Introduction to TAFB: Duties, Forecasts, and Products

Hugh Cobb, Chief TAFB

28 February 2016

Tropical Analysis and Forecast Branch (TAFB)

- **Year round (24/7/365) products**
  - Marine forecasts (Gridded, Graphical and Text) and discussions (MIM)
  - Surface analyses and discussions (TWD)
  - Aviation forecasts and warnings (backup responsibilities) ***
  - Satellite-derived rainfall estimates
- **Hurricane Season**
  - Tropical cyclone intensity estimates using Dvorak technique
  - Media support to NHC (English, Spanish, French)
  - Radar tracking of tropical cyclones
  - Forecast support to Hurricane Specialists (Marine)

TAFB produces 55 graphic products & 56 text products each day.

TAFB Forecast Duties

Gridded/Text Marine Forecast Products

Northeast Pacific High Seas Forecast
(FZPN03 KNHC)

Southeast Pacific High Seas Forecast
(FZPN04 KNHC)

Tropical Cyclone Wave Height Estimates

Meteorological Discussion

East Pacific Tropical Weather Discussion
(AXPZ20 KNHC)

Satellite Products

Dvorak Tropical Cyclone Satellite Intensity Estimates

Microwave Satellite Position Estimates

Satellite Rainfall Estimates

Graphical Products

Sea State Analysis
Wind & Wave Forecasts
Wave Period Forecasts
High Wind Graphic
TC Danger Area Graphic

TAFB Forecast Duties

Gridded/Text Marine Forecast Products

Atlantic High Seas Forecast
(FZNT02 KNHC)
Gulf of Mexico Offshore
Waters Forecast (FZNT24 KNHC)
Caribbean/Atlantic Offshore
Waters Forecast (FZNT23 KNHC)
NAVTEX Forecasts (3)
(FZNT25 KNHC, FZNT26 KNHC, & FZNT27 KNHC)
VOBRA Forecasts (2)
(FZNT25 KNHC, FZNT26 KNHC, & FZNT27 KNHC)

Graphical Products

Sea State Analysis
Wind & Wave Forecasts
Wave Period Forecasts

Meteorological Discussion

Marine Weather Discussion
(AGXX40 KNHC)

TAFB Forecast Duties

Surface Analysis
6-hourly for area from 20S to 30N between 10E and 140W
3-hourly mainly for Gulf of Mexico, Florida, Mexico

Pan-American Temperature/Precipitation Table

Meteorological Discussion

Atlantic **T**ropical **W**eather **D**iscussion

Graphical Forecast Products

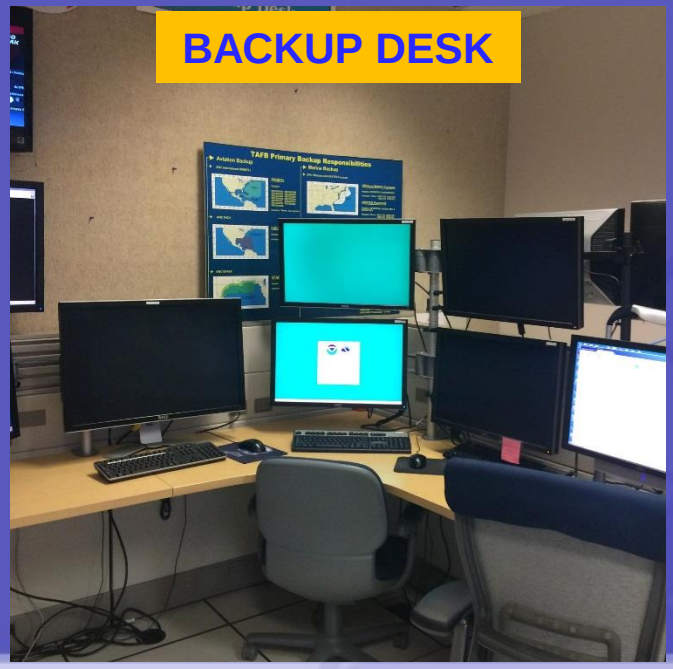
Surface Prog. Forecasts

Additional TAFB Duties

TAFB Staffs "4th" Desk between August 10 - October 20.
Relieves other 3 desks during the busy peak of the hurricane season.

Back-Up Responsibilities

- OPC's Atlantic High Seas & Offshore Forecasts
- Honolulu S. Pacific HSF & Satellite Products
- Aviation Products over Caribbean & Gulf of Mexico (FACA & SIGMETS)



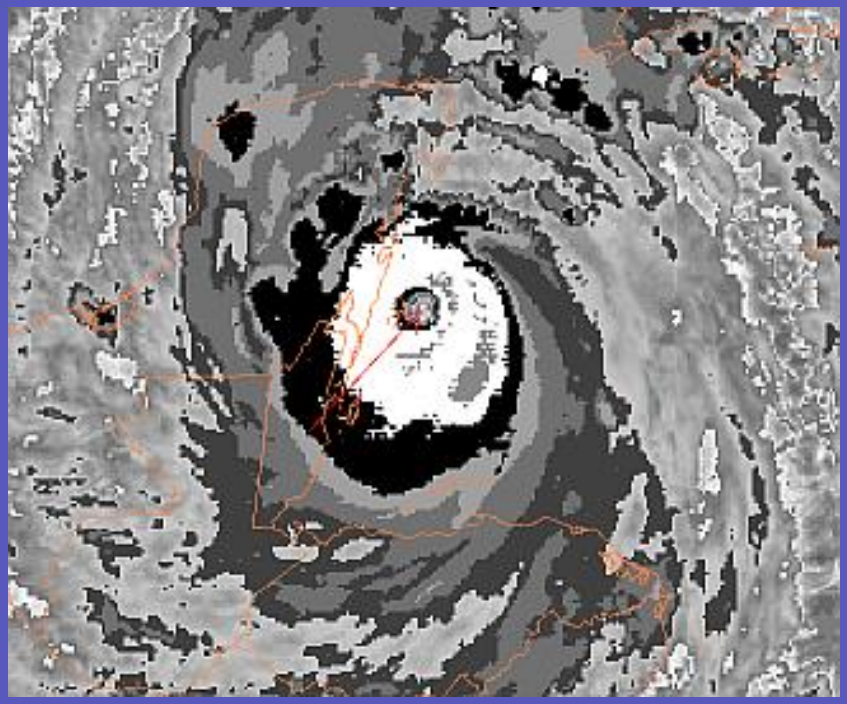
Additional TAFB Duties

Hurricane Support Meteorologists

- WSR-88D radar fixes for landfalling tropical cyclones
- Media support during tropical cyclone events
- Tropical cyclone forecast support
- Hurricane Liaison Team (HLT)

