Newfoundland and Labrador Hurricane Season Outlook 2019

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1.0 Atlantic Hurricane Season Outlook 2019

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 ENSO condition, sea surface temperatures (SSTs) model prediction, and weather patterns. The ENSO condition forecast has limited long-range skill. Models have limited long-range skill in predicting SSTs, vertical wind shear, moisture availability, stability, and predicting weather patterns. The seasonal weather pattern prediction is an outlook to an overall season, but it doesn't convey the daily and weekly changes in the pattern. The short-term variability in the weather 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 amplifies the uncertainty of such predictions.

Several agencies issue an Atlantic hurricane season outlook, including the National Oceanic and Atmospheric Administration (NOAA), Colorado State University (CSU), and the University College London (UCL). The NOAA's 2019 Atlantic Hurricane Seasonal Outlook predicts a most likely near-normal season (40%), followed by a 30% chance of an above-normal season and a 30% chance of below-normal season. The Colorado State University (CSU) predicts a near normal activity. It is worth noting that the NOAA and CSU use a 30-year (1981-2010) based-climatology. Meanwhile, the University College London (UCL) predicts that the 2019 Atlantic hurricane season is expected to be slightly below (10%) the long-term (1950-2018) normal and about 20% below the recent (2009-2018) ten-year normal. Table 1 below summaries the prediction from each source.

Table 1. Atlantic basin 2019 hurricane forecast by NOAA, CSU, and UCL.

	NOAA	CSU	UCL
Named Storms	9-15	13	12
Hurricanes	4-8	6	6
Major Hurricanes	2-4	2	2

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. The La Niña and El Niño are terms used when the Niño 3.4 region is in the negative and positive phase, respectively.

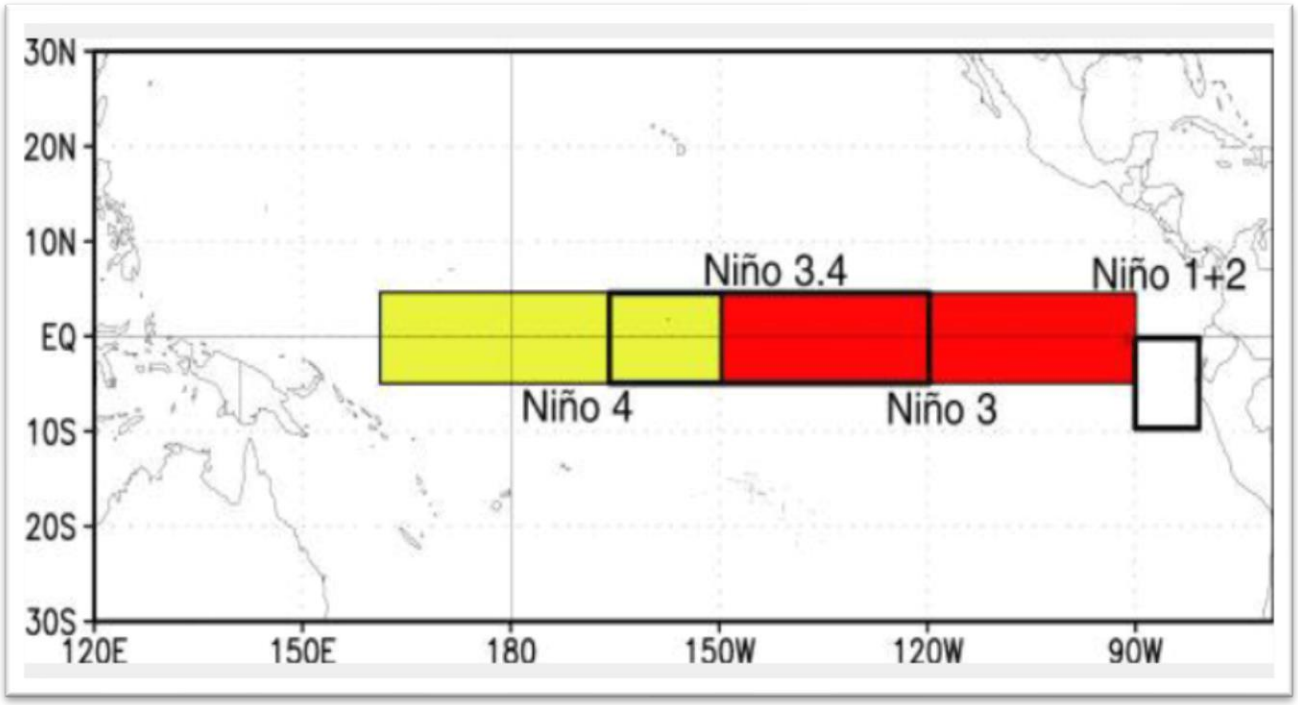

Figure 1. NINO Regions.

The La Niña phase is climatologically associated with weaker vertical wind shear, weaker trade winds, and increased atmospheric instability across the Atlantic basin 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 greater atmospheric stability across the Atlantic basin. 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 El Niño phase is expected to persist into the fall. During the peak hurricane season months of August, September, and October, there's a 60% chance of the Pacific basin remaining in El Niño conditions, with a 35% chance of ENSO neutral conditions, and only a 5% chance of La Niña conditions. Most of the ENSO models indicate the El Niño will remain weak through the summer and into the fall. Given this, it is likely the ENSO state will suppress Atlantic tropical cyclone activity somewhat.

