

2021 Atlantic Hurricane Season Outlook: August 12, 2021

We are monitoring the developing season closely. This briefing provides an update to our early-season briefing released on June 7. As the hurricane season enters the months of peak activity, we provide an update on how the season appears to be shaping up.

Current Situation

With 6 named storms so far (Ana, Bill, Claudette, Danny, Elsa, and Fred) the 2021 season is progressing at a rapid pace. In fact, Elsa was the earliest 5th named storm on record. All eyes are currently on Tropical Storm Fred that formed the middle of this week. We expect Fred to regain tropical storm strength as it skirts along the Greater Antilles toward the Florida Straits. Conditions are clearly favorable for storm activity.

Storms that form in the deep tropical North Atlantic are typically our strongest hurricanes. We already had one such storm (Elsa) indicating that this region is primed for hurricane development. The past 5 years has seen above normal activity. Will 2021 extend this unbroken run of above normal activity? Even if we had average activity for the rest of the season, we would still exceed the average numbers of named storms. What are the chances we'll exceed last year's record breaking 30 named storms, and 11 US landfalls?

As a reminder, the 30-year historical period we use as a baseline was updated this year from the period 1981 to 2010 to the more recent period 1991 to 2020. This gives a more up-to-date view of historical activity. With most of this new period being in an active hurricane period, the new normal hurricane activity has shifted upwards to 14.4 named storms, 7.2 hurricanes and 3.2 major hurricanes. Compare that with our previous normal activity of 12.1 named storms, 6.4 hurricanes, and 2.7 major hurricanes. This represents an increase in normal activity of about 12 to 18%.

Forecasts

The most recent forecasts issued last week are worth paying attention to. They contain real skill. The early August forecasts are unanimous in calling for above average activity (**Table 1**). This is relative to the new higher averages and so these forecasts certainly call for an active season. This would be a continuation of the recent 5-year streak of above normal activity. Note that the forecasts in **Table 1** include the storms that have already happened. Note also that the National Oceanic and Atmospheric Administration (NOAA), and the UK Met Office forecast ranges of activity to reflect the forecast uncertainty. They state a 70% likelihood of the numbers falling within these ranges.

NOAA raised both the floor and the ceiling of its forecast range compared to its late May forecast, and now expects 15-21 named storms. This is higher than the normal range and they are not ruling out the chance of an extremely active season. But beating 2020 is unlikely. This nudge upwards reflects their observation that the deep tropical North Atlantic is primed for hurricane development. Here, ocean temperatures warmed faster than normal in June and July, trade winds are weaker than normal, and wind shear is light. They also observed a stronger than normal West African Monsoon. This suggests the atmosphere is favorable for strong easterly waves to track across the North Atlantic and focus energy for hurricane development. They also note an increasing likelihood of La Niña becoming established before the season is over. Perhaps most important is the near-zero chance of El Niño this year that would suppress hurricane activity.

Interestingly, Tropical Storm Risk (TSR) reduced the proportion of strong storms relative to their early season forecast but kept the numbers of named storms the same at 18. This reduction reflects a forecast for brisk, less favorable trade winds across the tropical North Atlantic. However, they raised the forecast of US landfalling activity which they now forecast to be above the recent 10-year average. This is based on favorable steering flow throughout July and the increased likelihood for a weak La Niña later in the season that favors storm formation closer to the coast.

The latest forecast from Colorado State University (CSU) is nearly the same as their June 3 forecast, calling for an above average season. They note the overall warm ocean and weak wind shear. In-line with TSR, they call for slightly above normal chance of major hurricanes making landfall in the Continental US and Caribbean.