Dvorak Classifications

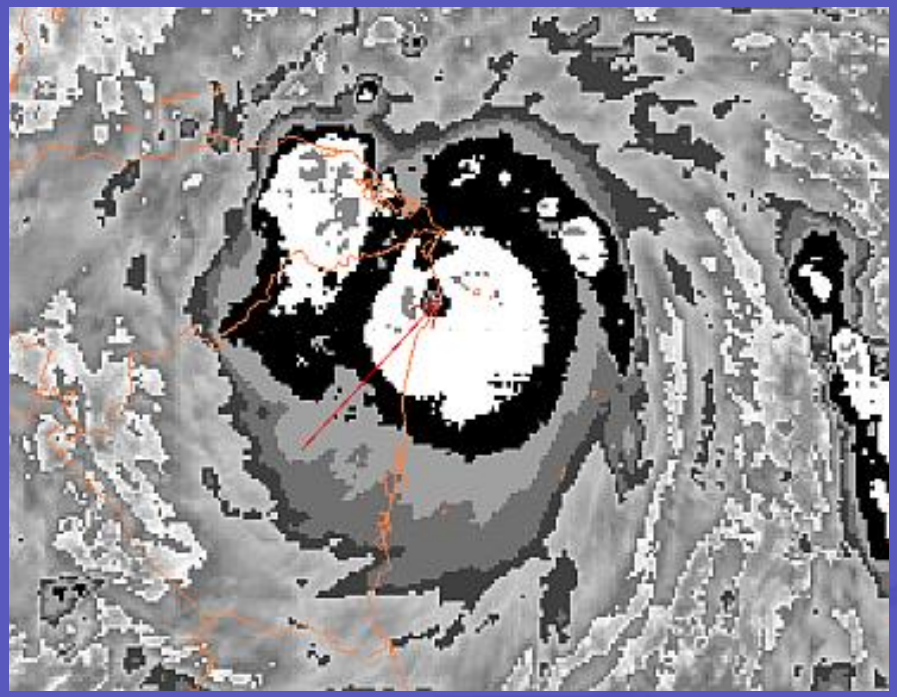
DEAN 21 August 0615 UTC



T 7.0/7.0
140 KT 921 MB

RECON 8/21/0605 UTC
156 KT (FLV) – 140 KT
909 MB

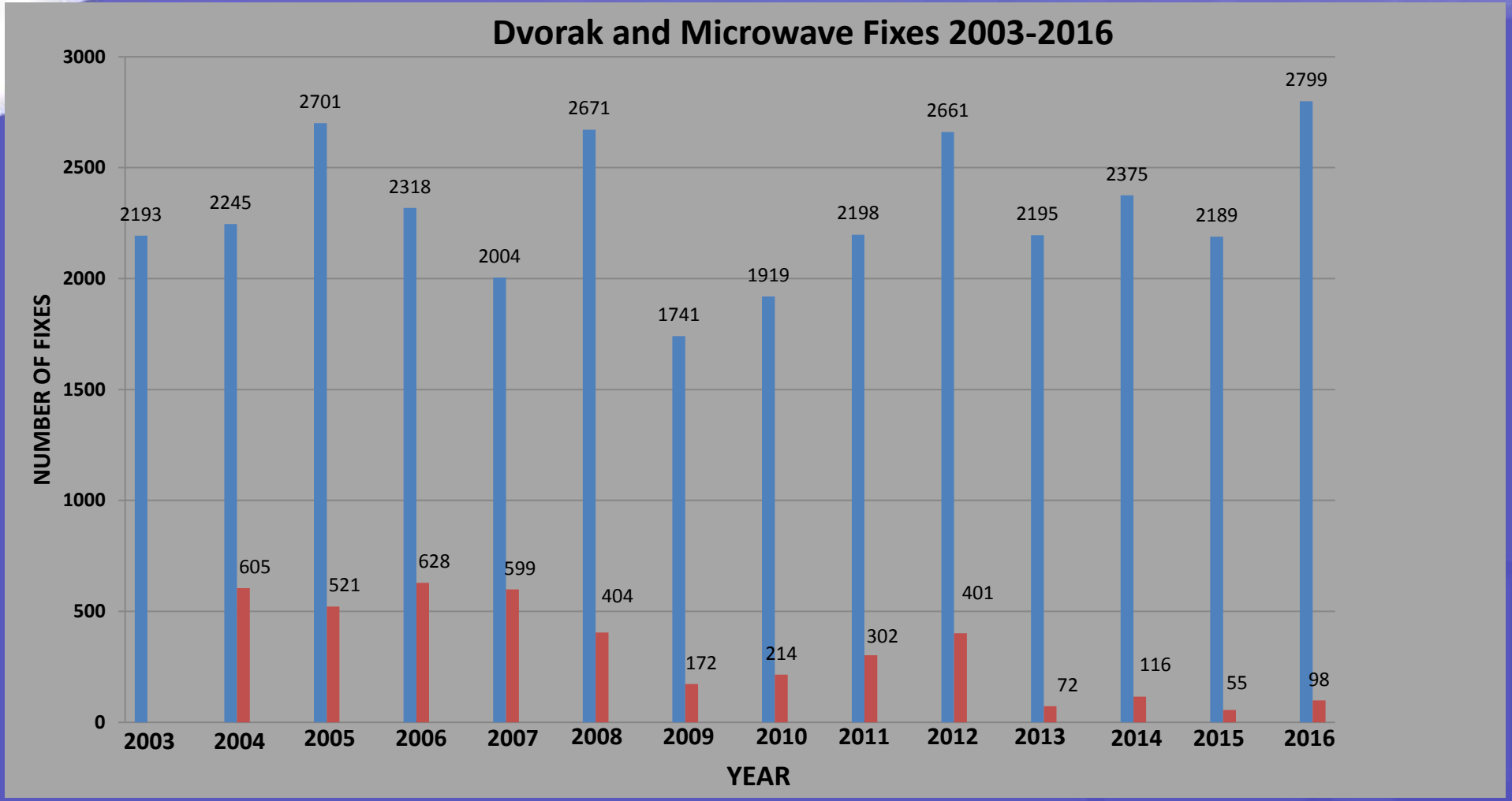
FELIX 4 September 1145 UTC



T 7.0/7.0
140 KT 921 MB

RECON 9/04/0702 UTC
148 KT (FLV) – 133 KT
939 MB

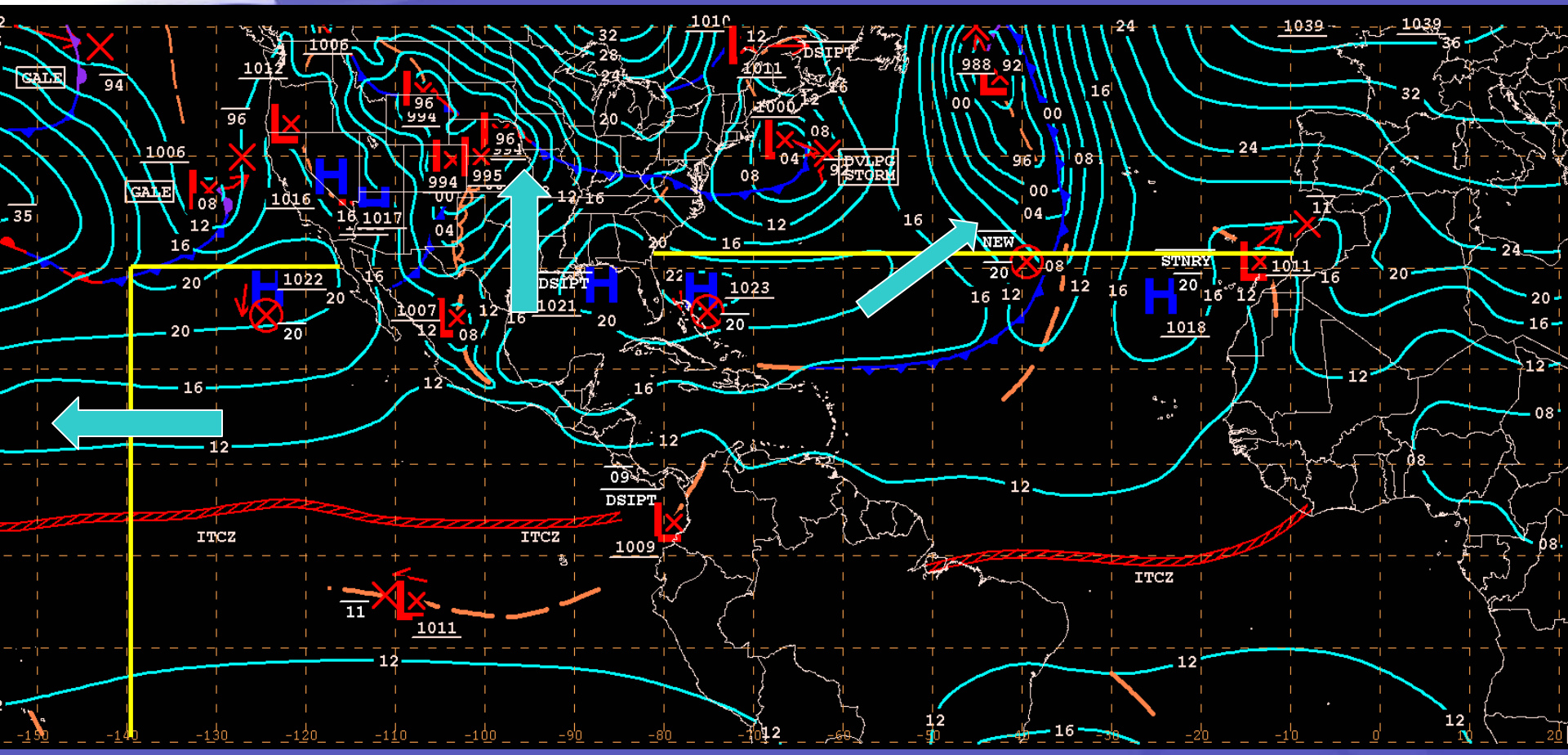
Dvorak Classifications (Intensity & Position Estimates)



Microwave Fixes began in 2004

Surface Analysis
and
Tropical Weather Discussions

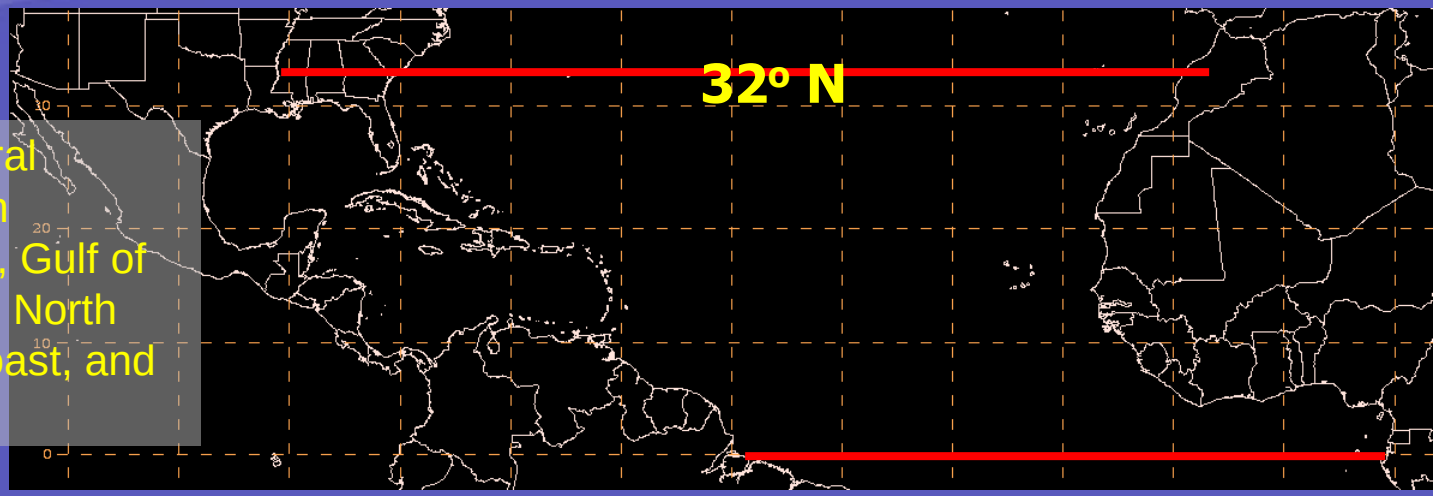
Unified Surface Analysis

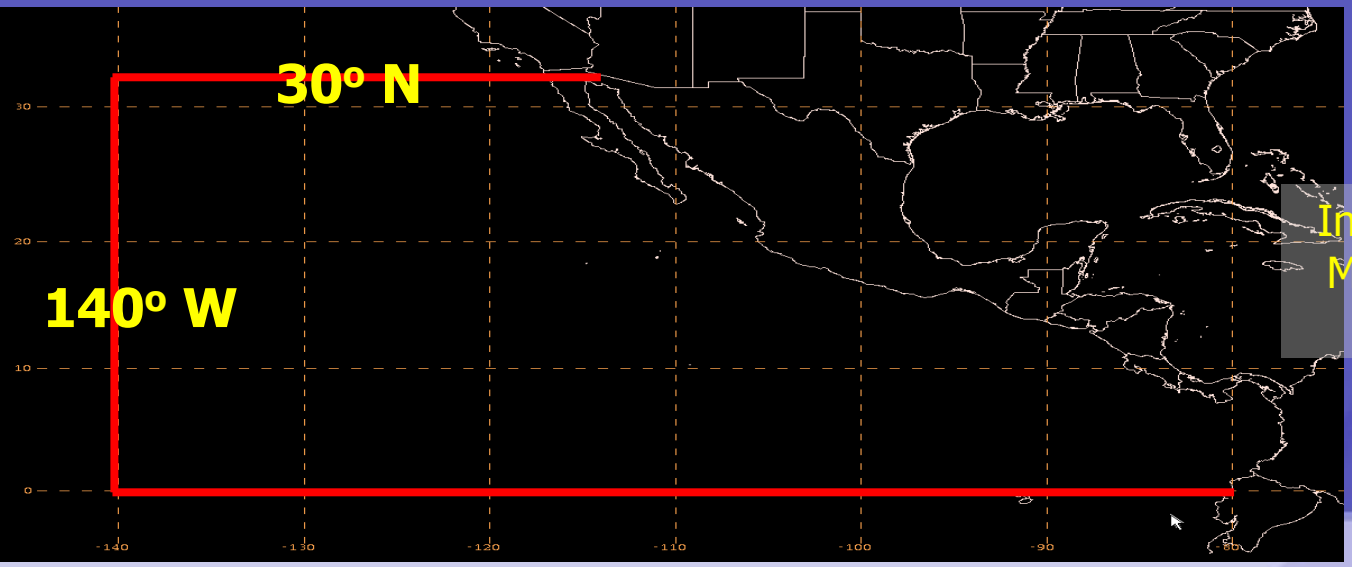


TWD Areas of Responsibility

- North Atlantic

Includes: Mexico, Central America, northern South America, Florida/SE US, Gulf of Mexico, Caribbean Sea, North Atlantic to the African coast, and coastal west Africa





- East Pacific

Includes west coastal areas of Mexico, Central America, and northern South America

What is the Tropical Weather Discussion (TWD)?

- **Plain language narrative text product describing:**
  - Major synoptic scale features and significant areas of disturbed weather
  - Short-term trends and forecasts (up to ~48 hours)
  - Meteorological reasoning for current features/weather and trends/forecasts
  - Model performance; degree of confidence in forecast
- Two separate products cover tropical North Atlantic and eastern North Pacific Oceans, and adjacent land areas
- Provides tropical weather information to those who need to know the current state of the atmosphere and expected trends

General TWD Format

- **Special Features**
  - Tropical and Subtropical Cyclone
  - Significant feature that has the possibility of developing into a TC.
  - Extra-tropical marine warning areas
- **Tropical Waves**
- **ITCZ/Monsoon trough**
- **Discussion**- Areas can change with weather pattern
  - Gulf of Mexico
  - Caribbean
  - Hispaniola
  - Atlantic/Eastern Atlantic

Special Features Section

- Overall structure or appearance of system
- Indicate future intensity changes following current TC forecast
- Discuss associated middle/upper level features and convection

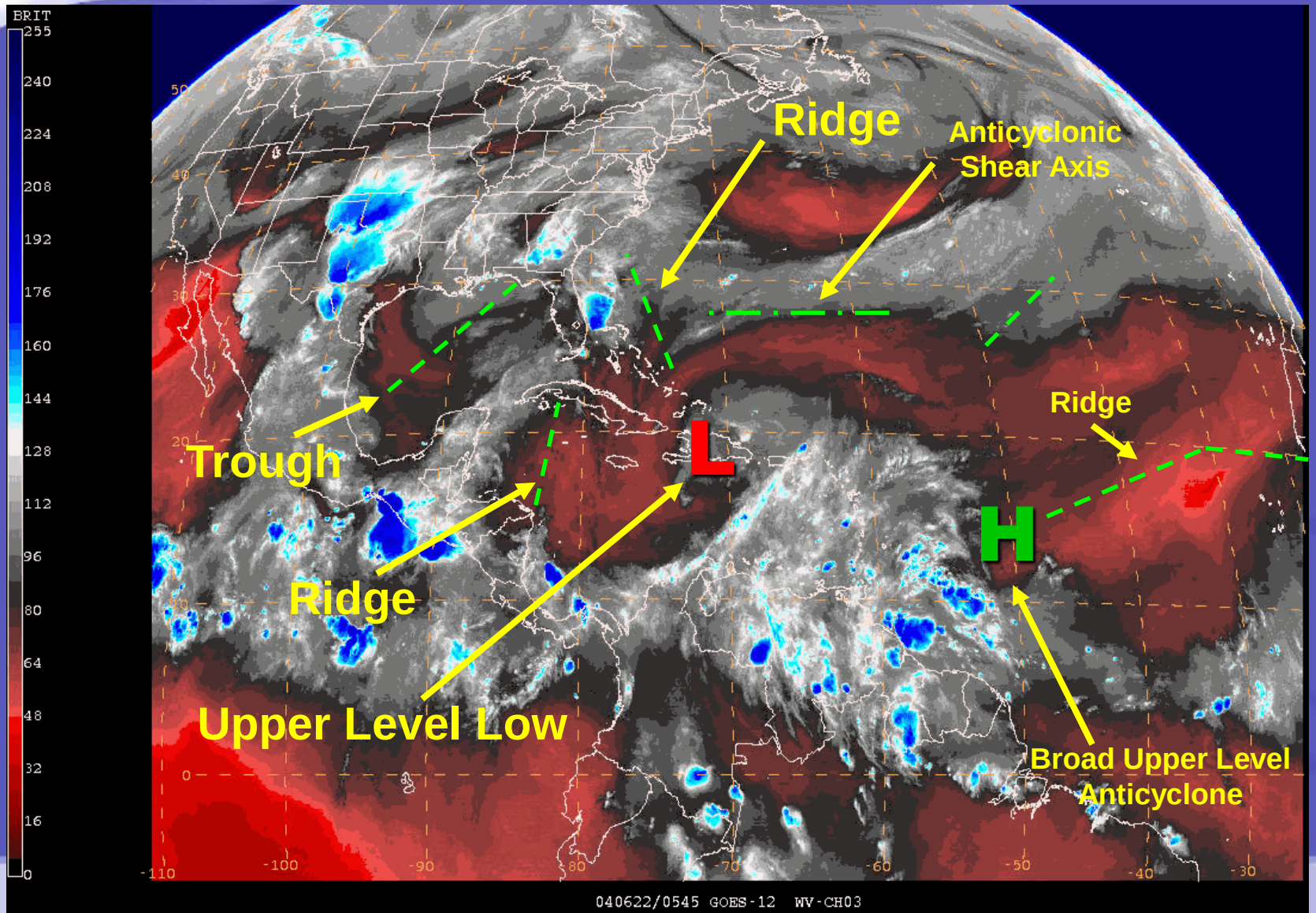
Tropical Waves Section

- Discuss from east to west
- Summarize strength, position (including level of uncertainty), and movement, including reference to familiar geographic locations
- Provide reasons for positioning (wind shifts in timesections, pressure falls, features in satellite Hovmoeller diagrams, etc.)
- Indicate associated convection, other impacts

