Supplemental Material

Supplementary materials for "Effect of storm size on sea surface cooling and tropical cyclone intensification in the western north Pacific"

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Description of the material

Figure S1: The along track *WPi* as a function of latitude for TCs Neoguri and Lekima.

Figure S2: Spatial pattern of composited cold wake SSTA associated with tropical storms in the tropical WNP.

Figure S3: Spatial pattern of composited cold wake SSTA associated with Cat 3–5 TCs in the tropical WNP.

Figure S4: Comparison of the rotation of local wind/*f* for Ctl_exp, Lar_exp and Slow_exp.

Figure S5: Various types of composited VWS as a function of R34 for TS, Cat 1–2 and 3–5 TCs.

Figure S6: The probability density function of R34 for TS, Cat 1–2 and Cat 3–5 TCs.

Table S1: As Table 1 in the main text, statistics of the composited cold wakes for different R34 and Uh groups associated with tropical storms (TS).

Table S2: As Table 1 in the main text, statistics of the composited cold wakes for different R34 and Uh groups associated with Cat 3–5 TCs.

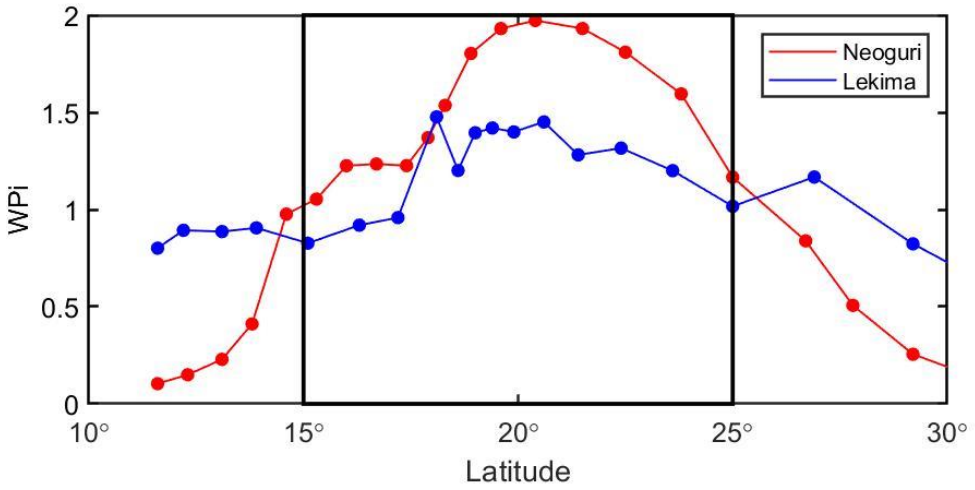

Figure S1. The *WPi* along TC track as a function of latitude for TCs Neoguri (red) and Lekima (blue). The focused domains from 15 to 25 °N are indicated by black-solid lines.

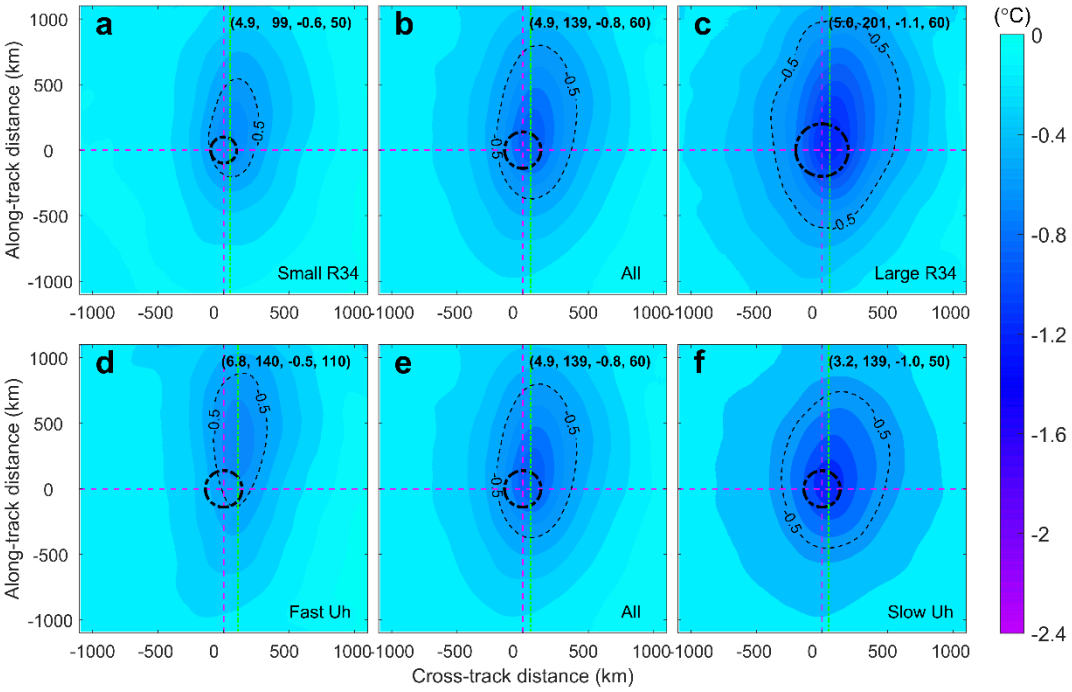

Figure S2. Same as Fig. 5, but for tropical storms.

