



July 2015

2015 WESTERN NORTH PACIFIC BASIN TROPICAL CYCLONE PREDICTIONS

2015 TROPICAL CYCLONE PREDICTIONS

The Guy Carpenter Asia-Pacific Climate Impact Centre (GCACIC) and the School of Energy and Environment, City University of Hong Kong have released their 2015 predictions for tropical cyclone formations and landfalls.

The region is currently experiencing El Niño conditions that are predicted (with a more than a 90 percent chance) to continue through the Fall of 2015, as stated in the June 11, 2015 advisory from the Climate Prediction Centre (NOAA/U.S.). Consistent with El Niño years, the prediction shows fewer than average tropical cyclone landfalls in the Western North Pacific Basin, especially in the southern part of the region.

T-1 | 2015 PREDICTIONS FOR THE NUMBER OF TROPICAL CYCLONES

Comparison of the Historical and Projected Number of Tropical Cyclones (The projection period is from June 1, 2015 through November 30, 2015)		
	2000-2010 Average Number of Tropical Cyclone Formations (JTWC)	Regional Climate Model Forecast (GCACIC)
Tropical Cyclone Formations	23.0	19.9
Tropical Cyclone Landfalls	17.4	10.3

(Source: The Joint Typhoon Warning Center and the Guy Carpenter Asia-Pacific Climate Impact Centre)

T-2 | 2015 PREDICTIONS FOR THE NUMBER OF TROPICAL CYCLONE LANDFALLS BY REGION

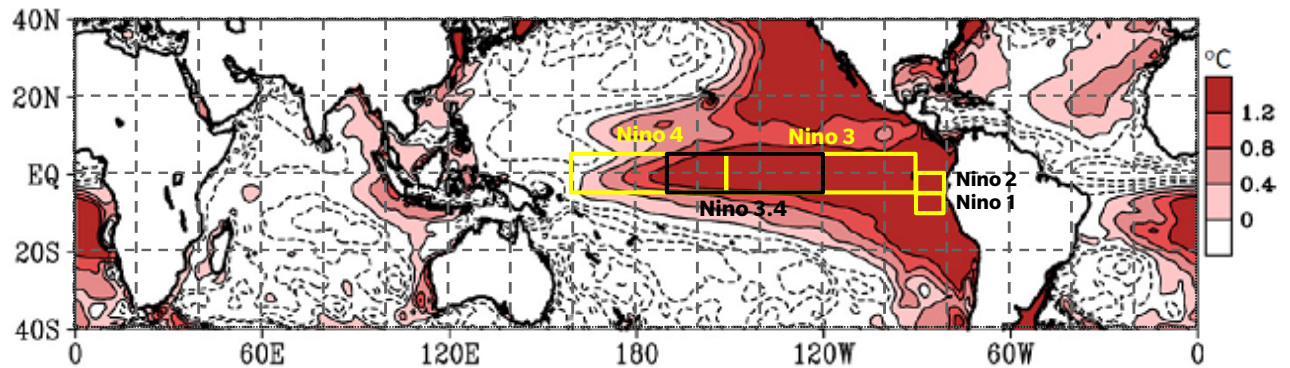
Comparison of the Historical and Projected Number of Tropical Cyclone Landfalls (The projection period is from June 1, 2015 through November 30, 2015)		
Region	2000-2010 Average Number of Tropical Cyclone Formations (JTWC)	Regional Climate Model Forecast (GCACIC)
Japan and Korea	4.5	3.0
Eastern China and Taiwan	4.4	3.3
South China, Vietnam and the Philippines	8.5	4.0

(Source: The Joint Typhoon Warning Center and the Guy Carpenter Asia-Pacific Climate Impact Centre)

In table T-2, tropical cyclone landfalls are counted in each region they pass through. The number of landfalls in table T-1 are the total across all three regions.

The current El Niño conditions of above average sea surface temperatures (SSTs) along the eastern equatorial Pacific Ocean will continue through November 2015. The above average SST predictions in the El Niño regions for June through November are shown in the following chart.