Atlantic seasonal hurricane forecasts issued between August 2 and August 5, 2021

Table 1. Summary of 2021 Atlantic Seasonal Hurricane Forecasts Issued in Early August

Data Source	Date Issued	# Named Storms	# Hurricanes	# Major Hurricanes	ACE ¹
1991-2020 average (Source NOAA/CPC)		14.4	7.2	3.2	122.1
Average of 5 analog years (Source CSU)	Aug 5, 2021	16	8	5	153
Colorado State University	Aug 5, 2021	18	8	4	150
NOAA/CPC	Aug 4, 2021	15-21	7-10	3-5	142-246
Tropical Storm Risk	Aug 5, 2021	18	7	3	122
UK Met Office	Aug 2, 2021	12-18	4-8	1-5	64-168

¹Accumulated Cyclone Energy (ACE) is a combined measure of hurricane intensity, duration and frequency. ACE is calculated as the sum of the square of the maximum wind speed in each 6-hour period during the life of a tropical cyclone from the time it reaches tropical storm strength (wind speeds ≥ 65 kmph (39 mph)) in units of 10^4 ; $ACE = 10^{-4} \sum v^2_{max}$, where v is measured in knots.

Analog years

An alternative view to forecast models is provided by hurricane activity in past years that had similar July climate conditions and Aug-Sept-Oct forecast conditions to this year. CSU uses this approach to qualitatively correct their forecast. CSU's selected analog years – 1996, 2001, 2008, 2011, 2016, 2017 – are characterized by cool-neutral to weak La Niña conditions and slightly warmer than normal North Atlantic Ocean temperatures for the peak of the hurricane season. The average activity among these 6 analog years is shown in the above table and indicates above normal numbers of named storms, hurricanes, and major hurricanes, and is close to their official forecast.

Climate Signals: Ocean Temperatures

The formation and development of hurricanes is highly dependent on the available energy in the upper layers of the ocean. Therefore, ocean temperatures are often used as a proxy for available energy and is a major factor in determining seasonal activity.

This year, North Atlantic Ocean temperatures warmed faster than normal during the first half of the summer and are now broadly warmer than normal (**Figure 1, top panel**). There are a couple of remaining cool spots off the coast of North Africa and off Florida's East Coast. But dynamical model forecasts indicate these should warm up to become warmer than normal for the peak of the hurricane season. This anticipated warming will favor storm development in the deep tropics - the breeding ground for our most intense hurricanes.

To sustain strong hurricanes the ocean heat must extend down through the top few hundred meters of the ocean. A summary measure of this heat is known as the Ocean Heat Content (OHC). **Figure 1, bottom panel** shows that high OHC extends across the main hurricane development regions.

The highest warmth extends across parts of the Caribbean and with a hotspot in the Gulf of Mexico associated with the loop current. These hotspots inject energy into hurricanes as they pass over, as was the case for Hurricane Katrina in 2005. These reservoirs of heat, should they persist, are more than sufficient to nurture and intensify passing hurricanes.

