMUDA

Bermuda Weather Service www.weather.bm

Facebook <https://www.facebook.com/BermudaWeatherService>

BRAZIL/ BRASIL

Instituto Nacional de Meteorologia
(INMET) <http://www.inmet.gov.br/>

CANADA / CANADÁ

Canadian Hurricane Centre
Meteorological Service of Canada www.weather.gc.ca/hurricane/
www.hurricanes.ca

CAYMAN ISLANDS/ ISLAS CAIMÁN

C.I. National Weather Service www.weather.gov.ky

Facebook <https://www.facebook.com/cinws/>

COLOMBIA / COLOMBIA

Instituto de Hidrologia,
Meteorología y Estudios Ambientales www.ideam.gov.co

CURACAO AND SINT MAARTEN/ CURASAO Y SAN MARTÍN

Meteorological Department (Curaçao)
Sint Maarten www.meteo.cw
www.meteosxm.com

Facebook <https://www.facebook.com/Meteorological.Department.Curacao/>

Meteo App appshopper.com/weather/curacao-weather
 <https://play.google.com/store/apps/details?id=com.dwarfland.weather>

WhatsApp Forecaster Mobile +59995601089

COSTA RICA / COSTA RICA

Instituto Meteorológico Nacional www.imn.ac.cr

CUBA / CUBA

Instituto de Meteorología www.insmet.cu

DOMINICA/ DOMINICA

Dominica Meteorological Service www.weather.gov.dm

Facebook <https://www.facebook.com/dominica.met>

DOMINICAN REPUBLIC/ REPÚBLICA DOMINICANA

Oficina Nacional de Meteorología www.onamet.gov.do

Twitter:

Oficina Nacional de Meteorología,
Meteorología República Dominicana: [@onamet](https://twitter.com/onamet)
Ing. Gloria Ceballos Directora Nacional [@GloriaCeballos7](https://twitter.com/GloriaCeballos7)

EL SALVADOR /EL SALVADOR

Servicio Meteorológico Nacional www.snet.gob.sv

Observatorio Ambiental

Observatorio Ambiental. MARN www.marn.gob.sv

Twitter: @MARN_Oficial_sv

Facebook: @marn.gob.sv

FRANCE / FRANCIA

Météo-France www.meteofrance.com
 www.meteofrance.gp

Forecasters website : <http://www.meteo.fr/extranets>. This site has a
restricted access. Please request login and password from sherpa@meteo.fr

GUATEMALA / GUATEMALA

Instituto Nacional de Sismología, Vulcanología,
Meteorología e Hidrología (INSIVUMEH) www.insivumeh.gob.gt

Twitter [@insivumehgt](https://twitter.com/insivumehgt)

Facebook [@insivumeh](https://www.facebook.com/insivumeh)

HAITI

Centre National Météorologique www.meteo-haiti.gouv.ht

HONDURAS / HONDURAS

Servicio Meteorológico Nacional www.smn.gob.hn

JAMAICA/JAMAICA

Meteorological Service of Jamaica www.metservice.gov.jm

MEXICO / MEXICO

Servicio Meteorológico Nacional <http://smn.cna.gob.mx>

Twitter CONAGUA Clima: [@conagua_clima](https://twitter.com/conagua_clima)

NICARAGUA/NICARAGUA

Meteorological Services www.ineter.gob.ni

NETHERLANDS

Bonaire, Saba and St. Eustatius www.knmidc.org

PANAMA / PANAMÁ

Meteorological Services www.hidromet.com.pa

SPAIN / ESPAÑA

Agencia Estatal de Meteorología www.aemet.es

SAINT LUCIA / SANTA LUCÍA

Meteorological Services www.slumet.gov.lc

Facebook St Lucia Met

Twitter @st.luciaweather

TRINIDAD AND TOBAGO / TRINIDAD Y TABAGO

Meteorological Service www.metoffice.gov.tt

Facebook <https://www.facebook.com/Trinidad-and-Tobago-Meteorological-Service-270032093113015/>

Twitter @TTMetOffice

YouTube [Trinidad and Tobago Meteorological Service](https://www.youtube.com/TrinidadandTobagoMeteorologicalService)

