

2011 Typhoon Activity Prediction



Published by Shanghai Typhoon Institute of China Meteorological
Administration

June 23, 2011

Prediction of 2011 Northwest Pacific Basin and South China Sea Tropical Cyclone activities and Tropical Cyclone impacting China

Abstract

The STI's second climate predictions of 2011 tropical cyclone activities over Northwest Pacific Basin and South China Sea and tropical cyclone impacting China are made through physical analysis and model calculations. The results are : 26 - 28 Tropical Storms (TS) are forecast to form over the Northwestern Pacific Ocean and South China Sea in 2011. Of these, 6 - 8 are expected to make landfall over China. 12 - 14 Tropical Cyclones (TC) are expected to significantly affect China, of which 9 - 11 are expected to significantly affect South China and 8 - 10 are expected to significantly affect East China.

I. Forecast Results

It is forecast in 2011 that 26 - 28 Tropical Storms (TS) (see Appendix C)will form over the Northwestern Pacific (WNP) and the South China Sea (SCS). Of these, 6 - 8 are expected to make landfall in China. There are expected to be 12 - 14 Tropical Cyclones (TC) will significantly affect China, of which 9 - 11 will significantly affect South China and 8 - 10 will significantly affect East China (Table 1).

Table 1. 2011 Forecast of Tropical Cyclone Activity

	WNP+SCS TS Formation	TS Landfalls	TC with Major Impact (see Appendix A)		
			China	South China	East China
1961-2000 Mean (see	28±5.3	7±2.3	14±3.7	10±2.9	8±2.8

Appendix D) ±Stdev					
2011 Forecast	26-28	6-8	12-14	9-11	8-10

II. Predictors

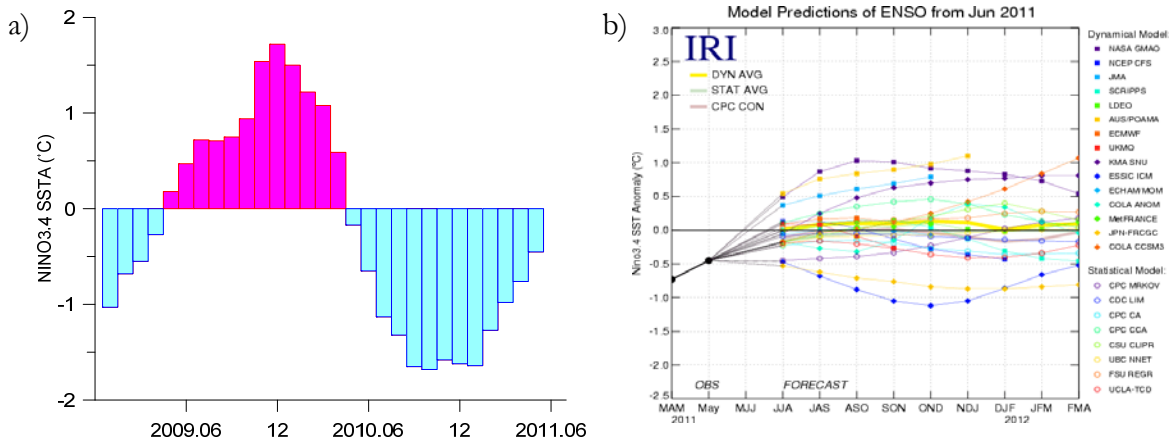
1. The effect of a ocean-atmosphere anomaly in the boreal spring prior to the TC season