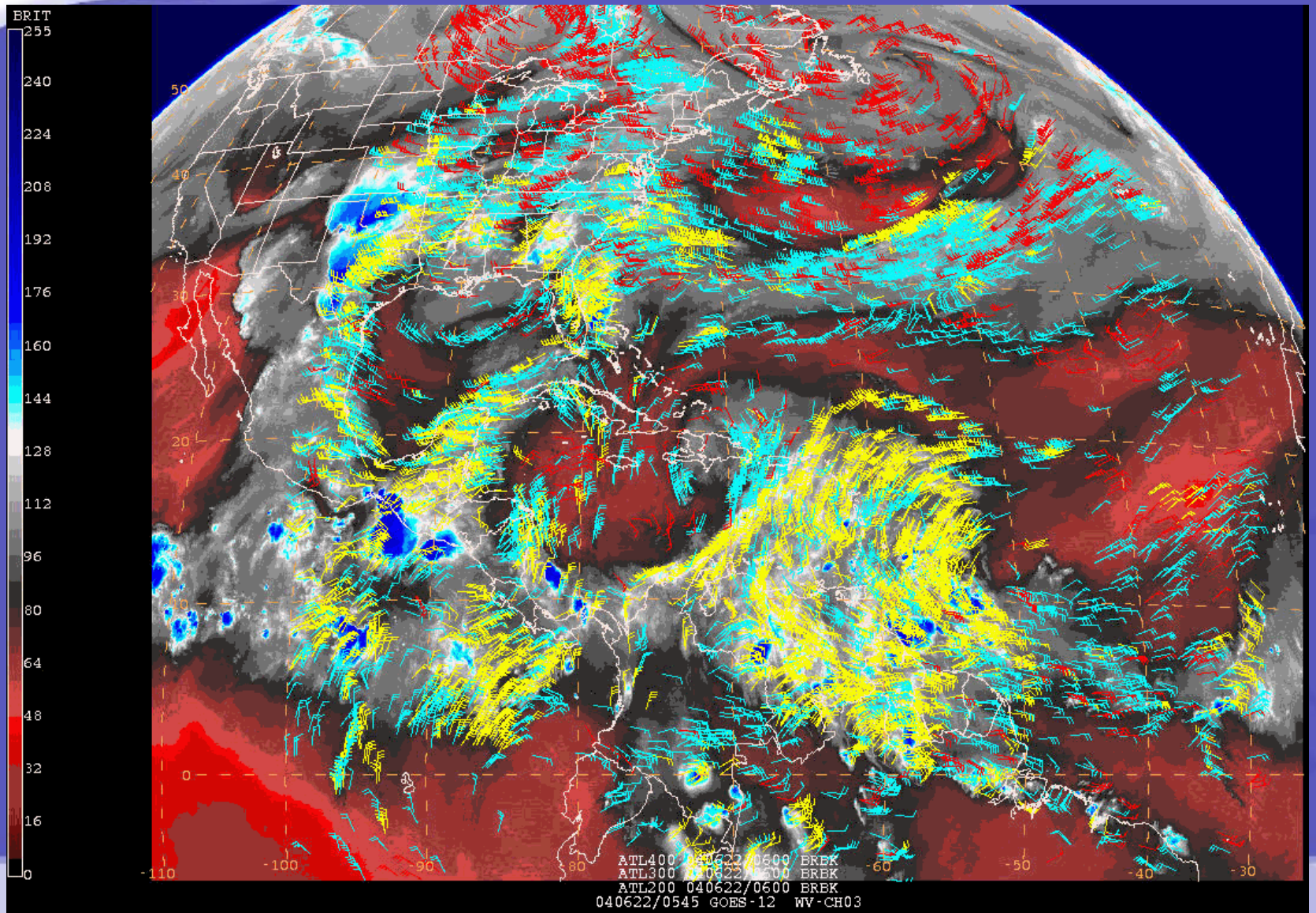
Data and Tools Needed to Construct a TWD

- Climatological knowledge and/or data
- Recent:
  - TAFB surface analyses
  - Surface and upper air observations
  - Geostationary infrared, water vapor, and visible imagery
  - Satellite-derived winds (e.g., QuikSCAT, GOES cloud- and water vapor-tracked winds)
  - Radar observations
  - Lightning Data
- Latest model analyses and forecasts
- (Tropical) Meteorological knowledge and analysis techniques

Water Vapor Image Interpretation: Locate Mid/Upper Level Features



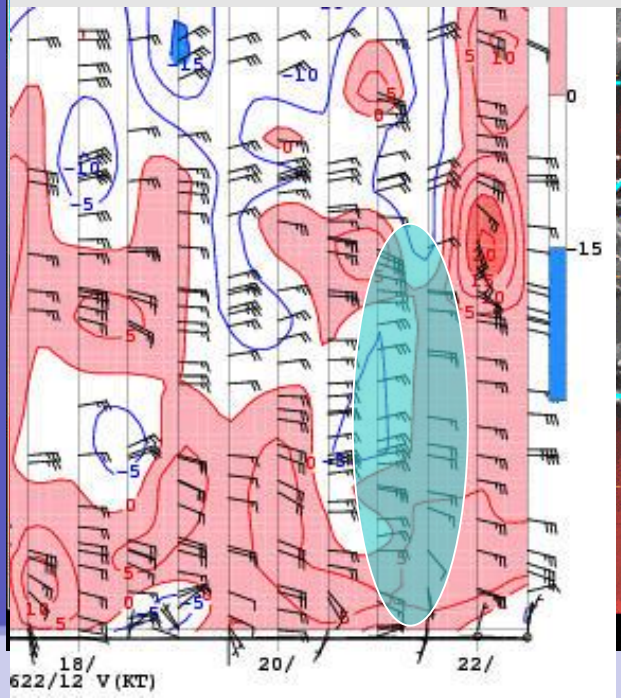
Water Vapor Image Interpretation: Satellite-Derived Wind Vectors

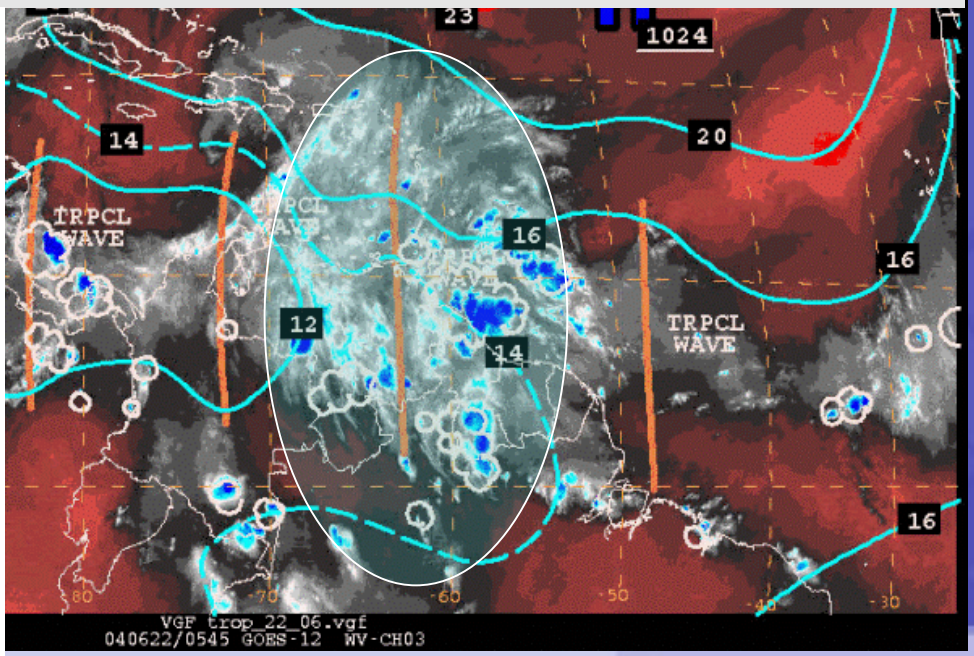


Relating Surface and Mid/Upper Levels

Example of reasoning for tropical wave position/placement

E CARIBBEAN TROPICAL WAVE LOCATED ALONG 63W S OF 19N MOVING WEST 15-20 KT. THE CAYENNE VERTICAL SOUNDING SHOWS A WEAK WAVE PASSAGE...GENERALLY ABOVE 900 MB...SOMETIME EARLY ON THE 21 JUN. BY EXTRAPOLATION...THIS WOULD PLACE THE WAVE IN THE VICINITY OF THE LESSER ANTILLES. THE CONVECTIVE PATTERN IS DISORGANIZED DUE TO STRONG VERTICAL SHEAR E OF AN UPPER LOW OVER HISPANIOLA AND MOST OF THE TSTMS ARE STILL LAGGING SE OF THE WINDWARD ISLANDS. WIDELY SCATTERED MODERATE CONVECTION FROM 7N-14N BETWEEN 54W-64W MOVING TOWARDS THE WINDWARD ISLANDS AND NE VENEZUELA.





TAFB Marine Forecasts

Marine forecasting timeline 1988-2000

- June 1988 - Tropical Satellite Analysis and Forecast (TSAF) Branch acquires High Seas responsibility from
  - WFO San Francisco (MIAHSFEP2)
  - WFO Miami (MIAHSFAT2)
- March 1993 – TSAF acquires High Seas responsibility for METAREA XVI – Peru (MIAHSFEP3)
- June 1995 – TSAF becomes TAFB
- June 2000 – TAFB acquires the Offshore waters forecast responsibility from
  - WFO Miami (MIAOFFNT3)
  - WFO New Orleans/Slidell (MIAOFFNT4)

Marine forecasting timeline 2001- 2010

- July 2001 - TAFB added new offshore waters forecast zone to cover the Tropical North Atlantic east of the Windward/Leeward Islands
- May-Oct 2010 – TAFB provides enhanced decision support services (EDSS) in the wake of the Deepwater Horizon Oil Spill
  - Gridded marine forecasts on the NDFD http://digital.weather.gov/
  - Graphicasts http://www.nhc.noaa.gov/aboutgraphicast.shtml

Marine forecasting timeline 2011- 2017

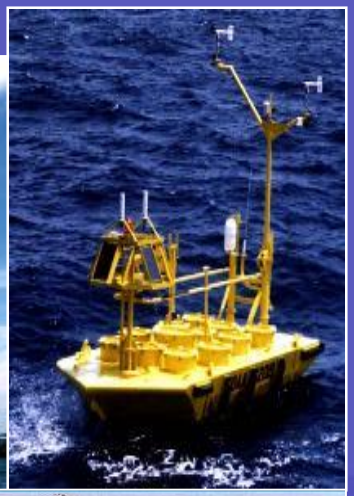
- Oct 2011 - TAFB submitted request to change marine zones in the offshore waters to smaller zones to provide more detail
- 3 April 2012 – Operational implementation of gridded marine forecasts and new offshore zones
- 20 March 2013 – TAFB marine grids on the NDFD experimentally
- 1 October 2013 - Sea State initialized in GFE using "optimum interpolation" techniques from NWP guidance/surface observations.
- September 2014 - TAFB provided full gridded backup for OPC offshore zones.

