Hurricane Season Outlook 2018

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Table of Contents

Table of Figures

1.0 Atlantic Hurricane Season Outlook 2018

June 1st marks the beginning of the Atlantic hurricane season. Although the season stretches for the period between June 1st to November 30th, hurricanes and tropical storms can form prior to or beyond that period. Nevertheless, the season's climatological activity peak occurs around September 10 each season.

There are numerous sources of weather data used in this hurricane outlook. The major sources are based on the prediction of the El Niño Southern Oscillation (ENSO) condition (measure of Sea Surface Temperatures (SSTs) in the equatorial Pacific), SSTs model prediction, and weather patterns. The ENSO condition forecast has a limited long-range skill and does not predict the strength of the predicted phases. Models have limited long-range skills in predicting SSTs, vertical wind shear, moisture availability, stability, and weather patterns. Nevertheless, the signals such models provide are useful for predicting the activity of the hurricane season. Although a general weather pattern is predicted for a season, such patterns are not expected to remain constant throughout the entire season. Daily and weekly changes in the pattern play a major role in development, intensification, and track of tropical storms and hurricanes. Furthermore, the intensity and duration of the predicted tropical storms and hurricanes can occur under different combinations of climatic signals which amplify the uncertainty of such predictions.

A few agencies issue an Atlantic hurricane season outlook. The National Oceanic and Atmospheric Administration (NOAA), Colorado State University (CSU), and the University College London (UCL) are considered the main three sources of the outlook. The NOAA's 2018 Atlantic hurricane seasonal outlook predicts a most likely near-normal season (40%), followed by a 35% chance of an above-normal season and a 25% chance of below-normal season. The Colorado State University (CSU) predicts a near-normal hurricane season activity. The NOAA and CSU use a 30-year (1981-2010) based-climatology. Meanwhile, the University College London (UCL) predicts that the 2018 Atlantic hurricane season is expected to be 15% below the long-term (1950-2017) average norm and 25% below the recent (2008-2017) ten-year norm. Table 1 below summaries the prediction from each source.

Table 1. Atlantic basin 2018 hurricane forecast by NOAA, CSU, and UCL.

	NOAA	CSU	UCL
Named Storms	10-16	13	9
Hurricanes	5-9	6	4
Major Hurricanes	1-4	2	1

Tropical storms and hurricanes form over water and fuelled by the warm water surface, thus SSTs are an important factor, among others, in storm development and strength. The

El Niño Southern Oscillation (ENSO) is a measure of the SST anomaly in different Niño regions in the equatorial Pacific as seen in Figure 1. The neutral phase is determined when the Niño 3.4 region is within ±0.5 °C. La Niña and El Niño are terms used when the Niño 3.4 region is in the negative and positive phase, respectively.

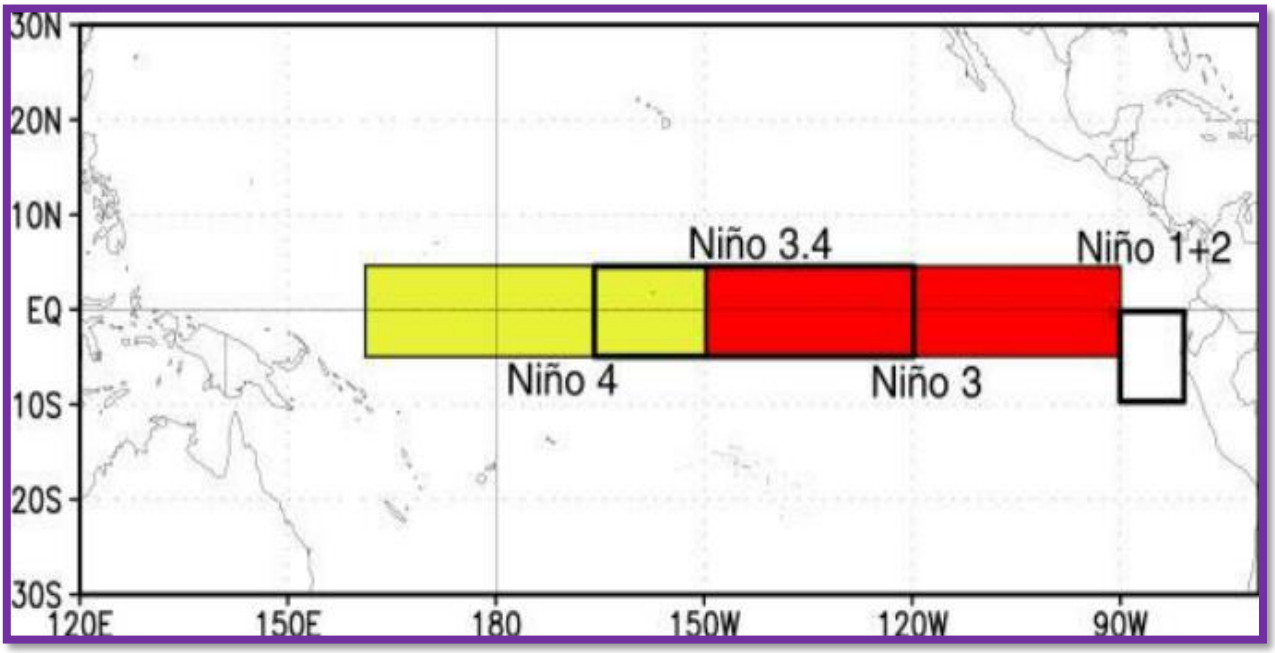

Figure 1. NINO Regions.

The La Niña phase is climatologically associated with weaker vertical wind shear, weaker trade winds, and atmospheric instability in the Main Development Region (MDR) which in turn helps the overall organizational structure of any tropical storm. Meanwhile, the El Niño phase suppresses storm organization due to stronger wind shear, stronger trade winds, and atmospheric stability in the MDR. It is also worth noting that both ENSO phases have opposite effects on the Pacific and Atlantic basins.

Figure 2 shows the probabilistic ENSO forecast based on the Niño 3.4 SST anomaly. The figure shows that the current neutral phase is predicted to gradually transition to El Niño later this year. Equal chances (44% and 45%) of neutral and El Niño phases are given for the 2018 peak hurricane season (Aug-Sept-Oct). The ENSO condition is likely to be in the positive-neutral phase (i.e. near +0.5 °C) or in a weak El Niño (+0.6 to 0.8 °C) by the peak hurricane season. Transitioning to the El Niño phase would eventually suppress storm formation as discussed earlier.