F-1 | CLIMATE FORECAST SYSTEM V2, SEA SURFACE TEMPERATURE PREDICTION FOR JULY THROUGH NOVEMBER MINUS THE AVERAGE FROM 2000 TO 2010



(Source: Climate Forecast System V2)

A study by Wang and Chan¹ shows a distinction needs to be made between strong and moderate El Niño periods. If this distinction is not made the impact of El Niño would be overstated in moderate El Niño periods and understated in strong El Niño periods. The findings from this study show that during strong El Niño years the tropical cyclone formations tend to shift southeastward, their lifespan is longer and their tracks are significantly different with more cyclones recurving northward.

Another study by Camargo and Sobel² focused on the 13 strongest El Niño years between 1950 and 2002 and concluded that during El Niño years, tropical cyclones have a longer life span and a stronger intensity with more Saffir Simpson Scale Category 3 to 5 storms.

1 Wang B. and J.C.L. Chan (2002): How strong ENSO events affect tropical storm activity over the Western North Pacific. *Journal of Climate*, **15**, 3252–3265

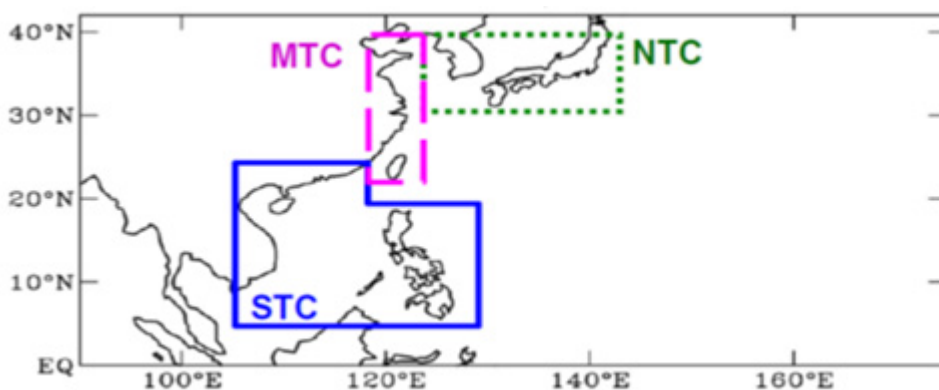
2 Camargo S.J. and A. H. Sobel, 2005: Western North Pacific Tropical Cyclone Intensity and ENSO. *Journal of Climate*, **18**, 2996–3006.

DETAIL OF FINDINGS

A recent study³ in 2014 by Huang⁴ and Chan⁵ 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 document, RegCM3 refers to this Regional Climate Model, Version 3, while CFSv2 is the global Climate Forecast System, version 2, from the U.S. National Center for Environmental Prediction.

The global Climate Forecast System is used by the RegCM3 as initial 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 for the number of tropical cyclone landfalls are provided for three regions listed in the table below and shown in the corresponding map.

F-2 | SELECTED DOMAIN FOR STC, MTC AND NTC



(Source: Guy Carpenter Asia-Pacific Climate Impact Centre)

Code	Name	Region	Provinces in China
NTC	Northern Tropical Cyclones	Japan and Korea	N/A
MTC	Middle Tropical Cyclones	Eastern China and Taiwan	Jiangsu, Shanghai, Zhejiang, Fujian
STC	Southern Tropical Cyclones	South China, Vietnam and the Philippines	Guangdong, Guangxi and Hainan

³ 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

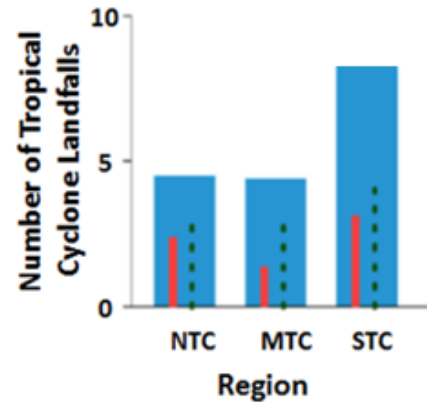
⁴ Department of Earth Sciences, National Taiwan Normal University

⁵ Guy Carpenter Asia-Pacific Climate Impact Centre and the School of Energy and Environment, City University of Hong Kong

LANDFALL CYCLONES BY REGION

The forecast suggests fewer than average tropical cyclones will make landfall in East Asia in 2015 for the months of June through November. The chart on the right shows the landfall predictions based on the regional cyclone model (green dotted line), the global model (red lines) and the 2000 through 2010 historical average (blue bars).

