Unexpected Limitation of Tropical Cyclone Genesis by Subsurface Tropical Central-North Pacific during El Niño

AUTHORS

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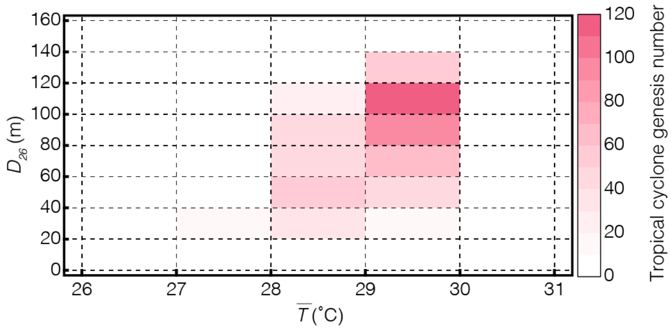
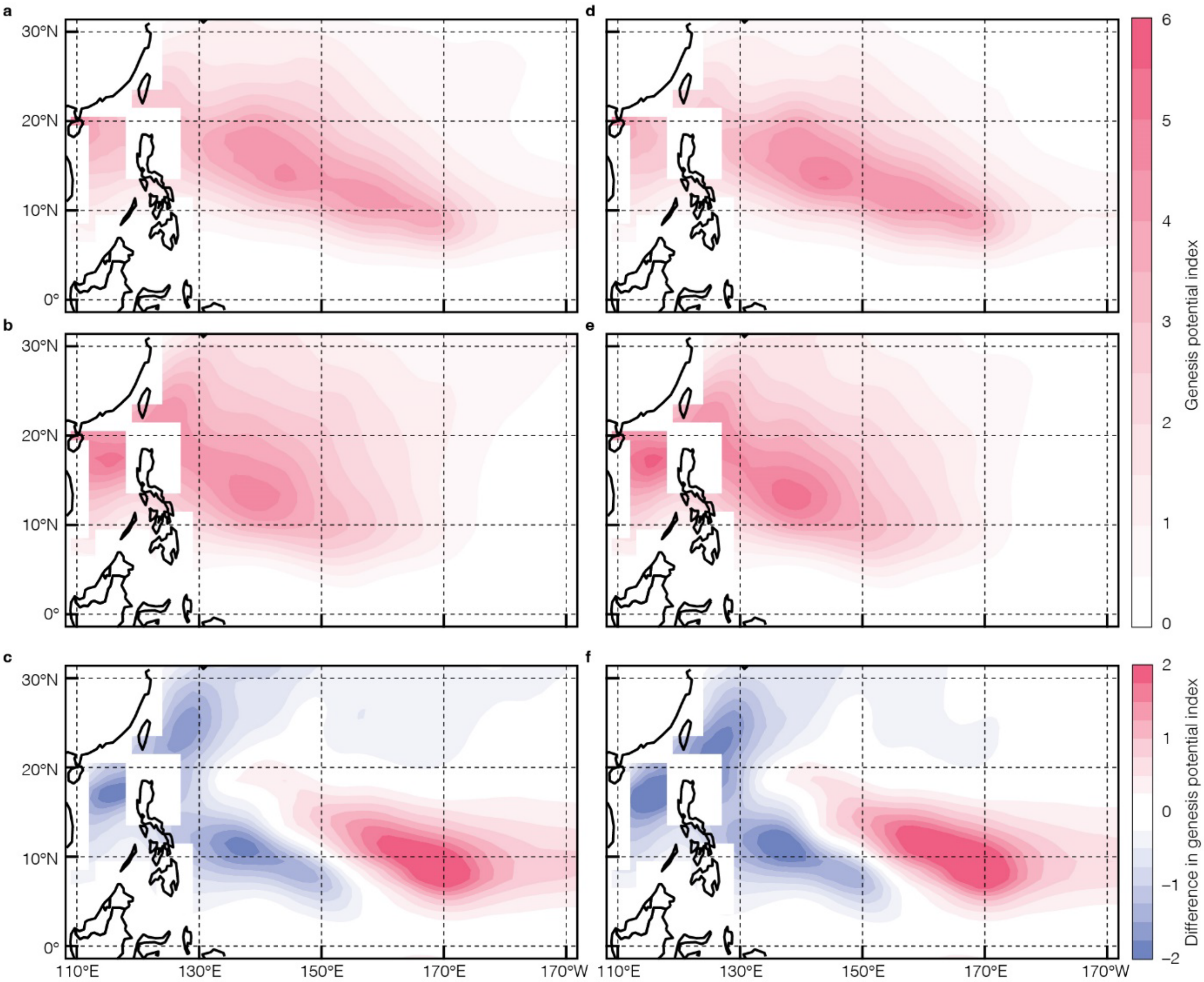
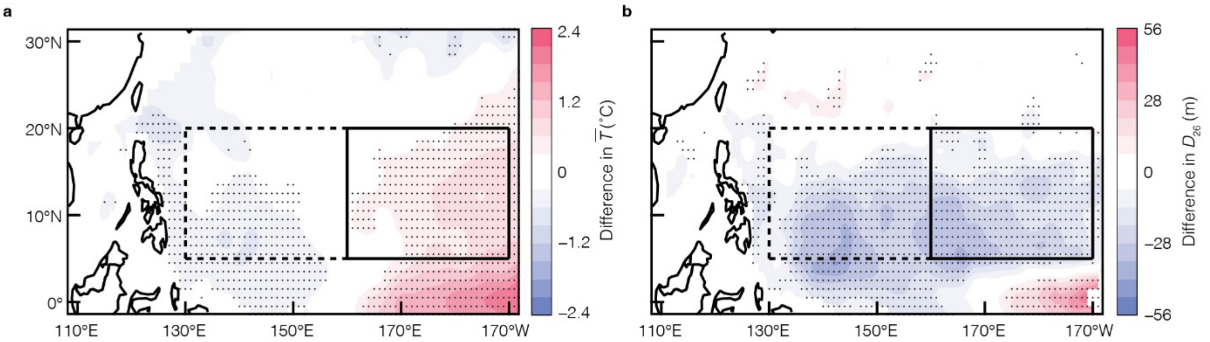
This PDF contains Supplementary Figures 1-9 and Supplementary Tables 1-2.