Oceanic Signals

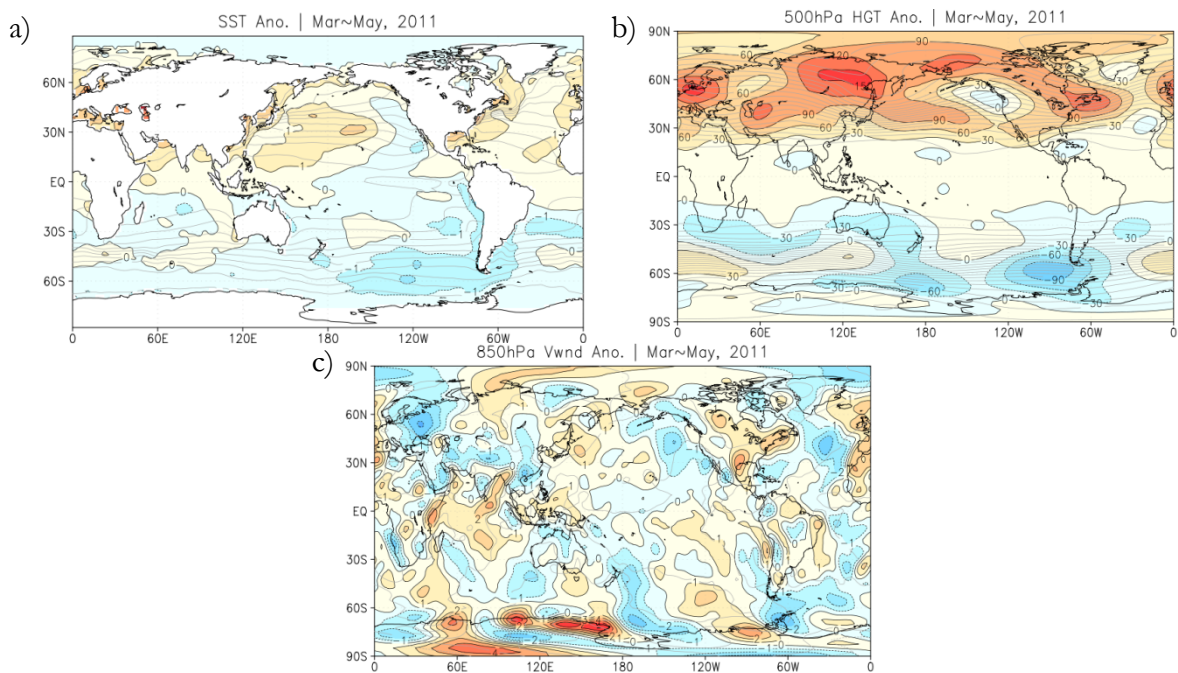
The major La Nina (LN) event starting in the boreal summer of 2010 is abating now (Graph 1a). The predictions made by climate model and statistical methods show(Graph 1b), the La Nina will end soon, the anomaly of SST over Nino3.4 district will gradually turn to normal state ($|SSTA| \leq 0.5^{\circ}\text{C}$), and it will last until the end of 2011. The anomaly of SST over Peru coast area in boreal spring was weak(Graph 2a). These phenomena indicate the tropical circulation impacted by ENSO will turn to normal state, and thus its controlling effects on TC activities will be weak.

Atmospheric Signals

In the boreal spring, the positive anomaly of 500 hPa geo-potential height over the Equatorial India Ocean- Western Pacific Ocean was very weak, the anomaly of 500 hPa geo-potential height over coastal area of western North American was weak too(Graph 2b). These conditions indicate the formation of TS in later season will be near the state of normal year.



Graph 1. SST Anomaly over Nino3.4 district: a) Real b) Predictions



Graph 2*. Anomaly Distributions of SST (a), 500hPa Geopotential Height (b), and 850hPa north-south wind (c) from March 2011 to May 2011

Signals for TC impacting China

The monsoon activity is the major factor influence the number of TCs landfall China and impacting China. The South China Sea summer Monsoon set up early in 2011, but its intensity was weak, while Mei-Yu front was quite active in subtropical area. The anomaly of 500hPa geo-potential height over southwest Australia was below normal and the anomaly of 500hPa geo-potential height over equatorial Western Pacific Ocean was above normal(Graph 2b), while the cross equator flow was strong(Graph 2c). The little degree of all these anomalies indicates the number of TCs landfall China will be around normal. On the other hand, the weak South China Sea summer Monsoon and the weak East Asia summer monsoon (the rainband stopped at the Middle-down stream of Yangtze River during the early June) indicate the number of TCs influencing South China will be around normal and the number of TCs influencing East China will be above the normal at small degree.