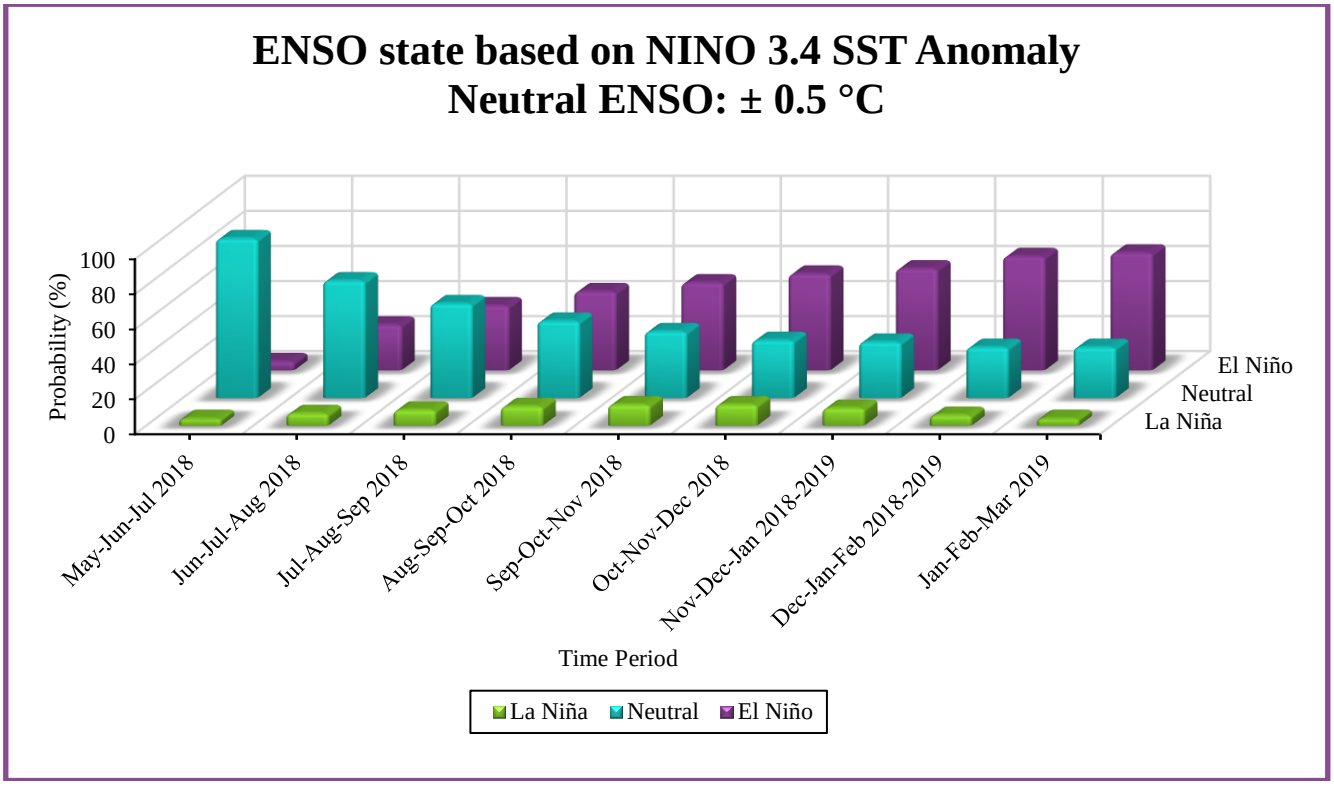

Figure 2. ENSO Probability Forecast (©IRI/CPC).

Hurricane season predictions consider the various and complex interactions of intra-seasonal variables such as the ENSO and Atlantic Multidecadal Oscillation (AMO), Madden-Julian Oscillation (MJO), mid-level moisture, and Atlantic sea level pressure and upper air patterns. The AMO is a mode that measures decadal SST variability in the Atlantic basin. The MJO is an index that measures the variability (1 to 3 months) in the tropical atmosphere. The current negative phase of the AMO (below normal SST in the North Atlantic) is conducive to higher surface pressures over the tropical Atlantic with drier atmospheric mid-levels.

The latest SST observations (Figure 3) indicate a cooling anomaly in the below-normal SSTs in the tropical Atlantic, near the Main Development Region (MDR), 10-20 °N and 60-20 °W. The figure shows the tropical Atlantic (red boxes) temperature anomaly on May 3 and May 28, 2018, respectively. Such cold anomaly is expected to be associated with drier mid-levels and higher surface pressure in the tropical Atlantic, which in turn limits the formation of tropical waves or storms. The cold anomaly in the tropical Atlantic correlates with the negative phase of AMO. The warming trend in the NIÑO 3.4 region can also be noticed in Figure 3 (purple boxes).

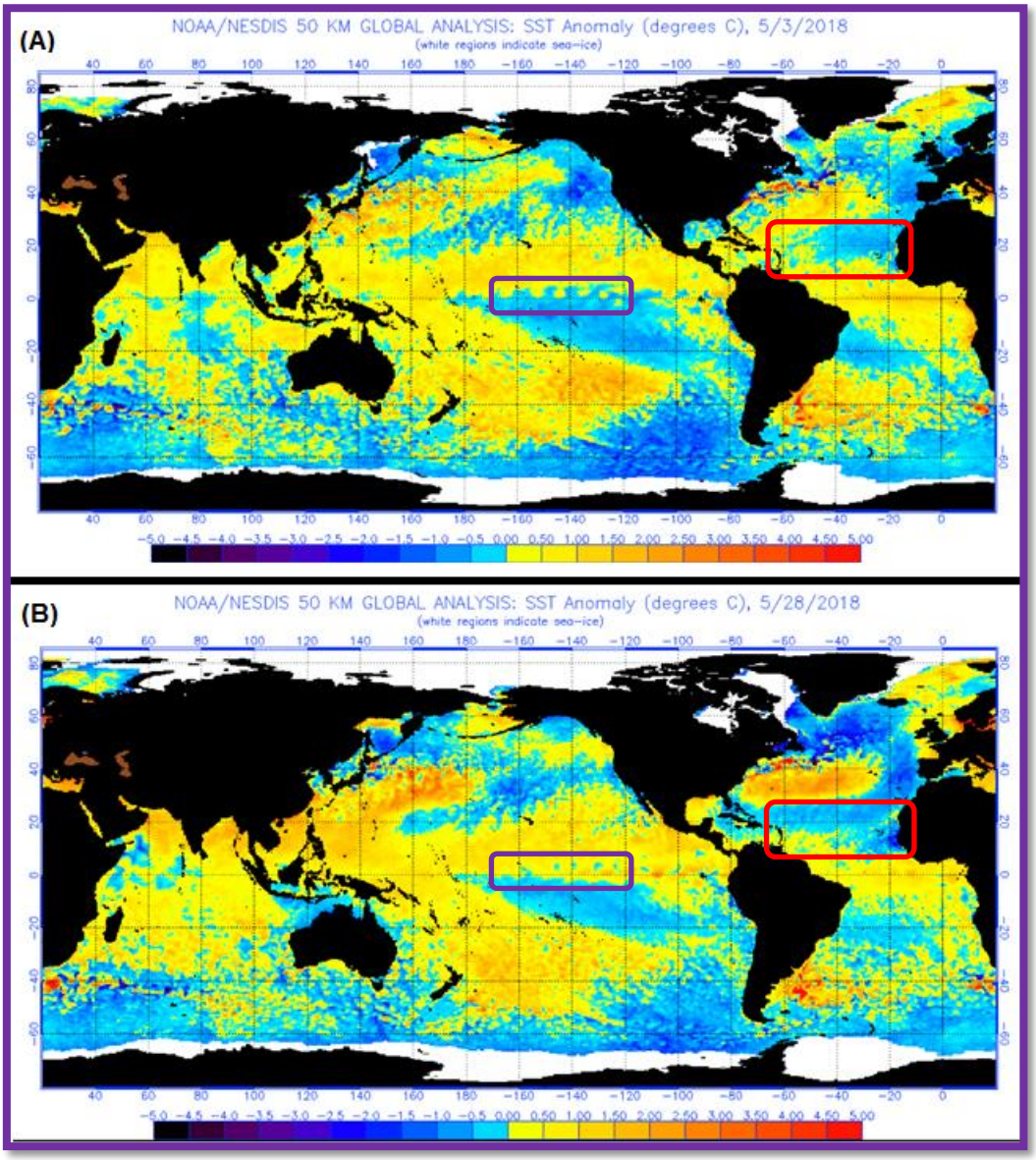

Figure 3. Global SST Anomaly on May 3 (A) and May 28 (B), 2018. The red boxes show the MDR region and the purple boxes show the Niño 3.4 region (©NOAA).

