GUY CARPENTER

2018 Western North Pacific Basin Tropical Cyclone Predictions

The Guy Carpenter Asia-Pacific Climate Impact Centre (GCACIC) at the School of Energy and Environment, City University of Hong Kong, has released its 2018 predictions for tropical cyclone formations and landfalls using a regional climate model focusing on East Asia. The model uses information from a global climate prediction model made available in April 2018.

Consistent with a situation typical to an El Niño Southern Oscillation (ENSO) neutral year following a La Niña year, the number of tropical cyclones between May 1 and October 31 is predicted to be near- to below-normal. Consequently, the number of tropical cyclone landfalls is also expected be near- to below-normal in all regions of East Asia.

T1– HISTORICAL AND PREDICTED AVERAGES OF TROPICAL CYCLONE LANDFALLS FROM MAY TO OCTOBER, BY LOCATION

Location	1968-2015 Average	GCACIC Regional Climate Model Forecast, 2018
Japan and Korea	4.9	3.7
Eastern China and Taiwan	3.6	3.0
South China, Vietnam and the Philippines	7.3	4.9

Currently, weak La Niña conditions are present with below average sea surface temperatures (SSTs) across the central and eastern equatorial Pacific with near normal cloudiness and winds. The U.S. National Oceanic and Atmospheric Administration (NOAA) predict the La Niña conditions to weaken and transition into ENSO-neutral conditions (Figure 1) during May. The ENSO-neutral conditions are expected to continue through the 2018 Northern Hemisphere summer.

