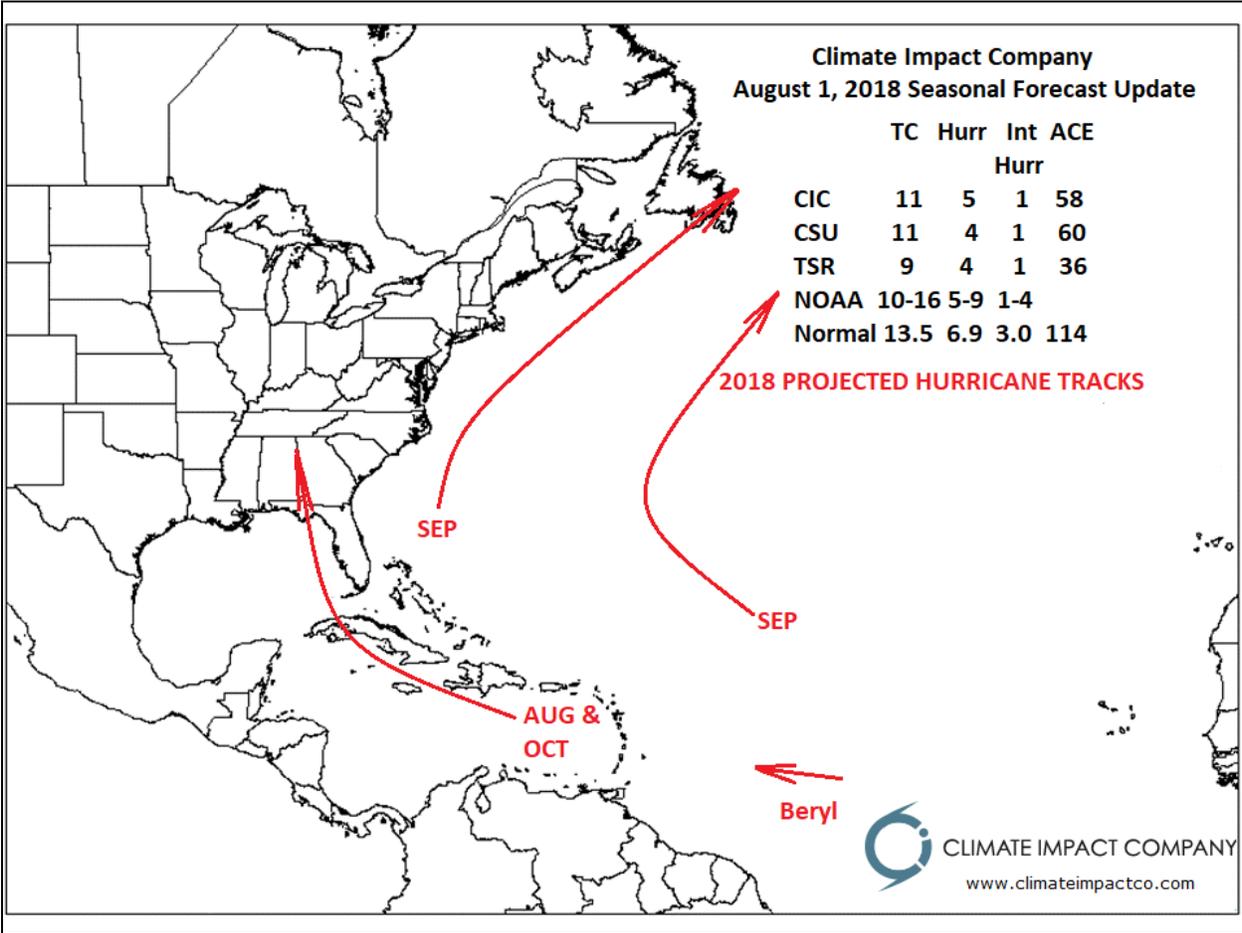


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Climate Impact Company Seasonal Forecast North Atlantic/East Pacific 2018 Tropical Cyclones