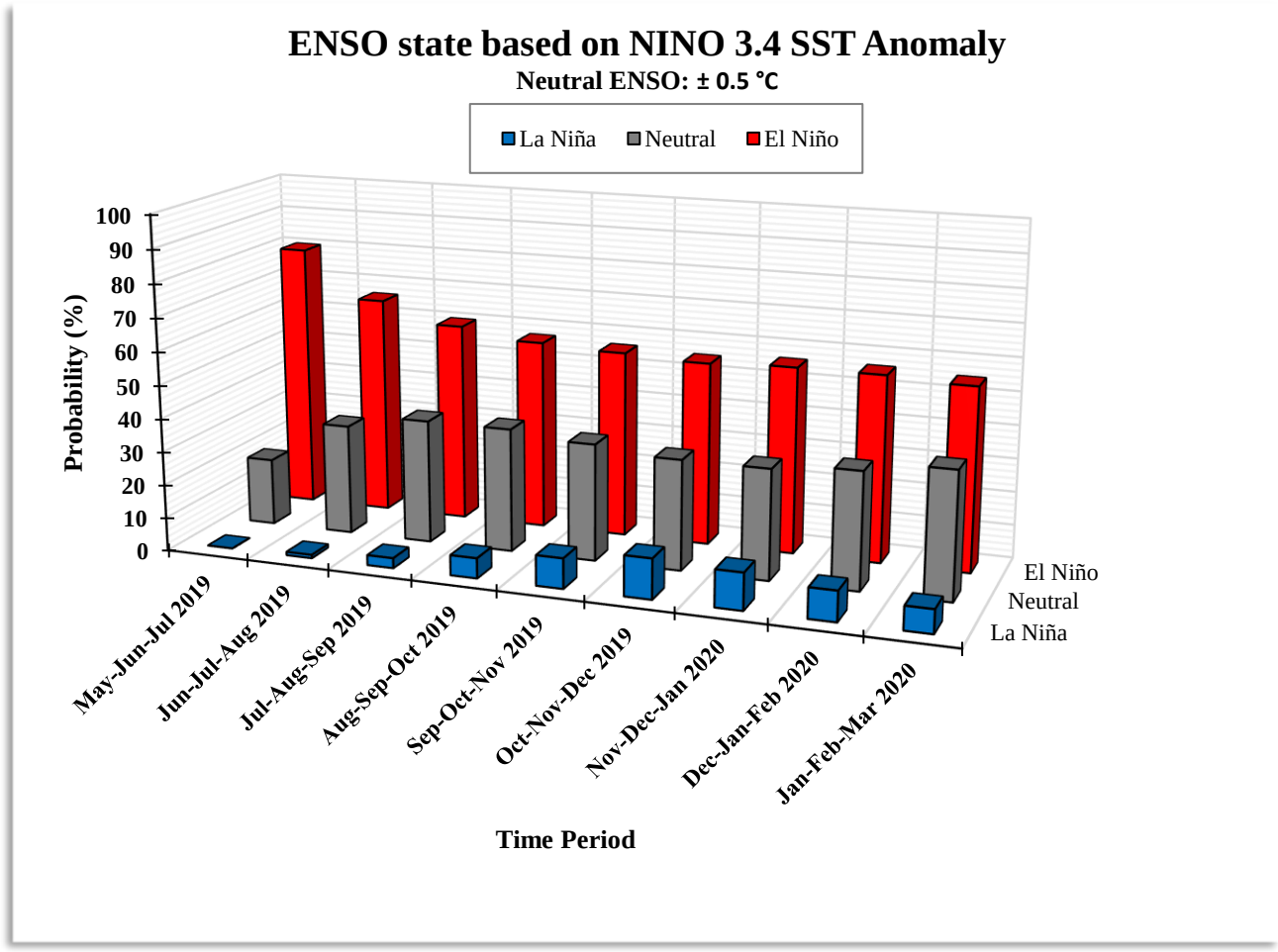

Figure 2. ENSO Probability Forecast (©IRI/CPC).

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 MJO is an index that measures the variability (1 to 3 months) in the tropical atmosphere. The AMO is a mode that measures the decadal SST variability in the Atlantic basin. The current positive phase of the AMO (above normal SST in the North Atlantic) is conducive to lower surface pressures over the tropical Atlantic with moister atmospheric mid-levels.

The latest SST observations (Figure 3) indicate an increasing warming anomaly 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 2 and May 27, 2019, respectively. Such relatively warmer temperatures are expected to be associated with moister mid-levels and lower surface pressure in the tropical Atlantic, which in turn increases the formation of tropical cyclones. The slightly warmer anomaly in the tropical Atlantic correlates with a weak positive phase of AMO. There is some disagreement between the agencies on the AMO phase, given that the colder SSTs in north Atlantic, near Newfoundland, are usually more associated with the negative phase of the AMO, as noted by CSU. In the Pacific Ocean, the positive anomaly in NIÑO 3.4 region can also be noticed in Figure 3 (purple boxes).