* Figure description:

Figure2.a) Global ocean surface temperature anomaly (the difference from the climate mean), warm color tone areas represent positive anomaly (warmer than the climate mean), cool color tone areas represent negative anomaly (colder than the climate mean). Sea surface temperature is an important thermal condition for the formation of tropical cyclone.

Figure 2.b) Global 500hPa geo-potential height anomaly (the difference from the climate mean), warm color tone represents positive anomaly (greater than the climate mean), cool color tone represents negative anomaly (less than the climate mean).

Figure 2.c) Global 850hPa north-south wind anomaly (the difference from the climate mean), warm color tone represents positive anomaly (warmer than the climate mean), cool color tone represents negative anomaly (colder than the climate mean).

2. Results of Objective Method Forecast Models

Predictions of TS formation, landfall and influence to East and South China applied spring signals by Objective Method Forecast Models are summarized in Table 2. TS formation, TS landfall and TC impacting South China are forecast to fall in the range of one standard deviation to the long term average, i.e. normal. TC affecting China and East China by Optimal Subset Regression fall out of one standard deviation from the long term average. The number of TCs influencing China is expected to be below the long term average while the number of TCs influencing East China is expected to be above the long term average.

Table 2. Forecast of TS and TC 2011 by Objective Methods (Made in June)

(Comparing with April's results ,↓means decreasing ,↑means increasing ,red denotes opposite trend ; underline means over $\pm 1\sigma$)

	WNP+SCS TS formations	TS landfalls in China	TC with Major Impact (see Appendix A)		
			China	South China	East China
1961-2000 mean \pm stdev	28 \pm 5.3	7 \pm 2.3	14 \pm 3.7	10 \pm 2.9	8 \pm 2.8
Stepwise Regression	-1.7↓	+1.0↓	+1.9↑	-1.0↑	+0.5↓
Optimal Subset Regression	-0.9↓	+1.7	<u>-4.5</u>	-1.1↑	<u>-3.1↓</u>

III. Conclusion

According to the above analysis, 26 - 28 Tropical Storms (TS) are forecast to form over the Northwestern Pacific Ocean and South China Sea in 2011. Of these, 6 - 8 are expected to make landfall over China. 12 - 14 Tropical Cyclones (TC) are expected to significantly affect China, of which 9 - 11 are expected to significantly affect South China and 8 - 10 are expected to significantly affect East China.



Appendix

A. Definitions of TC with Major Impact

1. TS landfalls: Tropical Cyclones with Tropical Storm strength when making landfall in China
2. TCs are considered to significantly effect a given area through satisfying one of the three following conditions:
 - (i) An aggregate precipitation in the given area of over 50 mm; or (ii) average wind of magnitude over 7 or a gust over 8 in given area; or (iii) aggregate precipitation of over 30 mm and an average wind over 6 or a gust over 7 in given area.
3. 'South China' refers to Guangdong, Guangxi and Hainan provinces. 'East China' refers to Fujian, Jiangxi, Zhejiang, Anhui, Shanghai, Jiangsu and Shandong.

B. Performance Review of Annual Forecasts

Table 3. Annual forecast of TS formations and TS landfalls

Year	TS formations over WNP+SCS (mean: 28, stdev: 5.3)				TS landfalls in China (mean: 7, stdev: 2.3)			
	Forecast		Actual		Forecast		Actual	
2005	23-25	below normal	23	below normal	6-8	normal	8	normal
2006	27-29	normal	24	below normal	7-9	above normal	5	below normal
2007	26-28 24-26*	below normal	25	below normal	6-8 5-7*	normal	7	normal
2008	27-29	normal	22	below normal	7-9	above normal	10	above normal
2009	24-26	below normal	23	below normal	8-9 6-8*	above normal normal*	10	above normal
2010	22-24 23-25*	below normal	14	below normal	5-6 6-8*	below normal normal*	7	normal

Notes: "*" indicates "revised", grey color indicates a difference between forecast and actual result.

