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# **2015 Hurricane Briefing for the Institute for Catastrophic Loss Reduction**

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**Warning Preparedness Meteorologist**

**Canadian Hurricane Centre**

**Environment Canada**

# Contents

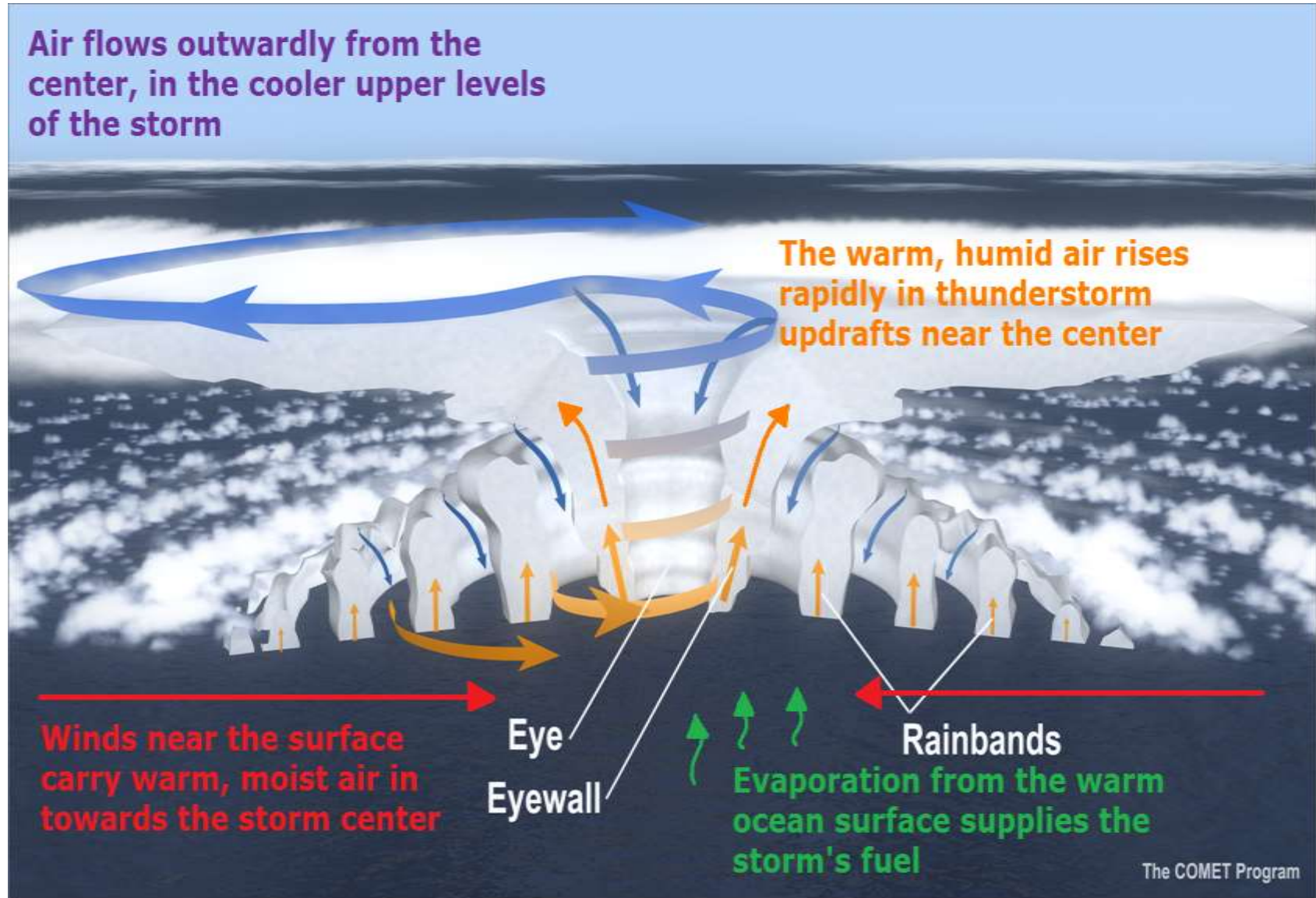
- Tropical Cyclone Primer
- Summary of the 2014 Hurricane Season
- Hurricane Readiness - Monitoring tropical cyclones during hurricane season
- Outlook for the 2015 Hurricane Season

# Tropical Cyclones

- A relatively large and long-lasting low pressure system with well-defined centre
- No fronts attached (unlike a winter storm)
- Intensity is driven by water temperature
- Classified by maximum sustained surface wind speed