An additional observation that can be made from Figure 3 is the SST warming anomaly over the Gulf of Mexico and majority of the eastern seaboard of the United States and near the Canadian Maritimes. Kim et al. (2009) studied the impact of shifting patterns of Pacific Ocean warming on North Atlantic tropical cyclons. Figure 4 shows the track density anomaly for the period from August to October for East-Pacific Warming (EPW), Central-Pacific Warming (CPW), and East-Pacific Cooling (EPC).

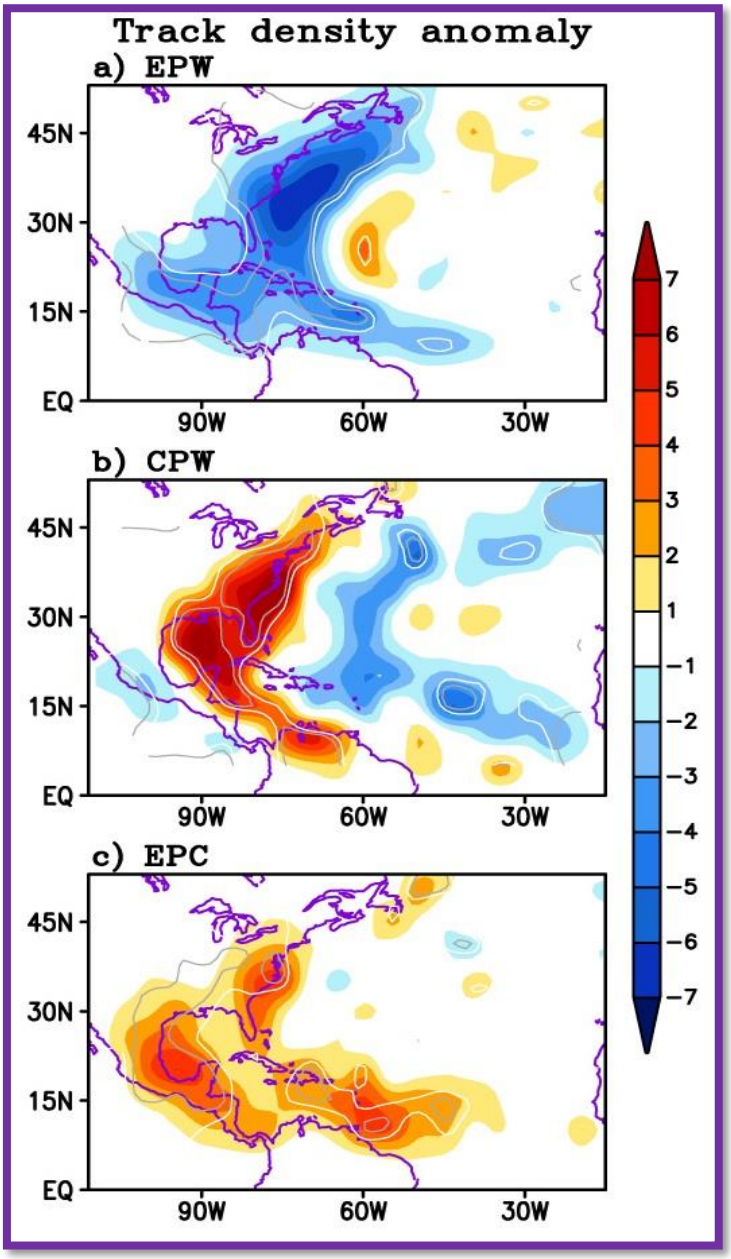

Figure 4. Composites of track density anomaly (multiplied by 10) during the Aug-Oct period for (a) EPW, (b) CPW, and (c) EPC.

2.0 Historical Newfoundland and Labrador Hurricane Season

The Environment and Climate Change Canada (ECCC) records show Newfoundland being impacted by a higher number of tropical storms than Labrador as seen in Figure 5. This figure shows the frequency of tropical storms by year for Newfoundland (a) and Labrador (b) between 1901 and 2000.