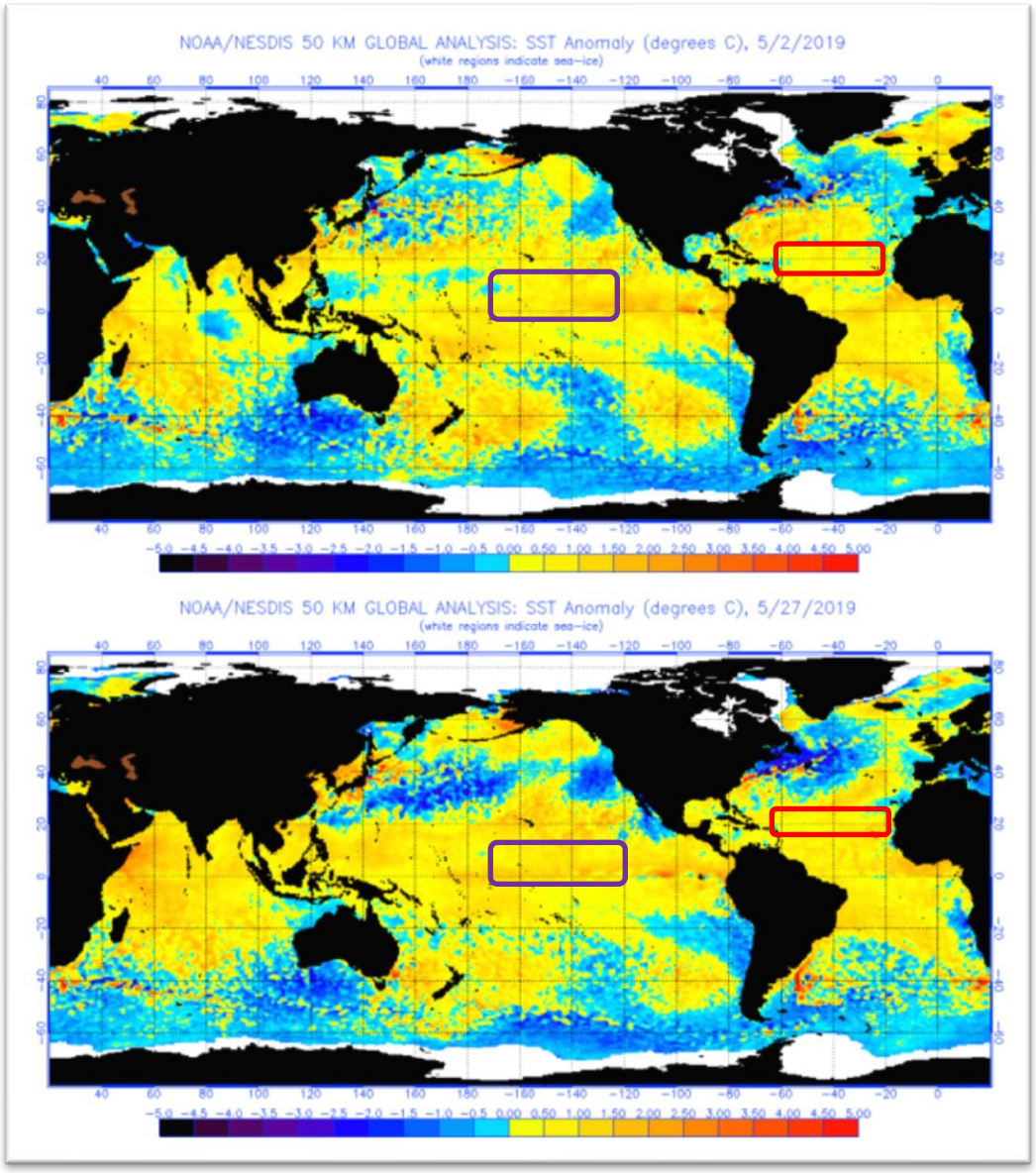

Figure 3. Global SST Anomaly on May 2 (above) and May 27 (below), 2019. The red boxes show the MDR region and the purple boxes show the Niño 3.4 region (©NOAA).

An additional observation that can be made from Figure 3 is the SST anomaly has reversed from negative to positive in the Gulf of Mexico. The SST anomalies near Atlantic Canada have cooled through May.

The Wood Seasonal Outlook Team has noticed a few anomalies over the past month such as positive anomalies of rainfall over the southern African Sahel region, a growing positive SST anomaly in the MDR as mentioned above, and a weaker than normal Bermuda-Azores High. If such anomalies continue, it could aid in the development of tropical storms in the MDR region. The current global atmospheric models are depicting a drier Sahel region and a normal-strength Bermuda-Azores High throughout September followed by a wetter Sahel region on October.

The Wood Seasonal Outlook Team is anticipating a near normal Atlantic Hurricane Season with a noticeable monthly variation in tropical wave activity; peaking in late September and into October.

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 4. This figure shows the frequency of tropical storms by year for Newfoundland (a) and Labrador (b) between 1901 and 2000.