Tropical Cyclones:
Six Month Period May 1 - October 31

Approximately **20** Formations predicted by GCACIC in 2018

Which is less than

25.6 Formation Average 1968 - 2015

Of approximately 20 formations predicted

Less than **12** Landfalls predicted by GCACIC in 2018

Which is less than

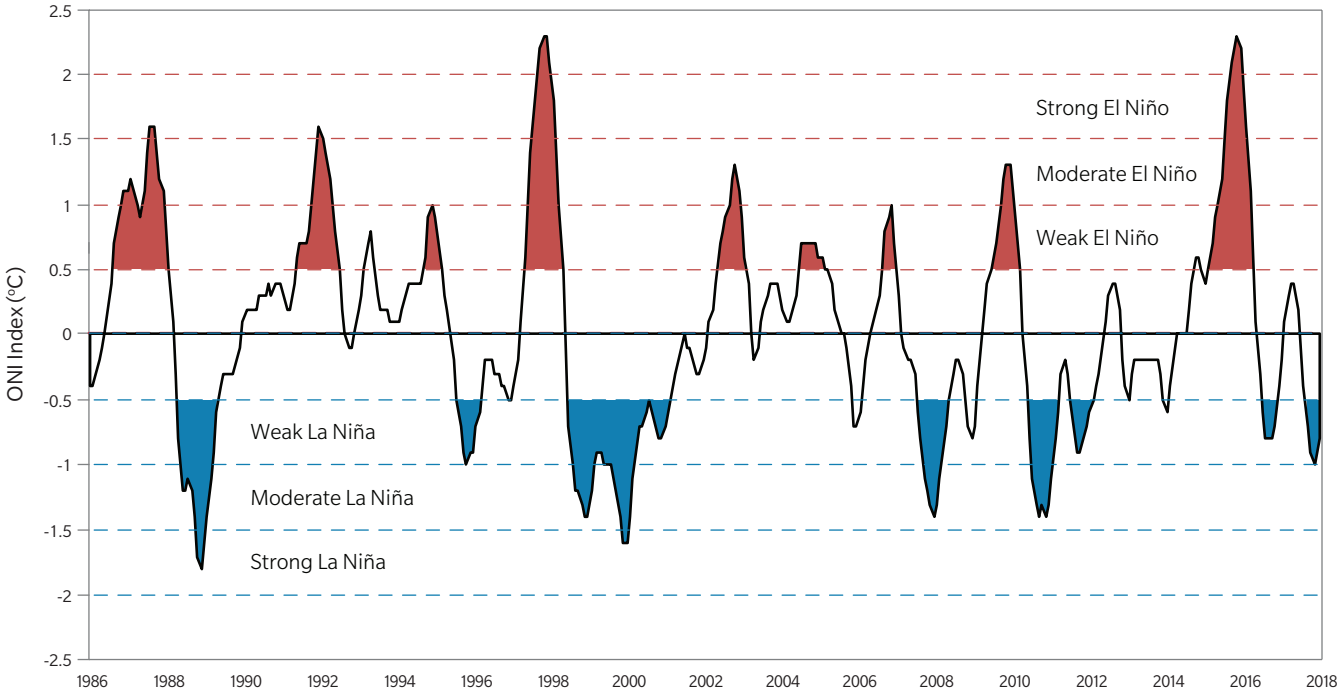
16 Landfall Average 1968 - 2015

Source: Guy Carpenter

MARSH & McLENNAN COMPANIES

Many dynamic and statistical models are used for ENSO predictions. Many of these models predict the Oceanic Niño Index (ONI), which is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO. ONI is defined as the three-month running mean SST anomalies in the Niño region 3.4 that corresponds to latitudes of 5°N-5°S and longitudes of 120°W-170°W. ONI is expected to transition to neutral conditions into the -0.5°C to +0.5°C range for several months during the Northern Hemisphere summer. Following this period, there is considerable forecast uncertainty due to the lower prediction accuracy for forecasts made at this time of year.

F1 – OCEANIC NIÑO INDEX (ONI)



Source: NOAA

Based on tropical cyclone data from the Joint Typhoon Warning Centre (JTWC) using the Saffir-Simpson scale, the number of landfalls during these ENSO-neutral years that follow a La Niña (1986, 1996, 2001, 2008 and 2012) is compared with the long-term average from 1986-2015. The number of landfalls is compared for tropical cyclones of 34 knots and higher.

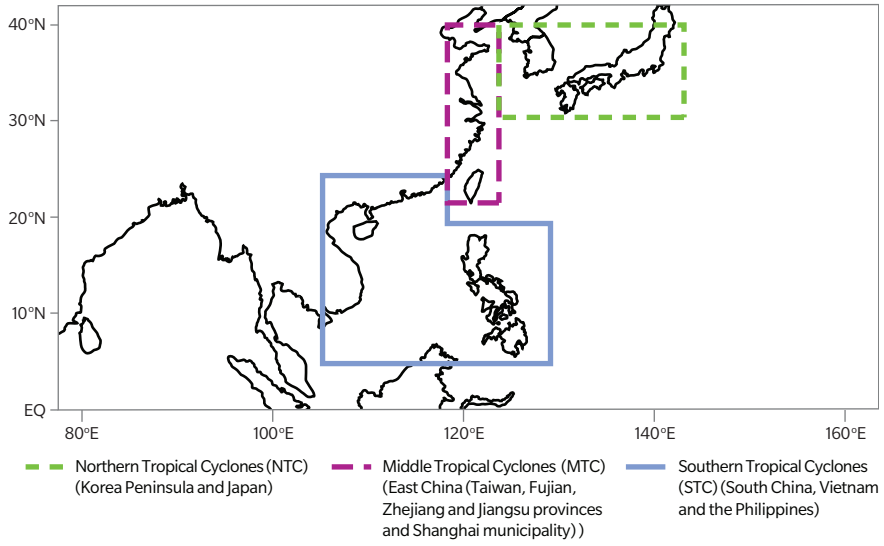
Based on these five neutral years (Table 2), the average number of tropical cyclone landfalls is below average for Japan and Korean and South China, Vietnam and the Philippines and above average for Eastern China and Taiwan.

T2– HISTORICAL AVERAGES OF TROPICAL CYCLONE LANDFALLS FROM MAY TO OCTOBER FOR 1986 TO 2015 AND ENSO-NEUTRAL YEARS THAT FOLLOW A LA NIÑA (1986, 1996, 2001, 2008 AND 2012)

Number of Tropical Cyclone Landfalls				
Region	**1986-2015 Average**	**1986, 1996, 2001, 2008 and 2012 Average**	**Difference**	**% Difference**
Japan and Korea	4.9	4.0	-0.9	-18.4%
Eastern China and Taiwan	3.6	3.8	0.2	5.6%
South China, Vietnam and the Philippines	7.3	7.2	-0.1	-1.4%
Total	**15.8**	**15.0**	**-0.8**	**-5.1%**