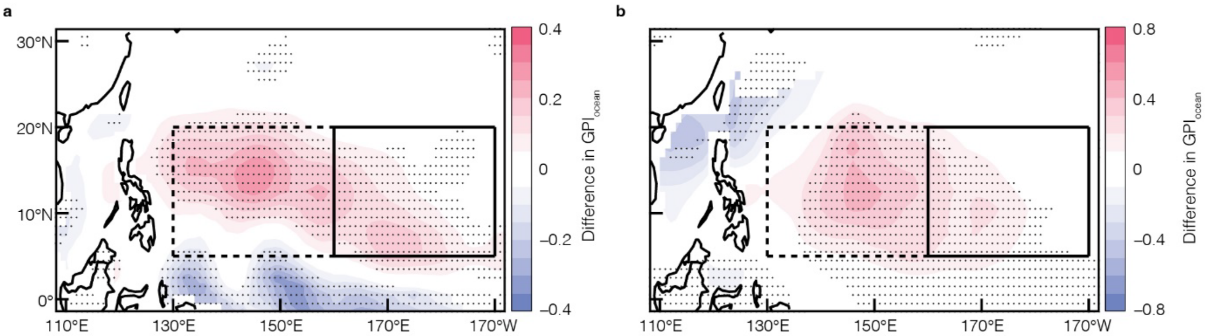
Supplementary Fig. S1 | Joint distribution of tropical cyclone genesis numbers with respect to the mean temperature in the upper mixed layer ($\overline{T}$) and 26ºC isotherm depth (D_{26}). More tropical cyclones are formed when D_{26} is deeper given the same $\overline{T}$. The conclusion stays valid even if the bin size of $\overline{T}$ is reduced.