UNITED STATES OF AMERICA / ESTADOS UNIDOS DE AMÉRICA

National Hurricane Centre /
Centro Nacional de Huracanes www.nhc.noaa.gov

Facebook <https://www.facebook.com/NWSNHC/>
Twitter - Operational accounts @NHC_Atlantic @NHC_Pacific @NHC_TAFB
Interactive Outreach accounts @NWSNHC @NHC_Surge

PUERTO RICO / PUERTO RICO

Weather Service Forecast Office www.srh.noaa.gov/sju
www.upr.clu.edu/nws

VENEZUELA / VENEZUELA

National Institute of Meteorology
and Hydrology (INAMEH)

www.inameh.gob.ve

**TROPICAL CYCLONE ADVISORY MESSAGE
FOR INTERNATIONAL CIVIL AVIATION**

1. TC ADVISORY:
2. DTG: Year month date (yyyymmdd)/time (in UTC) (using "Z")
of issue
3. TCAC: Name of TCAC (location indicator or full name)
4. TC : Name of tropical cyclone
5. NR: Advisory number (starting with "01" for each cyclone)
6. PSN: Position of the centre in degrees and minutes
(Nnnnn" or "Snnnn", "Wnnnnn" or "Ennnnn")
7. MOV: Direction and speed of movement respectively to at least
eight compass points ("N", "NE", "E", "SE", "S", "SW", "W",
"NW") and in km/h (or kt)
8. C: Central pressure (in hPa)
9. MAX WIND: Maximum surface wind near the centre
(mean over 10 minutes, in km/h (or kt))
10. FCST PSN +12 HR: Forecast of centre position for fixed valid time of ... UTC
(12 hours after time of issuance of the advisory)
11. FCST MAX WIND +12 HR: Forecast of maximum surface wind for fixed valid time
of ...UTC (12 hours after time of issuance of the advisory)
12. FCST PNS +18 HR: Forecast of centre position for fixed valid time of ... UTC
(18 hours after time of issuance of the advisory)
13. FCST MAX WIND +18HR: Forecast of maximum surface wind for fixed valid time
ofUTC (18 hours after the issuance of the advisory)
14. FCST PSN +24HR: Forecast of centre position for fixed valid time of UTC
(24 hours after issuance of the advisory)
15. FCST MAX WIND +24HR: Forecast of maximum surface wind for fixed valid time
of...UTC (24 hours after the issuance of the advisory)
16. NXT MSG: Expected year month date (yyyymmdd)/time (in UTC)
(using "Z" of issuance of next advisory (using "BFR",
if applicable) or NO MSG EXP"

Note.—The numbers 1 to 16 are included only for clarity and they are not part of the advisory message shown in the example below.

EXAMPLE

ADVISORY MESSAGE FOR TC

TC ADVISORY

DTG: 19970925/1600Z
TCAC: YUFO
TC: GLORIA
NR: 01
PSN: N2706 W07306
MOV: NW 10KT
C: 965HPA
MAX WIND: 45KT
FCST PSN +12HR: 260400 N2830 W07430
FCST MAX WIND +12HR: 45KT
FCST PSN +18HR: 261000 N2852 W07500
FCST MAX WIND +18HR: 40KT
FCST PSN +24HR: 261600 N2912 W07530
FCST MAX WIND +24HR: 45KT
NXT MSG: 19970925/2000Z

CHAPTER 9

TROPICAL CYCLONE NAMES

The lists in Table I and Table II contain the names to be used during 2019-2024 to identify the named tropical cyclones of the Caribbean Sea, the Gulf of Mexico, the North Atlantic Ocean and the eastern North Pacific, respectively. These lists of names will be rotated forward beyond 2024 so that the 2019 names will be used again in 2025.

The name of a tropical cyclone may be retired or withdrawn from the active list at the request of any Member State if that tropical cyclone acquires special notoriety because of human loss or injury, damage and other impacts (e.g. socio-economic) or other special reasons. It is through consensus opinion of the members (or the majority, if required) during the session of the RA IV Hurricane Committee immediately following that season, that the name would be withdrawn from the active list. When replacement names are proposed, the RA IV Hurricane Committee will use the consensus opinion of the members (or majority, if required) to select the replacement for the withdrawn name. In replacing a name, which must start in the same letter of the alphabet as the retired name, the proposal needs to consider the pattern of the list which has alternating gender names, as well as respecting the balance of the language of origin across the list of names, and is respectful of any sensitivities. The replacement name cannot be on any other active RA-IV tropical cyclone name list or a previously retired name. When selecting a new name, consideration must be given to the pronunciation of the name in all languages of the Committee, the complexity of the name for communication purposes (i.e.: whether it uses accents) and the length of the name for modern communication channels (such as social media).