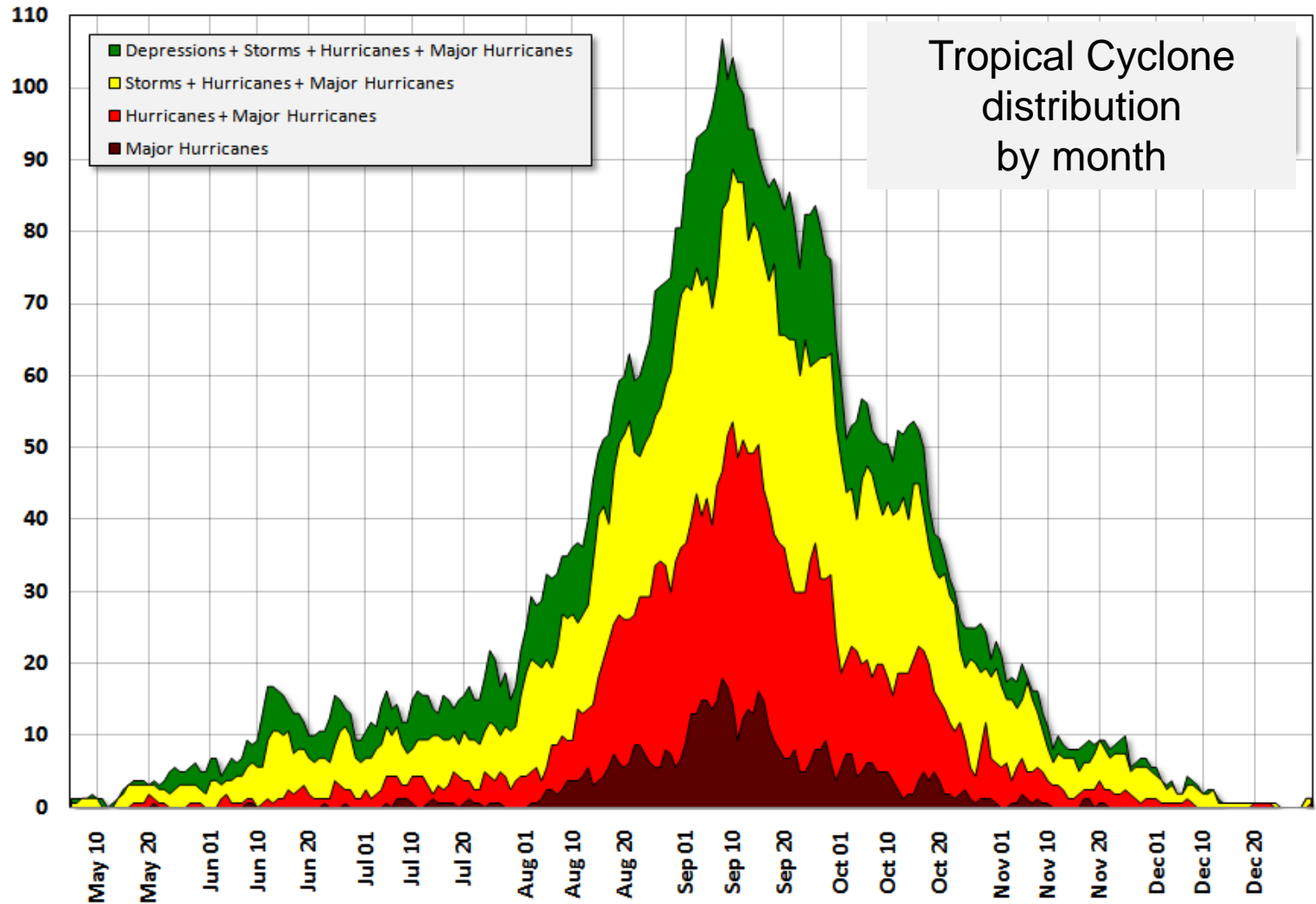


# Tropical Cyclones – Nature's Heat Engine



# Tropical Cyclone Climatology

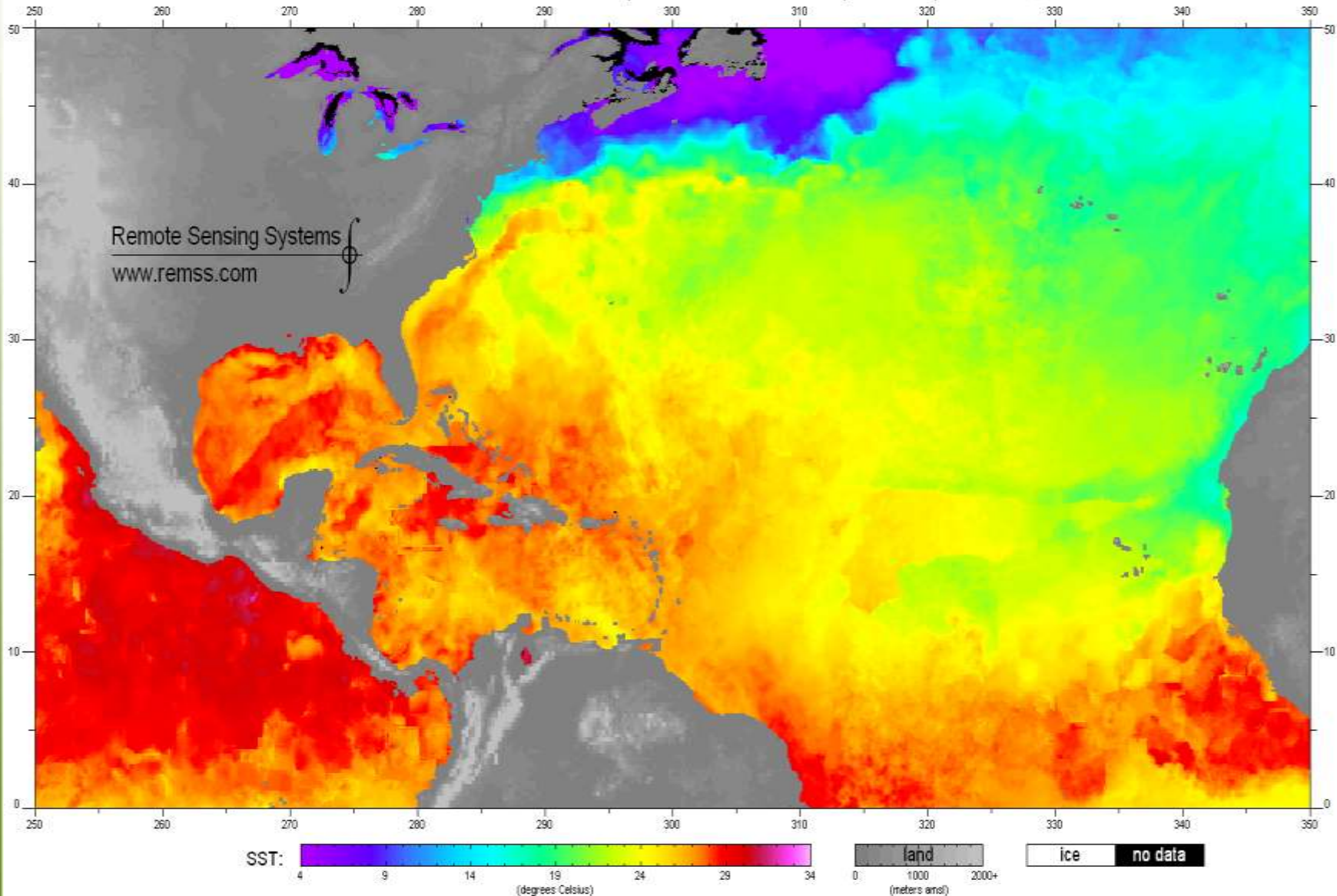
Number of North Atlantic Basin Tropical Cyclones per 100 Years





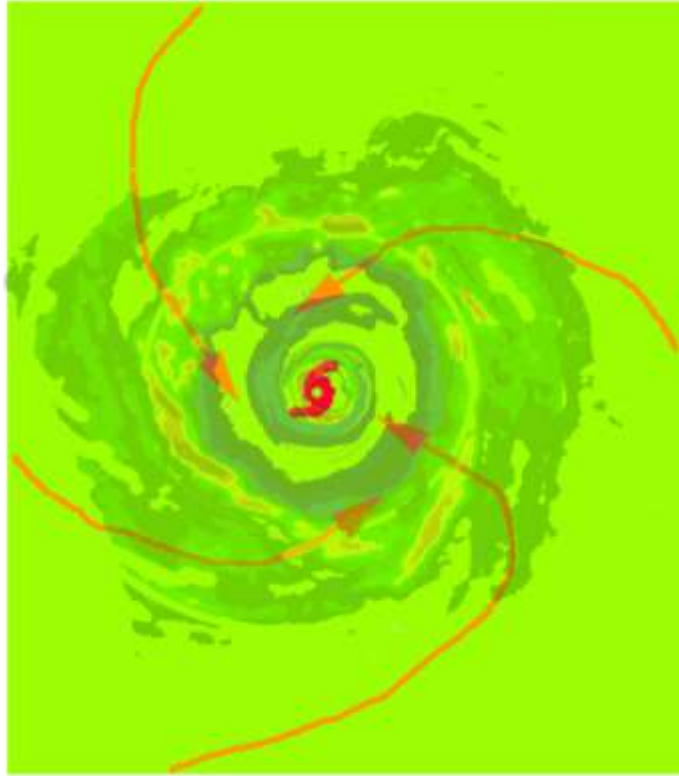
# Current Water Temperature

MW + IR OI v4.0 RT Sea Surface Temperature: 2015/06/05 (~12 UTC) - Atlantic, North



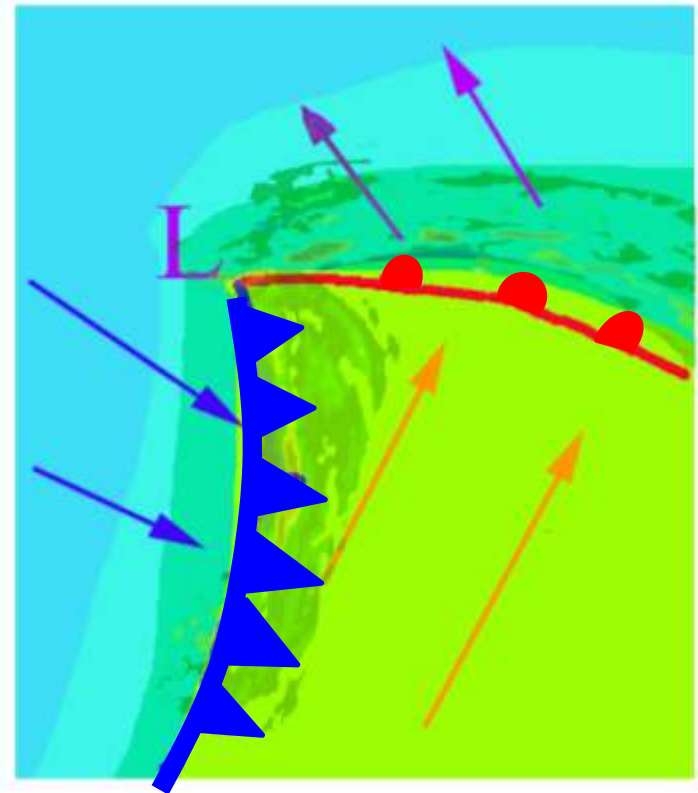
# Tropical vs. Extratropical

## Tropical



- Symmetric around the centre
- No cold sections – no fronts
- Driven by warm water temperature

## Extra-Tropical

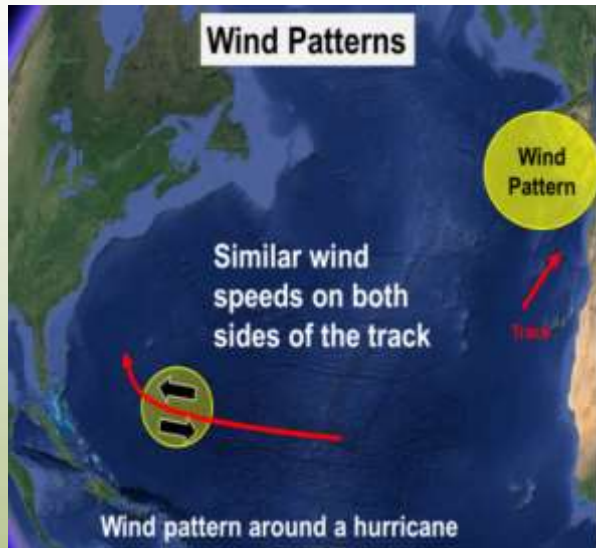


- Has a cold section and a warm section – i.e. has fronts
- Driven by horizontal temperature difference