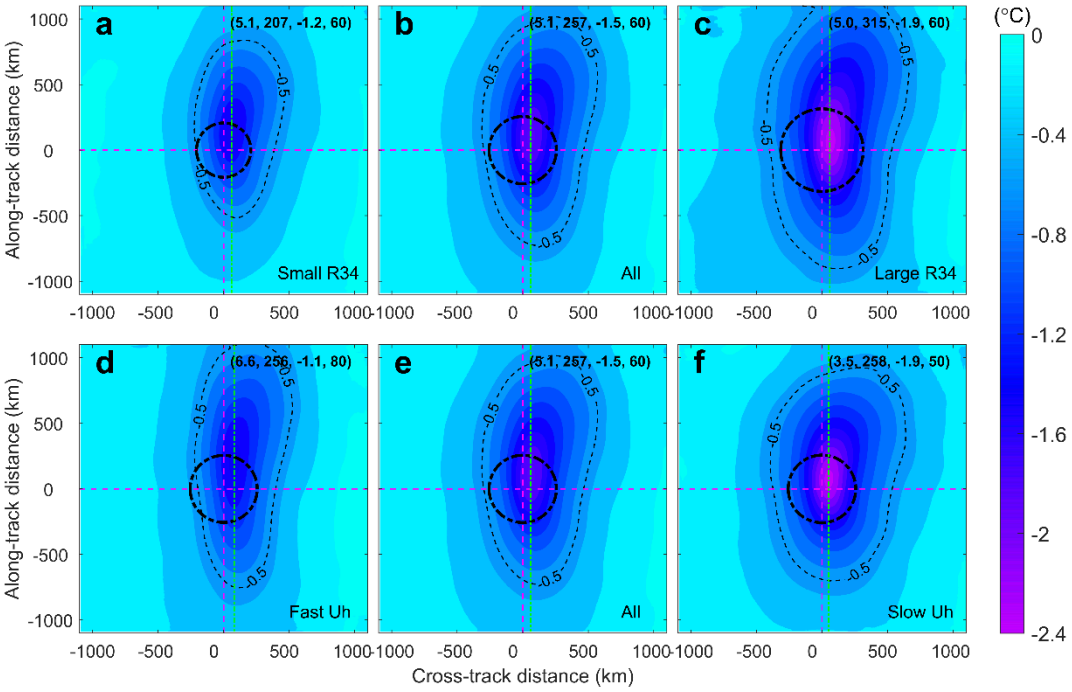

Figure S3. Same as Fig. 5, but for Cat 3–5 TCs.