Whenever more storms develop in a given year than the number of names in the relevant list, the Greek alphabet (Alpha, Beta, etc.) will be used to name the subsequent systems.

A tropical cyclone which passes from one basin to another will retain its name.

TABLE I

Names to be used for named tropical cyclones in the Caribbean Sea, the Gulf of Mexico and the North Atlantic Ocean

2019	2020	2021	2022	2023	2024
Andrea	Arthur	Ana	Alex	Arlene	Alberto
Barry	Bertha	Bill	Bonnie	Bret	Beryl
Chantal	Cristobal	Claudette	Colin	Cindy	Chris
Dorian	Dolly	Danny	Danielle	Don	Debby
Erin	Edouard	Elsa	Earl	Emily	Ernesto
Fernand	Fay	Fred	Fiona	Franklin	Francine
Gabrielle	Gonzalo	Grace	Gaston	Gert	Gordon
Humberto	Hanna	Henri	Hermine	Harold	Helene
Imelda	Isaias	Ida	Ian	Idalia	Isaac
Jerry	Josephine	Julian	Julia	Jose	Joyce
Karen	Kyle	Kate	Karl	Katia	Kirk
Lorenzo	Laura	Larry	Lisa	Lee	Leslie
Melissa	Marco	Mindy	Matthew	Margot	Milton
Nestor	Nana	Nicholas	Nicole	Nigel	Nadine
Olga	Omar	Odette	Owen	Ophelia	Oscar
Pablo	Paulette	Peter	Paula	Philippe	Patty
Rebekah	Rene	Rose	Richard	Rina	Rafael
Sebastien	Sally	Sam	Shary	Sean	Sandy

2019	2020	2021	2022	2023	2024
Tanya	Teddy	Teresa	Tobias	Tammy	Tony
Van	Vicky	Victor	Virginie	Vince	Valerie
Wendy	Wilfred	Wanda	Walter	Whitney	William

TABLE II

**Names to be used for named tropical cyclones
in the eastern North Pacific Ocean**

2019	2020	2021	2022	2023	2024
Alvin	Amanda	Andres	Agatha	Adrian	Aletta
Barbara	Boris	Blanca	Blas	Beatriz	Bud
Cosme	Cristina	Carlos	Celia	Calvin	Carlotta
Dalila	Douglas	Dolores	Darby	Dora	Daniel
Erick	Elida	Enrique	Estelle	Eugene	Emilia
Flossie	Fausto	Felicia	Frank	Fernanda	Fabio
Gil	Genevieve	Guillermo	Georgette	Greg	Gilma
Henriette	Hernan	Hilda	Howard	Hilary	Hector
Ivo	Iselle	Ignacio	Ivette	Irwin	Ileana
Juliette	Julio	Jimena	Javier	Jova	John
Kiko	Karina	Kevin	Kay	Kenneth	Kristy
Lorena	Lowell	Linda	Lester	Lidia	Lane
Mario	Marie	Marty	Madeline	Max	Miriam
Narda	Norbert	Nora	Newton	Norma	Norman
Octave	Odalys	Olaf	Orlene	Otis	Olivia
Priscilla	Polo	Pamela	Paine	Pilar	Paul
Raymond	Rachel	Rick	Roslyn	Ramon	Rosa
Sonia	Simon	Sandra	Seymour	Selma	Sergio
Tico	Trudy	Terry	Tina	Todd	Tara
Velma	Vance	Vivian	Virgil	Veronica	Vicente
Wallis	Winnie	Waldo	Winifred	Wiley	Willa
Xina	Xavier	Xina	Xavier	Xina	Xavier
York	Yolanda	York	Yolanda	York	Yolanda
Zelda	Zeke	Zelda	Zeke	Zelda	Zeke