Marine forecasting timeline 2011- 2017

- August 2015 – TAFB begins provision of Spot Marine Forecasts
- May 15, 2016 – Tropical Weather Discussions will be available in Mixed-Case format
- July 20, 2016 – Experimental East Pacific offshore waters forecasts
- Aug 1, 2016 – Operational WSP- based TC Danger Graphic for mariners
- Summer 2017 – HSFEP3 transferred to Peru (Met Area XVI)

Marine Observation Systems: Available Tools

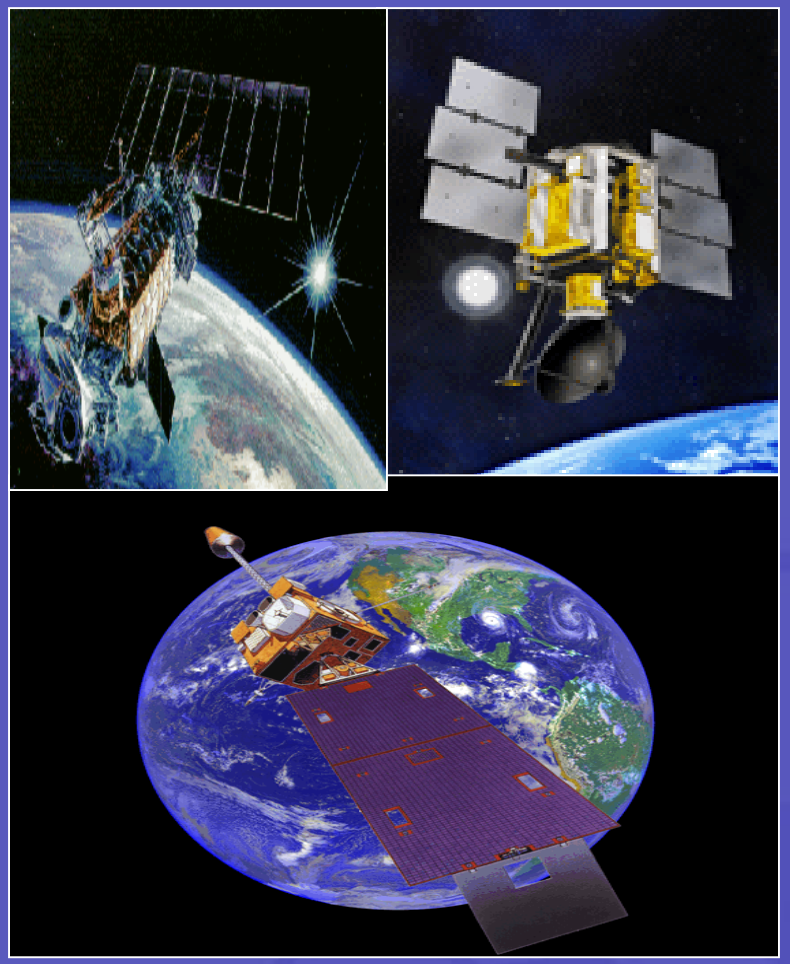
- Coastal-Marine Automated Network (C-MAN)
- Buoys (moored and drifting)
- Volunteer Observing Ship (VOS)
- Satellite Derived Products



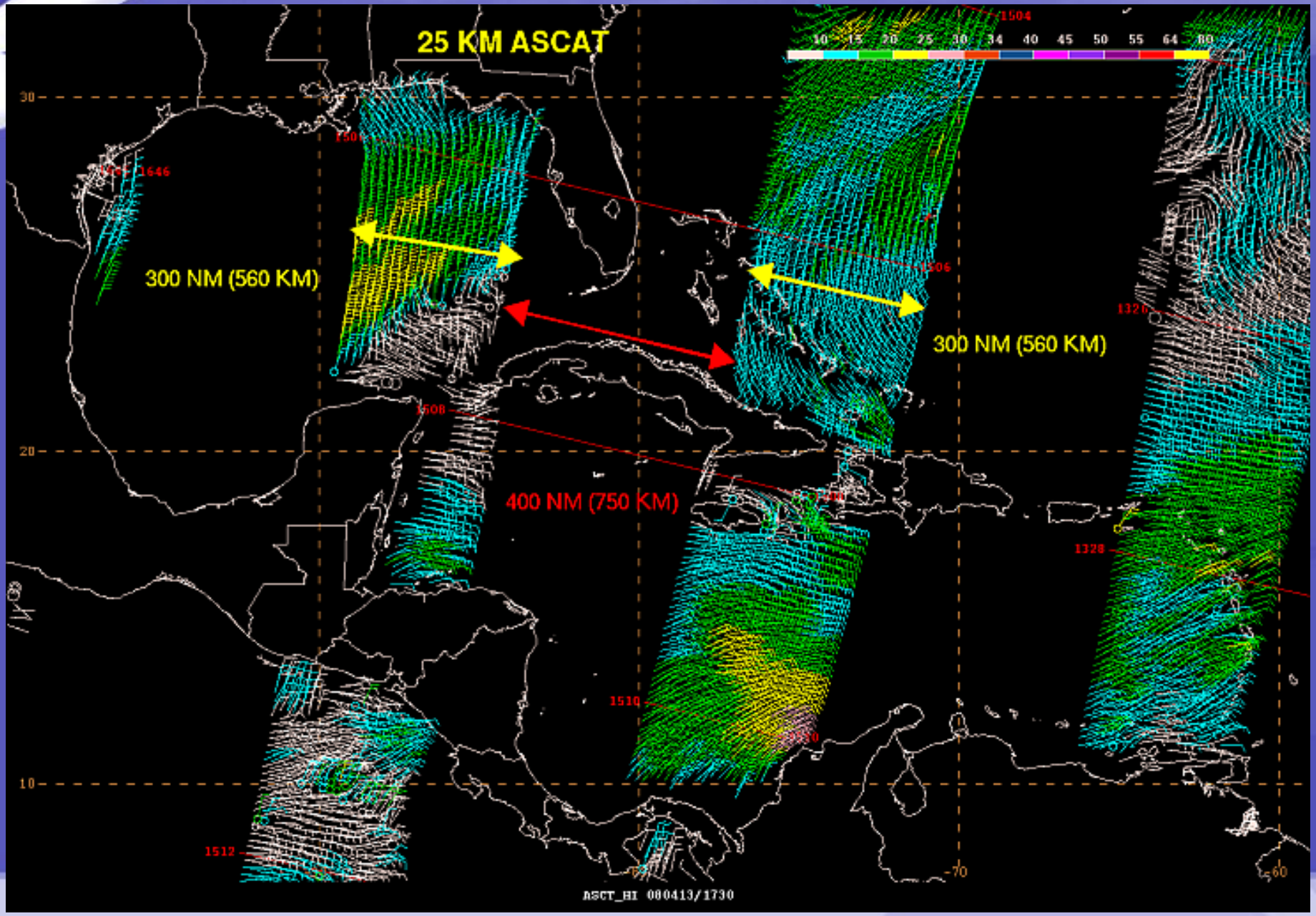
Satellite Data Sources

- WINDSAT 25 km
- ASCAT-A/B 25 km
- SSM/I (wind speed only)
- Satellite-derived winds (low-level cloud drift wind speed and direction)
- Altimeters: Jason I & II Envisat Cryosat and Sentinel

  (wave height only)
- TRMM (wind speed only)

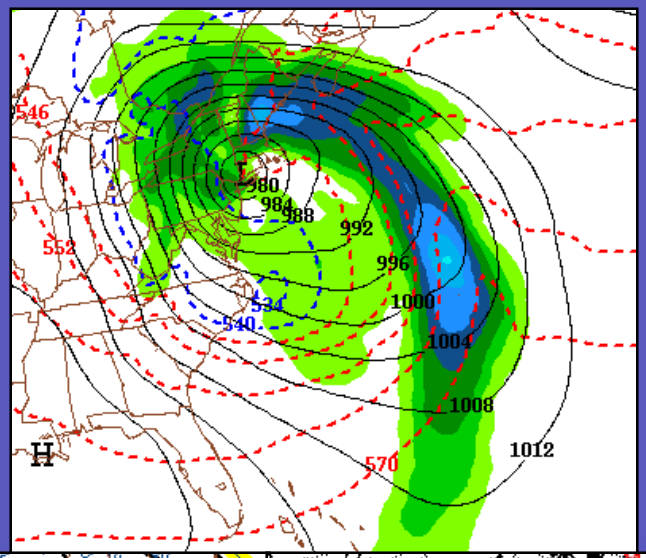


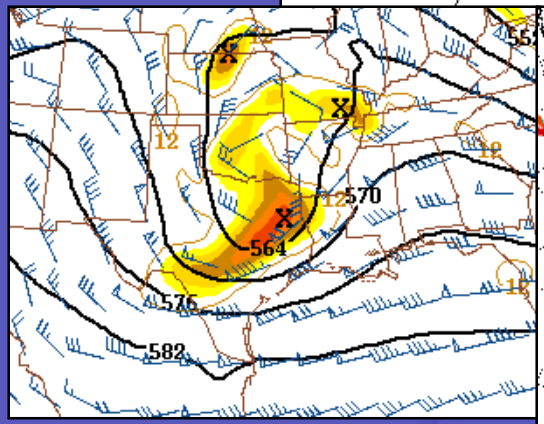
25 KM ASCAT Winds

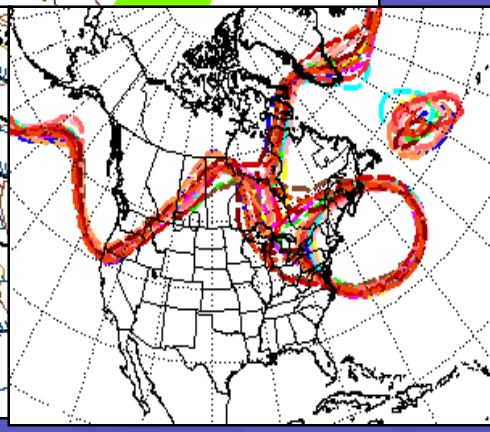


NWP Model Guidance

- GFS – Primary model for TAFB forecasters -13 km
- GFS Ensemble – Probability of 20 and 34 kt winds, mean MSLP, "spaghetti" high/low plots.
- NAM/SREF – limited domain problem for TAFB's large Area of Responsibility
- Other Global Models
  - NAVGEM
  - UKMET
  - ECMWF
  - CMC