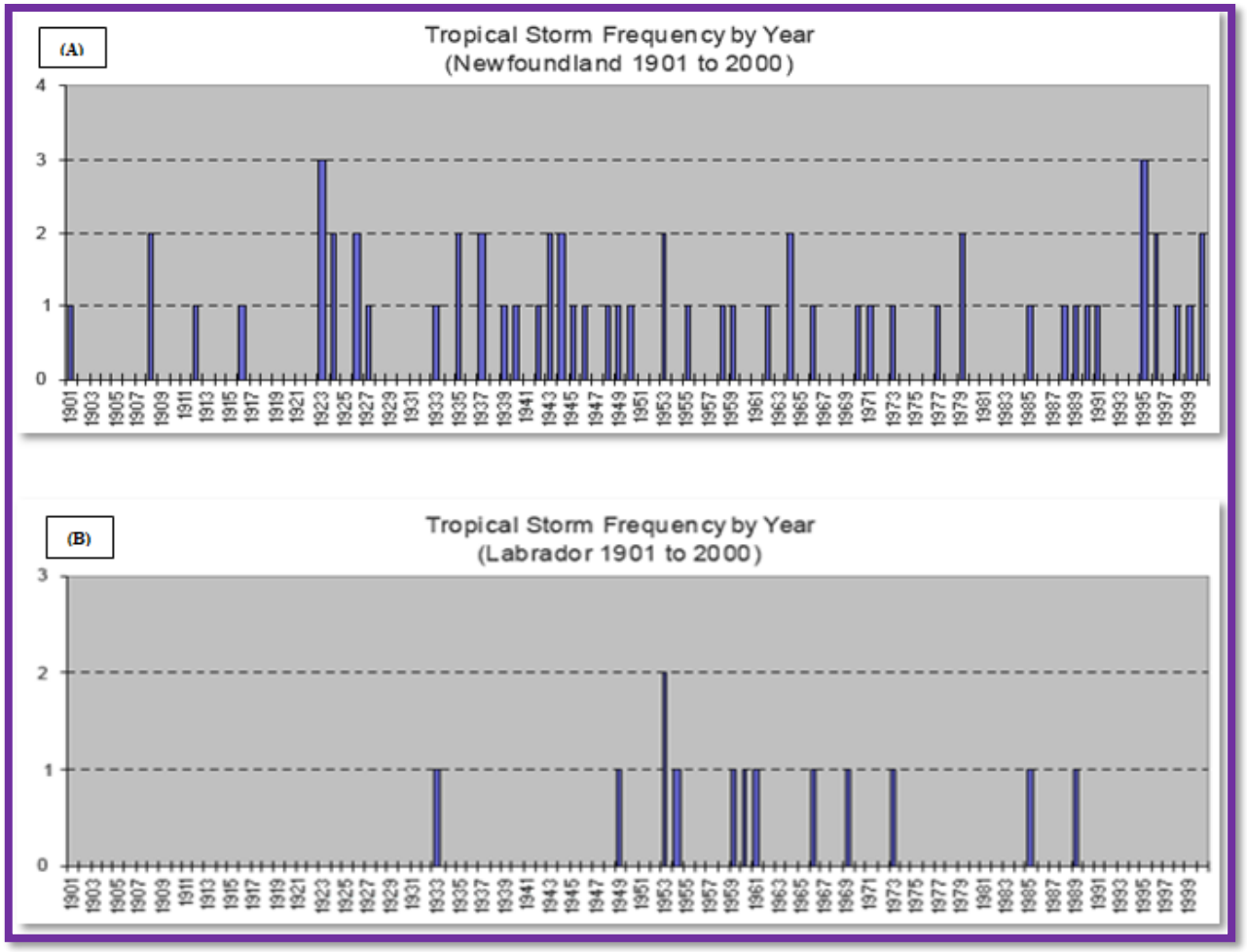

Figure 5. Tropical storm frequency by year for Newfoundland (A) and Labrador (B) between 1901 and 2000 (©ECCC).

The same records reveal the month of September as the peak month for tropical storm activity followed by October (Figure 6).

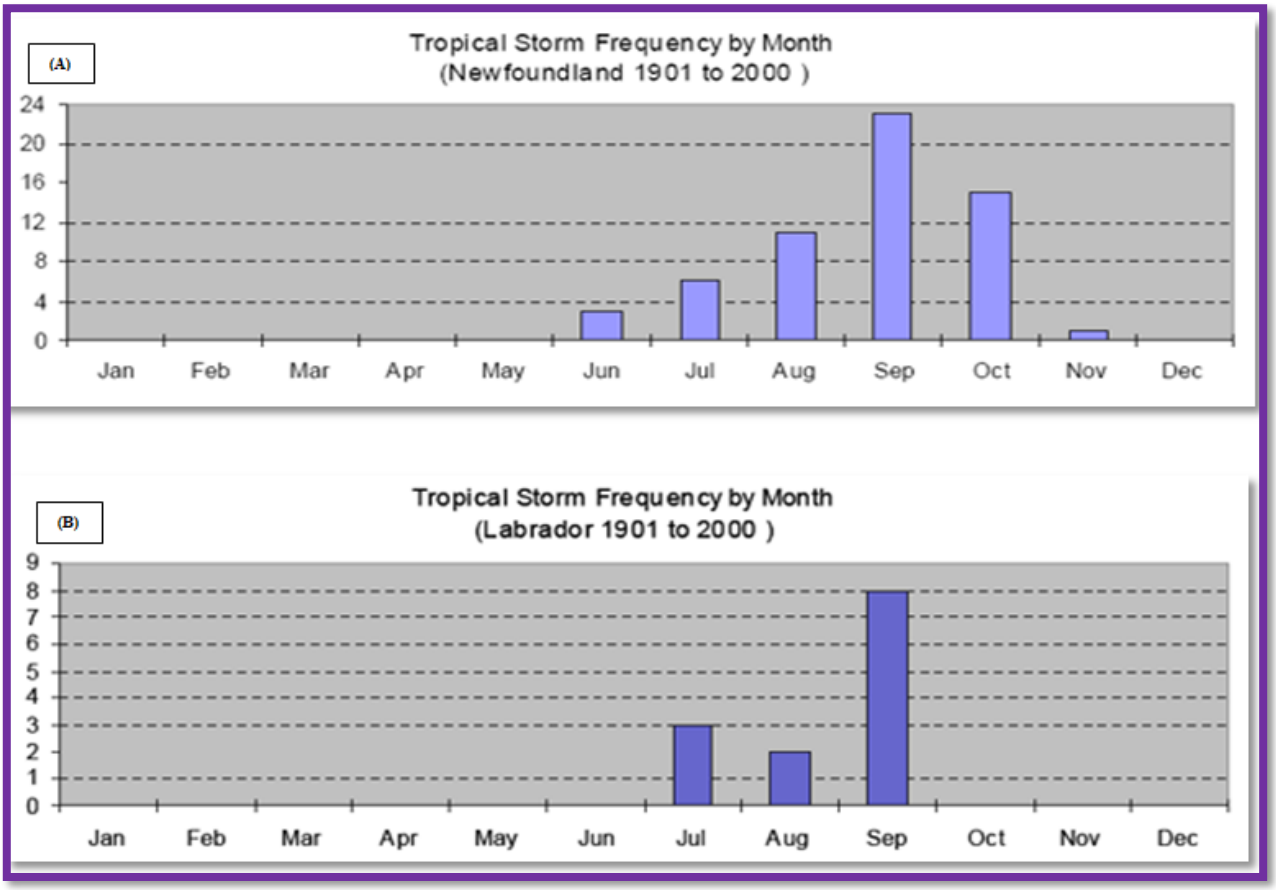

Figure 6. Tropical storm frequency by month for Newfoundland (A) and Labrador (B) between 1901 and 2000.

The archived data show 58 tropical and post-tropical storms and 4 hurricanes have made landfall or passed within 100 km of Newfoundland and Labrador for the period from 1960 through to 2017.

Figure 7 below shows the Florida State University (FSU) probabilistic tropical cyclones trekking over Newfoundland using 1886-2016 historical data. The figure shows that the storms affecting Newfoundland most regularly approach from the south-southwest.

