



July Forecast Update for Northwest Pacific Typhoon Activity in 2020

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Forecast Summary

TSR reduces its extended range outlook and predicts the 2020 Northwest Pacific typhoon season will see activity well below the 1965-2019 norm. The forecast uncertainty is quantified in terms of probability of exceedance.

The TSR (Tropical Storm Risk) extended range forecast for Northwest Pacific typhoon activity in 2020 anticipates a season with an ACE index that is 25% below norm. There is a 74% likelihood that ACE will be in the lower tercile of historical yearly values. The forecast spans the period from 1 January to 31 December 2020 (95% of typhoons occur historically after 1 May) and employs data through to early July 2020. The forecast includes deterministic and probabilistic projections for overall basin activity, and deterministic projections for the ACE index and numbers of intense typhoons, typhoons and tropical storms. TSR's three predictors for overall activity all point to a season with well below-norm intense typhoon numbers and well below-norm ACE. TSR has reduced its extended range outlook for three reasons: an increased likelihood of weak La Niña conditions occurring during August-September 2020, the June 2020 trade wind speed over the Northwest Pacific being unusually strong, and because the ACE activity through early July 2020 is well below norm. Forecast uncertainties remain but the precision of TSR's outlooks for upcoming Northwest Pacific typhoon activity issued in early July between 2003 and 2019 is good. We include robust forecast probability of exceedance information for the ACE index to quantify the forecast uncertainty. A final updated seasonal outlook will be issued in early August 2020.

NW Pacific ACE Index and System Numbers in 2020

		ACE Index	Intense Typhoons	Typhoons	Tropical Storms
TSR Forecast (\pm FE)	2020	216 (\pm 73)	7 (\pm 2)	14 (\pm 3)	26 (\pm 4)
55yr Climate Norm (\pm SD)	1965-2019	294 (\pm 100)	9 (\pm 3)	16 (\pm 4)	26 (\pm 4)
Forecast Skill at this Lead	1965-2019	46%	37%	19%	10%

- Key: ACE Index = Accumulated Cyclone Energy Index = Sum of the Squares of 6-hourly Maximum Sustained Wind Speeds (in units of knots) for all Systems while they are at least Tropical Storm Strength. ACE Unit = $\times 10^4$ knots².
- Intense Typhoon = 1 Minute Sustained Wind > 95Kts = Hurricane Category 3 to 5.
 Typhoon = 1 Minute Sustained Wind > 63Kts = Hurricane Category 1 to 5.
 Tropical Storm = 1 Minute Sustained Winds > 33Kts.
 SD = Standard Deviation.
 FE (Forecast Error) = Standard Deviation of Errors in Cross-Validated Hindcasts 1965-2019.
 Forecast Skill = Percentage Improvement in Mean Square Error Afforded by Cross-Validated Hindcasts 1965-2019 over Hindcasts Made with the 1965-2019 Climate Norm.
 Northwest Pacific = Northern Hemisphere Region West of 180°W Including the South China Sea. Any Tropical Cyclone (Irrespective of Where it Forms) Which Reaches Tropical Storm Strength Within this Region Counts as an Event.

There is only a 2% chance that the 2020 NW Pacific typhoon season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>335)), a 24% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (247 to 335)) and a 74%