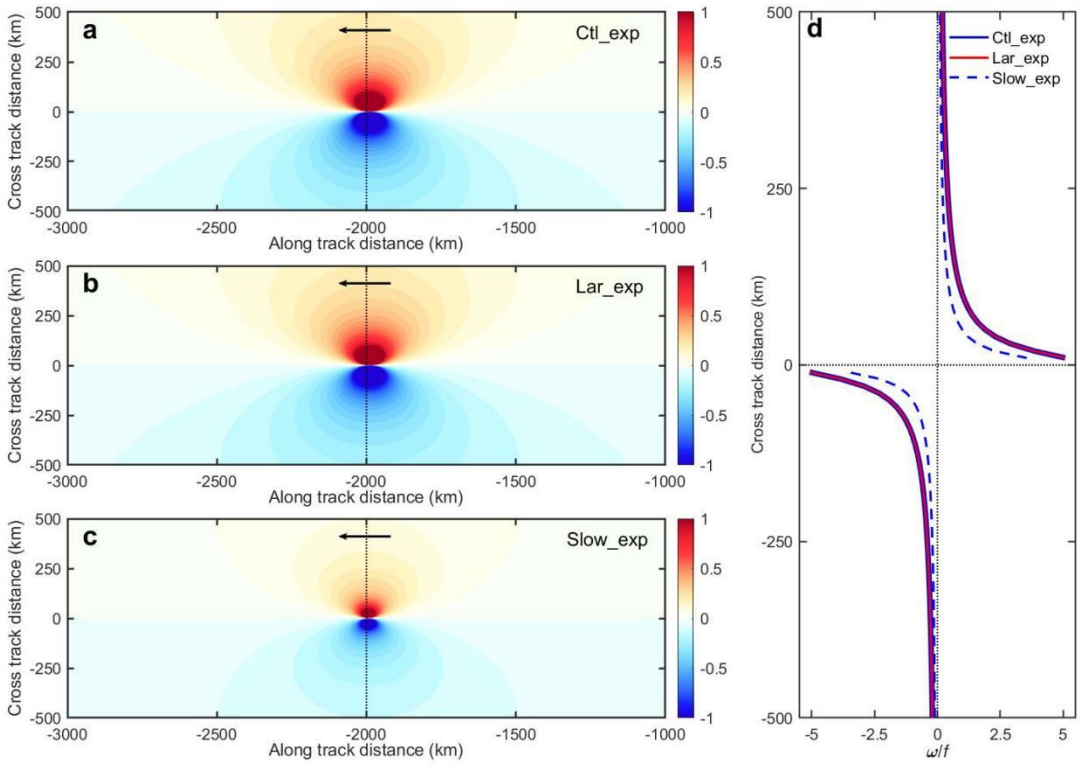

Figure S4. A snapshot of the spatial pattern of the rotation speed of local wind (ω) divided by local inertial frequency f (ω/f; a f plane at 20 °N is assumed here) for (a) Ctl_exp with R34=180 km and Uh= 5 m s^{-1}, (b) Lar_exp with R34=360 km and Uh= 5 m s^{-1}, and (c) Slow_exp with R34=180 km and Uh=2.5 m s^{-1}. For details of the three experiments please refer to Fig. 8 and Table 2 in section 3d in the main text. The black-vertical-dashed lines in (a), (b), and (c) indicate the cross-track sections in (d). The arrows in (a), (b) and (c) indicate the moving direction of TCs. (d) The average ω/f as a function of cross-track distance for Ctl_exp (solid-blue), Lar_exp (red) and Slow_exp (dashed-blue). Note that the lines for Ctl_exp and Lar_exp (solid-red and blue-lines) in (d) are completely consistent, indicating the changing of storm size do not change the resonance conditions between local wind and inertial ocean currents.