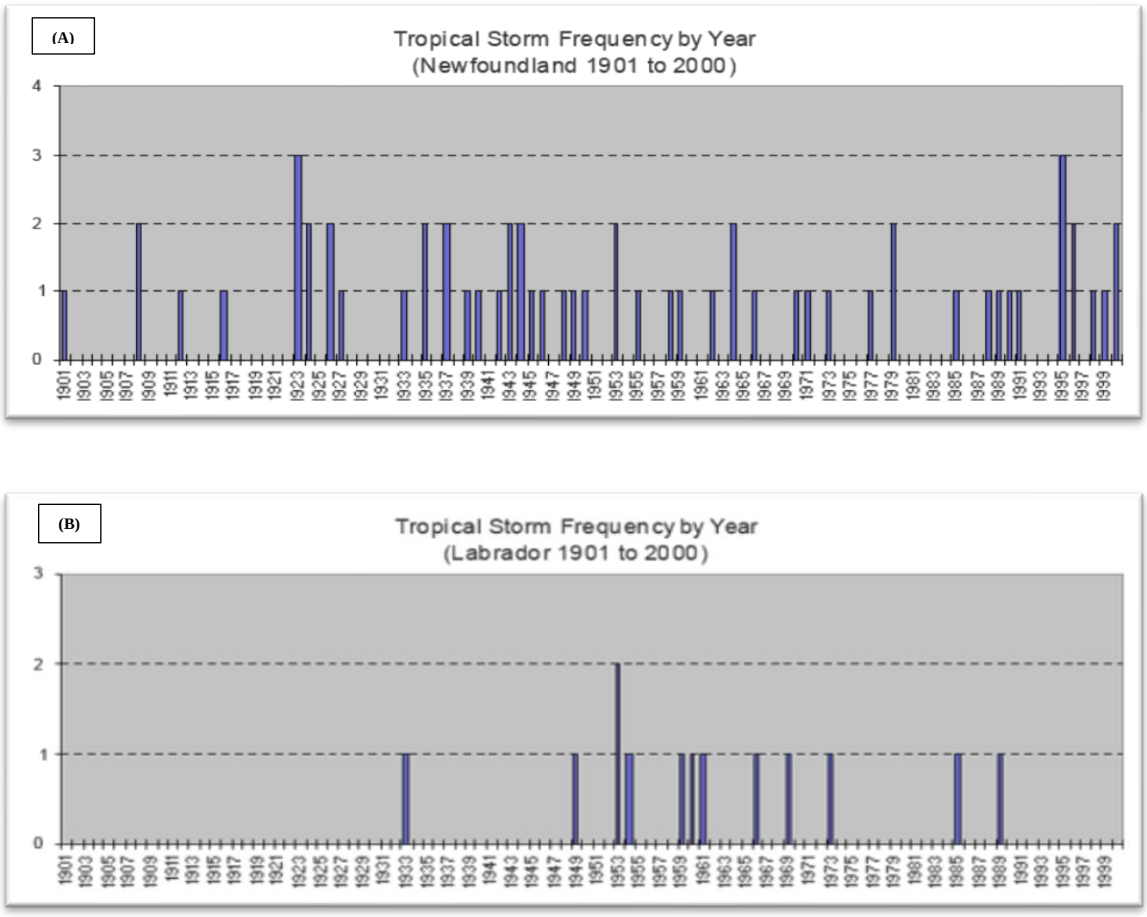

Figure 4. Tropical storm frequency by year for Newfoundland (A) and Labrador (B) between 1901 and 2000 (©ECCC).

The same records reveal the month of September as the peak month for tropical storm activity, followed by October (Figure 5).

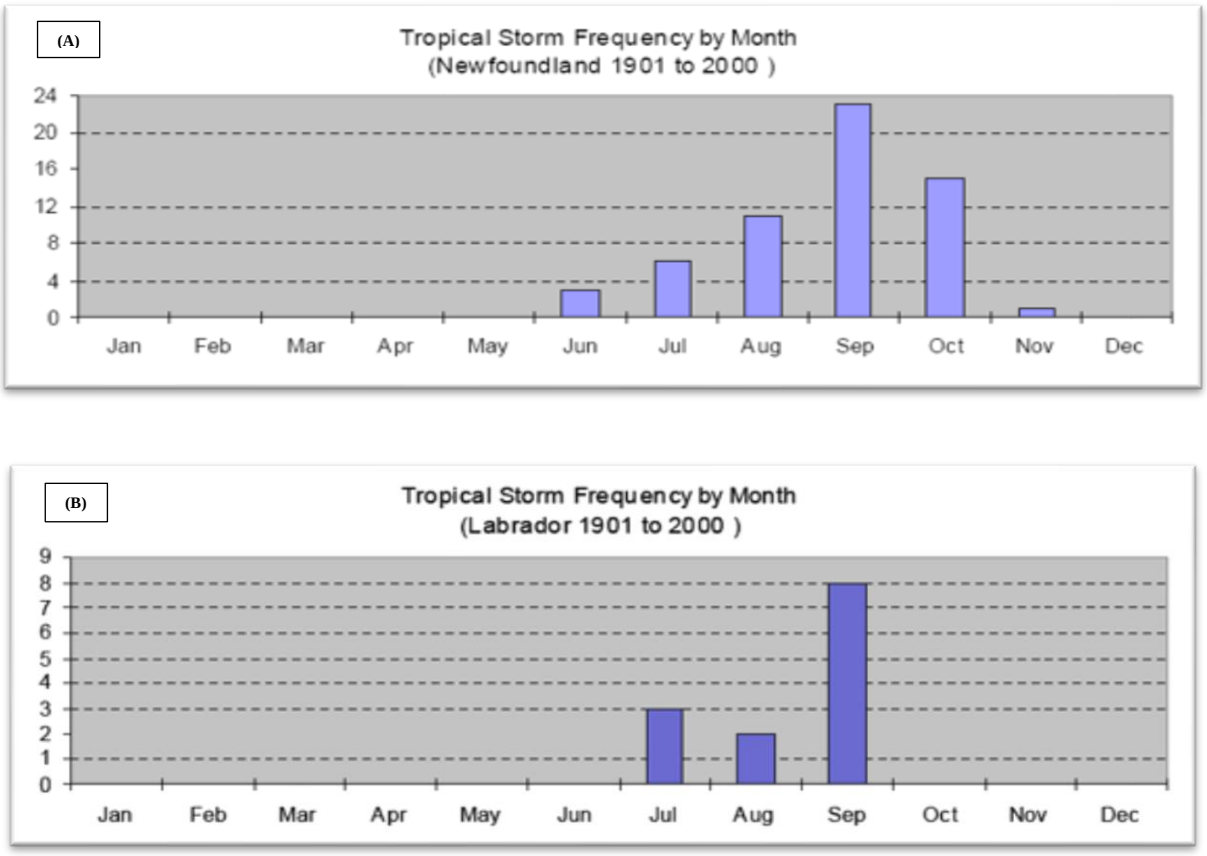

Figure 5. Tropical storm frequency by month for Newfoundland (A) and Labrador (B) between 1901 and 2000.