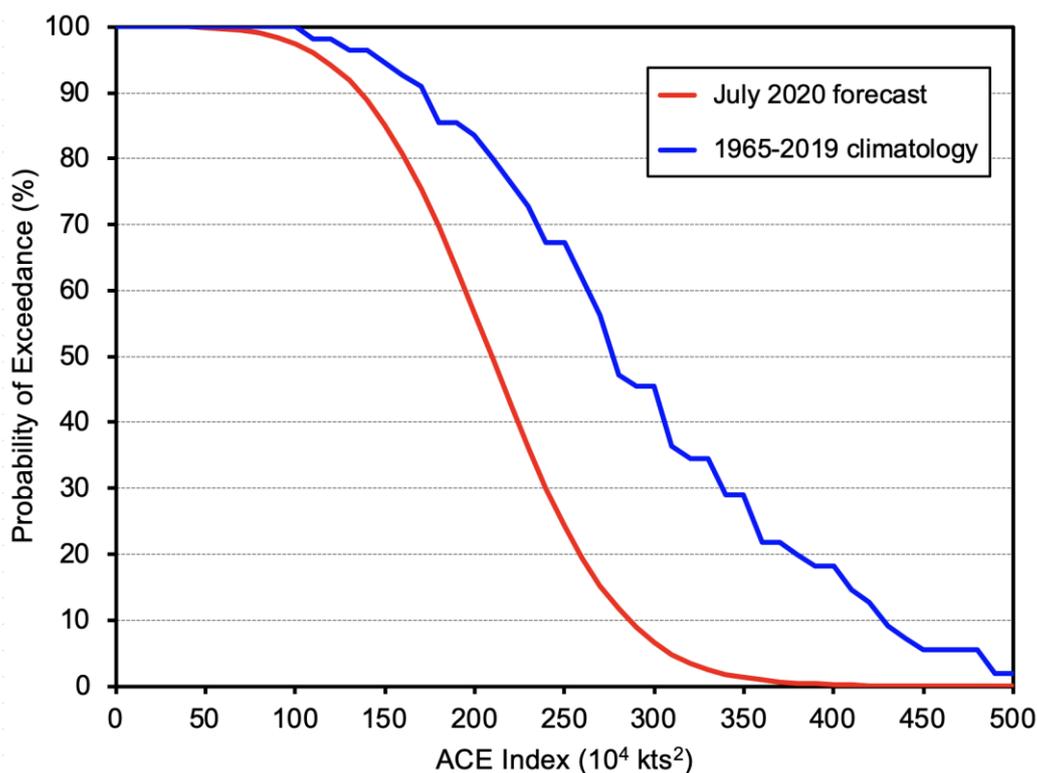
probability it will be below-normal (defined as an ACE index value in the lower tercile historically (<247)). The 55-year period 1965-2019 is used for climatology.

Key: Terciles = Data groupings of equal (33.3%) probability corresponding to the upper, middle and lower one-third of values historically (1965-2019).

Forecast Probability of Exceedance Plot for the 2020 Northwest Pacific Typhoon Season

Seasonal outlooks for Northwest Pacific typhoon activity contribute to the anticipation of risk for insurance companies, other weather-sensitive businesses, and local and national governments. However, the uncertainty associated with such forecasts is often unclear. This reduces their benefit and contributes to the perception of forecast ‘busts’. The robust assessment of risk requires a full and clear probabilistic quantification of forecast uncertainty with the forecast issued in terms of probability of exceedance (PoE). In this way the chance of each activity outcome occurring is clear for the benefit of users. Going forward TSR will be including robust forecast probability of exceedance (PoE) information based on the recommendation and methodology described in Saunders et al. (2020).

The figure below displays our current outlook for the Northwest Pacific ACE index in terms of PoE. The plot displays two PoE curves comprising the forecast PoE curve and the 1950-2019 climatology PoE curve. The forecast PoE curve is computed using a method similar to that described in section 3.3 of Saunders et al. (2020) while the climatology PoE curve is computed directly from observations. The figure specifies the current chance that a given ACE index will be reached in 2020 and how this chance compares to climatology.



Reference: Saunders, M. A., Klotzbach, P. J., Lea, A. S. R., Schreck, C. J., & Bell, M. M. (2020). Quantifying the probability and causes of the surprisingly active 2018 North Atlantic hurricane season. *Earth and Space Science*, 7, e2019EA000852. <https://doi.org/10.1029/2019EA000852>

Predictors for 2020

TSR uses three predictors in its July forecast update for Northwest Pacific typhoon activity. These are: (1) Our in-house forecast value for the August-September Niño 3.75 (region 5°S-5°N, 140°W-180°W) SST index; (2) The observed ACE activity up to the date of forecast issue; (3) The June 925 hPa trade wind speed for the region 2.5°N-12.5°N, 120°E-180°E. These predictors are used to make forecasts for the