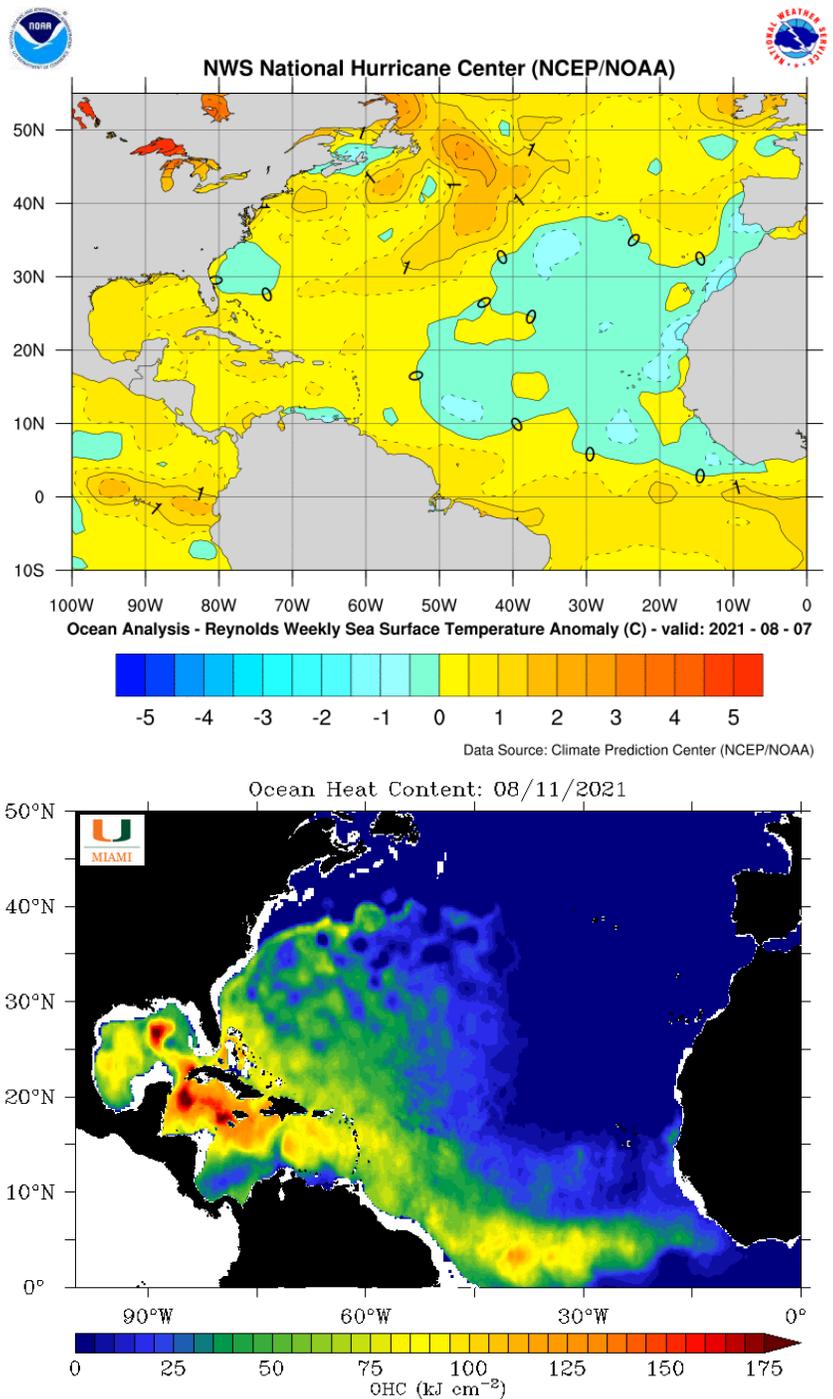


Figure 1. (top panel) Departure of weekly average sea surface temperature from a long-term average ($^{\circ}\text{C}$) valid on August 7, 2021. (bottom panel) Ocean Heat Content (KJ/cm^2) valid on August 11, 2021.

Sources: https://www.nhc.noaa.gov/tafb/atl_anom.gif: NCEP/NOAA, and <http://isotherm.rsmas.miami.edu/heat/web/atlantic.php>: University of Miami Rosenstiel School

Climate Signals: Emerging La Niña?

ENSO is currently in a neutral state but oceanic conditions over the equatorial Pacific are trending towards La Niña. This is evidenced by the cooler than normal waters that now extend across the central equatorial Pacific. The atmosphere, however, has not yet locked in step with the oceanic trend and looks fairly ENSO neutral.

We are still under a La Niña Watch, as issued by NOAA, which means that forecasts favor the development of La Niña in the coming months. Indeed, the latest forecasts now more strongly favor La Niña than the forecasts issued in May (Figure 2). The chance of El Niño has also shrunk to just 6%. This corresponds to a 94% chance of favorable conditions (neutral or La Niña). The emergence of La Niña would push hurricane activity towards the higher end of the forecast ranges.