The database of Newfoundland tropical (TC) and post-tropical cyclone (PTC) landfalls was extended to include the 2001-2018 seasons. Since 1950, there have been 51 TC or PTC that have made landfall on the Island of Newfoundland. During the same period, there were 30 neutral ENSO years, 19 La Niña years and 20 El Niño years.

Figure 6 below shows the Florida State University (FSU) probabilistic tropical cyclones trekking over Newfoundland using 1886-2016 historical data. Storms which affect Newfoundland most regularly approach from the south-southwest and generally pass near or west of Bermuda before arriving on the Newfoundland Coast.

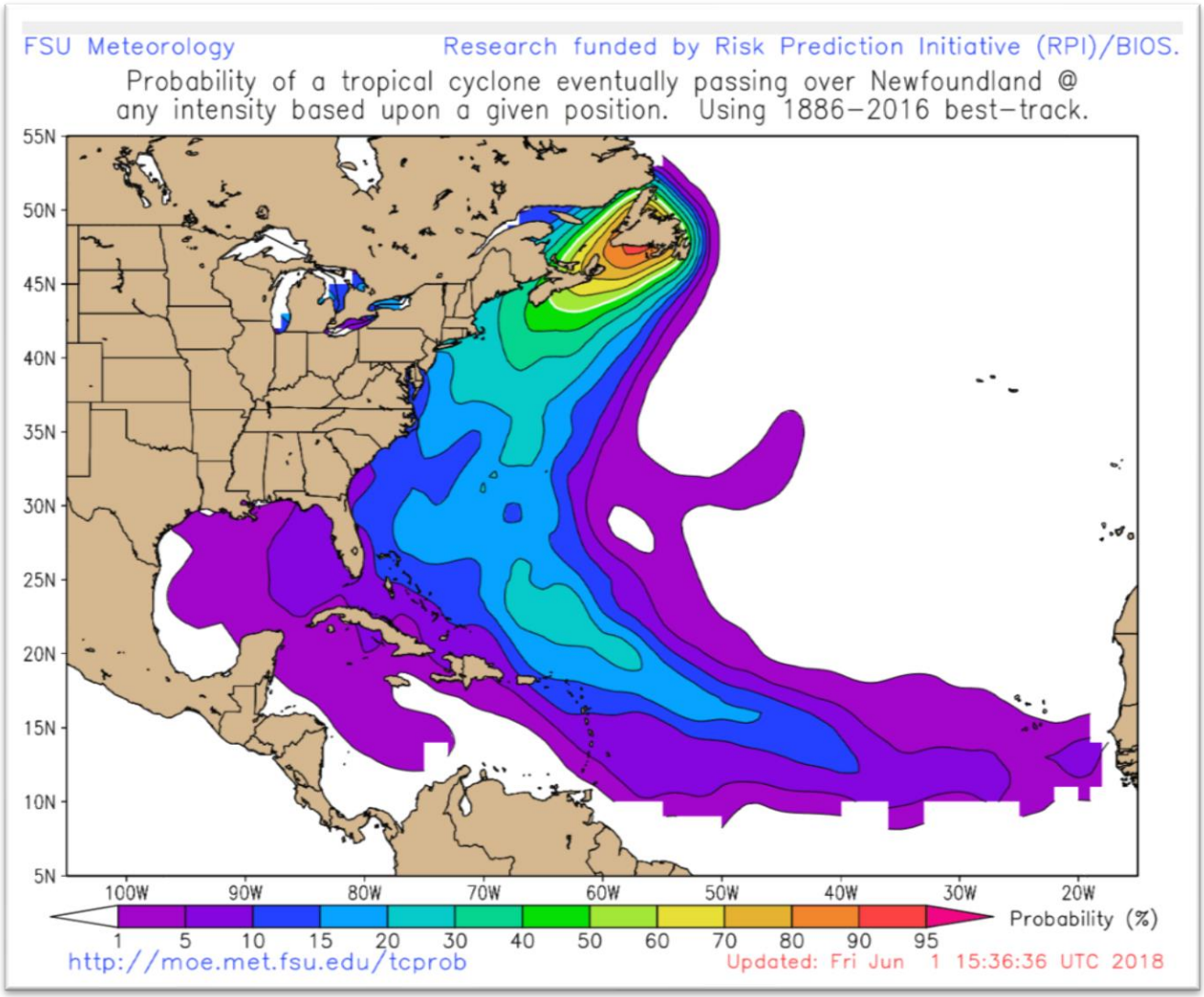

Figure 6. Newfoundland tropical cyclone probability using 1886-2016 historical track (©FSU).

3.0 Analog Years and Historical Tracks

Establishing ENSO as our base index and considering the AMO, SSTs, North Atlantic Oscillation (NAO), and Pacific-North America Index (PNA), the best analog years are 1980 and 2017. Figure 7 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.