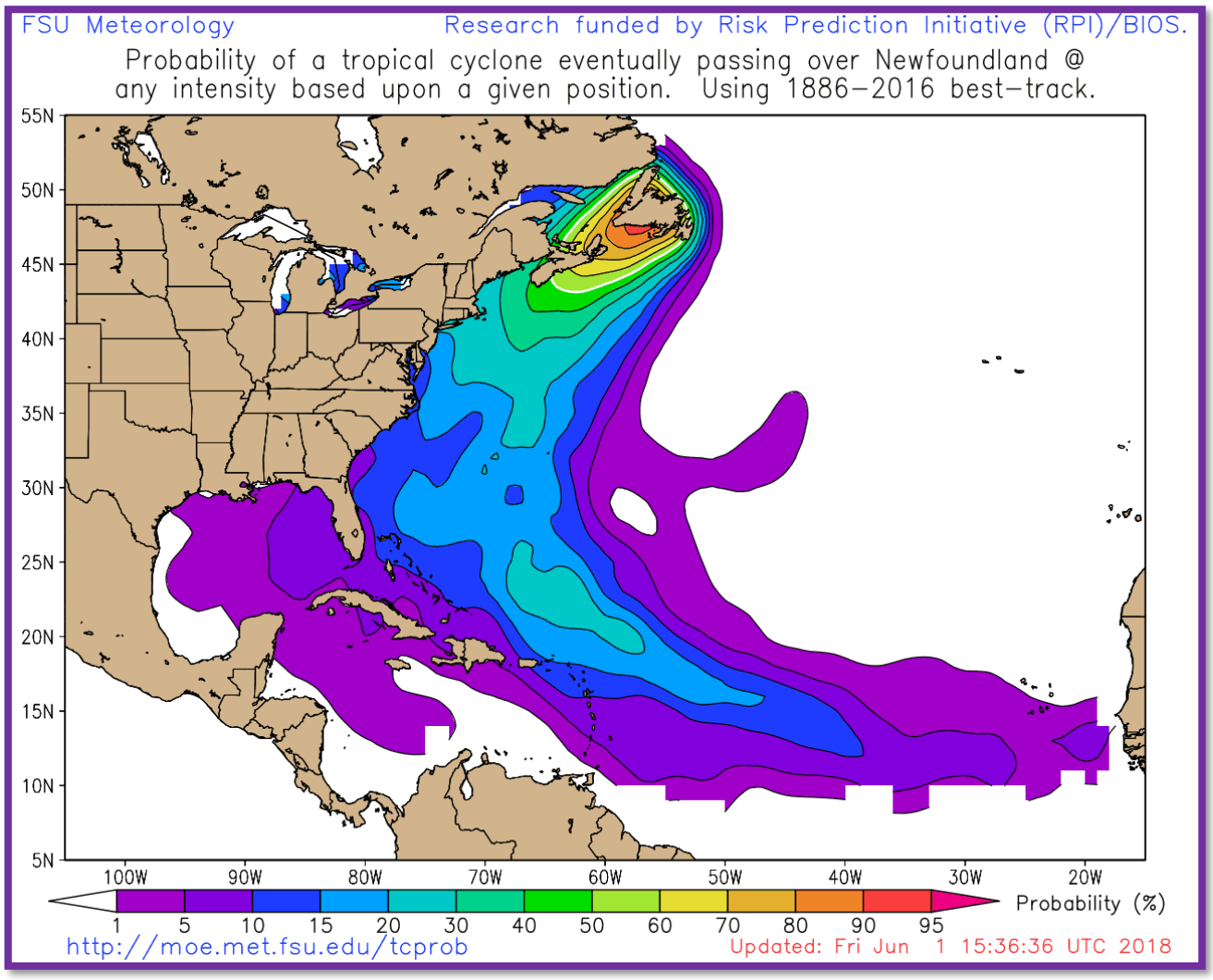

Figure 7. Newfoundland tropical cyclone probability using 1886-2016 historical track (©FSU).

3.0 Analog Years and Historical Tracks

Establishing ENSO as our base index and taking into account the AMO, SSTs, North Atlantic Oscillation (NAO), and Pacific-North America Index (PNA), the best analog years are 1986, 1989, 2006, and 2009. Figure 8 shows the upper air (500 hPa) geopotential height (m) composite anomaly based on 1981-2010 climatology for the period from June and through to November for the combined analog years. The main features in this figure are the anomalously lower heights over the Labrador Sea and the Bermuda High. Such a pattern creates a storm track along the eastern seaboard of the United States and Atlantic Canada.

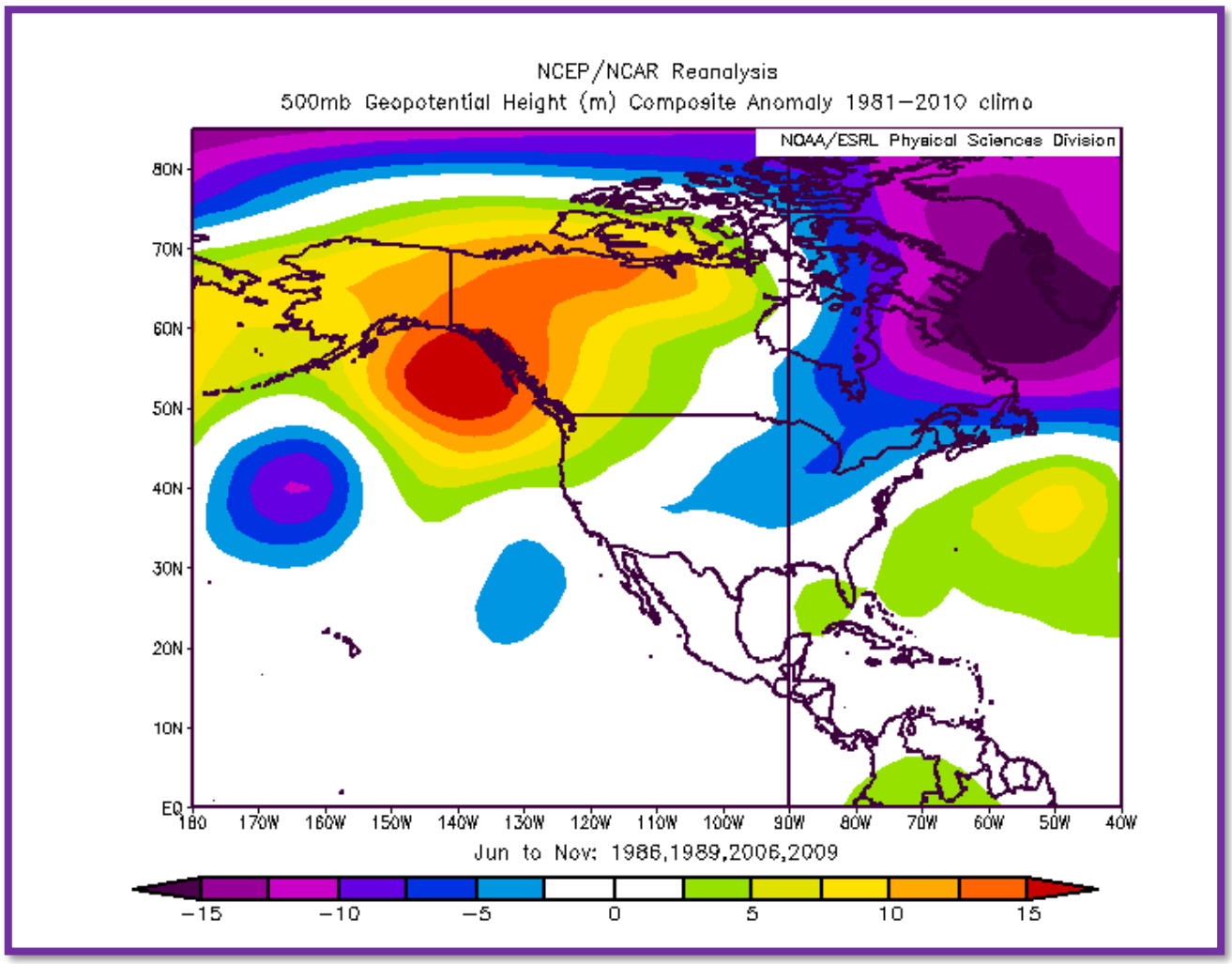

Figure 8. Upper air (500 hPa) Geopotential Heights (m) composite anomaly (1981-2010 climatology) for the period June through to November of the analogy years (1986, 1989, 2006, 2009) (©NOAA).