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Below Normal Activity; Southeast U.S. At Risk



Executive Summary: The Climate Impact Company 2018 North Atlantic basin tropical cyclone season forecast is updated on August 1st as the most active part of the 2018 season is underway. The seasonal outlook is very similar to the forecast issued May 31 and includes 11 tropical cyclones, 5 hurricanes and 1 intense hurricane. This outlook includes the 3 tropical cyclones and 1 hurricane which has already occurred in 2018. The accumulated cyclone energy forecast for the 2018 season has not changed at 58 which is much lower than last year's 226 (3rd highest on record). The seasonal activity forecast is below normal but 2 hurricanes are forecast to strike the U.S. Coast most likely in the Southeast U.S. from the eastern Gulf of Mexico. Another hurricane is forecast to emerge in the warm waters off the U.S. East Coast. The outer tropical North Atlantic is dormant due to unusually cool surface water. El Nino is approaching which inhibits seasonal activity. The evolution of El Nino has slowed in recent weeks therefore it is possible that while the number of hurricanes forecast for 2018 is confident there may be more tropical storms if El Nino fails or is delayed until late in the year. In the East Pacific the seasonal forecast indicates 17 tropical cyclones, 9 hurricanes and 5 intense hurricanes.

Regional forecast summary: The outlook is based on analog year projections adjusted for regional factors and previously issued climate forecasts by CIC.

1. Gulf of Mexico: The eastern Gulf of Mexico is forecast to encounter 2 northward moving hurricanes, one in August and another in October moving into the Florida Panhandle. One of these hurricanes is likely an intense hurricane. Other tropical cyclone activity is likely due to the warmer than normal SSTA in the Gulf region.
2. Mexico: Due to westerly shear produced by an approaching El Nino episode Mexico is not expected to encounter a hurricane from the east.
3. East Coast Virginia and north: The ocean surface is warmer than normal off the Northeast Corridor Coast and at least 1 hurricane in these waters is likely and occurs in September. Due to the warm waters other tropical cyclones are possible.
4. East Coast south of Virginia: Significant tropical cyclone activity is likely into the eastern Gulf of Mexico off the west coast of Florida. Hurricanes turning into the east coast of Florida or Southeast U.S. is less likely.
5. Caribbean: The Caribbean Sea is forecast much less active than last year given an approaching El Nino increasing upper westerly shear.

Climate discussion: Peak of season for tropical cyclone activity begins August 1st. So far, 3 tropical cyclones (of which 1 became a hurricane) have occurred in the North Atlantic basin. In the East Pacific 7 tropical cyclones have been observed. The warm bias of sea surface temperature anomalies (SSTA) having a tendency to drive above normal activity is located in the tropical East Pacific where a trend toward weak El Nino is occurring (*Fig. 1*). Meanwhile the coolest SSTA on record for the month of July in the Main Development Region (MDR) for North Atlantic hurricanes in the central and eastern tropical North Atlantic was observed (*Fig. 2*). Given the warmer than normal East Pacific and cooler than normal North Atlantic tropics seasonal activity is likely above normal in the East Pacific and below normal in the North Atlantic in 2018.