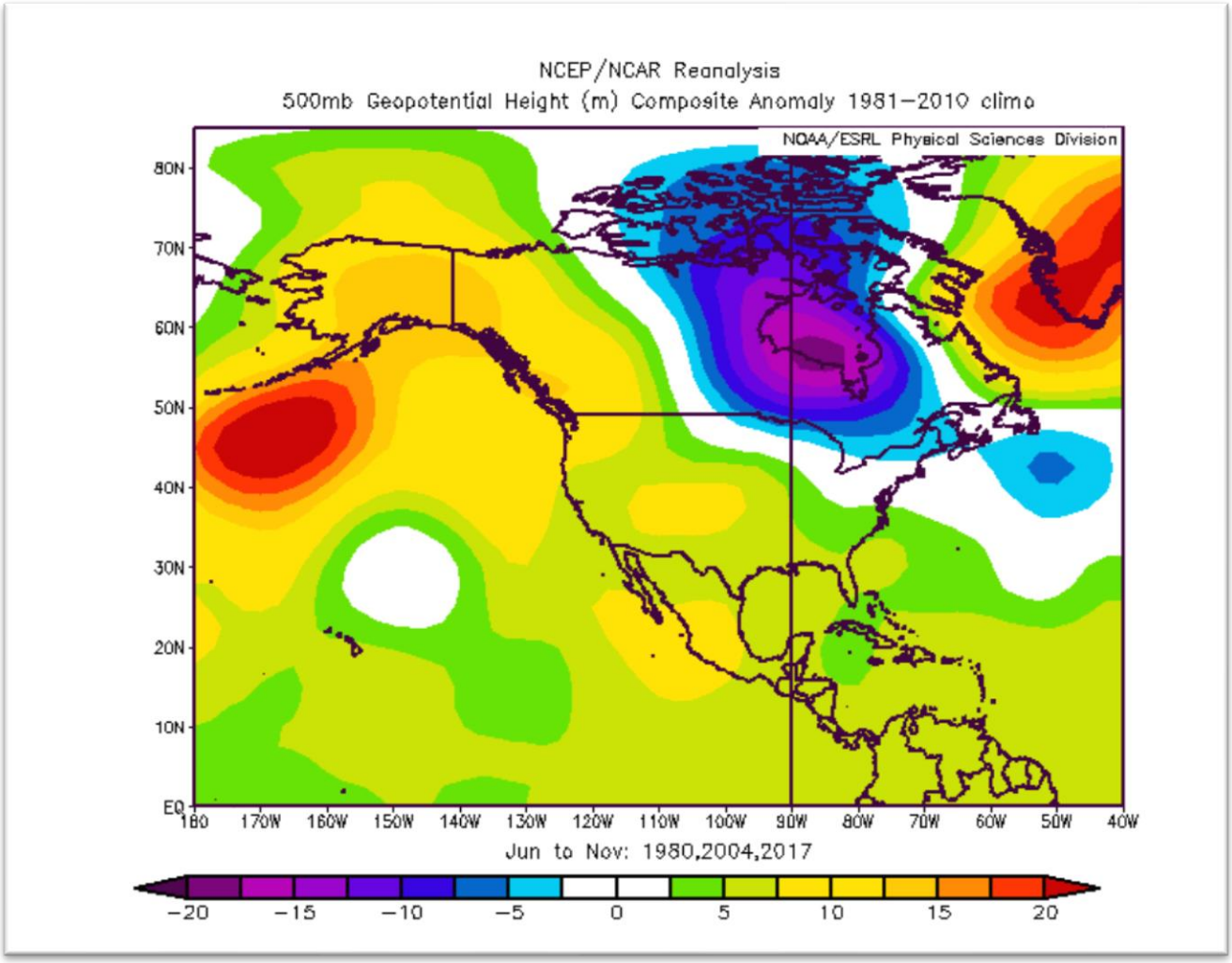

Figure 7. Upper air (500 hPa) Geopotential Heights (m) composite anomaly (1981-2010 climatology) for June through November of the analogy years (1980, 2004, 2017) (©NOAA).

The hurricane track charts for the analog years is given in Figures 8 to 10. The analog years are near-normal to above normal hurricane season. There was no noticeable major impact to Newfoundland and Labrador during the three analog years. Hurricane Nate in 2017 tracked into Newfoundland as a post-tropical remnant and produced about 20 mm of rain in Stephenville and wind gusts to 60 km/h in St. Lawrence. Hurricane Gaston in 2004 tracked just southeast of the Avalon Peninsula and produced 10 to 20 mm of rainfall and a wind gust of 70 km/h in St. John's.