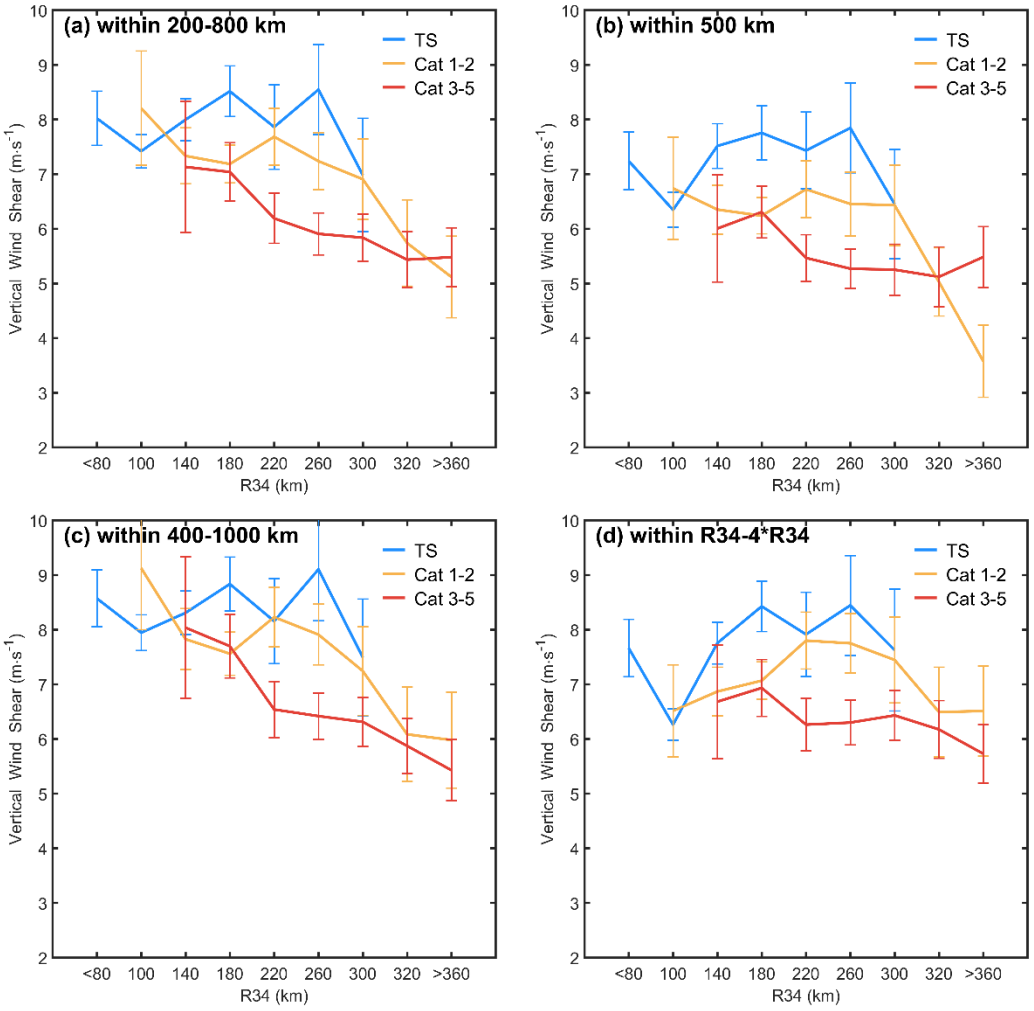

Figure S5. The composited the vertical wind shear as a function of R34 for TS (blue), Cat 1–2 (yellow) and 3–5 TCs (red), averaged within a ring of (a) 200–800 km, (b) 0–500 km, (c) 400–1000 km, and (d) R34 to 4×R34 from TC center. The vertical bars indicate the error bars with 95% confidence intervals.

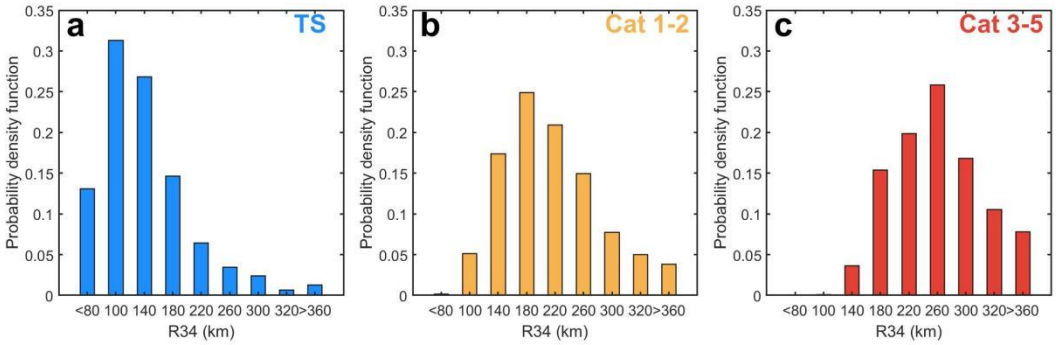

Figure S6. The probability density function (PDF) of R34 for (a) TS (blue), (b) Cat 1–2 (yellow) and (c) 3–5 TCs (red).

Table S1. As Table 1 in the main text, statistics of the composited cold wakes for different R34 and Uh groups associated with tropical storms (TS).

Experiments	R34 (km)	Uh ($m\ s^{-1}$)	RT (hour)	SSTA averaged within 100 km of TC center (℃)	Area (> 0.5℃) ($\times 10^4\ km^2$)	Max SSTA (℃)	Rightward shift (km)
All	139±2.6	4.9±0.1	21.8±1.0	-0.8	55.3	-0.9	60
Slow Uh	139±3.6	3.2±0.1	30.9±1.7	-1.0	75.3	-1.2	50
Fast Uh	139±3.8	6.8±0.1	12.0±0.4	-0.5	32.2	-0.7	110
Large R34	201±3.8	5.0±0.1	32.0±2.1	-1.1	117.9	-1.2	60
Small R34	99±1.3	4.9±0.1	15.2±0.7	-0.6	21.8	-0.7	50

Table S2. As Table 1 in the main text, statistics of the composited cold wakes for different R34 and Uh groups associated with Cat 3–5 TCs.

Experiments	R34 (km)	Uh ($m\ s^{-1}$)	RT (hour)	SSTA averaged within 100 km of TC center (℃)	Area (> 0.5℃) ($\times 10^4\ km^2$)	Max SSTA (℃)	Rightward shift (km)
All	257±3.7	5.1±0.1	35.7±1.7	-1.5	115.6	-1.8	60
Slow Uh	258±4.8	3.5±0.1	49.4±3.1	-1.9	130.5	-2.3	50
Fast Uh	256±5.6	6.6±0.1	22.3±0.6	-1.1	103.2	-1.5	80
Large R34	315±4.1	5.0±0.1	44.1±3.1	-1.9	170.1	-2.3	60
Small R34	207±2.3	5.1±0.2	28.6±1.6	-1.2	70.6	-1.5	60