PeakRe

# Seasonal Tropical Cyclone Activity Forecast
# North West Pacific Ocean and South China Sea
## April 2021

## Forecast Results

Based on current climatic conditions and activity in 2021 to date, this report forecasts:

- The formation of 24-27 tropical storms (TS) and/or stronger tropical cyclones/typhoons (TC) in the North Western Pacific Basin (NWP) and the South China Sea (SCS) in 2021.
- The number of TCs that become strong typhoons (STY) will stay below the long term climatic average (LTCA).
- 13-15 TCs are forecast to impact China in 2021 which is in line with the LTCA. However, TCs impacting South and East China are forecast to be more active, of which;
  - 13-14 are forecast to impact South China.
  - 11-13 are forecast to impact East China.
- 7-9 TCs are forecast to make landfall over China which is slightly above average.

| TC Count | TS or above formation | TS or above landfall | TC Impacting China | | |
|---|---|---|---|---|---|
| | | | Entire China | South China | East China |
| 1981-2010 EV/SD | 26±4.8 | 7±2.0 | 14±3.0 | 9±2.5 | 9±2.6 |
| 1991-2020 EV/SD | 25±4.5 | 7±1.9 | 14±3.0 | 9±2.5 | 9±2.6 |
| 2021 April Forecast | 24-27 | 7-9 | 13-15 | 13-14 | 11-13 |

*Table 1. 2021 seasonal forecasting of TC activity*


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## Prediction Factors

**Pre-season inter-ocean atmosphere conditions**

According to long-term sea surface temperatures (SST) observations, the 2020 summer El Niña event continued into the winter of 2020/21 (see Figure 1a). A moderately strong negative SST anomaly is therefore maintained over the Nino 3.4 zone (120°E-170°W, 5°S-5°N) while a positive SST anomaly is observed in tropical western Pacific.

Meanwhile, the positive anomaly of outward longwave radiation (OLR) in central Pacific shows reduced convective activity. A negative anomaly appears from the South China Sea to the central part of the western Pacific, with an intra-seasonal scale enhancement feature. Collectively this shows that convective activity is relatively strong. This also explains the formation and development of tropical storm Dujuan (No. 2101) east of the Philippines in mid- to late-February this year.