TABLE III
Names of Atlantic Storms Retired into Hurricane History

<u>Name</u>	<u>Year/Key</u>	<u>Location(s) affected</u>
Agnes	1972 +*	Florida, Northeast USA
Alicia	1983 *	North Texas
Allen	1980 *	Antilles, Mexico, South Texas
Allison	2001 *	Texas
Andrew	1992 *	Bahamas, South Florida and Louisiana
Anita	1977	Mexico
Audrey	1957 +*	Louisiana, North Texas
Betsy	1965 +*	Bahamas, Southeast Florida, Southeast Louisiana
Beulah	1967 *	Antilles, Mexico, South Texas
Bob	1991 *	North Carolina and Northeast U.S.
Camille	1969 +*	Louisiana, Mississippi and Alabama
Carla	1961 +*	Texas
Carmen	1974	Mexico, Central Louisiana
Carol ¹	1954 +*	Northeast U.S.
Celia	1970 *	South Texas
César	1996	Costa Rica, Nicaragua
Charley	2004 +	Cuba, USA
Cleo	1964 *	Lesser Antilles, Haiti, Cuba, Southeast Florida
Connie	1955 +	North Carolina
Dennis	2005	Cuba, Florida
David	1979 *	Lesser Antilles, Hispaniola, Bahamas, Florida and Eastern U.S.
Dean	2007	Mexico, Belize
Diana	1990	Mexico
Diane	1955 +*	Mid-Atlantic U.S. & Northeast U.S.
Donna	1960 +*	Bahamas, Florida and Eastern U.S., Turks and Caicos.
Dora	1964 *	Northeast Florida
Edna ¹	1954 +*	Northeast U.S.
Elena	1985 *	Mississippi, Alabama, Western Florida
Eloise	1975 *	Antilles, Northwest Florida, Alabama
Erika	2015	
Fabian	2003	Bermuda
Félix	2007	Nicaragua, Honduras
Fifi	1974	Belize, Guatemala, Honduras, El Salvador
Flora	1963	Haiti, Cuba, Tobago
Florence	2018	USA
Floyd	1999	Bahamas, North Carolina
Fran	1996	North Carolina
Frances	2004 +	Bahamas, Florida
Frederic	1979 *	Alabama and Mississippi
Georges	1998	U.S Virgin Is., Puerto Rico, Dominican Republic, Haiti, Cuba, Florida, Mississippi
Gilbert	1988	Lesser Antilles, Jamaica, Yucatan Peninsula, Mexico, El Salvador
Gloria	1985 *	North Carolina, Northeast U.S.
Greta	1978	Belize
Gustav	2008	Haiti, Jamaica, Cayman Islands, Cuba, Louisiana, USA
Hattie	1961	Belize, Guatemala
Harvey	2017	
Hazel	1954 +*	Antilles, North and South Carolina, Southern Ontario
Hilda	1964 +*	Louisiana
Hortense	1996	Puerto Rico, Dominican Republic, Nova Scotia

Hugo	1989 *	Antilles, Guadeloupe, Virgin Islands, Puerto Rico, South Carolina
Igor	2010	Canada
Ike	2008	Turks & Caicos Islands, Bahamas, Cuba, Texas& other US States
Ione	1955 *	North Carolina
Inez	1966	Lesser Antilles, Hispaniola, Cuba, Florida Keys, Mexico
Isabel	2003 +	North Carolina, District of Colombia, Virginia, Maryland
Isidore	2002	Cuba, Mexico, Louisiana, Mississippi
Iris	2001	Belize, Guatemala
Irma	2017	
Irene	2011	USA
Ivan	2004 +	Grenada, Jamaica, Cayman Islands, Cuba, Alabama, Florida
Janet	1955	Lesser Antilles, Belize, Mexico, Costa Rica
Jeanne	2004 +	Dominican Republic, Haiti, Bahamas, Turks and Caicos, Florida
Joan	1988	Curaçao, Venezuela, Colombia, Costa Rica, Nicaragua <crossed into the Pacific and became Miriam >
Joaquin	2015	
Juan	2003	Canada
Katrina	2005	Louisiana, Mississippi
Keith	2000	Belize and Mexico
Klaus	1990	Martinique
Lenny	1999	Lesser Antilles
Lili	2002	Cuba, Louisiana
Luis	1995	Lesser Antilles
Maria	2017	
Marilyn	1995	Lesser Antilles, Puerto Rico
Matthew	2016	Cuba, Haiti
Michael	2018	USA
Michelle	2001	Cuba
Mitch	1998	Cayman Is, Colombia, Honduras, Nicaragua, Guatemala, Belize, Costa Rica, Mexico, Florida
Nate	2017	
Noel	2007	Dominican Republic, Haiti, Cuba, Jamaica, Bahamas, Canada
Opal	1995	Central America, Mexico, Florida
Otto	2016	Costa Rica
Paloma	2008	Cayman Islands (Little Cayman & Cayman Brac), Cuba
Rita	2005	Louisiana, Texas
Roxanne	1995	Mexico
Stan	2005	Guatemala, El Salvador, Mexico
Sandy	2012	USA, Haiti, Dominican Republic, Cuba, Bahamas, Jamaica
Tomas	2010	Windward Islands
Wilma	2005	Mexico, Florida