C. Standard Classification of tropical cyclones

According to China Meteorological Administration, "Classification of tropical cyclones on the implementation of national standards" GBT 19201-2006 notice, tropical cyclone maximum wind speed at ground near the center is divided into 6 levels:

Name	Characteristic
Super TY	Maximum average wind speed near the bottom center \geq 51.0m/s, that is level 16 or above
Strong TY (STY)	Maximum average wind speed near the bottom center between 41.5 to 50.9m/s, that is level 14-15
Typhoon (TY)	Maximum average wind speed near the bottom center between 32.7 to 41.4m/s, that is level 12-13
Strong Tropical Storm (STS)	Maximum average wind speed near the bottom center between 24.5 to 32.6m/s, that is wind force level 10-11
Tropical Storm (TS)	Maximum average wind speed near the bottom center between 17.2 to 24.4m/s, that is wind force level 8-9
Tropical Depression (TD)	Maximum average wind speed near the bottom center between 10.8 to 17.1m/s, that is wind force level 6-7

This report discuss about tropical storm and levels above tropical cyclone frequency levels, that is maximum average wind speed near the bottom center is greater than or equal to 17.2m/s (level 8).

D. Description of the climate mean:

In accordance with the provisions of the World Meteorological Organization, using the average value of climate elements for 30 consecutive years as the standard climate value, generally updated once every 10 years, 2001 to 2010 period uses the average value from 1970-2000. Some variables can also use the average of 40 years data. Because when making this report, 2010 standard data have not yet been officially released, this report uses 1961-2000 average as the climate standard.

References:

1.Wu Daming, Lei Xiaotu, 1999: Frequency of tropical cyclones in the circulation analysis of abnormal in East China. *Journal Journal of Applied Meteorological Science*. 10,213-218 (*In Chinese*).

吴达铭, 雷小途, 1999: 华东地区热带气旋讯频数异常时的环流分析. *应用气象学报*, 10, 213-218.

2.Lei Xiaotu, 2001: Tropical cyclone frequency in the assessment of short-term climate prediction. *Journal of Applied Meteorological Science*. 12, 501-506 (*In Chinese*).

雷小途, 2001: 热带气旋频数的短期气候预测水平评估. *应用气象学报*, 12, 501-506.

3.He Min, Gong Zhensong, Xu Ming, Ying Ming, Song Wenling, 2007: Relationships between zonal wind anomalies in high and low troposphere and annual frequency of NW Pacific tropical cyclone. *Journal of Tropical Meteorology*. 23, 277-283 (*In Chinese*).

何敏, 龚振淞, 徐明, 应明, 宋文玲, 2007: 高低层纬向风异常与西北太平洋热带气旋生成频数关系的研究. *热带气象学报*. 23, 277-283.

4.Ying Ming, Wan Rijin, 2011: Impact on China's tropical cyclone frequency prediction. *Journal of Applied Meteorological Science*. 22(1):66-76 (*In Chinese*).

应明, 万日金, 2011: 影响我国的热带气旋年频数预测. *应用气象学报*, 22(1): 66-76.

5.Zhan R., Y. Wang, and X. Lei, 2011a: Contributions of ENSO and East Indian Ocean SSTA to the Interannual Variability of Northwest Pacific Tropical Cyclone Frequency. *J. Climate*, 24, 509–521.

6.Wei Fengying, *Modern diagnosis and prediction of climate statistics (2nd Edition)*, Beijing: China Meteorological Press, 2007 (*In Chinese*).

魏凤英. 现代气候统计诊断与预测技术 (第2版), 北京: 气象出版社, 2007