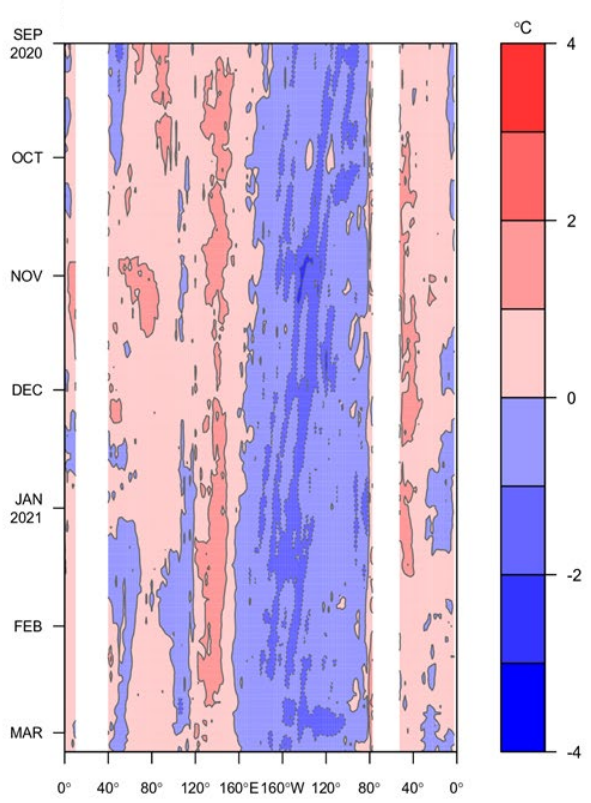


*Fig 1a. Evolution of SST anomaly for 5°S-5°N*

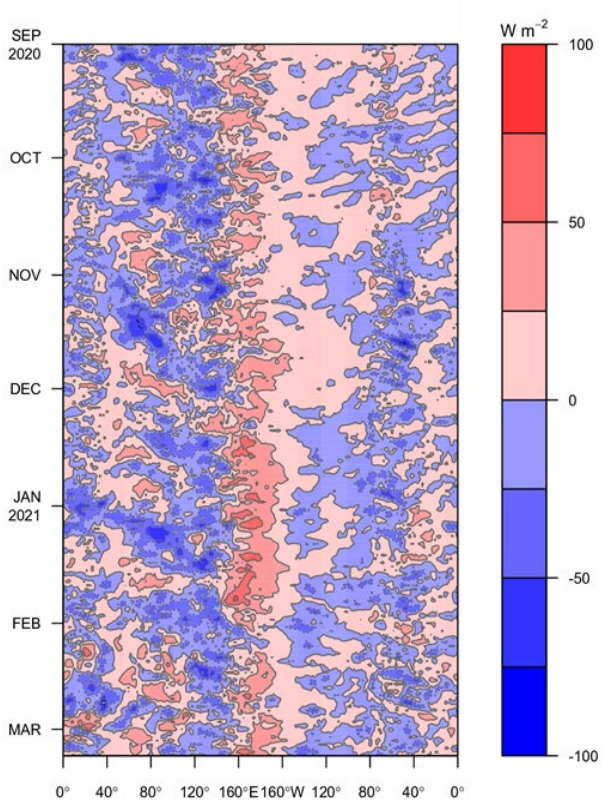


*Fig 1b. Evolution of OLR anomaly for 5°S-5°N*

Additionally the sea temperature of the East Indian Ocean in early winter was close to normal (Figure 2a), indicating that the signal strength is weaker than that of tropical Pacific. Figure 2 shows ocean and atmospheric circulation observations from the 2020/21 winter season in relation to the LTCA. The pattern showed is consistent with El Niña in tropical Pacific.