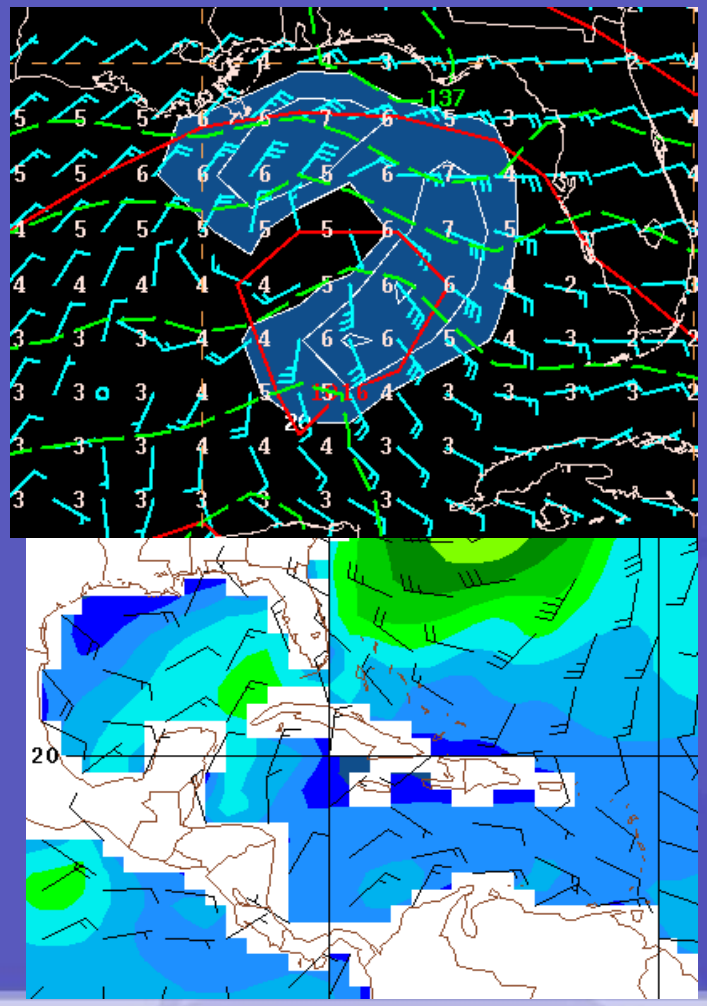


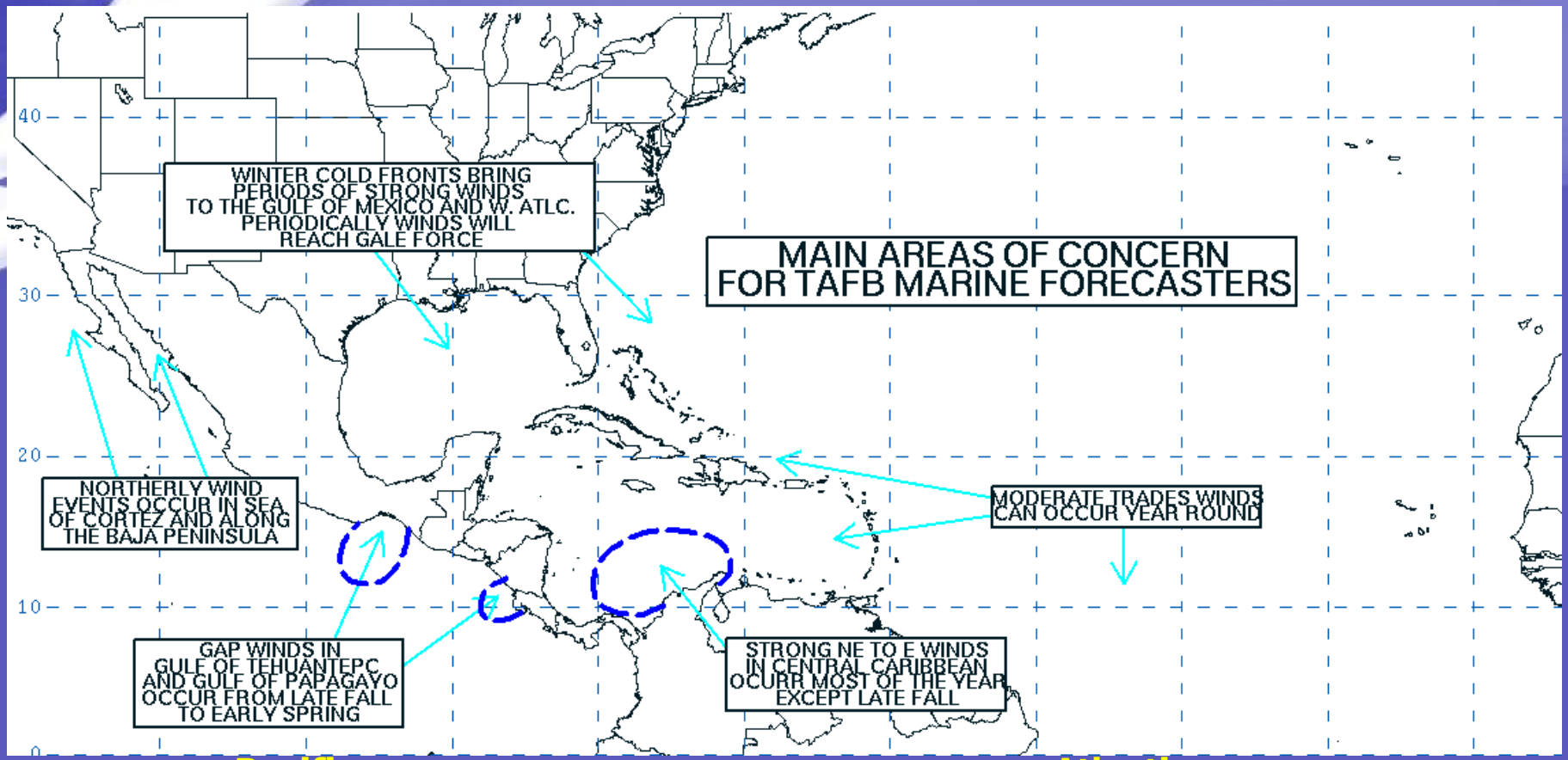




NWP Wave Model Guidance

- Multi-Grid NOAA Wavewatch III (GFS based wind field)
  - Regional scale (WNA/ENP)
  - WRF version (NAH-2014)
  - Ensembles
- NAVGEM Wave
- UKMET Wave
- ECMWF Wave
- WW3-FNMOC Ensembles





Pacific

- Cold Fronts
- NE Trades
- Funneling "Gap" winds
  - Gulf of Tehuantepec
  - Gulf of Fonseca/Papagayo
  - Gulf of Panama
  - Sea of Cortez
  - Baja California

Atlantic

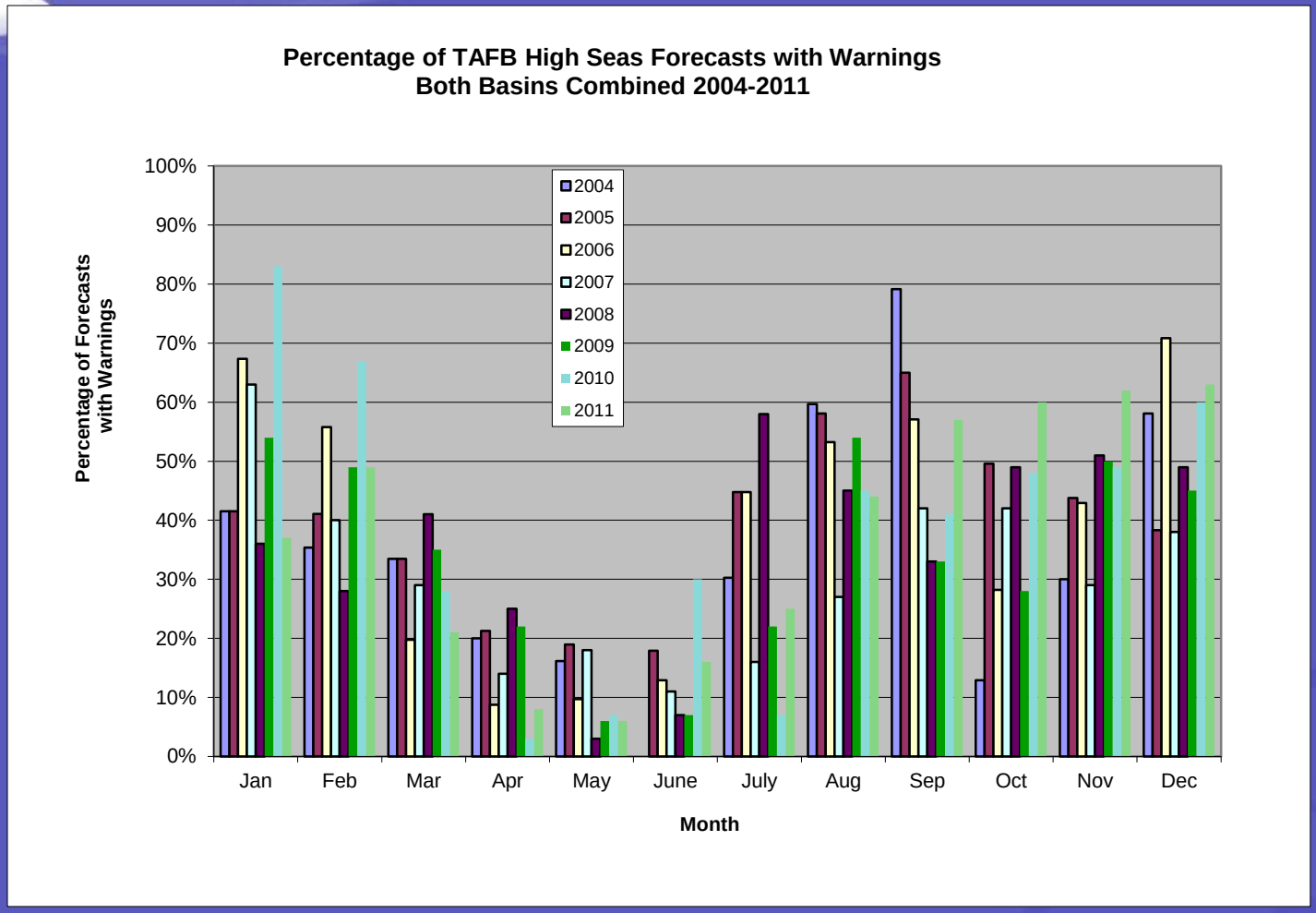
- Gales in Gulf of Mexico/SW North Atlantic in Winter
- Shelf water effect in NW Gulf of Mexico in winter
- Persistent Easterly Trades
- Funneling winds
  - Yucatan Channel
  - Florida Straits
  - Caribbean Passages
  - SW Caribbean within 60-120 NM of Colombian coast

High Seas Forecasts

- High Seas Forecast includes synopsis of primary weather features and 24 and 48 hour forecasts
- High Seas Forecasts only include winds 22.5 kt or greater and/or seas 8 ft or higher
- Significant Convection and Areas of Fog and Visibilities < 3 NM

~ 14 million sq. nautical miles

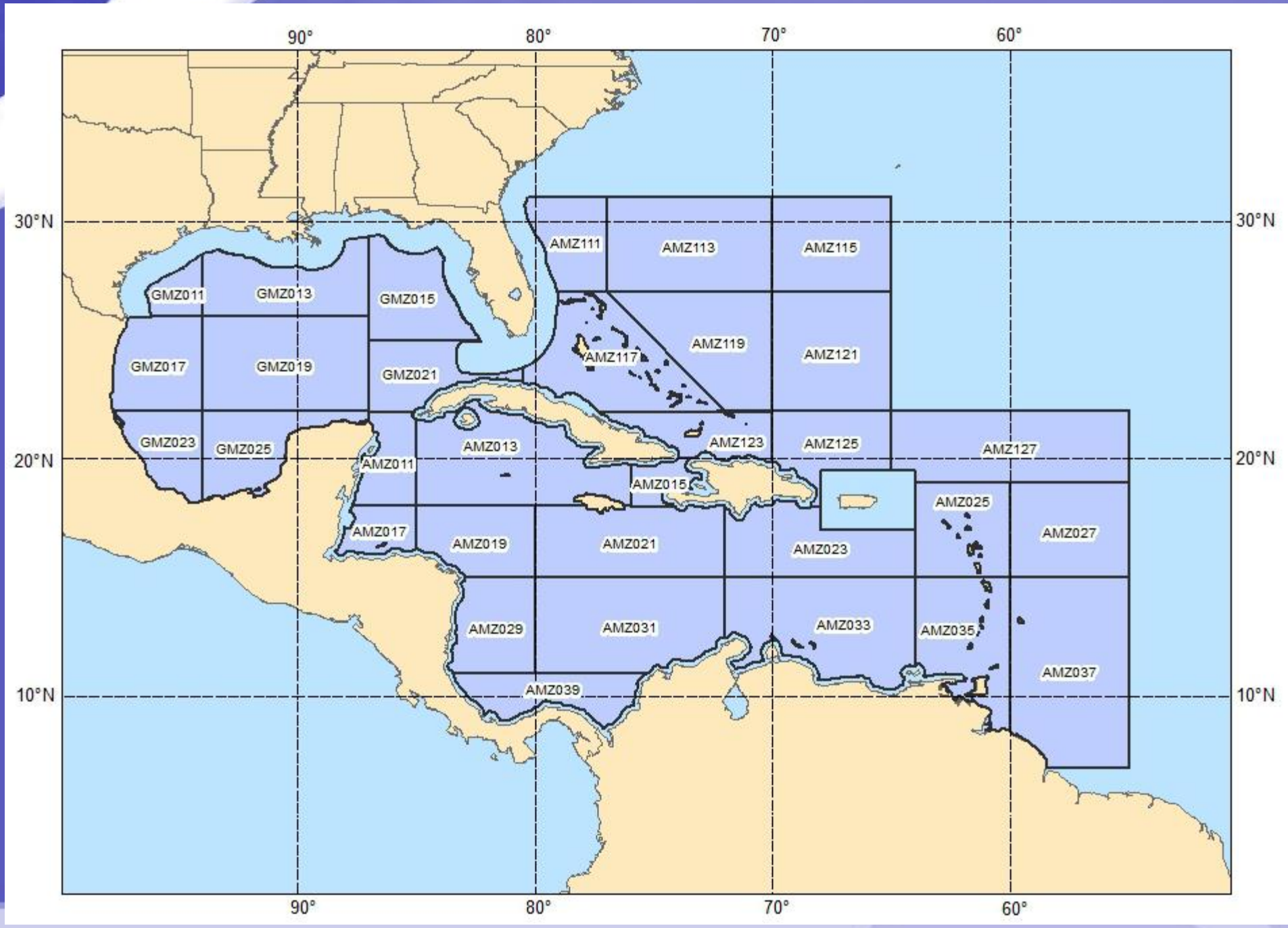
Average Monthly Percentage of TAFB High Seas Forecasts with Warnings* (Atlantic and East Pacific)