Key: + within the list of top 36 most deadly US tropical cyclones
* within the list of top 31 most costly US tropical cyclones in 1990 US dollars

¹

The name "Carol" was used again to denote a hurricane in the mid-Atlantic Ocean in 1965. However, because the name does not appear after that time, it is assumed that the name was retired retrospectively for the damages caused by the 1954 storm of the same name.

TABLE IV**Names of Eastern North Pacific Ocean Storms Retired into Hurricane History**

Eastern Pacific naming began in 1960 apparently with two lists of twenty female names. The scheme began with A (Annette) and continued until mid 1962 without starting over. The year 1961 began with Iva, and 1962 began with Valerie. The years 1963-65 completed the second alphabet and then the second alphabet was unexplainedly started over again in early 1965 after the last two names from the same alphabet had started the season. Interestingly in 1963, two named systems apparently merged, or appeared to merge, so their names were also merged and Jennifer and Katherine became Jen-Kath. In 1966 a scheme using four alphabetical lists of female names was instituted where one of the four, in turn, was started at the beginning of each year. This continued until 1978 when alternating male and female names were used. Prior to 1978, only two names were retired, Hazel and Adele, and it is not clear why either was retired.

In 1978, when alternating male and female names were first used, there were initially four lists, and so a list beginning with Aletta was used in 1978 and again in 1982. At that time two additional lists were added, so in 1983 and 1984, the new lists were used. Thereafter, until today, each list is reused every six years.

Several names have been retired, some for practical reasons such as a pronunciation ambiguity or a "socially unacceptable" meaning in one of the languages and others because they represented a significant human disaster. A name was retired if it appeared in a sequence one or more times, and was subsequently missing when the other names in the sequence were reused.

<u>Name</u>	<u>Year</u>
Adele	1970
Adolph	2001
Alma	2008
Fefa	1991
Fico	1978
Hazel	1965
Ismael	1995
Israel (replaced)	2001
Iva	1988
Kenna	2002
Knut	1987
Manuel	2013
Odile	2014
Patricia	2015 (Mexico)
Pauline	1997

CHAPTER 10

ARCHIVE OF TROPICAL CYCLONE DATA

In accordance with the directive of the WMO Executive Council (EC-XLV), Geneva, (July 1993) an international format for the archiving of tropical cyclone data is to be used by all RSMCs with activity specialization in tropical cyclones.

In the international format given in Attachment 10A, the Dvorak T-number (Position 35-36) and Dvorak CL-number (position 37-38) will be the ones determined at the centre submitting the data, in the case of the RA IV Hurricane Committee, by RSMCMiami-HurricaneCenter.

Complete historic data using this format will be made available for research applications. RSMC Miami will provide such data, to the Director of the National Climatic Data Center (NCDC), USA.

The Tropical Cyclone Programme (TCP) Division of the WMO Secretariat has the responsibility for the maintenance of the format, including assignment of the source codes to appropriate organizations, and authorizing additions and changes.