Details of Findings

F2 – THE THREE REGIONS IN WHICH THE NUMBER OF TROPICAL CYCLONE LANDFALLS IS PREDICTED

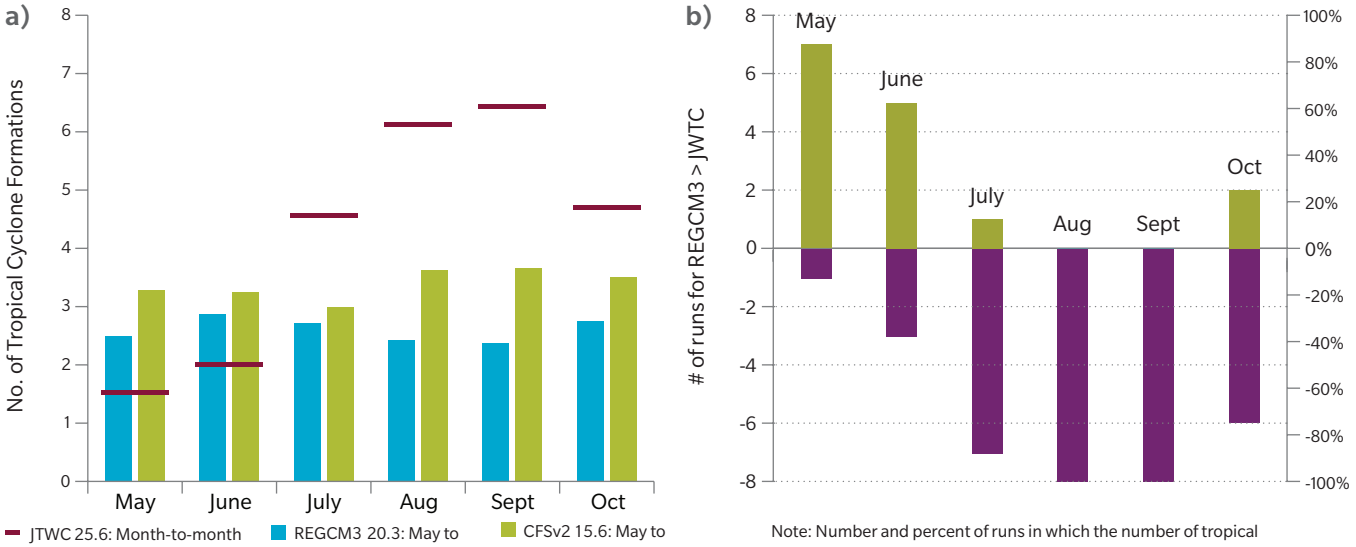


A 2014 study[1] by Huang and Chan shows it is possible to use a regional climate model to more accurately predict the number of tropical cyclone formations compared to predictions based solely on a global climate model. In this briefing, RegCM3 refers to the GCACIC's Regional Climate Model, Version 3, while CFSv2 is the global Climate Forecast System, Version 2, from the U.S. National Centers for Environmental Prediction.

The global Climate Forecast System is used by the RegCM3 as initial and boundary conditions for a dynamic downscaling model to predict the number of tropical cyclone formations and the number of landfalls with a lead time of one to six months. Predictions are for the three regions shown in Figure 2.

The RegCM3 model is run eight times, each using slightly different initial conditions so that the predicted numbers shown are the average of these eight runs. For the early season from May to June 2018, both the CFSv2 and RegCM3 predict the monthly number of tropical cyclone formations (Figure 3a) to be well above the climatology of the Joint Typhoon Warning Center. For the peak season of July to September, the number of tropical cyclone formations is predicted to be less than the climatology. This pattern is also seen in the spread of the eight RegCM3 runs (Figure 3b). The majority of the eight runs for the early season of May and June are above the average number of tropical cyclone formations. For the peak season, there are a below-average number of formations.

F3 – PREDICTIONS FOR MAY TO OCTOBER 2018 BASED ON APRIL 1-2, 2018 INITIAL CONDITIONS



JTWC 25.6: Month-to-month evolution of the number of tropical cyclone formations obtained from the climatology of the Joint Typhoon Warning Center from 1968 to 2015.