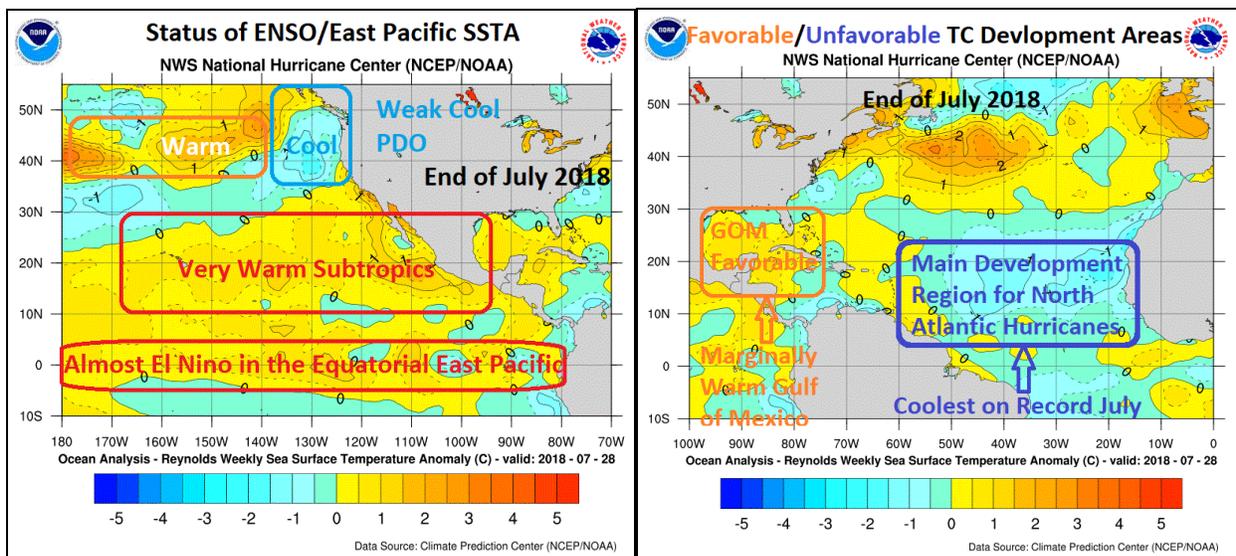


Fig. 1-2: The East Pacific/North Atlantic basin SSTA observations for the end of July 2018. Note the warmer regime in the East Pacific tropics compared to the North Atlantic.

Previous forecasts for the North Atlantic basin were trending toward below normal by private sector forecasters due to upper westerly shear inhibiting development caused by an expected El Nino episode combined with below normal upper ocean heat limiting seasonal activity in the cool waters of the central and east tropical North Atlantic basin (*Table 1*). The NOAA outlook was near to above normal. Of note is the diminished accumulated cyclone energy (ACE) forecast to below normal and greatly reduced from last year. In the East Pacific NOAA forecast 14-20 tropical cyclones, 7-12 hurricanes and 3-7 intense hurricanes which is slightly above normal.

	Tropical Cyclones	Hurricanes	Intense Hurricanes	Accumulated Cyclone Energy
CIC	11	4	2	58
CSU	11	4	1	60
TSR	9	4	1	36
NOAA	10-16	5-9	1-4	N/A
Last Year	17	10	6	226
30-Yr Normal	13.5	6.9	3.0	114.8

Table 1: The most recent seasonal activity forecasts for tropical cyclones across the North Atlantic basin in 2018.

Seasonal activity forecasts are somewhat dependent on the projected ENSO phase (*Fig. 3*). El Nino presence has a tendency to suppress North Atlantic tropical cyclone activity while enhancing activity in the East Pacific. The projections of evolving El Nino for 2018 remain valid. However, the process has slowed in recent weeks as surface temperatures remain slightly warmer than normal in the equatorial East Pacific and beneath El Nino threshold (*Fig. 4*). Plentiful upper ocean heat to drive an El Nino episode peaked in May and late June but has diminished slightly in recent weeks (*Fig. 5*). El Nino onset is delayed until autumn (*Fig. 6*).