The hurricane track charts for the analog years is given in Figures 9 to 12. It is clear from the figures that the analog years are near-normal to slightly below normal hurricane season which corresponds with the current hurricane season outlook. With the exception of 1986, the analog years show tropical and extratropical storms tracking through Atlantic Canada and specifically, Newfoundland, with Hurricane Bill bringing a 16-foot storm surge to the Nova Scotia coastlines.

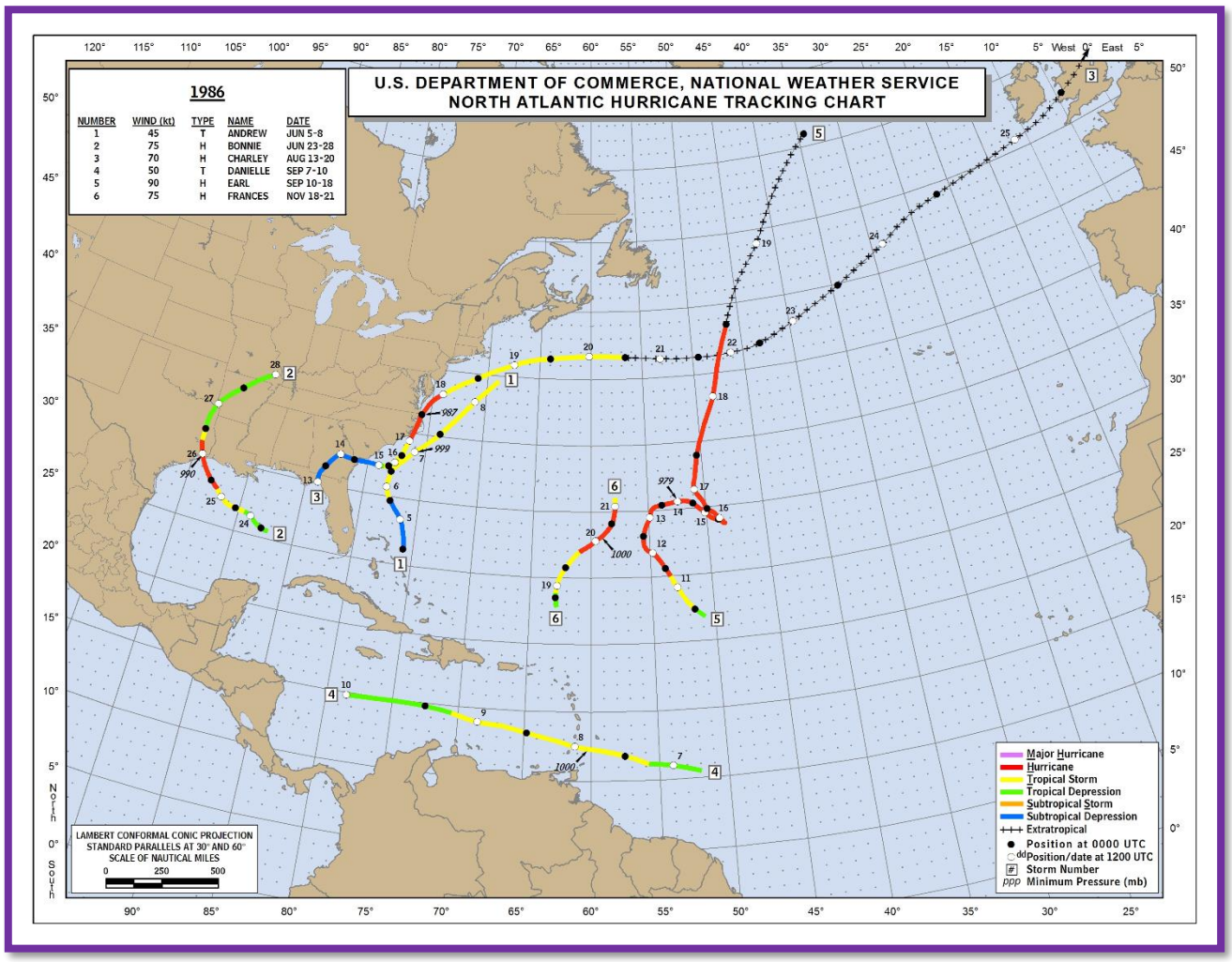

Figure 9. North Atlantic hurricane tracking chart (1986) (©NHC).