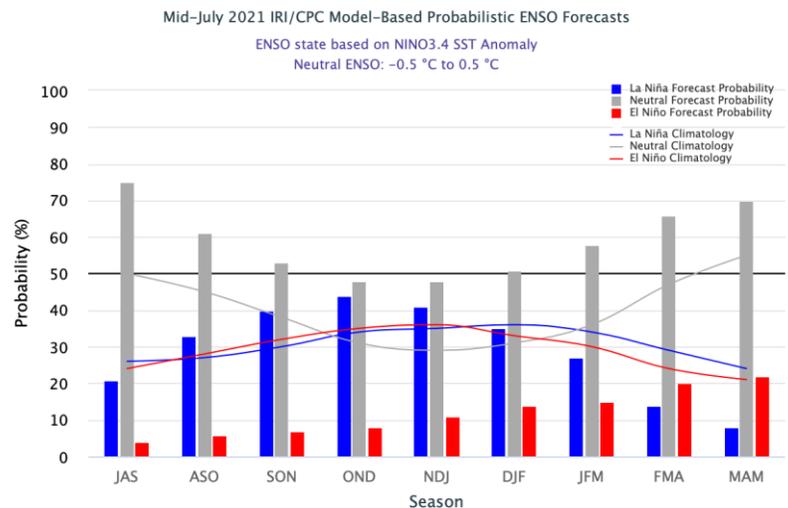


Figure 2. The official CPC/IRI ENSO probability forecast, based on a consensus of forecasters using human judgment and model output.

Source: International Research Institute for Climate and Society. Published July 19, 2021

Explainer: El Niño Southern Oscillation (ENSO)

The sloshing back and forth of warm water across the equatorial Pacific associated with El Niño Southern Oscillation (ENSO) exerts the strongest known control on Atlantic hurricane activity. The atmosphere responds with rising air following the warm water across the Pacific. In turn, this shifts the entire global overturning circulation.

During El Niño, when warm waters slosh over to the central and eastern Pacific, the ascending air drives strong winds aloft over the Western Atlantic. Such strong winds act to rip hurricanes apart. During La Niña, when warm waters slosh over to the Western Pacific, these hostile winds aloft over the Atlantic dissipate, leaving favorable conditions for hurricane activity.

Confidence

Forecasts issued in early August contain useful skill but all seasonal forecasts should be read with caution. They significantly outperform the standard benchmark of the so-called “persistence” forecast (a forecast of average activity every year). The sources of enhanced skill arise from persistence of temperature anomalies in the oceans and the fact we are past the April/May predictability barrier for ENSO. Remaining uncertainties stem from the progression of ENSO, the response of TCs to the forecast environmental conditions, and the influence of intra-seasonal variability that can raise or suppress activity for periods of a few weeks.

Summary

The collection of forecasts issued in early August are unanimous in calling for an active season. No forecasts call for an inactive season. Things to watch during the peak hurricane months of August and September are the potential emergence of La Niña (strengthening the case for an active season), and the evolution of hotspots of heat in the Gulf of Mexico associated with the Loop Current.

Additional advice

The Willis Re Analytics Team will report on all tropical storms and hurricanes in the North Atlantic and the Gulf of Mexico. This includes briefings and updates to our clients during hurricane events. These will contain the latest information from the National Hurricane Center, commentary on likely tracks and intensities and, when available, updates and modeling guidance from the catastrophe modeling companies.

Forecast information sources

Klotzbach, P. J., Bell, M. M. and J. Jones: "Forecast of Atlantic Seasonal Hurricane Activity and Landfall Strike Probability for 2021", Aug 5, 2021, Department of Atmospheric Science, Colorado State University, Fort Collins CO, U.S. Available at <https://tropical.colostate.edu/Forecast/2021-08.pdf>

Met Office: "North Atlantic tropical storm seasonal forecast 2021", Aug 2, 2021. Available at <https://www.metoffice.gov.uk/research/weather/tropical-cyclones/seasonal/northatlantic2021>

Rosencrans, M., and CoAuthors: NOAA 2021 Atlantic Hurricane Season Outlook. Issued Aug 4, 2021. Available at <https://www.cpc.ncep.noaa.gov/products/outlooks/hurricane.shtml>

Saunders, M. and A. Lea: "August Forecast Update for North Atlantic Hurricane Activity in 2021", Aug 5, 2021, Department of Space and Climate Physics, University College London, London, U.K. Available at <https://www.tropicalstormrisk.com/>

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