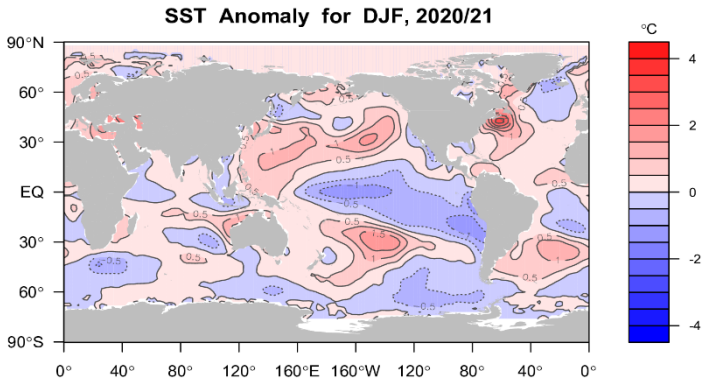


*Fig 2a. SST Anomaly for DJF, 2020/21*

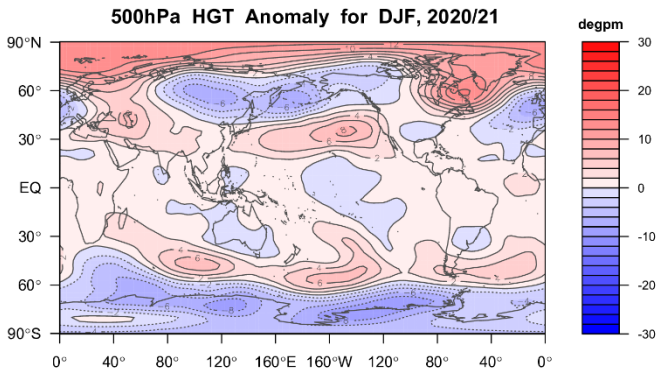


*Fig 2b. 500 hPa HGT Anomaly for DJF, 2020/21*

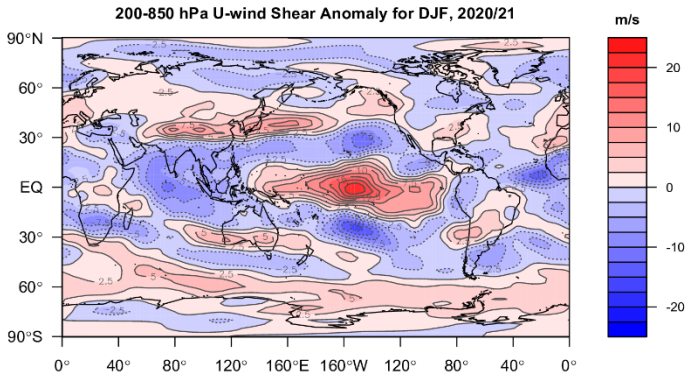


*Fig 2c. 200-850 hPa U-wind Shear Anomaly for DJF, 2020/21*

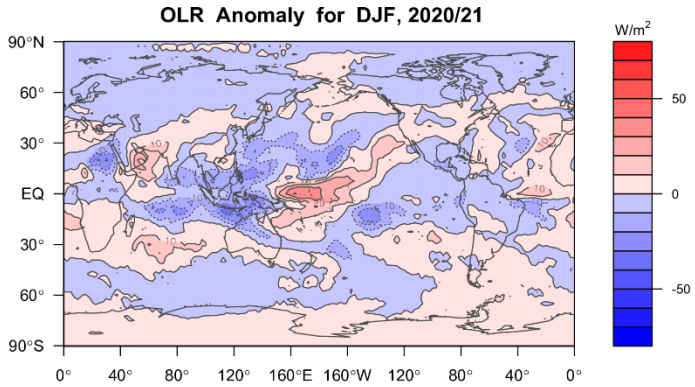


*Figure 2d. OLR Anomaly for DJF, 2020/21*

**Fig 3. Various plots showing the 5 year moving average of observations (lines and dots) compared to the annual historic record (histogram) around the 1981-2010 LTCA (dashed line) over the North Western Pacific (NWP) and South Chins Sea (SCS)**

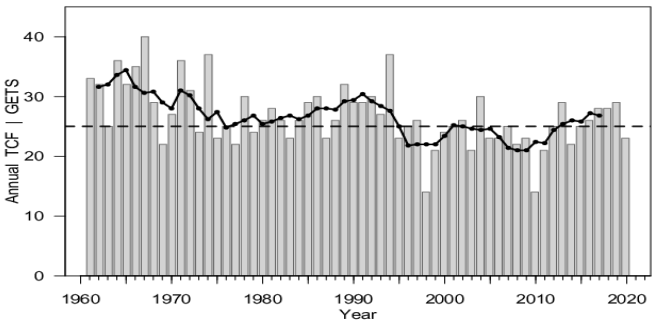


*Fig 3a. Formation over NWP and SCS*

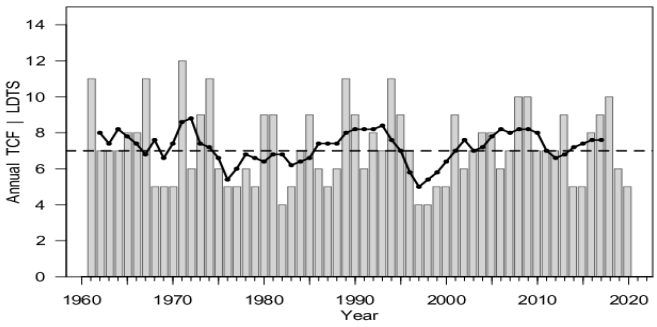


*Fig 3b. TS or stronger TC landfall count over China*

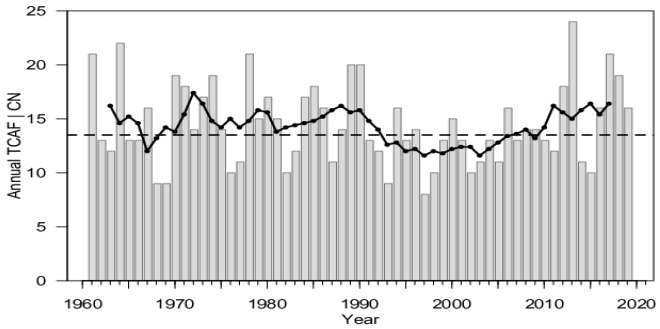


*Fig 3c. TC impacts in China*

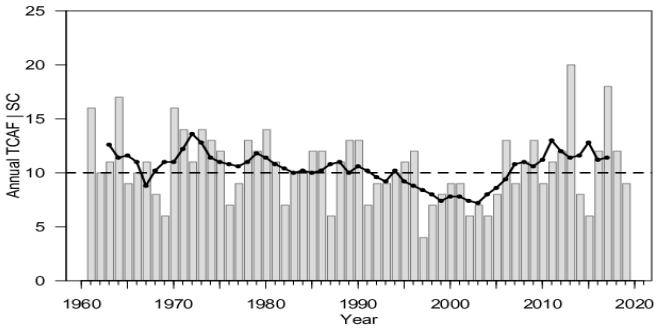


*Fig 3d. TC impacts in South China*

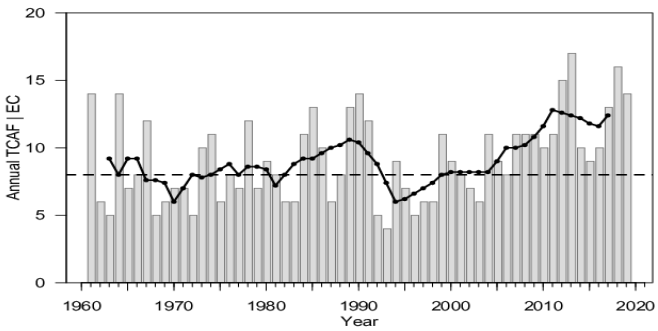


*Fig 3e. TC impacts in East China*

## Changes in Tropical cyclone activities

The individual charts in Figure 3 demonstrate the annual variation in various indicators of TC activity over the NWP and SCS regions. One common feature of all these charts is the noticeable decadal oscillation characteristics exhibited within the region. More specifically, annual formation of TCs has been below the LTCA since the mid-1990s while there is a trend of increasing formation since 2010 as well as an increased count of TCs that are impacting China.