F-3 | LANDFALL PREDICTIONS

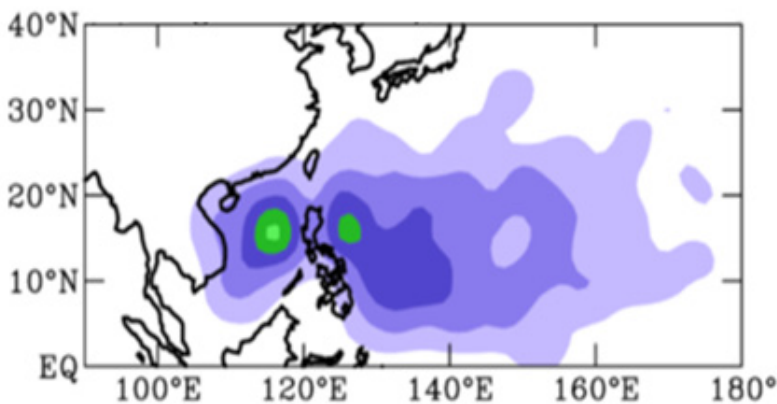


(Source: Guy Carpenter Asia-Pacific Climate Impact Centre)

CYCLONE FORMATIONS BY LOCATION

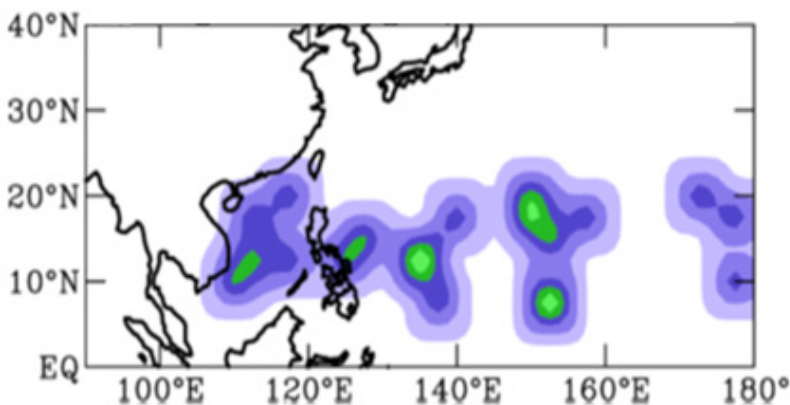
The charts below show the tropical cyclone formations for June through November. The legend refers to the number of tropical cyclone formations in an area corresponding to 5 degrees latitude and 5 degrees longitude over a one year period.

F-4 | CYCLONE FORMATIONS PER YEAR FOR 2000 TO 2010 (INCLUDES THE MONTHS OF JUNE THROUGH NOVEMBER)



(Source: Joint Typhoon Warning Center)