- Extratropical (Gale, Storm and Hurricane Force)
- Tropical (Tropical Storm and Hurricane)

Offshore Waters Forecasts

- Offshore Forecasts are Five (5) day forecasts geared toward recreational and smaller fishing vessels, which may spend a few days at sea
- Offshore Text forecasts derived from a gridded database through the use of text formatters, providing more detail than HSF.
- 32 zones (24 SW N Atlc/Carib and 8 GOMEX)
- Light winds may be stated as “5 to 10 kt”, seas are forecast down to nearest foot.
- Offshore forecasts are period rather than event driven


90°
80°
70°
60°
30°N
20°N
10°N
GMZ011
GMZ013
GMZ015
GMZ017
GMZ019
GMZ021
GMZ023
GMZ025
AMZ111
AMZ113
AMZ115
AMZ117
AMZ119
AMZ121
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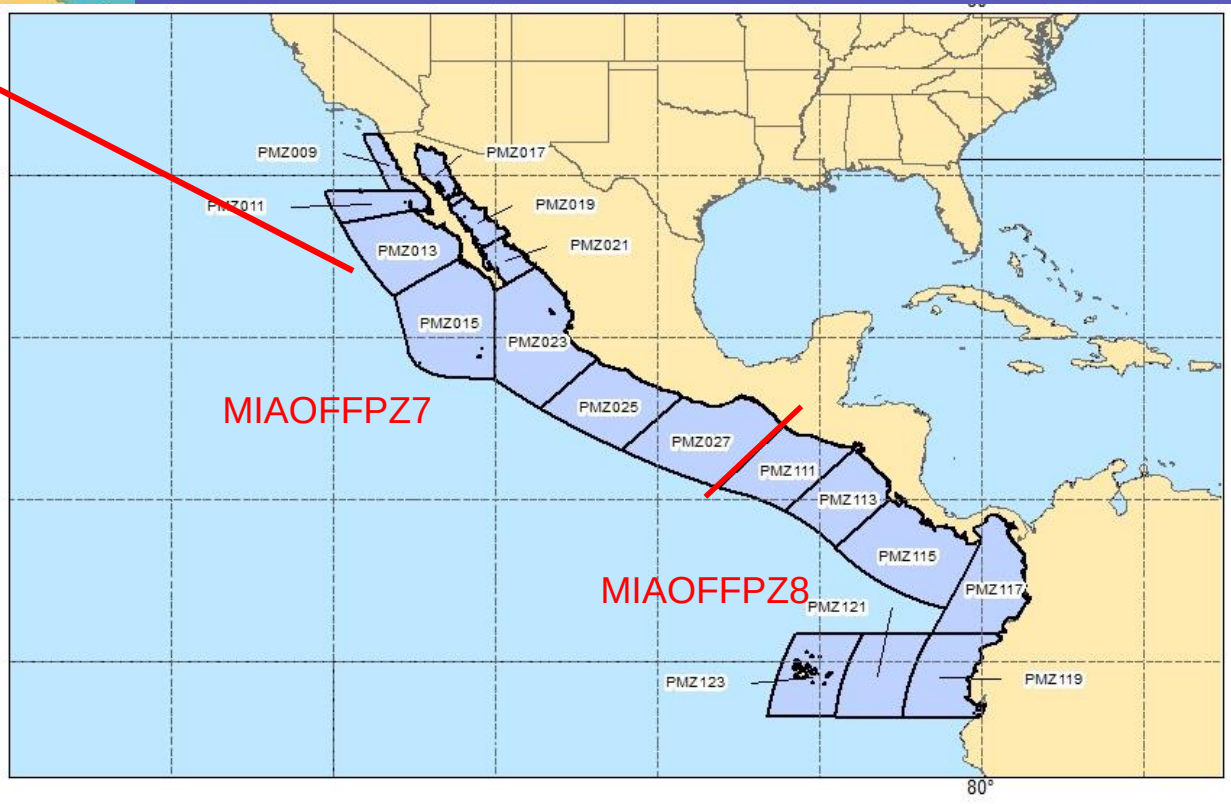
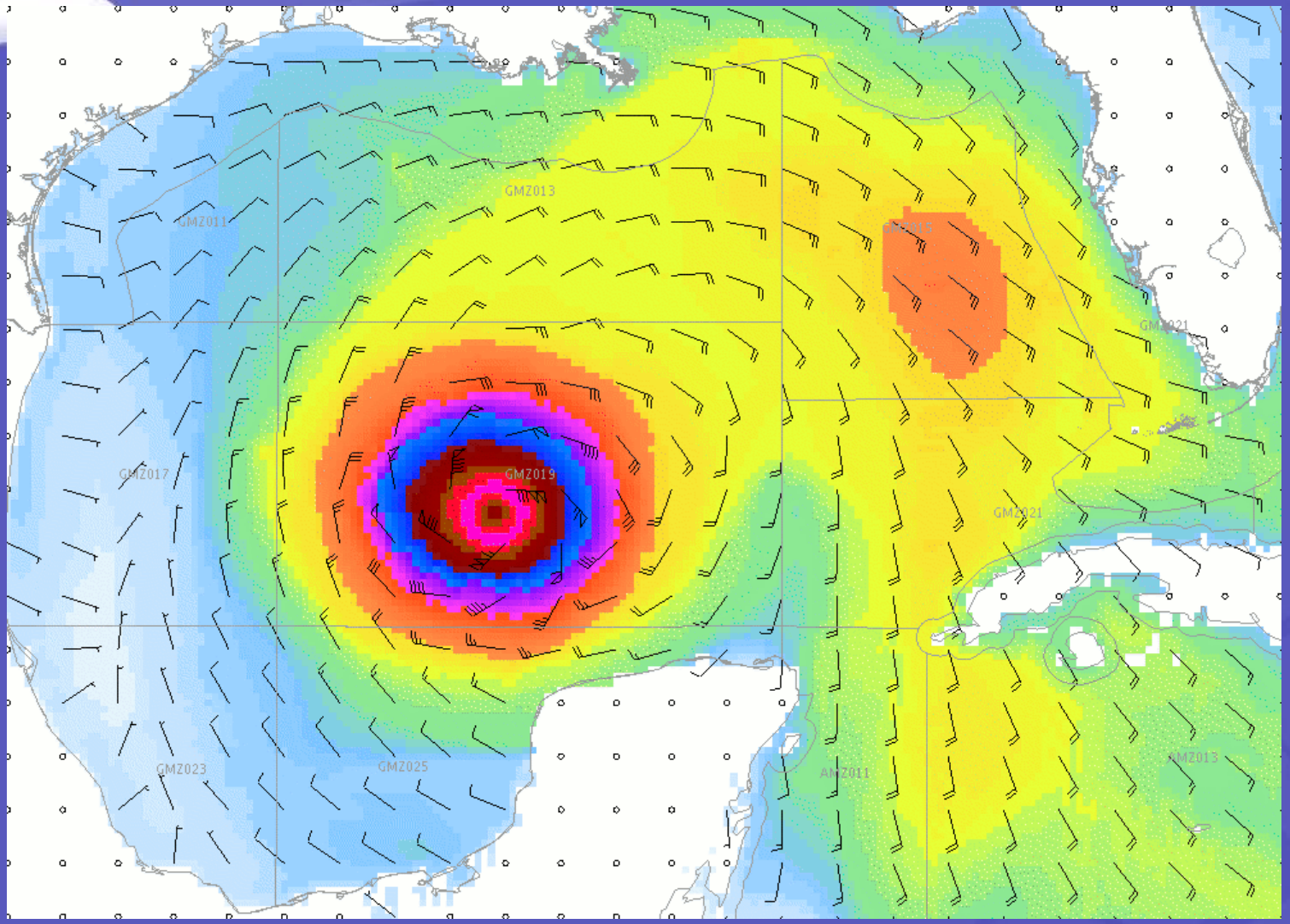
Experimental East Pacific Offshore Waters



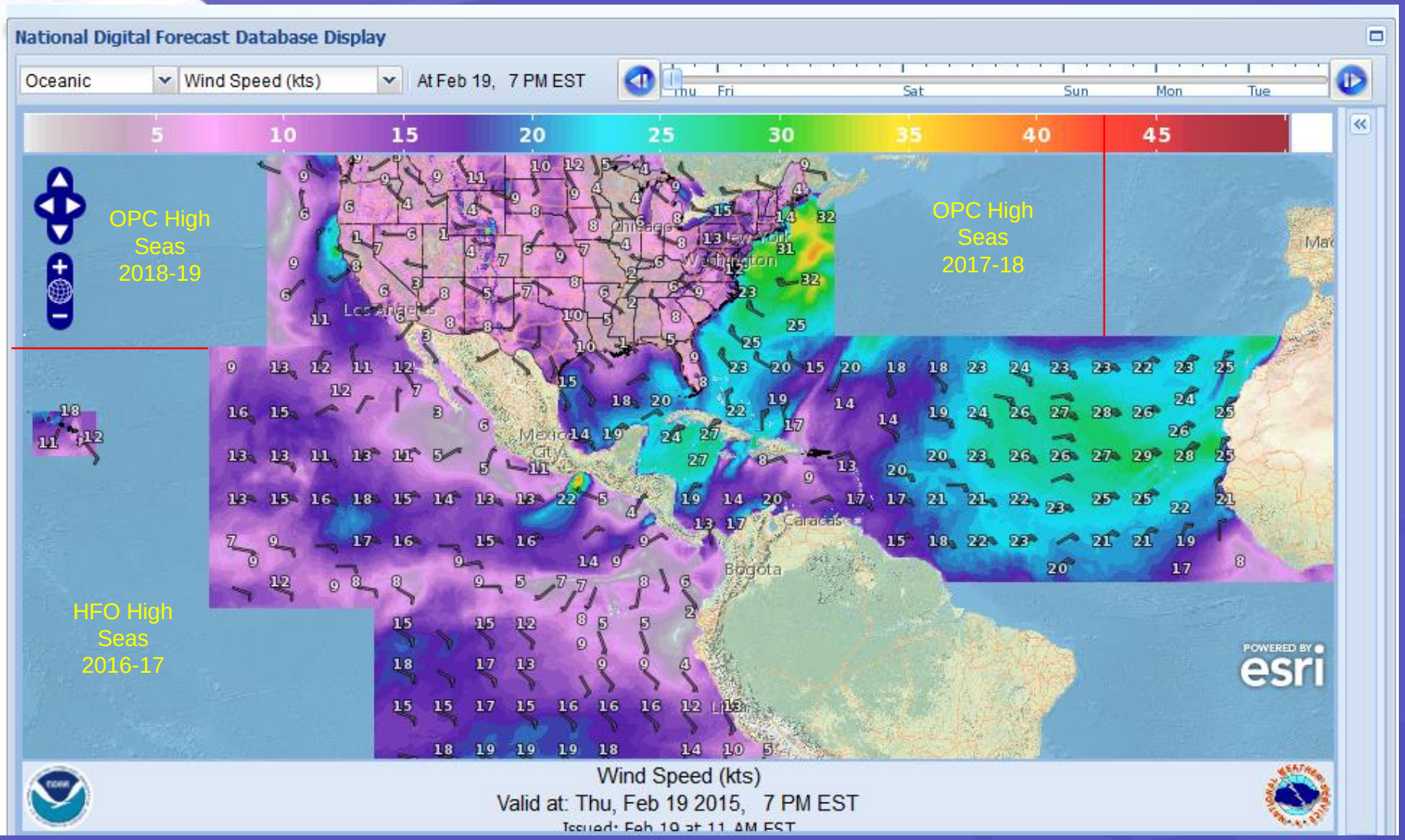
TAFB NDFD Gridded Marine Forecasts

- Spatial/Temporal resolution
  - 10 KM
  - 3-Hourly out to 72 hours
  - 6-Hourly 78-156 hours
- Parameters
  - 10-M Wind/Gusts w/ TCM Wind Tool
  - Significant Wave Height
  - Primary/Secondary Swell HGHT/Period/Direction (Not in NDFD)
  - Hazards

Gridded 10-m winds – Example Hurricane
34-50-64 (100) KT wind radii generated from TCM Wind Tool



NC Gridded Marine on NDFD



Marine Weather Discussion

- ***MIAMIMATS (AGXX40 KNHC)***
- **Issued Twice Daily – between 2:00-3:00 AM/PM**
- **Sections of Product**
  - Synopsis and Forecast Discussion
  - Current Warnings (Gale, Storm, T.C.)
- **Discussion Area**
  - Gulf of Mexico
  - Caribbean Sea
  - Southwest N Atlantic S of 31N W of 55W
- **Synopsis/Discussion**
  - Major synoptic scale features influencing Offshore Waters area
  - Significant/relevant surface/ship/buoy observations
  - SSMI/ASCAT Observations
  - Performance of models (GFS, NOGAPS, NWW3) with current forecast scenarios

Marine Weather Discussion
Coordination Tool

Marine Weather Discussion
NWS National Hurricane Center Miami FL
200 AM EST MON JAN 2 2017

Marine Weather Discussion for the Gulf of Mexico, Caribbean Sea, and Tropical North Atlantic from 07N to 19N between 55W and 64W and the Southwest North Atlantic including the Bahamas

...GULF OF MEXICO...