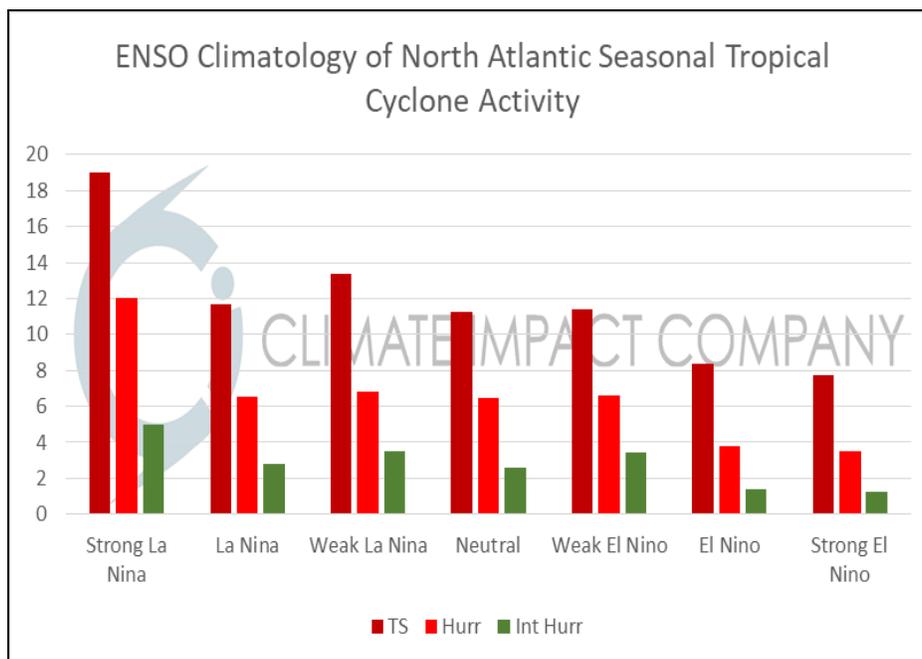


Fig. 3: No. Atlantic basin tropical cyclone season climatology based on ENSO.

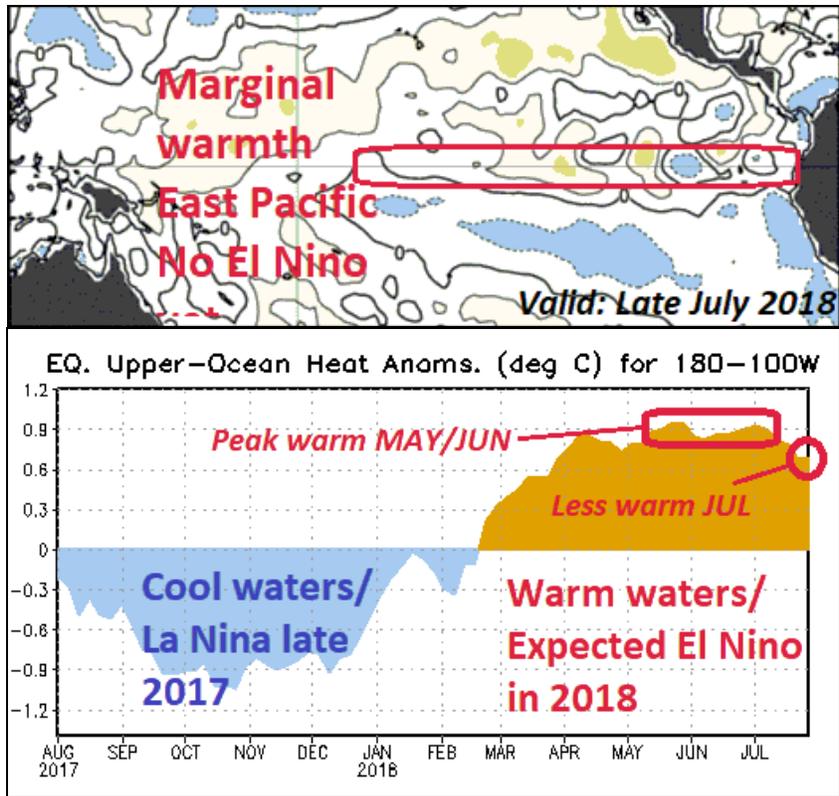


Fig. 4-5: SSTA in the equatorial East Pacific indicates neutral ENSO while plentiful subsurface oceanic warmth east of the Dateline to produce an El Niño has diminished slightly recently.