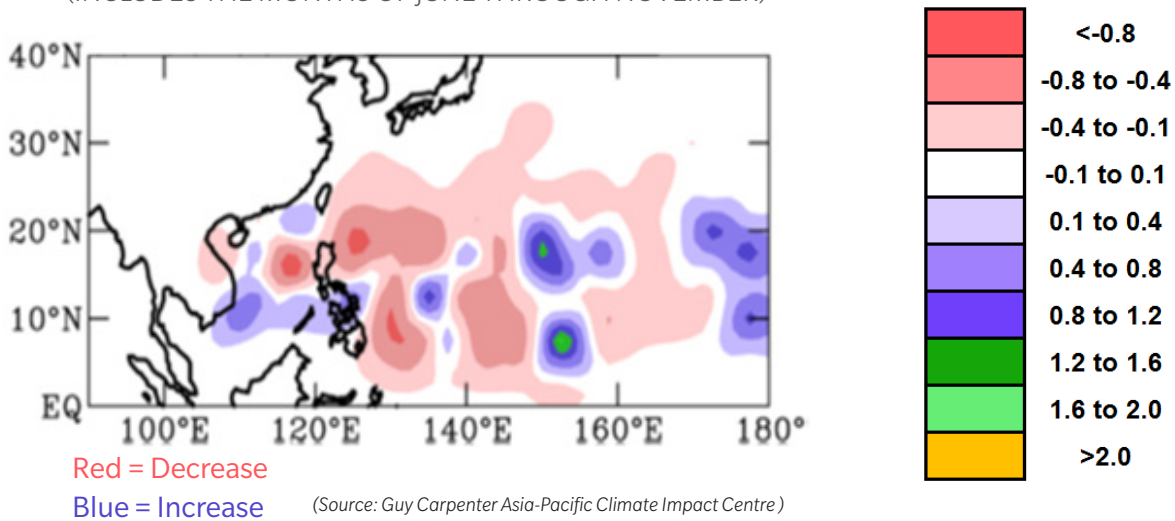
F-5 | 2015 PREDICTED CYCLONE FORMATIONS - REGIONAL CLIMATE MODEL (INCLUDES THE MONTHS OF JUNE THROUGH NOVEMBER)



(Source: Guy Carpenter Asia-Pacific Climate Impact Centre)

The chart below shows the difference with red areas being a decrease in tropical cyclone formations and the blues being an increase from the historical average.

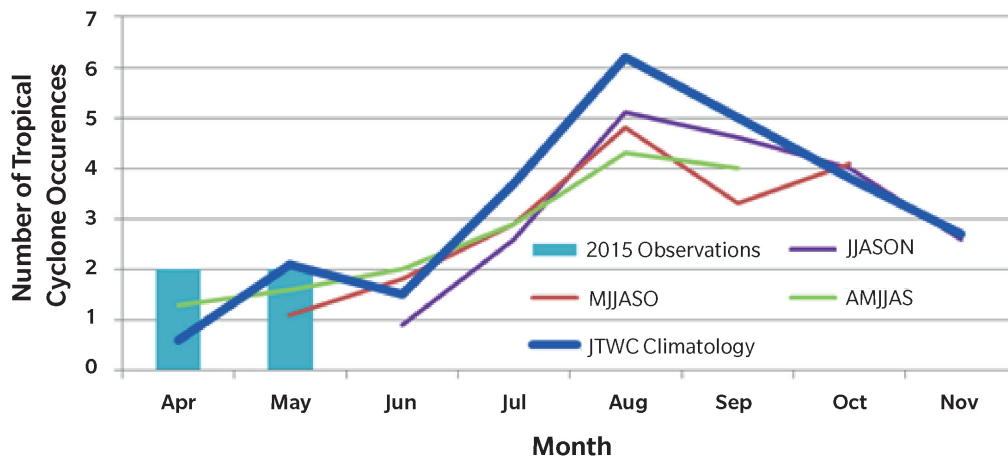
**F-6 | HISTORICAL AVERAGE VERSUS 2015 PREDICTIONS
(INCLUDES THE MONTHS OF JUNE THROUGH NOVEMBER)**



COMPARISON OF PREDICTIONS

Each tropical cyclone prediction is for a six month period. In the chart below, the light green line represents the initial predictions for the months April, May, June, July, August and September (AMJJAS). These predictions have been updated twice for May through October (MJJASO; red line) and June through November (JJASON; purple line). The light blue bar represents the most recent observations. The thick blue line is the historical average for 2000 through 2010 based on data from the JTWC. Overall, the regional climate model is predicting fewer than average tropical cyclone formations for June through November. The forecasts are based on an ensemble of simulations, which is why there can be a fractional number of landfalls.

**F-7 | REGIONAL FORECAST MODEL OF TROPICAL CYCLONE ACTIVITY
IN THE WESTERN NORTH PACIFIC BASIN**



(Source: Guy Carpenter Asia-Pacific Climate Impact Centre)

Updates to this study and the full report will be available at <http://www.cityu.edu.hk/gcacic>.

Readers should be aware that these are predictions and, as such, the actual tropical cyclone activity can vary significantly from the predictions shown in this report.

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