MODEL PREFERENCE: Global model consensus. Medium-high confidence.

A ridge extends from central Florida to southern Texas with fresh to locally strong southerly return flow expected to persist south of a low pressure area tracking east across the gulf coast states through Tuesday night. A weak cold front trailing from the low pressure area will skirt the coastal zones, with a surface trough extending south from the front to around 26N. Expect widespread showers and a few thunderstorms in the northern gulf this evening through Tuesday morning as the trough sweeps east over the area. Southerly winds will diminish to 15-20 kt by this evening behind the trough across north-central waters. High pressure building over the southern states Wednesday will push a cold front into the northern Gulf Wednesday, which will extend from southern Florida to central Mexico Thursday. The front will stall and weaken across the southern gulf Friday. Models are fairly good agreement, except for the European forecast, which depicts a much weaker front that stalls across the central gulf Wednesday night, and lifts it north as a warm front Thursday.

...CARIBBEAN SEA AND TROPICAL N ATLANTIC FROM 07N TO 19N BETWEEN55W AND 64W...

MODEL PREFERENCE: Global model consensus. High confidence.

The gradient between Atlantic high pressure and persistent low pressure over northern Colombia is supporting strong trade winds and 8-11 ft seas across the central Caribbean, with brief minimal gales expected tonight and again very briefly Mon night near the coast of Colombia, with seas building to 13-14 ft just downstream of the gale area. Locally strong trades will develop across the eastern Caribbean later today. Winds and seas will slowly subside across the forecast area Tuesday through Thursday. A weakening cold front is expected to stall and dissipate near the Yucatan Channel Thursday into Friday.

...SW N ATLANTIC INCLUDING THE BAHAMAS...

MODEL PREFERENCE: Global model consensus. Medium-high confidence.

A ridge extends from 31N65W to central Florida, and a weakening frontal boundary extends along 23N east of the Bahamas. Fresh to locally strong trades are occurring south of the ridge, including the Atlantic approaches to the Windward Passage. Little change is expected through Tuesday, when the gradient will relax somewhat across the tropics. Southwest winds will increase over the far NW waters ahead of a cold front moving off the Georgia coast Tuesday evening. The front will trail a surface trough across the waters north of 27N Wednesday and Thursday. A reinforcing cold front is expected to reach the northwest waters Thursday night, and extend from 31N70W across the Bahamas to the Straits of Florida Friday.

$$

.WARNINGS...Any changes impacting coastal NWS offices will be coordinated through AWIPS II Collaboration Chat, or by telephone:

.GULF OF MEXICO...
None.

.CARIBBEAN SEA AND TROPICAL N ATLANTIC FROM 07N TO 19N BETWEEN 55W AND 64W...
.AMZ031...CARIBBEAN FROM 11N TO 15N BETWEEN 72W AND 80W INCLUDING COLOMBIA BASIN...
Gale Warning early today into tonight.

.SW N ATLANTIC INCLUDING THE BAHAMAS...
None.

$$

*For detailed zone descriptions, please visit:
http://www.nhc.noaa.gov/abouttafbprod.shtml#OWF

Note: gridded marine forecasts are available in the National Digital Forecast Database (NDFD) at:
http://www.nhc.noaa.gov/marine/grids.php

For additional information, please visit:
http://www.nhc.noaa.gov/marine

$$

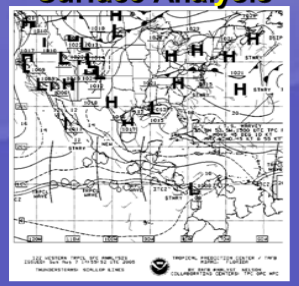
.Forecaster Mundell. National Hurricane Center.

Suite of Marine Radiofax Charts Produced by TAFB

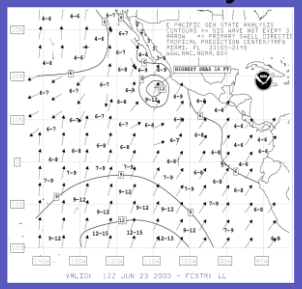
Pt. Reyes and Honolulu Radiofax

Pt. Reyes Broadcast Frequencies	Honolulu Broadcast Frequencies
4346 kHz	9982.5 kHz
8682 kHz	11090 kHz
12786 kHz	16135 kHz
17151.2 kHz	23331.5 kHz
22527 kHz	

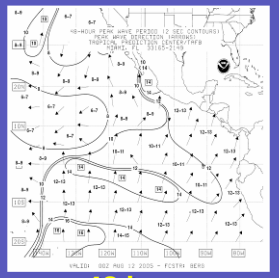
Surface Analysis



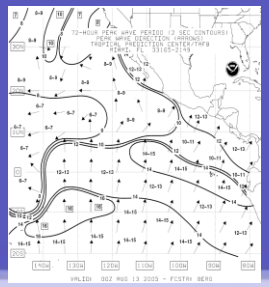
Sea State Analysis



Peak Wave Period & Swell Direction



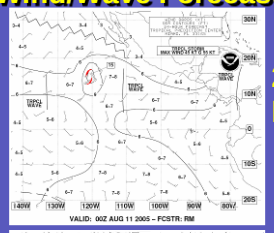
48 hr.



72 hr.

Wind/Wave Forecasts

24 hr.



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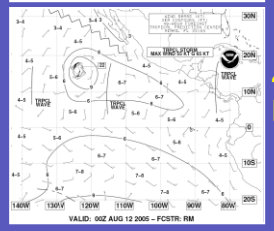

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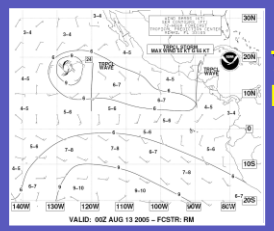
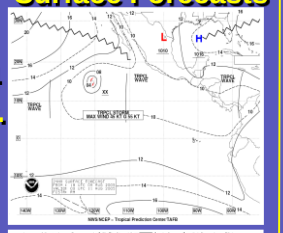
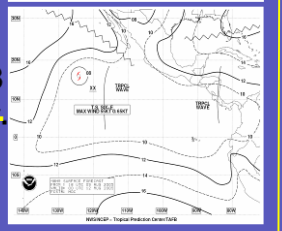
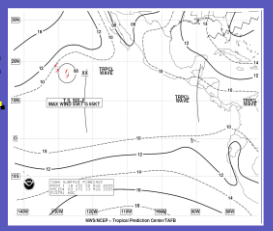


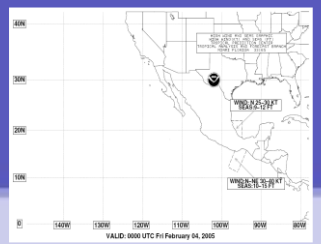
Surface Forecasts



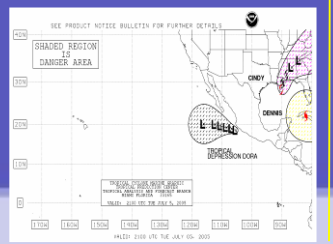




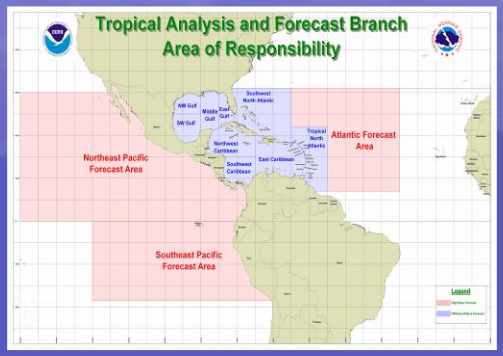
High Wind Graphic



TC Danger Graphic



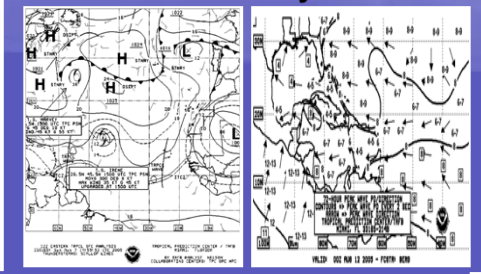
Tropical Analysis and Forecast Branch Area of Responsibility



New Orleans Radiofax

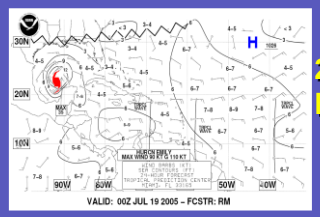
New Orleans Broadcast Frequencies
4317.9 kHz
8503.9 kHz
12789.9 kHz
17146.9 kHz

Surface Analysis

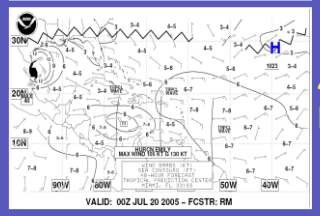


Wind/Wave Forecasts

24 hr.



48 hr.



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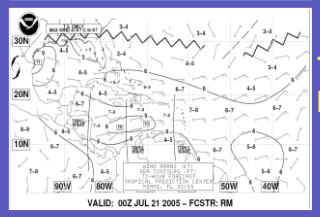
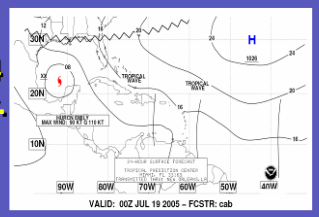
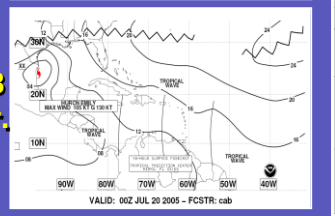
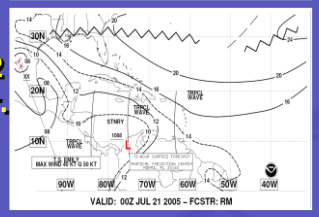


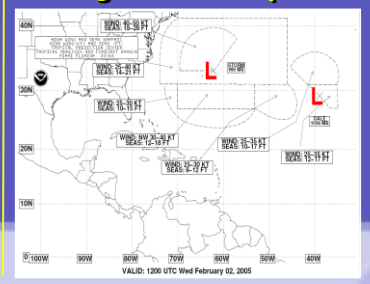
Surface Forecasts



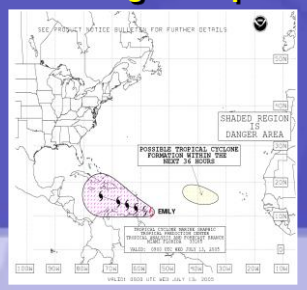




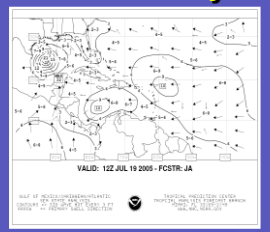
High Wind Graphic



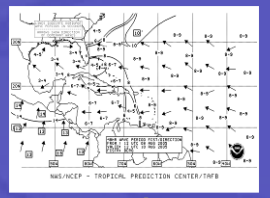
TC Danger Graphic



Sea State Analysis



Peak Wave Period & Swell Direction



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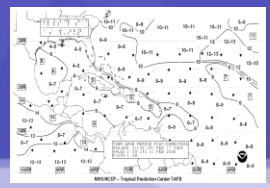