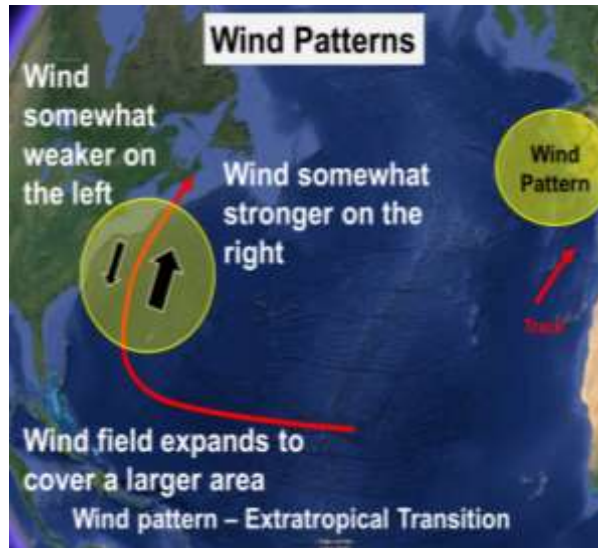


# From Tropical to Post-Tropical

Wind



Purely Tropical

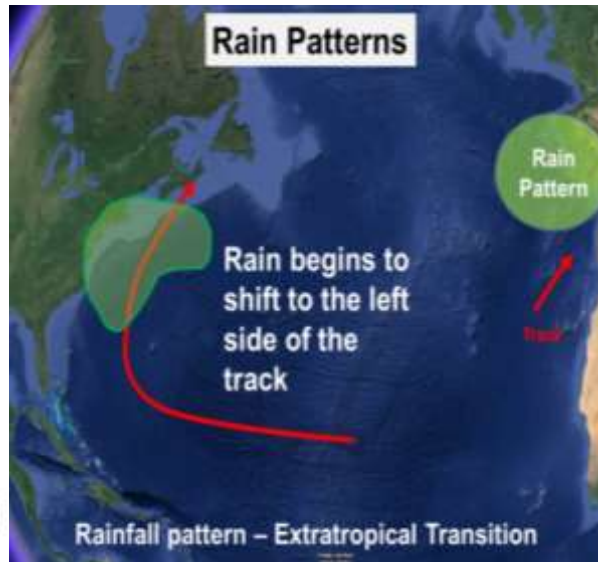
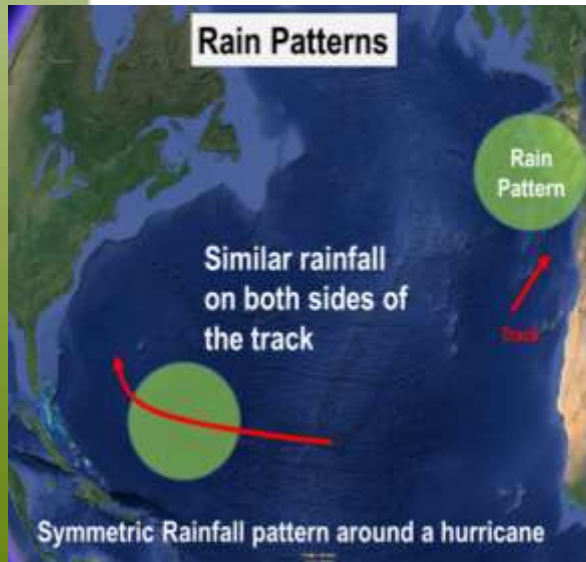


Extra-tropical transition



Post-Tropical

Rain



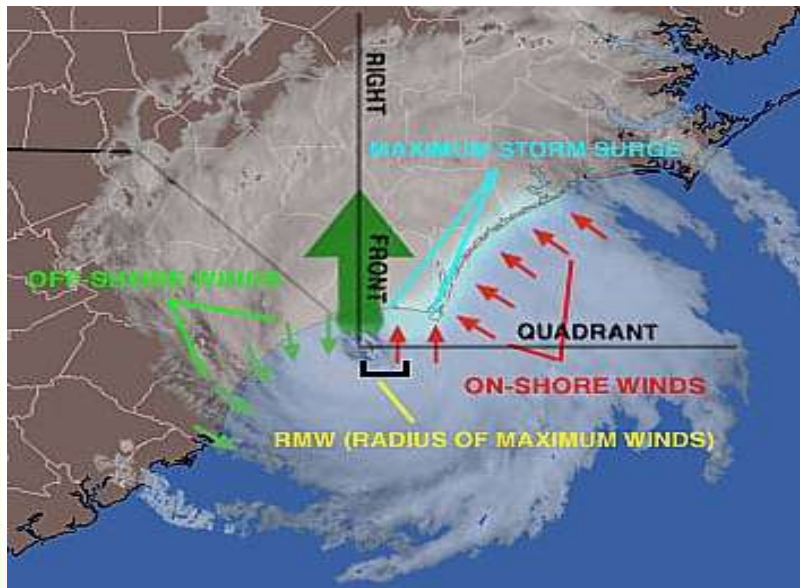
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# Tropical Cyclone Hazards

## Storm Surge

- Abnormal rise in water generated by a storm, over and above the astronomical tide
- Caused primarily by force of wind blowing across water surface
- Contribution by low pressure within center of storm is minimal



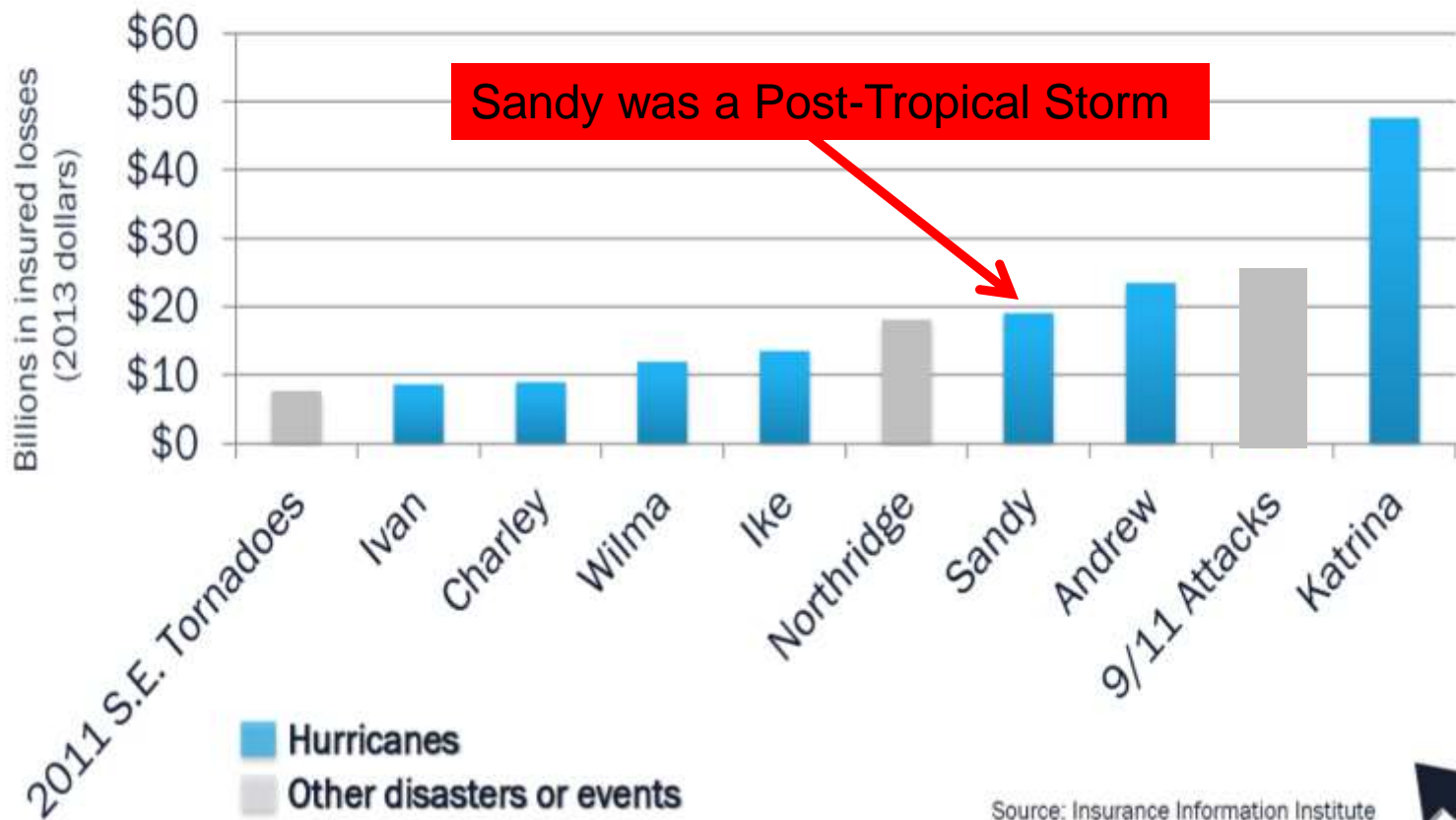
## Large Waves

- On occasion a particular phenomenon can give rise to extreme wave heights
- This threat is most significant along the Atlantic coast associated with accelerating post-tropical storms



# Tropical vs. Extratropical

## 7 Hurricanes in Top 10 U.S. Costliest Disasters



Source: Insurance Information Institute



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# Tropical Cyclone Hazards

<b>Tropical Cyclone Hazards</b>				
<b>Storm Type</b>	<b>Wind</b>	<b>Rain</b>	<b>Surge</b>	<b>Waves</b>
<b>Tropical Storm</b>	Moderate to strong winds both sides of track	Can be on both or either side of track	Typically not a major surge producer	Depends on wind speed
<b>Hurricane</b>	Very strong winds both sides of track	Both sides of track	Can be significant - highest near and to right of track	Depends on wind speed
<b>Post-Tropical Storm</b>	Strongest winds typically right of track	Heaviest rainfall typically left of track	Can be significant - highest near and to right of track	High risk of very large waves