**GLOBAL TROPICAL CYCLONE TRACK
AND INTENSITY DATA SET - REPORT FORMAT**

Position Content

1-9	Cyclone identification code composed by 2 digit numbers in order within the cyclone season, area code and year code. 01SWI2000 shows the 1st system observed in South-West Indian Ocean basin during the 2000/2001 season. Area codes are as follows: ARB = Arabian Sea ATL = Atlantic Ocean AUB = Australian Region (Brisbane) AUD = Australian Region (Darwin) AUP = Australian Region (Perth) BOB = Bay of Bengal CNP = Central North Pacific Ocean ENP = Eastern North Pacific Ocean ZEA = New Zealand Region SWI = South-West Indian Ocean SWP = South-West Pacific Ocean WNP = Western North Pacific Ocean and South China Sea
10-19	Storm Name
20-23	Year
24-25	Month (01-12)
26-27	Day (01-31)
28-29	Hour- universal time (at least every 6 hourly position -00Z,06Z,12Z and 18Z)
30	Latitude indicator: 1=North latitude; 2=South latitude
31-33	Latitude (degrees and tenths)
34-35	Check sum (sum of all digits in the latitude)
36	Longitude indicator: 1=West longitude; 2=East longitude
37-40	Longitude (degrees and tenths)
41-42	Check sum (sum of all digits in the longitude)
43	Position confidence* 1=good (<30nm; <55km) 2=fair (30-60nm; 55-110 km) 3=poor (>60nm; >110km) 9=unknown
44-45	Dvorak T-number (99 for no report)
46-47	Dvorak CI-number (99 for no report)
48-50	Maximum average wind speed (whole values) (999 for no report)
51	Units 1=kt, 2=m/s, 3=km per hour
52-53	Time interval for averaging wind speed (minutes for measured or derived wind speed, 99 if unknown or estimated)
54-56	Maximum Wind Gust (999 for no report)
57	Gust Period (seconds, 9 for unknown)
58	Quality code for wind reports: 1=Aircraft or Dropsonde observation 2=Over water observation (e.g. buoy) 3=Over land observation 4=Dvorak estimate 5=Other
59-62	Central pressure (nearest hectopascal) (9999 if unknown or unavailable)
63	Quality code for pressure report (same code as for winds)

* Confidence in the centre position: Degree of confidence in the centre position of a tropical cyclone expressed as the radius of the smallest circle within which the centre may be located by the analysis. "**position good**" implies a radius of less than 30 nm, 55 km; "position fair", a radius of 30 to 60 nm, 55 to 110km; and "position poor", radius of greater than 60 nm, 110km.

- 64 Units of length: 1=nm, 2=km
- 65-67 Radius of maximum winds (999 for no report)
- 68 Quality code for RMW:
 1=Aircraft observation
 2=Radar with well-defined eye
 3=Satellite with well-defined eye
 4=Radar or satellite, poorly-defined eye
 5=Other estimate
- 69-71 Threshold value for wind speed (gale force preferred, 999 for no report)
- 72-75 Radius in Sector 1: 315°-45°
- 76-79 Radius in Sector 2: 45°-135°
- 80-83 Radius in Sector 3: 135°-225°
- 84-87 Radius in Sector 4: 225°-315°
- 88 Quality code for wind threshold
 1=Aircraft observations
 2=Surface observations
 3=Estimate from outer closed isobar
 4=Other estimate
- 89-91 Second threshold value for wind speed (999 for no report)
- 92-95 Radius in Sector 1: 315°-45°
- 96-99 Radius in Sector 2: 45°-135°
- 100-103 Radius in Sector 3: 135°-225°
- 104-107 Radius in Sector 4: 225°-315°
- 108 Quality code for wind threshold (code as for row 88)
- 109-110 Cyclone type:
 01=tropics; disturbance (no closed isobars)
 02= <34 knot winds, <17m/s winds and at least one closed isobar
 03=34-63 knots, 17-32m/s
 04=>63 knots, >32m/s
 05=extratropical
 06=dissipating
 07=subtropical cyclone (nonfrontal, low pressure system that comprises initially baroclinic circulation developing over subtropical water)
 08=overland
 09=unknown
- 111-112 Source code (2 - digit code to represent the country or organization that provided the data to NCDC USA. WMO Secretariat is authorized to assign number to additional participating centres, organizations)
 01 RSMC Miami-Hurricane Center
 02 RSMC Tokyo-Typhoon Centre
 03 RSMC-tropical cyclones New Delhi
 04 RSMC La Reunion-Tropical Cyclone Centre
 05 Australian Bureau of Meteorology
 06 Meteorological Service of New Zealand Ltd.
 07 RSMC Nadi-Tropical Cyclone Centre
 08** Joint Typhoon Warning Center, Honolulu
 09** Madagascar Meteorological Service
 10** Mauritius Meteorological Service
 11** Meteorological Service, New Caledonia
 12 Central Pacific Hurricane Center, Honolulu
- Heading** 1-19 Cyclone identification code and name; 20-29 Date time
 30-43 Best track positions;
 44-110 Intensity, Size and Type;
 111-112 Source code.

** No longer used.