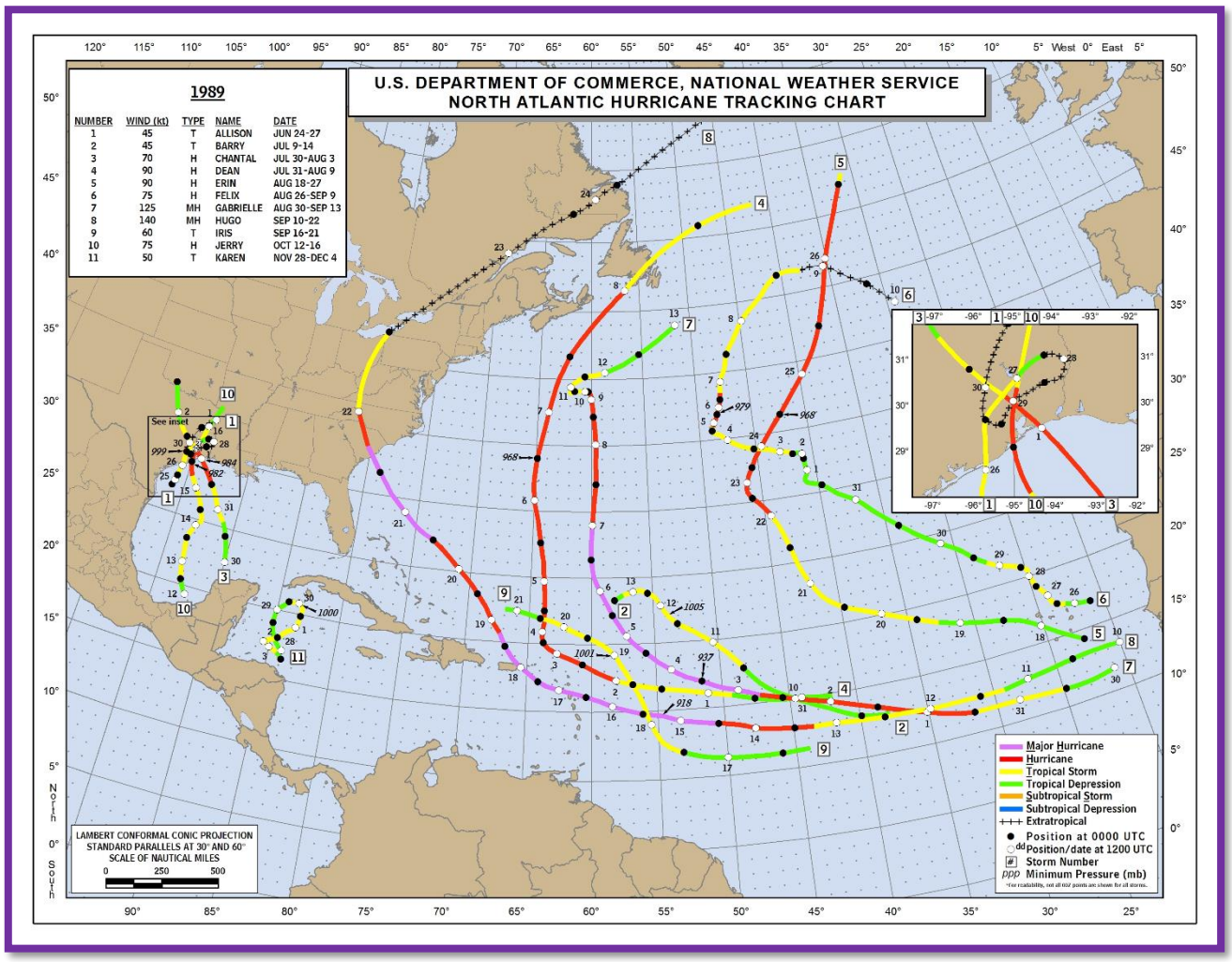

Figure 10. North Atlantic hurricane tracking chart (1989) (©NHC).

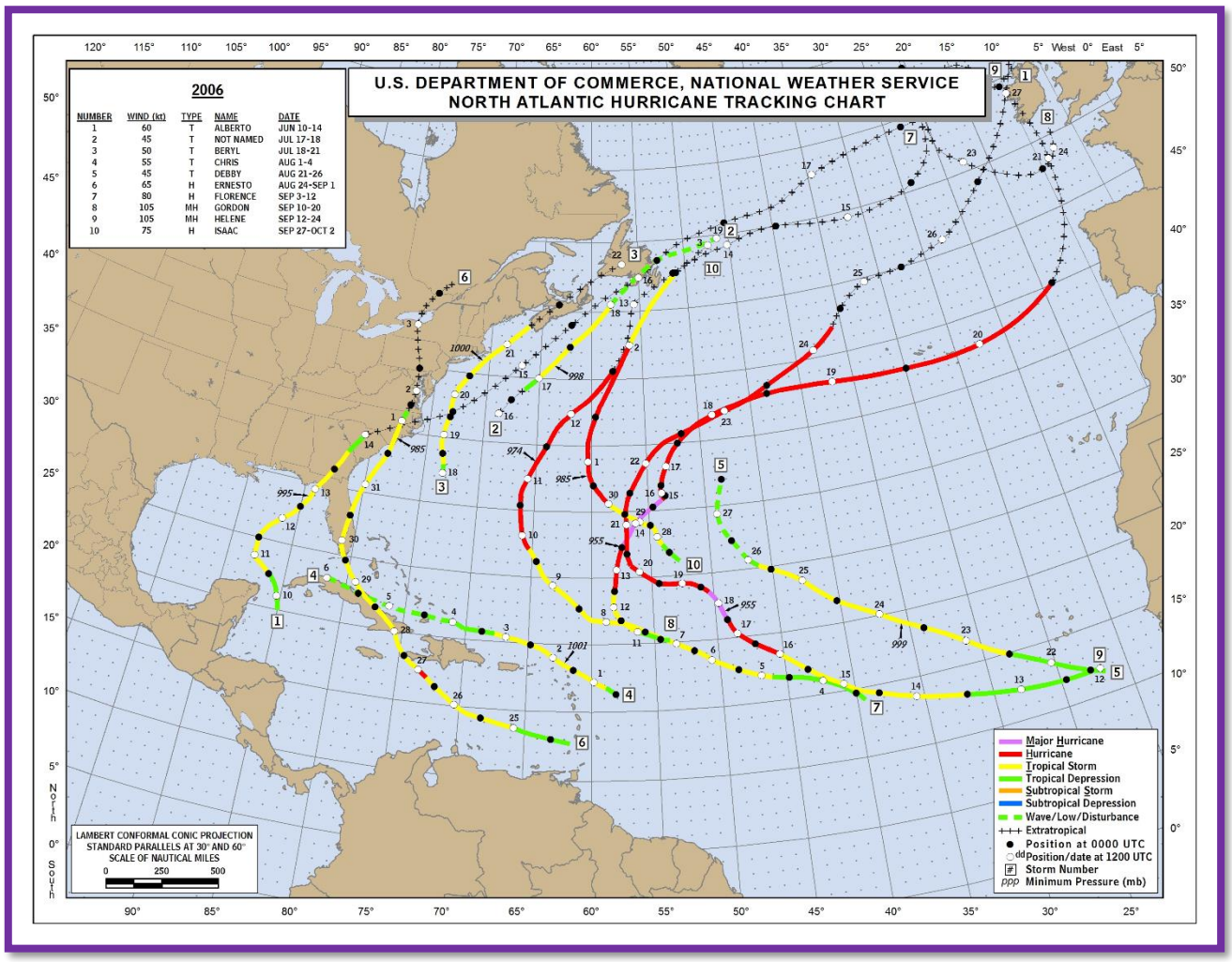

Figure 11. North Atlantic hurricane tracking chart (2006) (©NHC).