## Forecasting Results from Statistical Models

### Statistical Model

Forecasting results from each of the statistical models are shown in Table 2. It is observed that the range of forecasts is wider for both the number of tropical storms formed and those that could impact China. Conversely, the forecast for TS landfall is more consistent and pointing to a slightly increase from LTCA.

| | TS formation | TS landfall | TC Impacting China | | |
|---|---|---|---|---|---|
| | | | Entire China | South China | East China |
| 1991-2020 EV±SD | 25±4.5 | 7±1.9 | 14±3.0 | 9±2.5 | 9±2.6 |
| 2021 Forecast | 19.3 - 30.2 | 7.8 - 8.7 | 8.9 - 14.1 | 7.4 - 13.7 | 8.4 - 12.1 |

*Table 2. Forecasting results of the statistical model*

### Mixed Dynamic-Statistical Model

The mix dynamic-statistical model is based on the statistical relation between observations of TC activity and key zone factors such as SST anomalies during spring/summer, vertical wind shear change and lower layer vorticity (from the NCEP/CFS dynamic model). The forecasting results suggest that for the 2021 season there will be below average TS and severe typhoon (STY) formation and weaker than normal tropical cyclone activity.

| 2021 projection | | Jan | Feb-Mar | LTCA 1991-2020 EV±SD |
|---|---|---|---|---|
| TS Formation | Annual | 23.4 | 24.5 | 25±4.5 |
| | Apr-Dec | 22.4 | 23.5 | 24±4.5 |
| STY Formation | Annual | 6.5 | 6.8 | 9±3.5 |
| | Apr-Dec | 6.5 | 6.8 | 9±3.3 |

*Table 3. Forecasting results from the mixed dynamic statistical model*

Figure 4 presents the forecasting result probability distribution. It is noted that probability of seeing below average formation of tropical storms is higher. The probability for STY has changed from a bias towards below average formation in Jan to neutral in Feb-Mar.

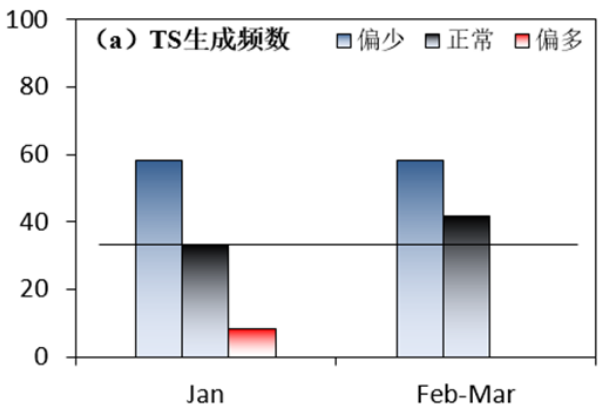


*Fig 4a. Statistical model results – 2021 tropical storm formation*

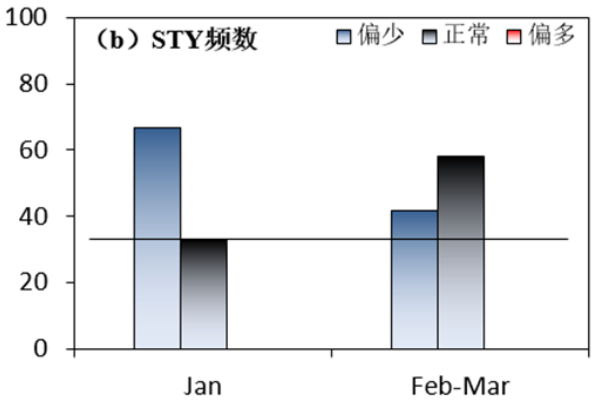


*Fig 4b. Statistical model results – 2021 severe tropical storm formation*

## Forecasting Results from Regional Model (iRAM2)

Using 5 CFSv2 outputs from different starting points in March as driver, the regional model iRAM2 forecasts that TS formation over the NWP and SCS will be slightly above the LTCA.

| Forecasting | E1 | E2 | E3 | E4 | E5 | Mean | LTCA |
|---|---|---|---|---|---|---|---|
| **TS formation** | 22 | 18 | 19 | 21 | 11 | 18.2 | 17.8 |