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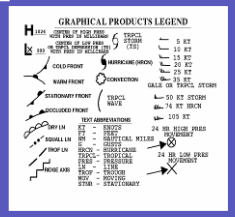
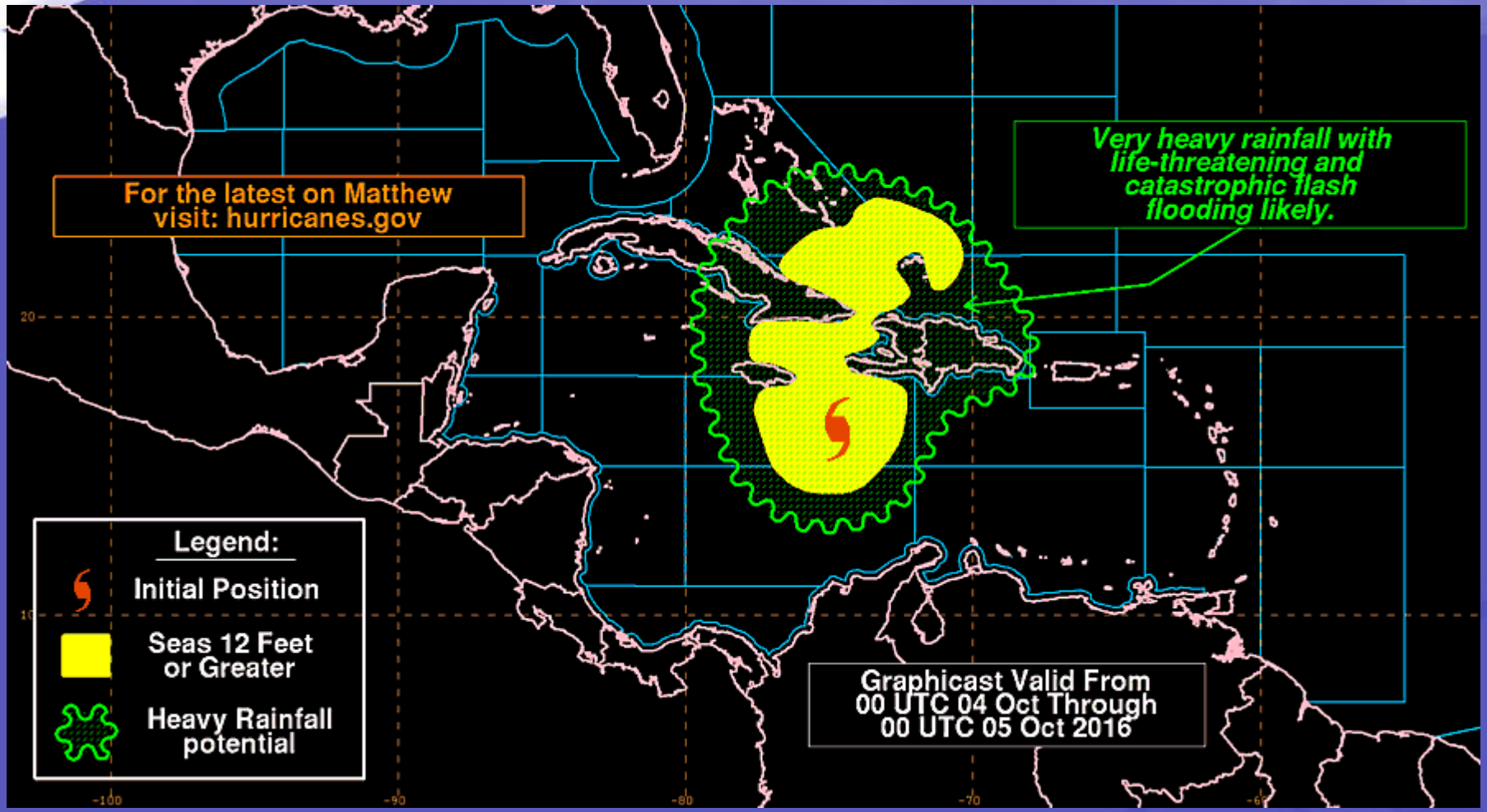


Decision Support Graphicast



New NHC Rainfall Product: Prototype Text

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TCCA22 KNHC 291843
STDWCA

SATELLITE TROPICAL DISTURBANCE RAINFALL ESTIMATES
NWS NATIONAL HURRICANE CENTER MIAMI FL
2115 UTC TUE AUG 29 2009

SYSTEM NAME                    DATE/TIME          LOCATION
-----------                    ---------          --------
T.S ANDRES                     29/1800 UTC        17.2N 102.3W

RAINFALL ESTIMATED BY SATELLITE VIA QMORPH...
24-HOUR RAINFALL MAXIMUM (FROM 18-18 UTC)- 235 MM AT 23.3N  99.2W
6-HOUR RAINFALL MAXIMUM (FROM 12-18 UTC)- 150 MM AT 24.2N 100.5W
RAINFALL DISTRIBUTION IN MM OVER THE LAST 6-HOURS (FROM 12-18 UTC)...

LATITUDE.........................LONGITUDE.........................
.......104W-103W 103W-102W 102W-101W 101W-100W 100W- 99W  99W- 98W
27-28N     0- 40      5- 40     10- 45     10- 45     10- 30      0- 20
26-27N     5- 40     10- 45     15- 55     20- 50     15- 30      5- 20
25-26N    15- 45     20- 70     35- 85     60-100     30- 70     20- 45
24-25N    40- 76     55-100    100-130    110-150     60-100     40- 75
23-24N    20- 50     45- 70     70- 90     70- 95     40- 65     15- 40
22-23N     0- 35      5- 40     10- 30     10- 25      5- 25      0- 10
.....................................................................

RAINFALL ESTIMATED BY SATELLITE VIA NRL-BLEND.
24-HOUR RAINFALL MAXIMUM (FROM 18-18 UTC)- 295 MM AT 23.3N  98.7W
6-HOUR RAINFALL MAXIMUM (FROM 12-18 UTC)- 125 MM AT 24.6N 100.2W
RAINFALL DISTRIBUTION IN MM OVER THE LAST 6-HOURS (FROM 12-18 UTC)...

LATITUDE.........................LONGITUDE.........................
.......104W-103W 103W-102W 102W-101W 101W-100W 100W- 99W  99W- 98W
27-28N     0- 35      5- 40     10- 45     10- 45      5- 25      0- 20
26-27N     0- 35     10- 45     15- 50     20- 50     10- 30      5- 20
25-26N    15- 45     20- 70     35- 80     65-100     25- 70     15- 45
24-25N    35- 75     55- 95    100-120    110-125     60-100     35- 75
23-24N    20- 45     45- 75     65- 85     70- 95     35- 70     15- 40
22-23N     0- 30      5- 40     10- 30     10- 30      5- 25      0- 10
.....................................................................

RAINFALL HINDCAST FROM THE 06Z GFS MODEL.
24-HOUR RAINFALL MAXIMUM (FROM 18-18 UTC)- 305 MM AT 23.1N 101.8W
6-HOUR RAINFALL MAXIMUM (FROM 12-18 UTC)- 130 MM AT 24.9N 101.9W
RAINFALL DISTRIBUTION OVER THE LAST 6-HOURS (FROM 12-18 UTC)...

LATITUDE.........................LONGITUDE.........................
.......104W-103W 103W-102W 102W-101W 101W-100W 100W- 99W  99W- 98W
27-28N     0- 30      5- 40     10- 45     15- 45      5- 25      0- 20
26-27N     0- 35     10- 45     15- 45     20- 50     10- 30      5- 20
25-26N    15- 45     20- 70     35- 85     60-100     30- 70     20- 45
24-25N    35- 75     55-100    100-130    100-125     65-100     40- 75
23-24N    20- 45     45- 70     70- 85     70- 95     40- 70     15- 40
22-23N     5- 35      5- 40     10- 30     10- 25      5- 25      0- 10
.....................................................................

DIFFERENCES BETWEEN THE SATELLITE AND MODEL DERRIVED RAINFALL
ESTIMATES INDICATE UNCERTAINTY IN THE AMOUNT OF RAIN RECEIVED

RAINFALL MAY BE UNDERESTIMATED ON THE WINDWARD SIDE OF TERRAIN

FOR ADDITIONAL INFORMATION PLEASE VISIT
HTTP://WWW.HURRICANES.GOV/RAINFALL

FORECASTER NELSON
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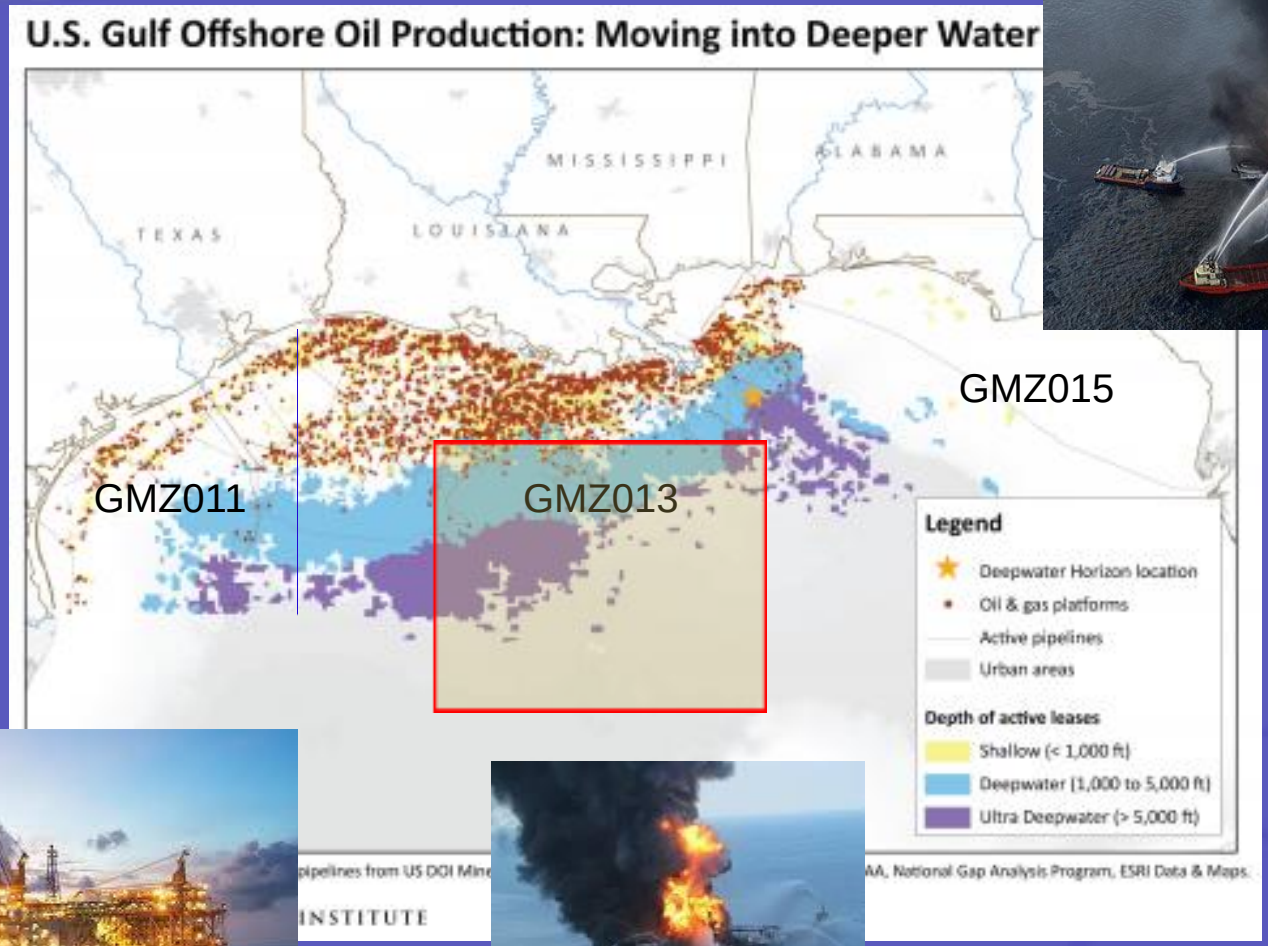
- Similar to old text product in format, with differences in content:
- 24-hour QPE from 3 methods
  - Presented as a range of rainfall within a 1°x1° box
  - Covers total area of 6°x6° centered near disturbance
- Earth-relative coordinates (i.e. no reference to "left-of-center"/"right of center")

TAFB Plans 2017-20

- Enhanced marine products on the web
  - Point and click forecasts (MFM, Zones)
- Enhanced Decision Support Services (Local high resolution grids)
- Enhanced Ecological Support Services (HAB, Oil Spill)
- Collaborate/expansion of gridded marine forecasts with International MET services

Possible nested GFE/SWAN domains for Gulf of Mexico Offshore DSS



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  305-229-4424 (Atlantic)
  305-229-4426 (Analyst)
  305-229-4454 (Hugh Cobb)

E-mail: Hugh.Cobb@noaa.gov