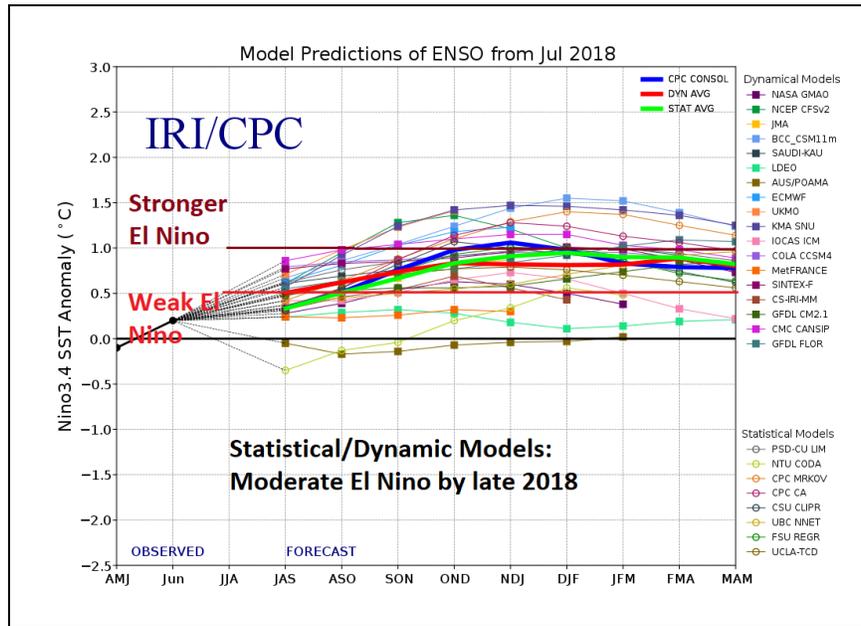


Fig. 6: IRI/CPC collection of statistical and dynamic ENSO phase forecast models trend toward El Niño for later 2018.

Normally, ENSO phase is a dominant factor predicting seasonal tropical cyclone activity in the North Atlantic basin. However, the historic cool SSTA in the tropical/subtropical North Atlantic basin east of the Caribbean Sea is a sharply suppressing factor on hurricane development in this region.

Two primary factors controlling the activity amount for the remainder of the 2018 tropical cyclone season across the North Atlantic basin is the suppressing of seasonal activity influences of an approaching El Nino and cool outer tropical North Atlantic basin. During the past 30 years an evolving El Nino occurring when the North Atlantic tropics were cooler than normal has occurred only twice: 1994 and 2002 (*Fig. 7*). The 1994 and 2002 analogs are used to estimate additional tropical cyclone activity in 2018.