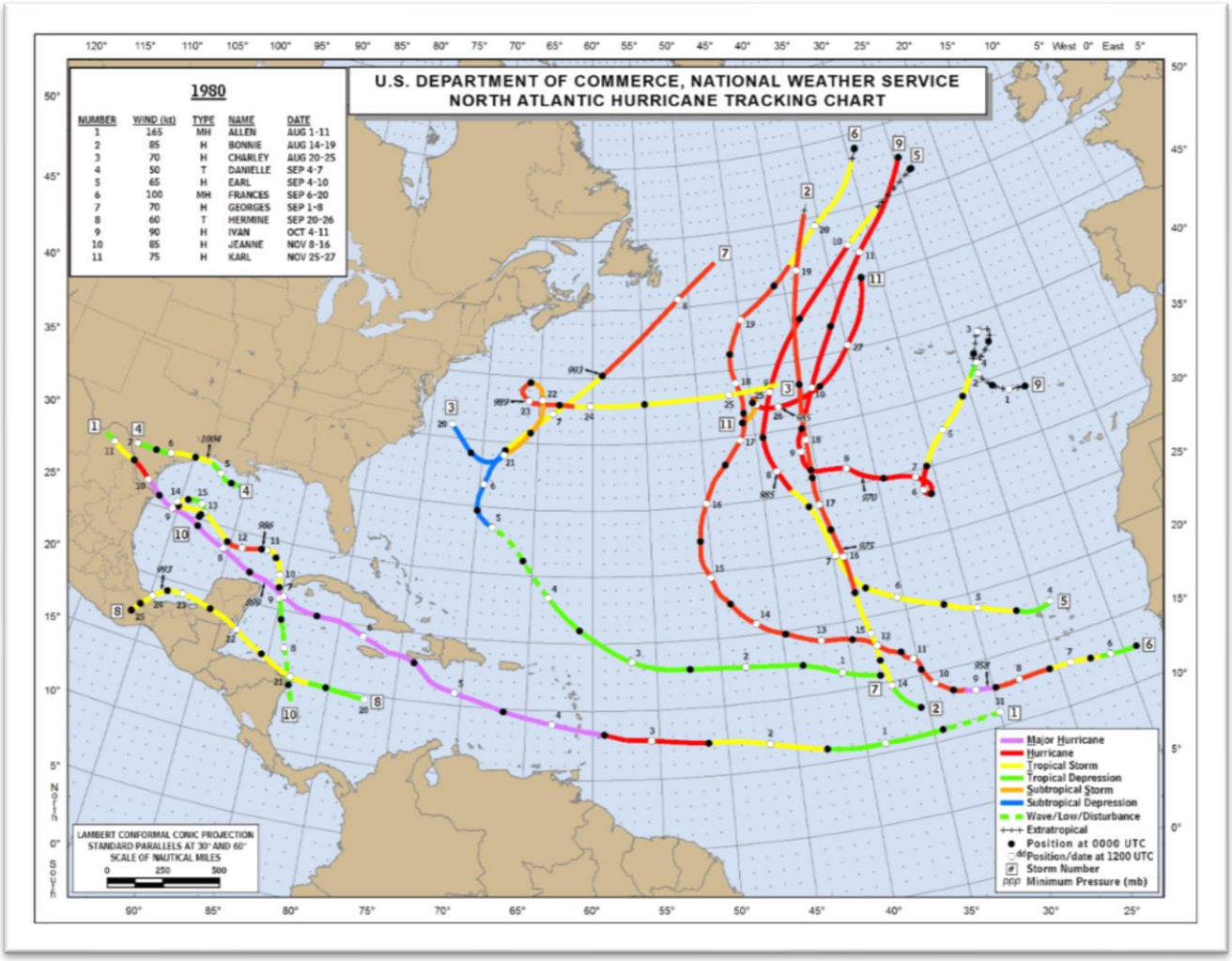

Figure 8. North Atlantic Hurricane Tracking Chart (1980) (©NHC).

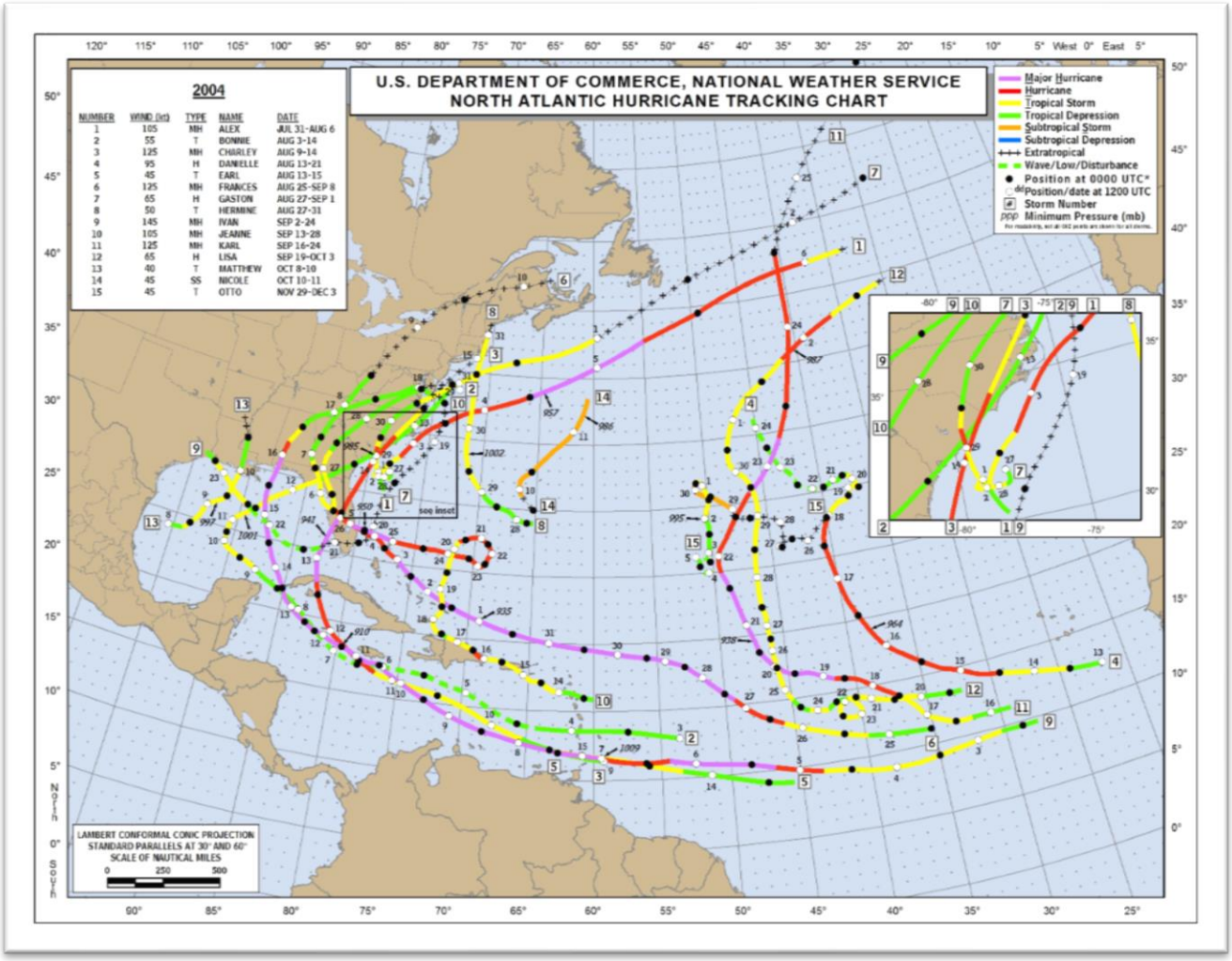

Figure 9. North Atlantic Hurricane Tracking Chart (2004) (©NHC).