# Hurricane Season 2014 in Review



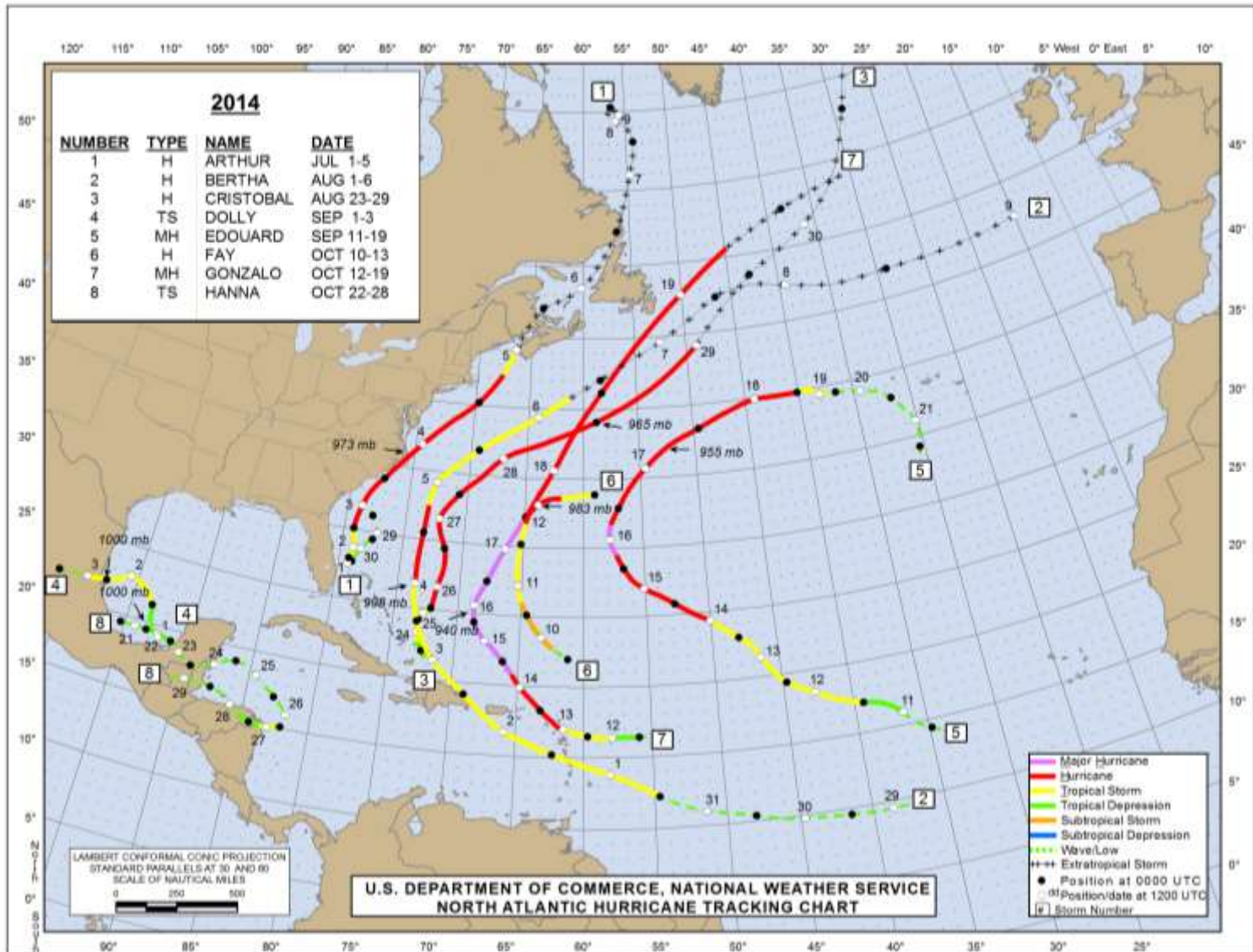
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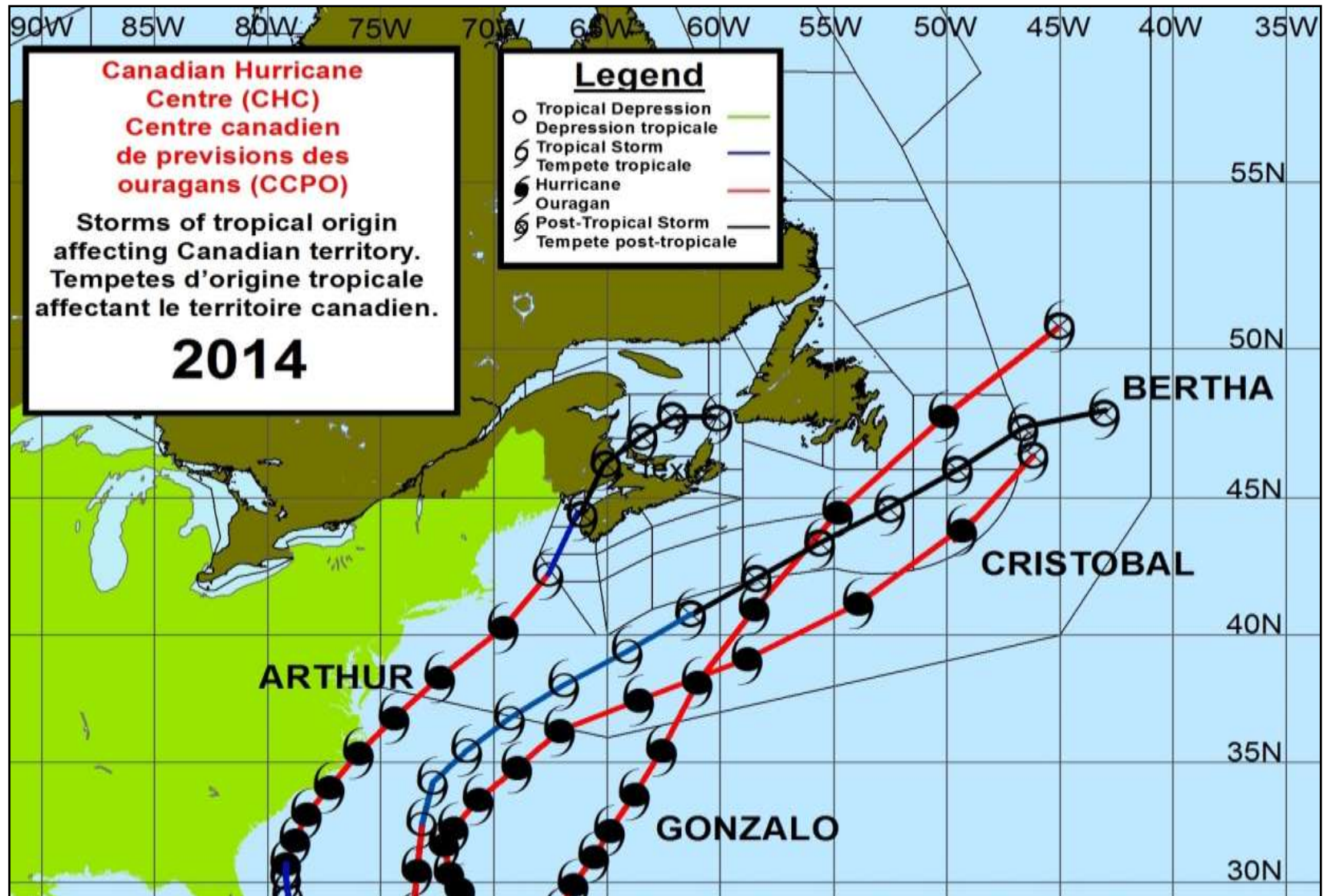
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# 2014 Season in Review