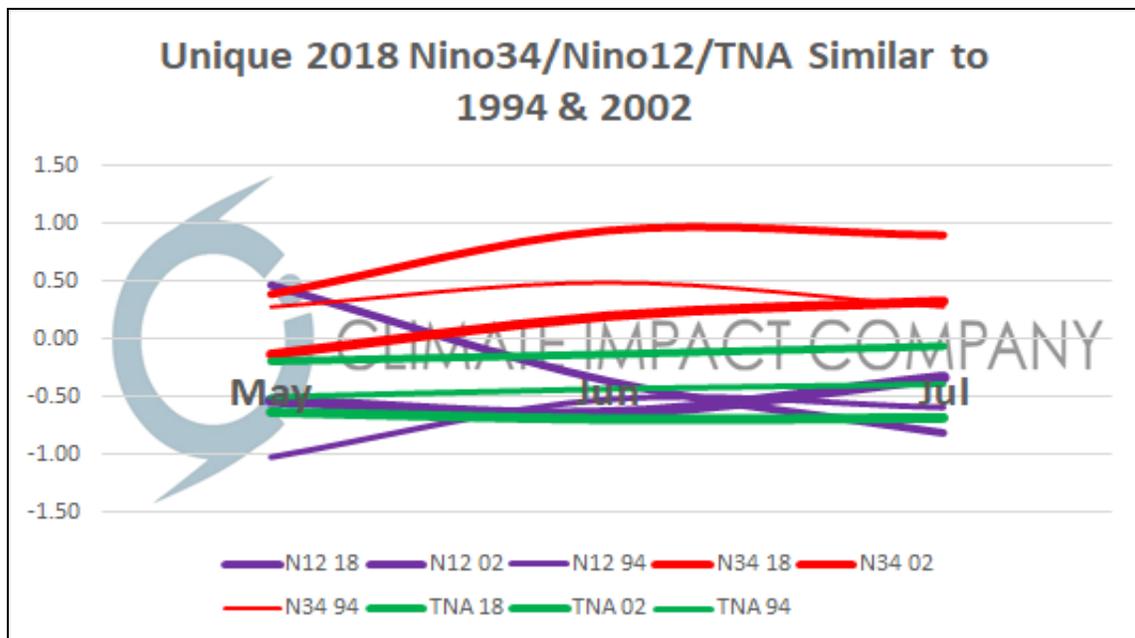


Fig. 7: Paralleling the MAY/JUN/JUL 2018 pattern of Nino34, Nino12 and TNA index is 1994 and 2002. The character is warmer waters of the equatorial East-central Pacific (Nino34) versus the far eastern equatorial Pacific (Nino12) combined with cool tropical North Atlantic index.

Other factors: Below normal rainfall is forecast for far western tropical Africa indicating below normal frequency of strong tropical waves moving into the tropical North Atlantic basin. The quasi-biennial oscillation (QBO) is shifting to negative phase implying below normal upper atmospheric ventilation to cause/sustain low latitude hurricanes, another inhibiting factor for the 2018 season. -QBO favors most of the 2018 seasonal activity occurring in the subtropics.

North Atlantic basin forecast: Each forecast factor described are inhibiting influences on seasonal activity in the North Atlantic basin: Approaching El Nino, cool tropical North Atlantic surface, below normal rainfall in far western tropical Africa and negative quasi-biennial oscillation across the equatorial Atlantic. The remainder of 2018 outlook is driven by the primary drivers of seasonal activity: ENSO and North Atlantic tropical SSTA. Other factors such as QBO are used to adjust seasonal forecast tracks. The selected analogs are 1994 and 2002. Seasonal activity for 1994 and 2002 after August 1 are averaged and added to observed activity in 2018 so far to produce the updated forecast. The outlook indicates an additional 8 tropical storms, 4 hurricanes and 1 intense hurricane after August 1st. The 2018 seasonal forecast is adjusted to 11 tropical storms, 5 hurricanes and 1 intense hurricane which is very similar to the previous outlook (11/4/2). The accumulated cyclone energy forecast remains at 58 which is much below normal (114) and well below last year (226).

	Tropical Storms	Hurricanes	Intense Hurricanes	ACE Index
1994 (after Aug. 1)	6	3	0	28
2002 (after Aug. 1)	10	4	2	60
Average	8	3.5 (4)	1	44
2018 so far	3	1	0	14.4 (14)
Forecast	11	5	1	58
Previous	11	4	2	58
Last Year	17	10	6	226
Climatology	13.5	6.9	3.0	114.8

Table 2: Analog calculation for 2018 North Atlantic basin tropical cyclone activity.

Projected tracks: The hurricane tracks of 1994 and 2002 are averaged for development areas and general forward movement (around the subtropical high pressure steering) and adjusted slightly for 2018 factors such as -QBO. The updated outlook indicates 2 hurricane tracks into the Southeast U.S. from the eastern Gulf of Mexico. One event is in August and the other in October (matching wet CIC climate forecasts for each month). Two other hurricanes are off the East U.S. Coast.