*Table 4. TS formation forecasting from iRAM2 regional model for April to Sept*

## Summary / Conclusion

In the winter of 2020/21, the tropical atmosphere-ocean system has maintained a medium-strength La Niña – a condition that is expected to persist for the spring season. Tropical climate is then projected to turn neutral in late spring-early summer, yet the outlook will be more uncertainty towards summer-autumn. Based on latest analyses of the La Niña impact, and considering the output of different forecasting models, it is projected that in 2021 the formation of Tropical Storms in the Western North Pacific and South China Sea will be slightly higher than normal while the formation of Strong Typhoons will be slightly lower. The number of Topical Storms making landfall in China is forecast to be slightly above average.

In terms of the number of TC impacting on the whole of China, the number is projected to be normal. Individually the number impacting either South or East China will be above average.

# APPENDIX

**Landfall Count**

Landfall count means the count of tropical cyclones with the strength of at least a tropical storm making landfall in China

**Major Impact**

A TC with major impact should satisfy at least one of the three following conditions

- Aggregate precipitation in the given area of over 50 mm or
- Average wind level ≥ 7 (or a gust1 ≥ 8) in given area or
- Aggregate precipitation of over 30 mm and an average wind scale ≥ 6 (or a gust ≥ 7) in given area

**Subtropical High**

An atmospheric high pressure system located on average between latitude 20° to 40° in both hemispheres

**Tropical Cyclone Scale**

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

| Name | Wind Speed | Beaufort | Saffir-Simpson | Report Category |
|---|---|---|---|---|
| Super Typhoon | ≥ 51.0 m/s | Scale 16 | CAT 4-5 | Strong Typhoon (STY) |
| Strong Typhoon | 41.5 - 50.9 m/s | Scale 14 - 15 | CAT 2-3 | |
| Typhoon | 32.7 - 41.4 m/s | Scale 12 - 13 | CAT 1 | Tropical Cyclone (TC) |
| Strong Tropical Storm | 24.5 - 32.6 m/s | Scale 10 - 11 | Tropical Storm | Tropical Storm (TS) |
| Tropical Storm | 17.2 - 24.4 m/s | Scale 8 - 9 | | |
| Tropical Depression | 10.8 - 17.1 m/s | Scale 6 - 7 | Tropical Depression | Tropical Depression |

**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 and generally updated once every 10 years, the 2011 to 2020 period uses the average value from 1981-2010.

**Wind Speed**

Average maximum wind speed within 2 minutes near the eye wall of the tropical cyclone

**El Niño**

A climate pattern that occurs when sea surface temperatures in the east-central equatorial Pacific Ocean rise to above-normal levels for an extended period of time.

**La Niña**

A climate pattern that occurs when sea surface temperatures in the east-central equatorial Pacific Ocean stays below normal levels for an extended period of time.

**South China**

Guangdong, Guangxi & Hainan

**East China**

Fujian, Jiangxi, Zhejiang, Anhui, Shanghai, Jiangsu & Shandong

**OLR**

Outgoing longwave radiation

## About Peak Re

Peak Reinsurance Company Limited ("Peak Re"), authorised by the Insurance Authority of Hong Kong, is a global reinsurance company headquartered in Hong Kong. It is one of the few locally established reinsurance companies in Asia Pacific underwriting both life and non-life reinsurance business.

With shareholder equity of US$1.1 billion as of 31 December 2019, it enjoys an A- rating from A.M. Best, a leading international credit rating agency for the insurance industry, and ranks among the top 30 global reinsurance groups in terms of net written premiums.*

Peak Re strives to provide innovative and forward-looking reinsurance services for customers in Asia Pacific, Europe, the Middle East and Africa, and the Americas. It tailors risk transfer and capital management solutions to best-fit clients' needs.

Fosun International Limited (00656.HK) and Prudential Financial, Inc. hold approximately 87% and 13% of Peak Re via Peak Reinsurance Holdings Limited, respectively.

** Source: S&P Top 40 Global Reinsurance Groups 2019*

## About STI

Shanghai Typhoon Institute (STI) is a state-level institution founded with the approval of the Ministry of Science and Technology, the Ministry of Finance and the State Commission Office for Public Sector Reform. Its mission is to undertake basic and applied research related to tropical cyclones. As one of the research units providing the best route predication for tropical cyclones in East Asia, STI has developed and maintained a database of meteorological information specific to cyclone activities in China.

Since 2015, Peak Re has partnered with the Shanghai Typhoon Institute (STI) on research projects related to North-West Pacific basin and South China Sea tropical cyclones.