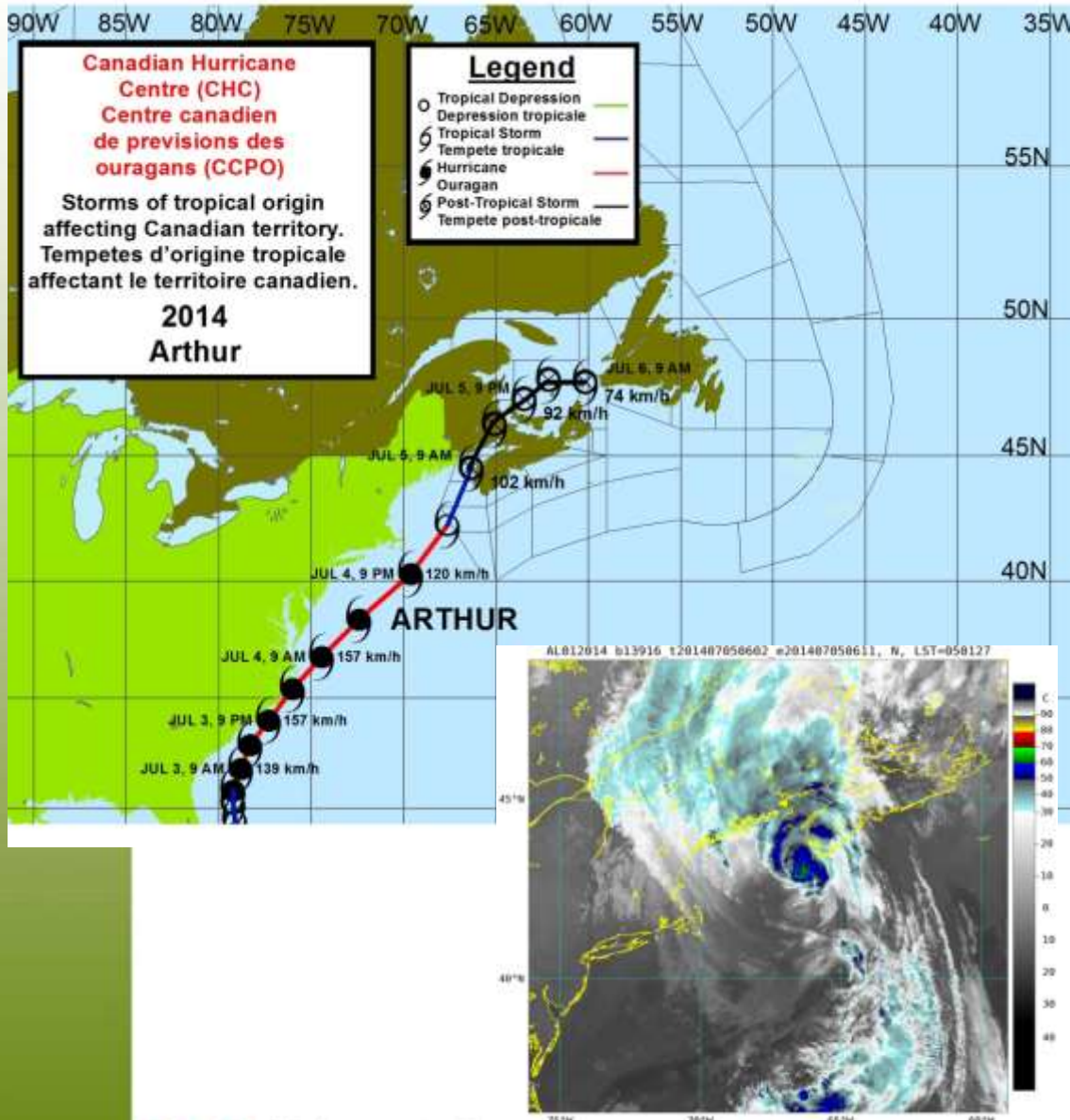


# 2014 Season in Review – CHC Response Zone





# 2014 Season in Review – Arthur

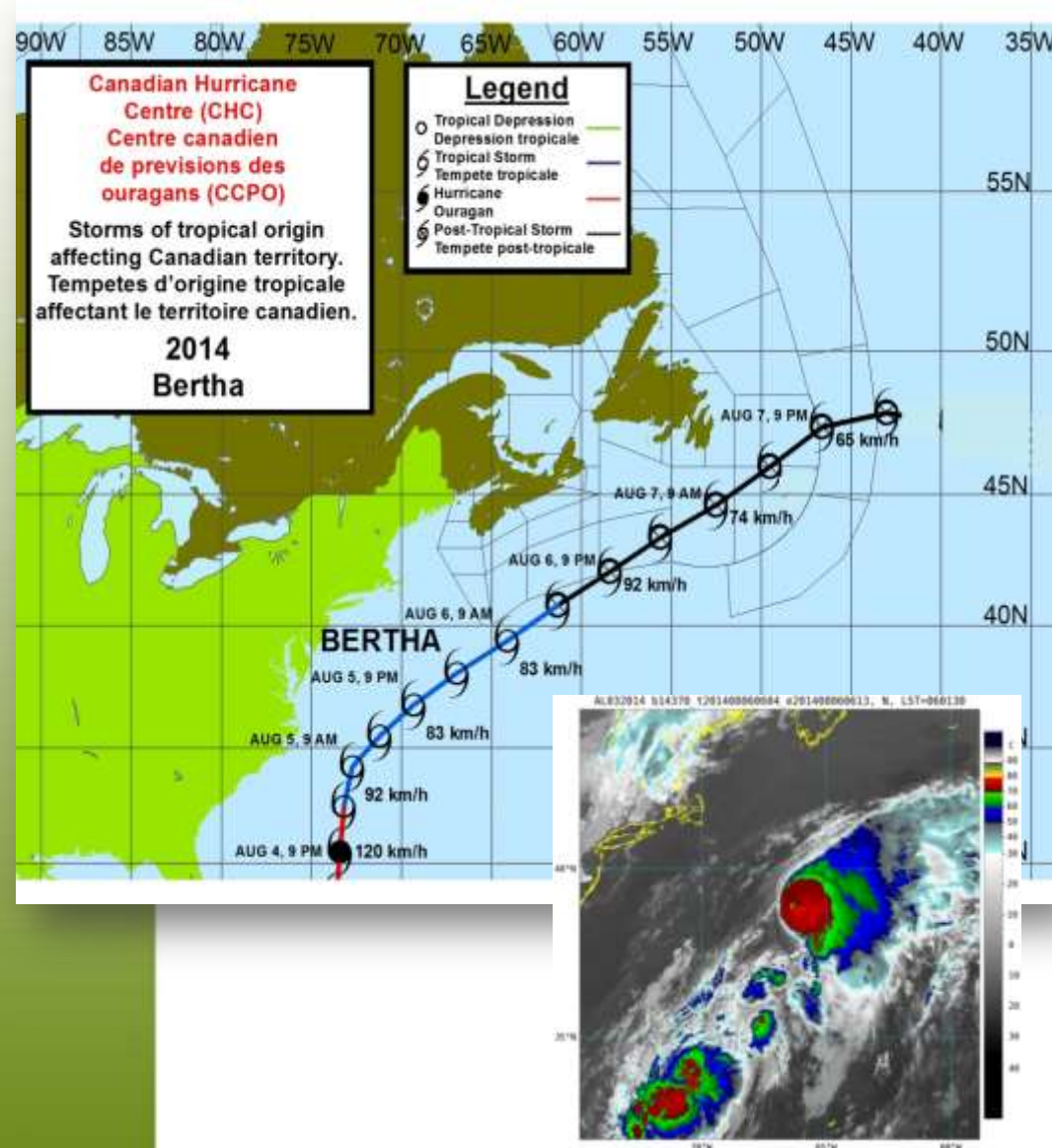


- Formed on July 1<sup>st</sup> off the coast of Florida
- Arthur became the first hurricane of the 2014 season at 6 am on July 3<sup>rd</sup>
- Upgraded to category 2 status later that evening
- Made landfall along the Outer Banks of North Carolina on during the night of the 3<sup>rd</sup> into the 4<sup>th</sup> of July
- Declared post-tropical on the morning of July 5<sup>th</sup>
- Made landfall near Meteghan NS around 0730 on July 5<sup>th</sup>



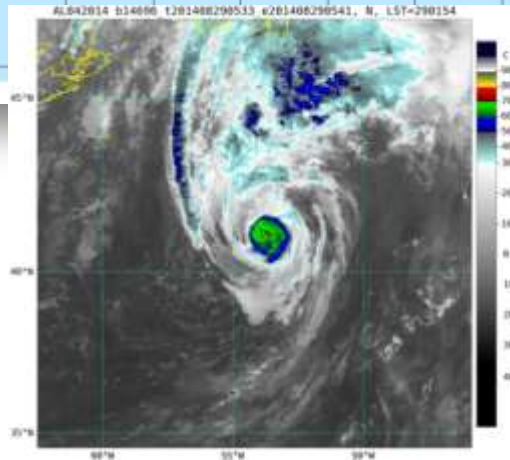
# 2014 Season in Review – Bertha

- Formed on August 1<sup>st</sup>.
- Became a hurricane early on August 4<sup>th</sup> then later weakened to a tropical storm.
- Merged with a trough and became post-tropical August 6<sup>th</sup>.
- No impact to Atlantic Canada except for some swell along the Atlantic Coast of Nova Scotia and Newfoundland.