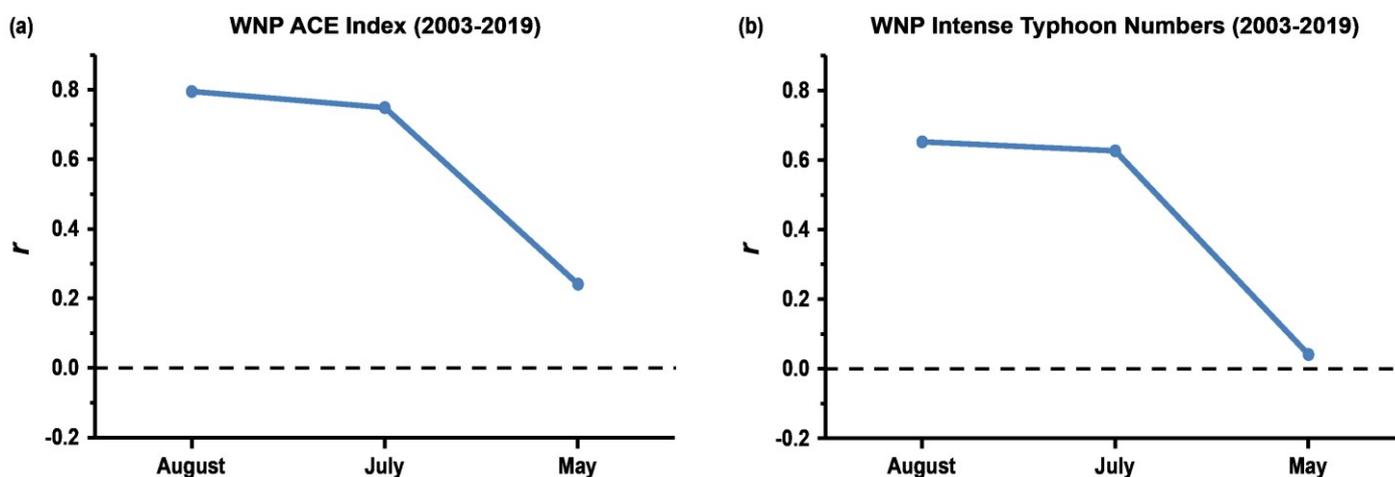
ACE Index and intense typhoon numbers. Typhoon numbers and tropical storm numbers are forecast by using their observed regression with intense typhoon numbers. Our prediction of the August-September Niño 3.75 index includes the current (19th June 2020) consensus ENSO outlook for the August-September 2020 Niño 3.4 index issued by the International Research Institute for Climate and Society.

The three TSR predictors all point to the Northwest Pacific typhoon season in 2020 being well below-norm. We anticipate the 2020 August-September Niño 3.75 SST anomaly being -0.41 ± 0.32 °C. The observed 2020 ACE activity up to today (9 July 2020) is 84% below-norm. The June 2020 trade wind speed measured at 925 hPa is the third strongest since 1965. Colder than norm Niño 3.75 SSTs in August-September are linked to below-norm ACE. A stronger trade wind speed in June is linked to current and seasonal cyclonic vorticity over the Northwest Pacific region where intense typhoons form being below-norm, and thus to fewer intense typhoons and to a below-norm seasonal ACE. Below-norm ACE activity through early July is also linked to subsequent below-norm seasonal ACE activity.

TSR anticipates there is a 74% likelihood that the 2020 ACE Index will be in the lower tercile (<247) and there is less than a 10% chance that the 2020 Northwest Pacific ACE Index will exceed its climatology value of 294×10^4 kts². Although uncertainties remain the precision of TSR’s seasonal typhoon outlooks issued in early July between 2003 and 2019 is good as shown below.

The Precision of TSR Seasonal Forecasts 2003-2019

The figure below shows the skill of the TSR-publicly-released seasonal outlooks for Northwest Pacific ACE (left panel) and intense typhoon numbers (right panel) assessed for the 17-year period 2003-2019. Skill is shown as the Pearson correlation r between the forecast values (issued separately in early May, early July and early August) and the observed values. The figure shows low prediction skill from early May but good prediction skill ($r = 0.63$ to 0.75) by early July. The correlation skill for typhoon numbers for the 2003-2019 period (not shown) is lower reaching 0.34 by early August.



Further Information

For more information about the TSR forecasts and their verifications for Northwest Pacific typhoon activity please see http://www.tropicalstormrisk.com/for_typh.html. The final TSR forecast update for the 2020 Northwest Pacific typhoon season will be issued on Thursday 6 August 2020.

Appendix – Predictions from Previous Months

a) Deterministic forecast

NW Pacific ACE Index and System Numbers 2020					
	ACE Index ($\times 10^4$ knots ²)	Intense Typhoons	Typhoons	Tropical Storms	
Average Number (\pm SD) (1965-2019)	294 (\pm 100)	9 (\pm 3)	16 (\pm 4)	26 (\pm 4)	
TSR Forecasts (\pm FE)	9 July 2020	216 (\pm 73)	7 (\pm 2)	14 (\pm 3)	25 (\pm 4)
	21 May 2020	258 (\pm 80)	8 (\pm 2)	15 (\pm 3)	26 (\pm 4)

b) Tercile probabilistic forecast

NW Pacific ACE Index 2020				
		Tercile Probabilities (%)		
		below normal	normal	above normal
	Climatology 1965-2019	33.3	33.3	33.3
TSR Forecasts	9 July 2020	74	24	2
	21 May 2020	55	34	11