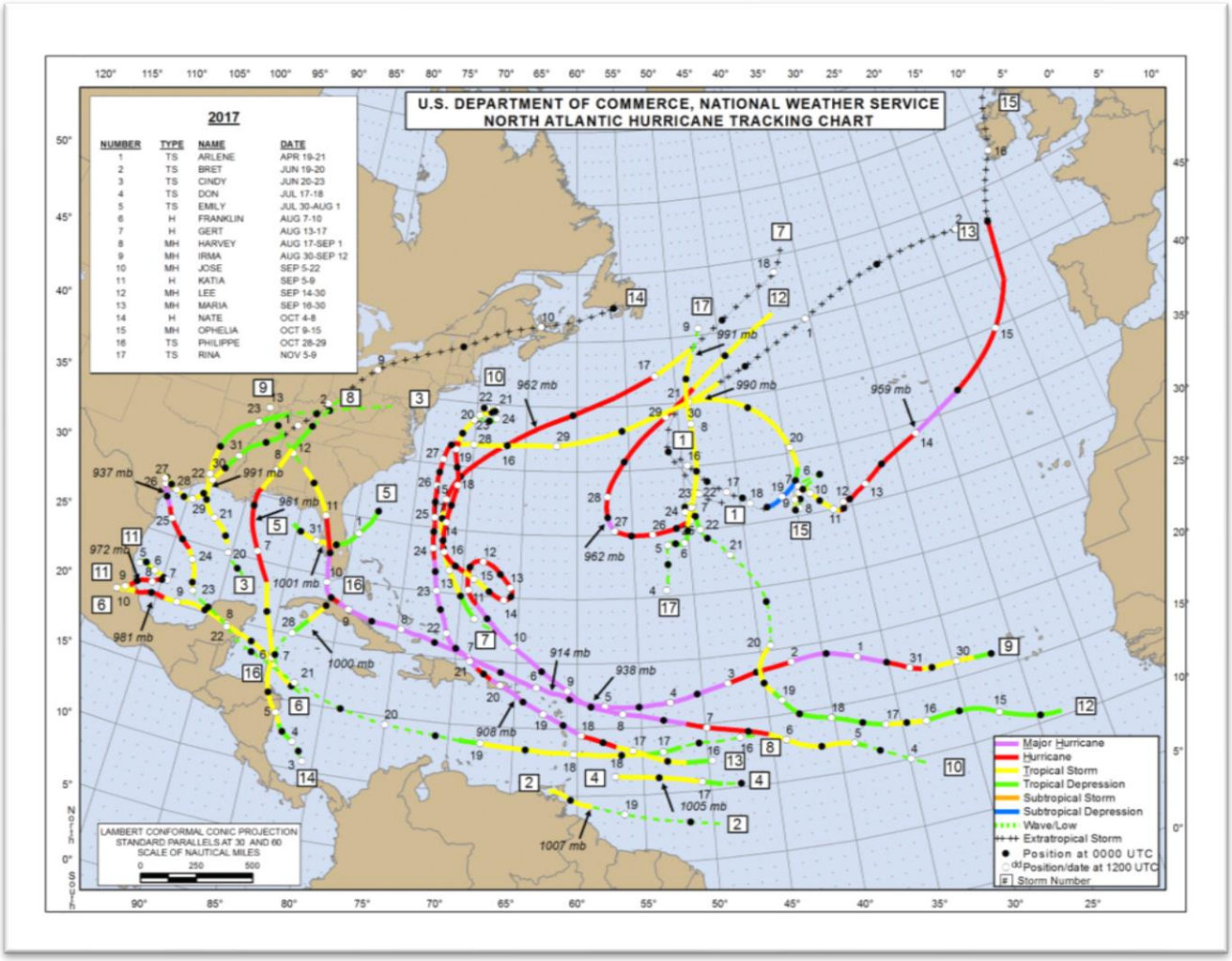

Figure 10. North Atlantic Hurricane Tracking Chart (2017) (©NHC).

4.0 Newfoundland and Labrador Hurricane Season Outlook 2019

The current Atlantic Hurricane Season is forecast to be near normal given the different global indices discussed earlier. The analog years show lower pressure over the northeast USA and eastern Canada extending eastward through the Grand Banks with a normal-strength Bermuda High. Such a weather pattern promotes a storm track east of Atlantic Canada with substantial risk to areas over the Grand Banks.

This season holds a lower risk of 1 to 2 tropical or extratropical cyclones tracking through Newfoundland and Labrador with the highest impact expected to be along southern Newfoundland as seen in Figure 11. 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 below-normal SSTs from Nova Scotia to Newfoundland could weaken any storm tracking toward Atlantic Canada. However, the Wood team believes the general steering pattern and enhancement from upper level troughs is more important for intense tropical cyclone impacts in Atlantic Canada. While the overall pattern and analogs don't appear to be conducive for larger tropical cyclone impact, we can never rule out the possibility of an intense tropical cyclone impact to Newfoundland and Labrador. The most likely impact to Newfoundland and Labrador from a tropical or post-tropical cyclone will always remain heavy rain and flooding.

Figure 11. Newfoundland and Labrador 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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