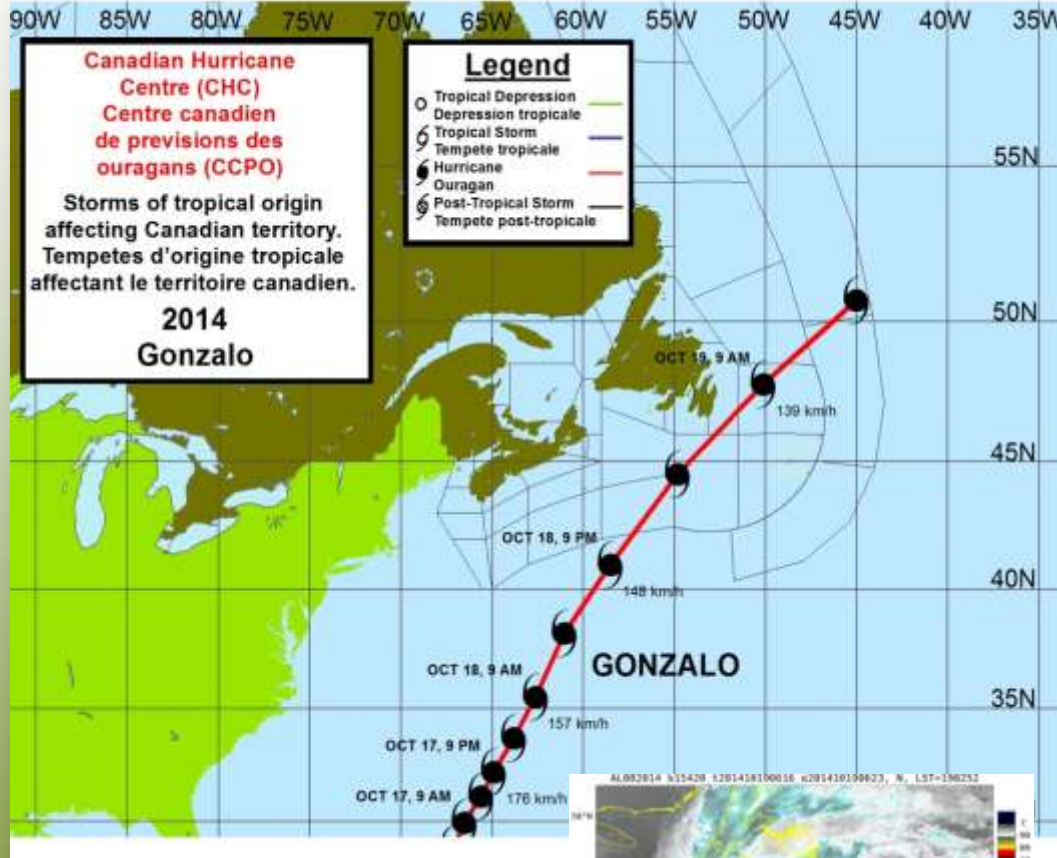
# 2014 Season in Review – Cristobal



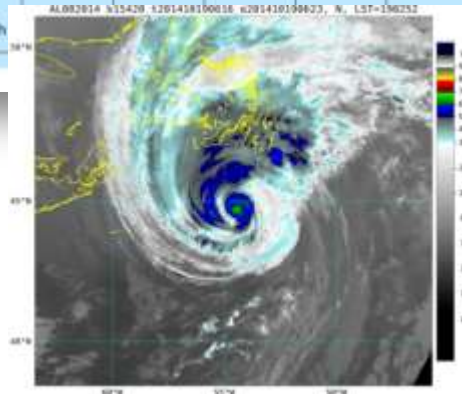
- Formed on August 24<sup>th</sup> and became a hurricane on August 25<sup>th</sup>.
- Reached maximum intensity of 140 km/h August 29<sup>th</sup> south of St. Johns
- Became post-tropical but still at hurricane force while rapidly exiting the eastern edge of the Grand Banks.
- Impacts primarily limited to wind and waves offshore.



# 2014 Season in Review – Gonzalo



- Formed on October 12<sup>th</sup>.
- Intensified to Category 4 strength on October 15<sup>th</sup>.
- Peak intensity of 230 km/h on October 16<sup>th</sup>.
- Passed directly over Bermuda as a Category 2 hurricane.
- Tracked rapidly and came within 60 km Cape Race early on October 19<sup>th</sup>.
- Produced gusty winds, rain and large waves reaching over 20 m





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# Hurricane Readiness



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# Hurricane Weather Products - Monitoring

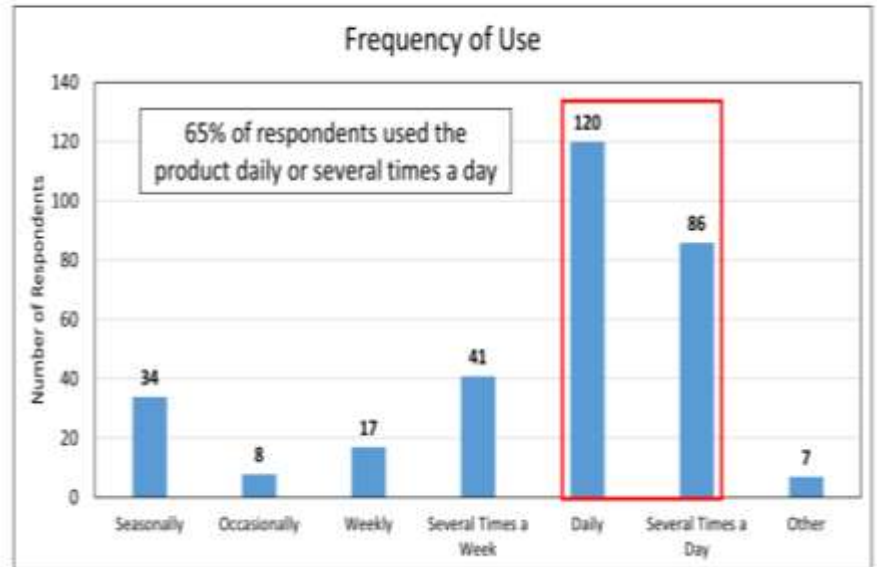
- A good tool to check overall tropical activity is the Tropical Weather Outlook issued by the NHC



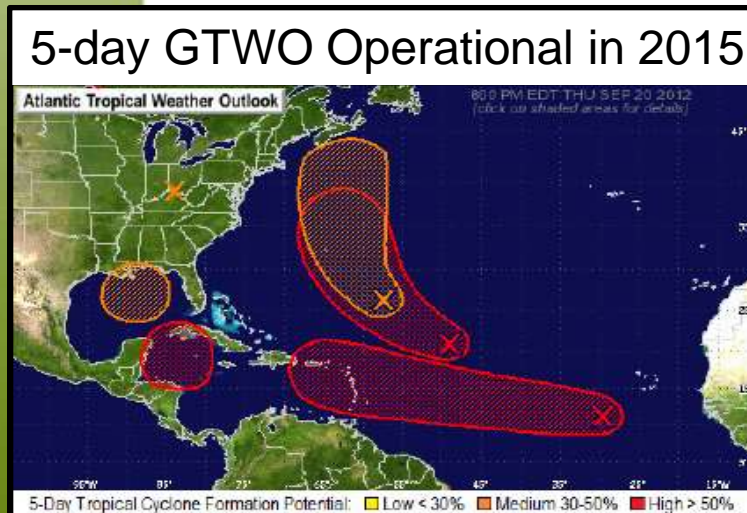
User Feedback on 5-Day GTWO  
Survey Results



48 hour GTWO



5-day GTWO Operational in 2015



Categories	2014	2015
Low	< 30%	< 40%
Medium	30-50%	40-60%
High	> 50%	> 60%

[www.nhc.noaa.gov/gtwo\\_atl.shtml](http://www.nhc.noaa.gov/gtwo_atl.shtml)

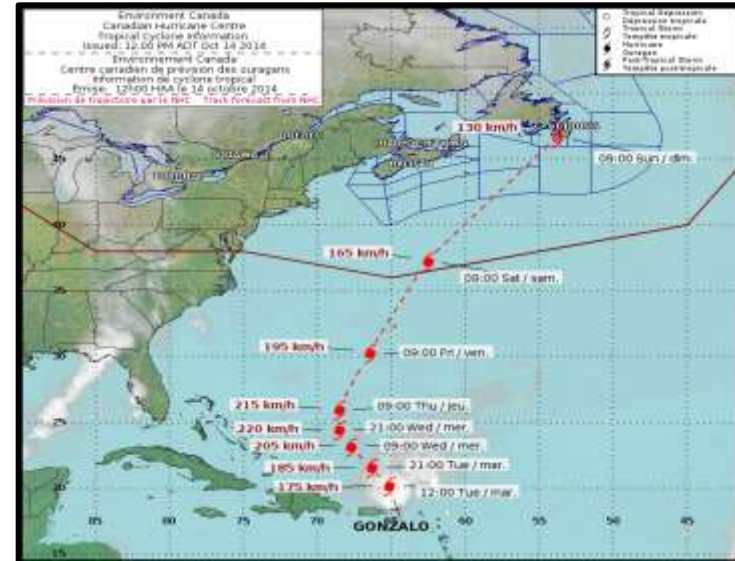


# Hurricane Weather Products – beyond 120 hrs

- Tropical Weather Outlook (NHC) still a good place to start
- CHC will show the track as issued by the NHC on the CHC website but generally no text products are issued beyond 5 days
- All tracks will be displayed on the CHC hurricane track map
  - **Red tracks are NHC-issued tracks**

[www.hurricanes.ca](http://www.hurricanes.ca)

[www.nhc.noaa.gov](http://www.nhc.noaa.gov)

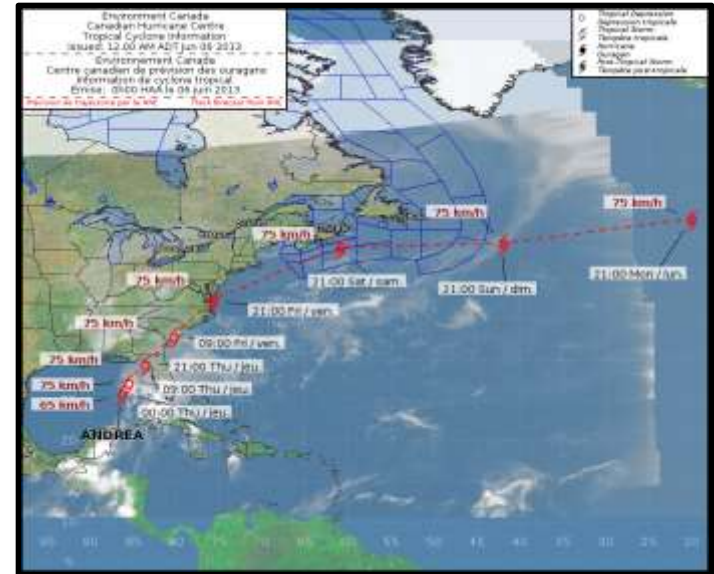


# Hurricane Weather Products – 96 to 120 hrs

- CHC will issue preliminary bulletins 4 or 5 day before the storm's arrival to provide an overview for Canadian territory
- All tracks will be displayed on the CHC hurricane track map
  - **Red tracks are NHC-issued tracks**

[www.hurricanes.ca](http://www.hurricanes.ca)

[www.nhc.noaa.gov](http://www.nhc.noaa.gov)



W06231 CW96 060648  
TROPICAL CYCLONE INFORMATION STATEMENT ISSUED BY THE CANADIAN HURRICANE CENTRE OF ENVIRONMENT CANADA AT 12:18 AM ADT THURSDAY 6 JUNE 2013.