REGCM3 20.3: May to October 2018 predictions from GCACIC's Regional Climate Model.

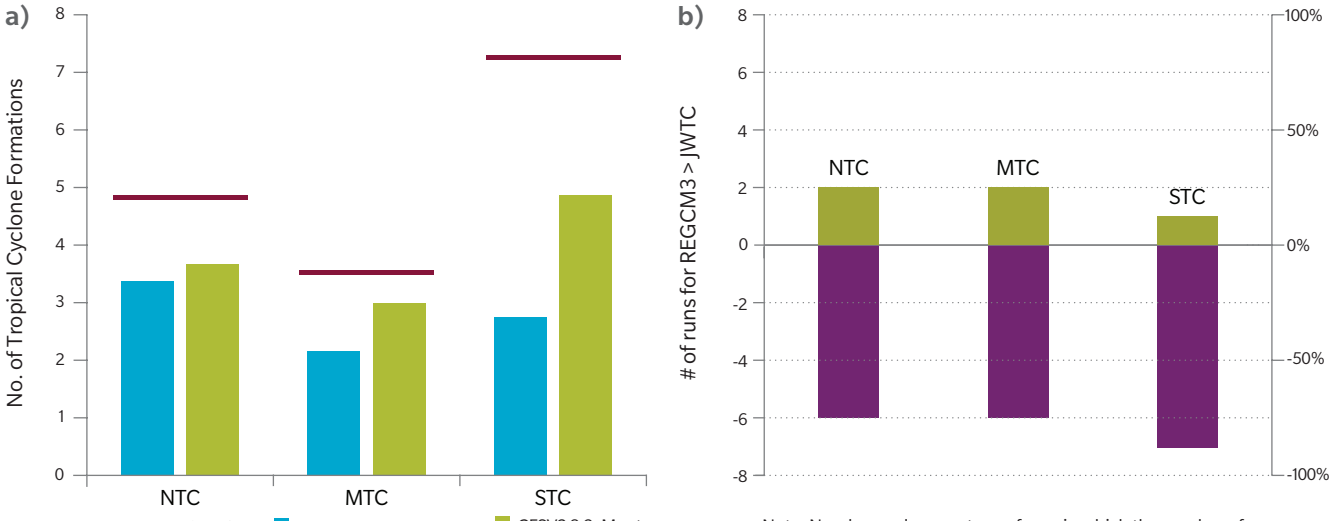
CFSv2 15.6: May to October 2018 predictions from global Climate Forecast System.

Note: Number and percent of runs in which the number of tropical cyclone formations is above or below average.

1. Huang, W.R. and J. C. L. Chan, 2014: Dynamical downscaling forecasts of western North Pacific tropical cyclone genesis and landfall. *Climate Dynamics*, 42, 2227–2237.

Given the high probability of a below-normal number of tropical cyclone formations in the peak season, it is likely that the number of landfalling tropical cyclones in each of the three East Asia regions is to be near or below-normal (Figure 4a). Indeed, the average number of landfalling cyclones for NTC and STC is well below the JWTC climatology while the MTC average is near-normal. In addition, 75 percent of the runs for the NTC and MTC and 88 percent of the runs for STC regions are below the average number of landfalls (Figure 4b).

F4 – PREDICTIONS FOR MAY TO OCTOBER 2018 BASED ON APRIL 1-2, 2018 INITIAL CONDITIONS



JWTC 15.7: Number of tropical cyclone landfalls in each region obtained from the climatology of the Joint Typhoon Warning Center from 1968 to 2015.

REGCM3 11.6: May to October 2018 predictions from GCACIC's Regional Climate Model.

CFSV2 8.3: May to October 2018 predictions from the global Climate Forecast System.

Note: Number and percentage of runs in which the number of tropical cyclone landfalls in each region is above average or below average.

Summary

Based on the regional climate model, it is expected that the number of tropical cyclone formations in the western North Pacific and the number of tropical cyclones making landfall in all parts of East Asia during the period May to October 2018 will likely be near- to below-normal. This is consistent with a near- to below-normal number of tropical cyclone formations in an ENSO neutral year.

The regional climate model has been modified and validated for the Australian region and will be run in September-October for the upcoming 2019/2020 Australia cyclone season.

About Guy Carpenter

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