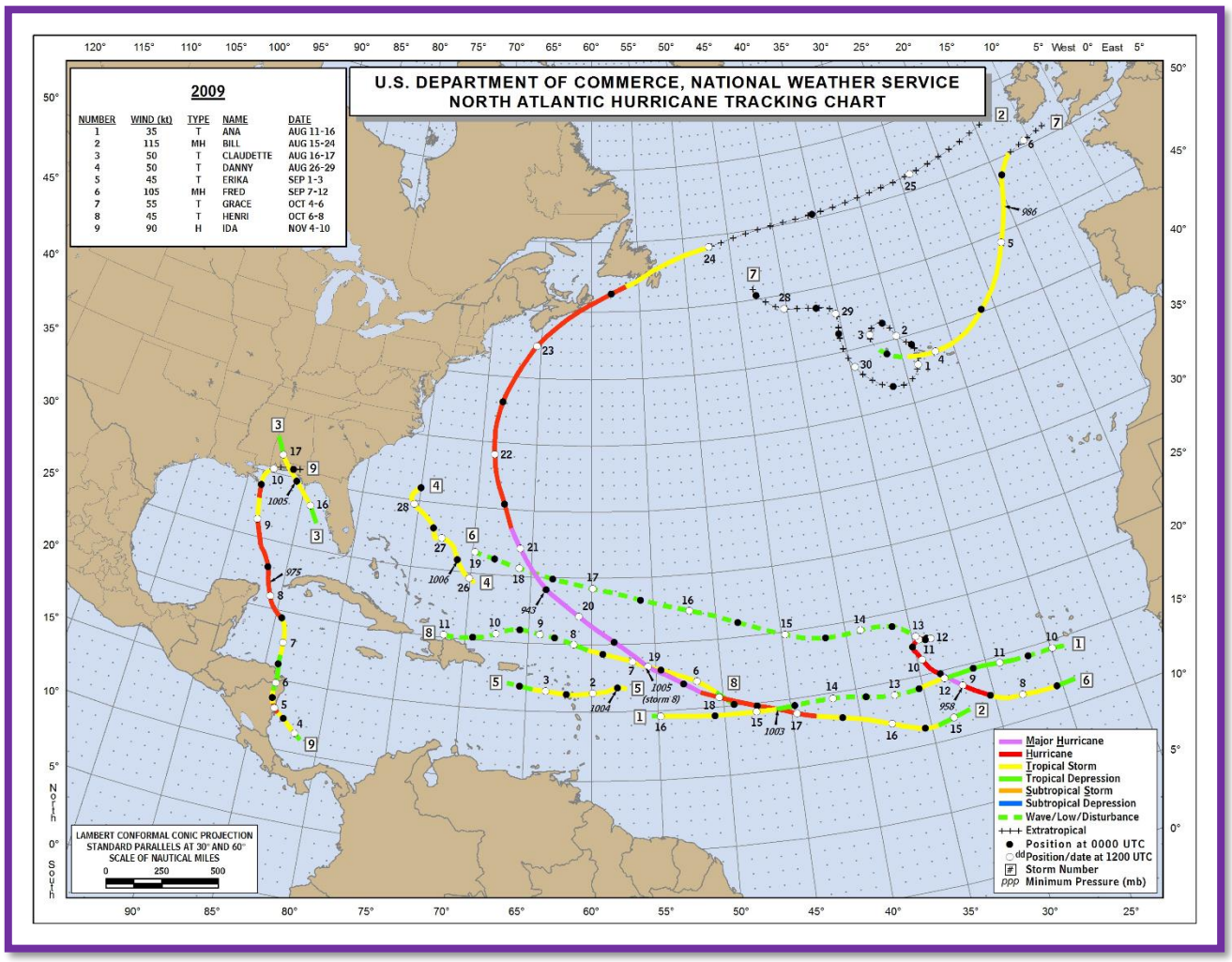

Figure 12. North Atlantic hurricane tracking chart (2009) (©NHC).

4.0 Newfoundland and Labrador Hurricane Season Outlook 2018

The current hurricane season is forecast to be near-normal to slightly below normal given the different global indices discussed earlier. The analog years show lower pressure over the Labrador Sea with a prominent Bermuda High. Such a weather pattern promotes a storm track across the eastern seaboard of the United States and Atlantic Canada.

This season holds a higher risk of 1 to 4 tropical or extratropical cyclones tracking through Newfoundland and Labrador with the highest impact expected to be along southern Newfoundland as seen in Figure 13. Furthermore, there is a slighter risk for an extratropical storm or remnants of a storm tracking through the southern half of Labrador. Although the records show storms affecting Newfoundland in the first five months of the season, September appears the month with the highest number of storms passing near or through Newfoundland.

The current area of above-normal SSTs near Nova Scotia (Figure 3-B) is likely to maintain the organization of any tropical storms tracking into that area. Tropical storms transitioning into strong low pressures are likely to produce periods of heavy rainfall and strong sustained winds.

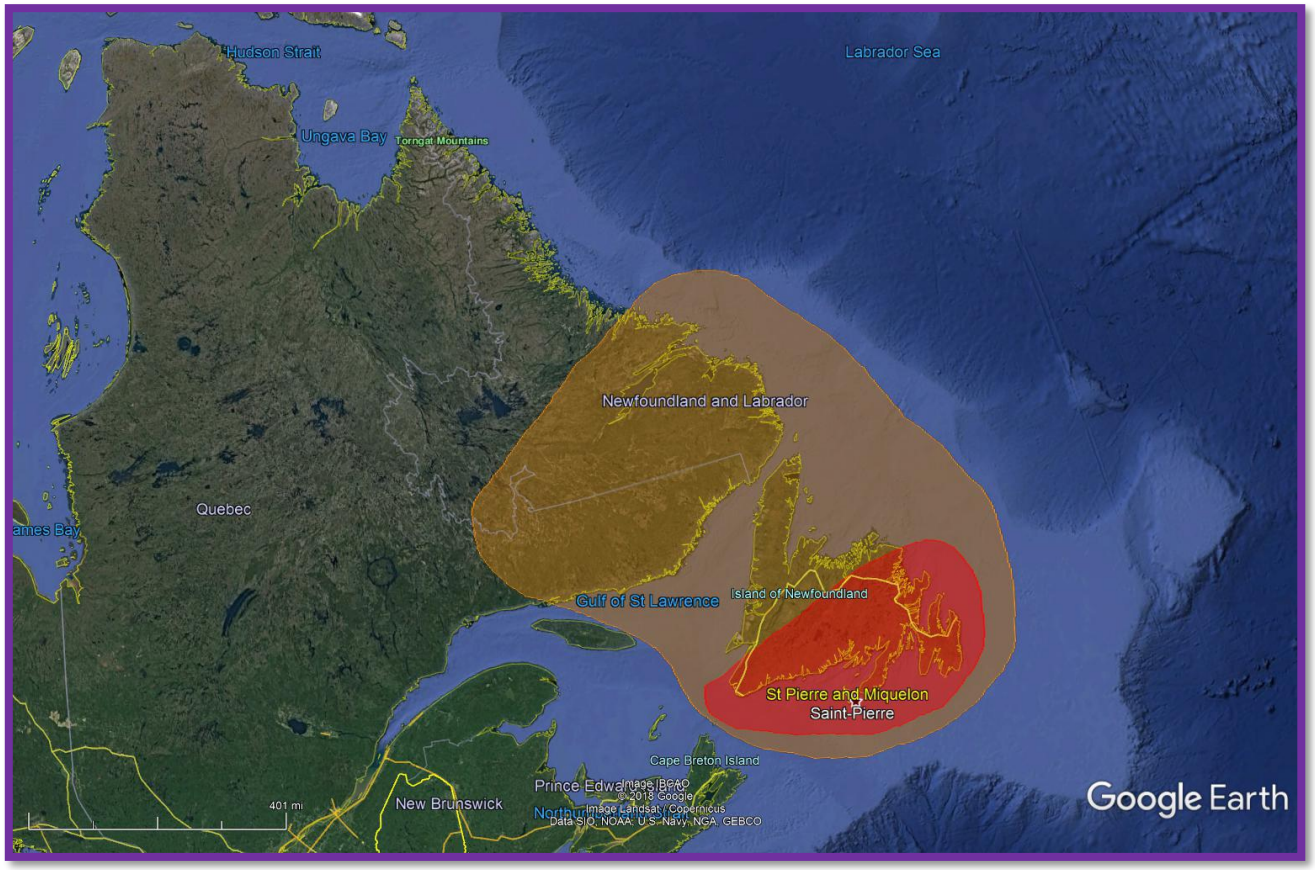

Figure 13. Newfoundland and Labrador 2018 hurricane season risk map.

5.0 Closure

We trust that this report meets your needs. Please do not hesitate to contact the author if you have any questions or comments regarding the hurricane season outlook.

Yours sincerely,

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