-----  
TROPICAL CYCLONE INFORMATION STATEMENT FOR:  
=NEW= ATLANTIC PROVINCES.

FOR TROPICAL STORM ANDREA.

THE NEXT STATEMENT WILL BE ISSUED BY 3:00 PM ADT.

NEWLY-FORMED TROPICAL STORM ANDREA WEST OF FLORIDA EXPECTED TO TRANSFORM INTO WET LOW PRESSURE SYSTEM AFFECTING ATLANTIC CANADA THIS WEEKEND.

-----  
==DISCUSSION==  
THE NATIONAL HURRICANE CENTER (NHC) IN MIAMI FLORIDA HAS DECLARED AN AREA OF HEAVY RAINFALL AND GUSTY WINDS WEST OF FLORIDA AS TROPICAL STORM ANDREA - THE FIRST NAMED STORM OF THE 2013 HURRICANE SEASON. THIS STORM IS NOT EXPECTED TO ATTAIN SIGNIFICANT WIND INTENSITY, BUT WILL LIKELY TRANSFORM INTO A WET LOW PRESSURE SYSTEM AS IT TRACKS TOWARD THE MARITIME PROVINCES THIS WEEKEND.

THE CANADIAN HURRICANE CENTRE WILL MAINTAIN A GENERAL WATCH OF THE LOW PRESSURE SYSTEM AND ITS ASSOCIATED RAINFALL WITH UPDATES AS NECESSARY. WE WILL ISSUE ANOTHER BULLETIN THURSDAY AFTERNOON TO UPDATE EXPECTED RELATED WEATHER FOR EASTERN CANADA AND SIMPLY CARRY THE NHC FORECAST TRACK ON OUR WEBSITE AT [WWW.WEATHER.GC.CA/HURRICANE/TRACK\\_E.HTML](http://WWW.WEATHER.GC.CA/HURRICANE/TRACK_E.HTML) (ALL LOWERCASE). IF DEEMED NECESSARY TO ACTIVATE THE FORECAST DESK 24/7, A SPECIFIC TRACK WITH ADDITIONAL DETAILS WILL BE ISSUED ON THE WEBSITE AND WILL APPEAR BLUE ON THE MAP.

END/FOGARTY/BOEGEL



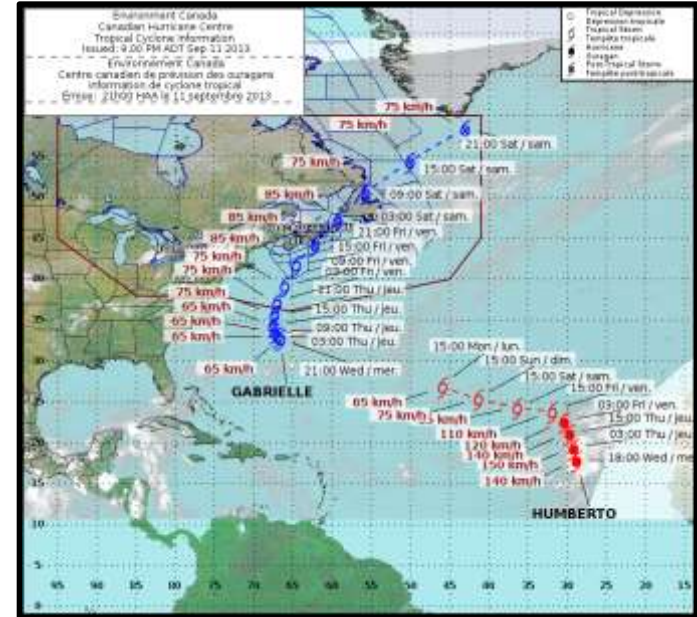
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# Hurricane Weather Products – 72 hrs or less

- CHC will typically begin to issue regularly scheduled information bulletins every 6 hours about 72 hours prior to the storm entering the response zone
- Issue times are 3 and 9 am and pm
  - All tracks will be displayed on the CHC hurricane track map
  - **Blue tracks are CHC-issued tracks**
  - **Red tracks are NHC-issued tracks**



**Bulletin Structure**

- 1) Summary information on initial position, intensity, motion
- 2) Public impacts
  - warnings broken down by hazard (wind, rainfall, surge/waves)
- 3) Marine impacts and warning



NOUVEAU CHER 201000  
 TROPICAL CYCLONE INFORMATION STATEMENT ISSUED BY THE CANADIAN METEOROLOGICAL CENTRE OF ENVIRONMENT CANADA AT 9:00 AM AST MONDAY 20 SEPTEMBER 2010.  
 INFORMATION STATEMENT FOR:  
 HURRICANE GABRIELLE  
 HURRICANE GABRIELLE  
 THE NEXT STATEMENT WILL BE ISSUED BY 3:00 PM AST  
 1000 NORTH OF BERTHELE, EXPECTED TO CROSS THE GABRIELLE BANKS AND CAUSE HEAVY RAIN AND GUSTY WINDS TO BEYOND/BEHIND ON TUESDAY.  
 SUMMARY OF BASIC INFORMATION AT 9:00 AM AST  
 LOCATION: 25.1 N 84.0 W  
 ABOUT 120 KM NORTH SOUTHWEST OF BERTHELE  
 MAXIMUM SUSTAINED WINDS: 120 KM/H  
 PRESENT MOVEMENT: NORTH NORTHEAST AT 20 KM/H  
 CENTRAL PRESSURE: 997 MB  
 PUBLIC WEATHER IMPACTS AND WARNING SUMMARY  
 WHILE THE CENTRE OF GABRIELLE IS EXPECTED TO PASS WELL SOUTHWEST OF THE AVACON PENINSULA LATER IN TUESDAY, IT IS EXPECTED TO SPREAD HEAVY RAIN ACROSS CENTRAL AND EASTERN PORTIONS OF THE PROVINCE THURSDAY MORNING. IN ADDITION, A ZONE OF LOW PRESSURE UNSTABLE TO LOW WILL CROSS BERTHELE TODAY AND TOMORROW AND SPREAD RAINFALL BY 3:00 PM.  
 THE NORTH COAST OF THE ISLAND WILL EXPERIENCE HEAVY RAIN AND WINDS TO THIS COAST. THE ISLAND WILL EXPERIENCE HEAVY RAIN AND WINDS TO THIS COAST. THE ISLAND WILL EXPERIENCE HEAVY RAIN AND WINDS TO THIS COAST.  
 1. WINDS  
 2. RAINFALL  
 EXCESSIVE RAINFALL WILL AND FLOODING COULD CAUSE DAMAGE TO PROPERTY AND INFRASTRUCTURE.  
 PLEASE REFER TO THE PUBLIC AND MARINE FORECASTS AND WARNING ISSUED BY ENVIRONMENT CANADA FOR MORE INFO.  
 WWW.METWEATHER.CA

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 WWW.METWEATHER.CA

[www.hurricanes.ca](http://www.hurricanes.ca)

# Hurricane Weather Products – 36 hrs or less

## Watches and Warnings

- Once the storm is close enough and forecast confidence is higher watches and warnings are issued in addition to the information bulletins

**Tropical Storm:** winds 70 km/h to 118 km/h

**Hurricane:** winds 119 km/h or more

**A Watch:** wind conditions possible within 36 hours

**A Warning:** wind conditions expected within 24 hours

Note: It is recommended that all storm preparation activities be complete prior to the arrival of Tropical Storm Force winds



# Operational Response to Hurricanes

## Social Media

- Using Twitter again this year to point to updates in the hurricane status
- We will continue to experiment with YouTube to post short updates on active storms approaching Canada



@environmentca



# Public Awareness – HAT 2015 in Halifax



- First stop of the 2015 HAT was in Halifax on May 3<sup>rd</sup>
- USAF C-130 Hercules and NOAA G-IV on display
- Extensive attendance and media coverage to promote hurricane awareness