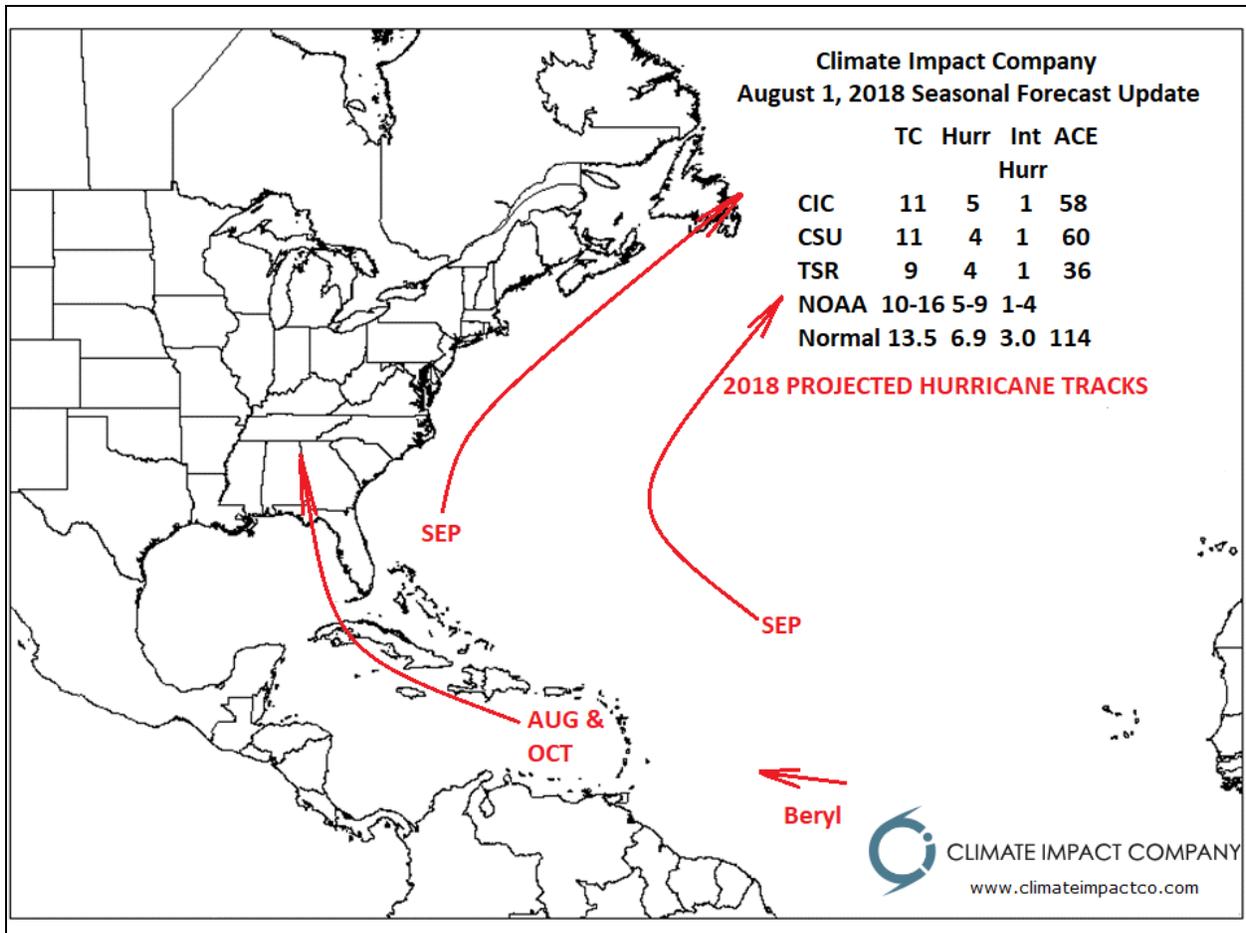


Fig. 8: Climate Impact Company seasonal forecast and projected hurricane paths for the 2018 North Atlantic tropical cyclone season.

East Pacific tropics: Combining the 1994 and 2002 analog years the projected seasonal forecast for the East Pacific basin is 17 tropical cyclones, 9 hurricanes and 5 intense hurricanes. Implied is almost all of the activity after August 1 becomes a hurricane and about half of those events are intense hurricanes. Several to as many as 6 tropical cyclones affect the southern Baja California/south Mexico Coast.