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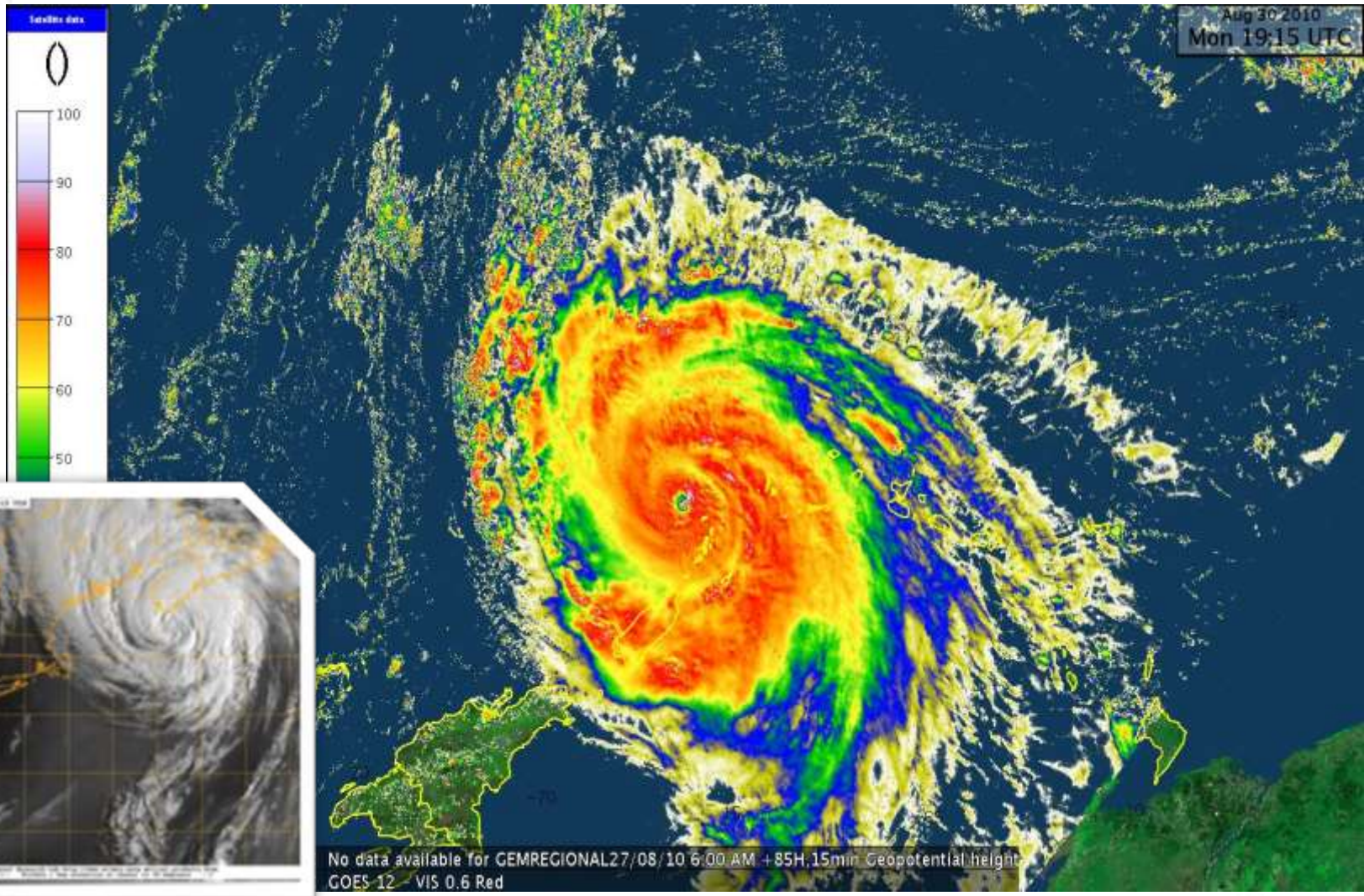
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# 2015 Hurricane Season Outlook





# 2015 Hurricane Season Outlook

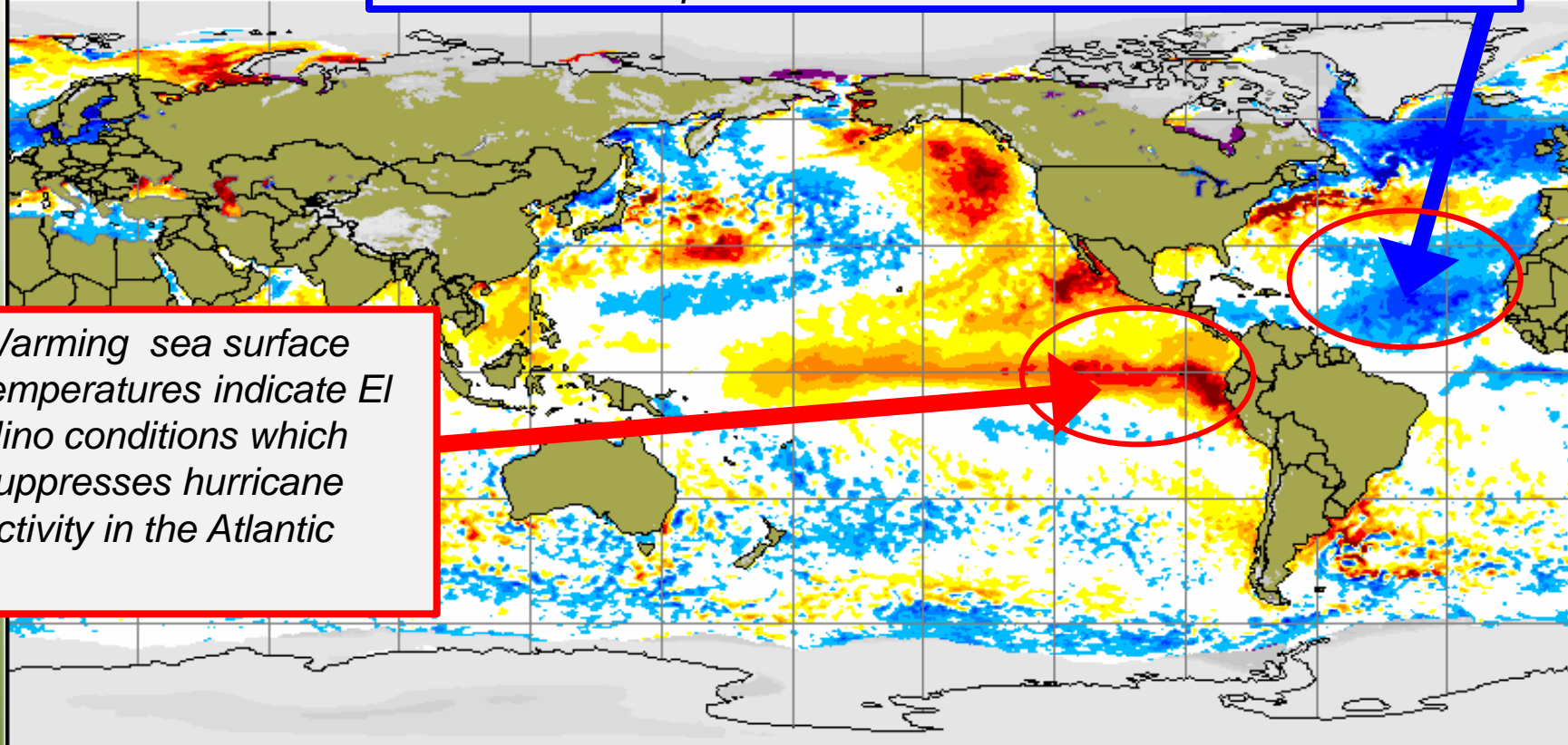
	Named Storms	Hurricanes Category 1 to 5	Major Hurricanes Category 3-5
National Oceanic and Atmospheric Administration (US)	6-11	3-6	0-2
Colorado State University	10	4	1
Tropical Storm Risk	8	3	1
1981-2010 Average	12	6	2 - 3
1961-2010 Average	11	6	2

# Global Sea Surface Temperatures

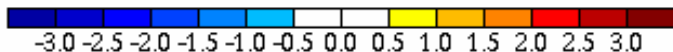
Global sea surface anomaly a  
05 Jun 2015

Cooler water temperatures over the Atlantic means fewer storms

Warming sea surface temperatures indicate El Nino conditions which suppresses hurricane activity in the Atlantic

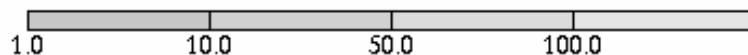


Sea surface temperature anomaly / Anomalie de la température de la mer (C)



-3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0

Snow depth / Épaisseur de la neige (cm)



Uncovered sea ice  
Glace marine à découvert  
Climatologie 1995-2009 Climatologie

# List of Atlantic Storm Names

2015	2016	2017	2018	2019	2020
Ana	Alex	Arlene	Alberto	Andrea	Arthur
Bill	Bonnie	Bret	Beryl	Barry	Bertha
Claudette	Colin	Cindy	Chris	Chantal	Cristobal
Danny	Danielle	Don	Debby	Dorian	Dolly
Erika	Earl	Emily	Ernesto	Erin	Edouard
Fred	Fiona	Franklin	Florence	Fernand	Fay
Grace	Gaston	Gert	Gordon	Gabrielle	Gonzalo
Henri	Hermine	Harvey	Helene	Humberto	Hanna
Ida	Ian	Irma	Isaac	Imelda	Isaias
Joaquin	Julia	Jose	Joyce	Jerry	Josephine
Kate	Karl	Katia	Kirk	Karen	Kyle
Larry	Lisa	Lee	Leslie	Lorenzo	Laura
Mindy	Matthew	Maria	Michael	Melissa	Marco
Nicholas	Nicole	Nate	Nadine	Nestor	Nana
Odette	Otto	Ophelia	Oscar	Olga	Omar
Peter	Paula	Philippe	Patty	Pablo	Paulette
Rose	Richard	Rina	Rafael	Rebekah	Rene
Sam	Shary	Sean	Sara	Sebastien	Sally
Teresa	Tobias	Tammy	Tony	Tanya	Teddy
Victor	Virginie	Vince	Valerie	Van	Vicky
Wanda	Walter	Whitney	William	Wendy	Wilfred







**....it only takes one storm to  
make it a bad year!**



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