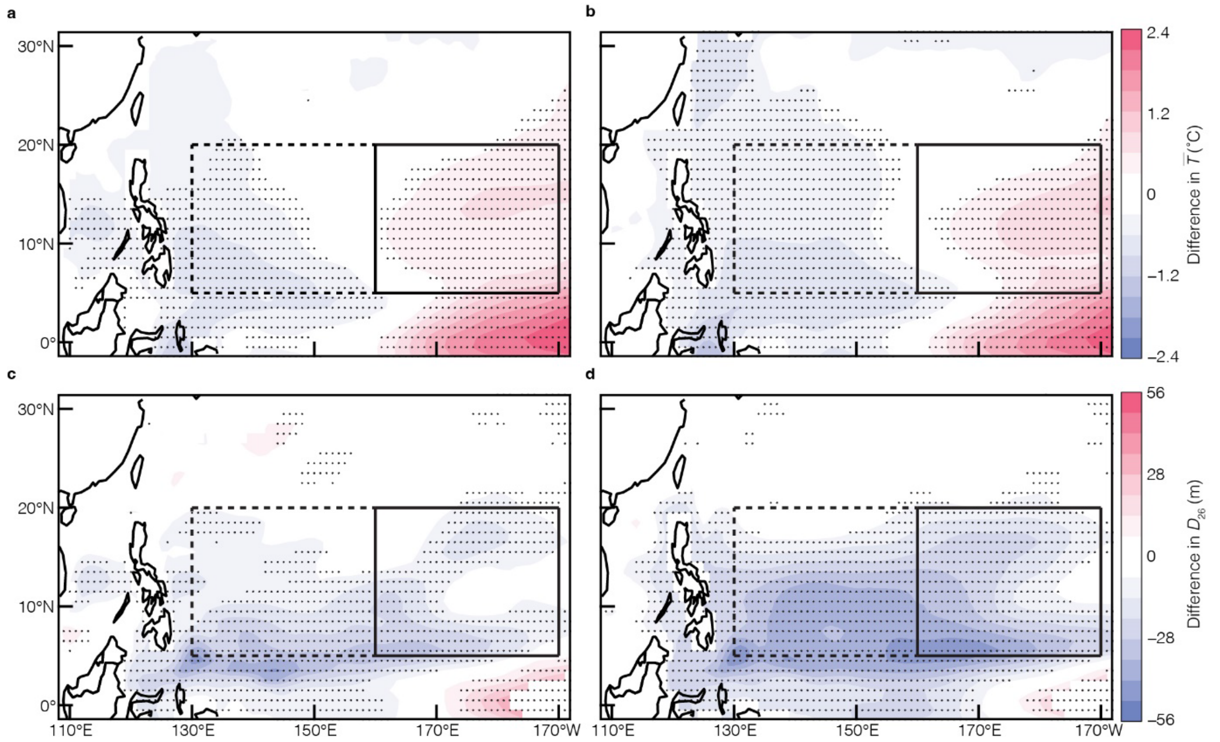
Supplementary Fig. S2 | Tropical cyclone genesis numbers during El Niño and La Niña and their differences. Same as Fig. 2a to 2c, but **a** to **c** are obtained using the genesis potential index (GPI) created by (28), and **d** to **f** are obtained with the GPI created by (29).



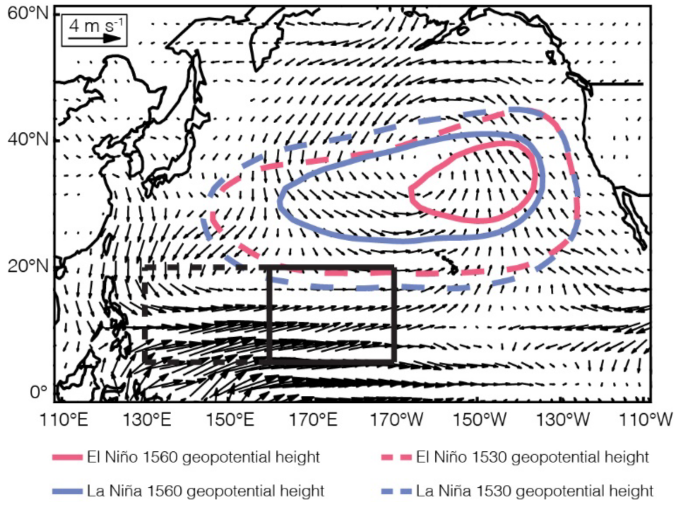
Supplementary Fig. S3 | Differences of the upper mixed layer ($\overline{T}$) and 26°C isotherm depth (D_{26}) between the two phases of ENSO based on BOA_Argo data. a is for $\overline{T}$ and **b** is for D_{26}. The temporal coverage is from 2004 to 2019.



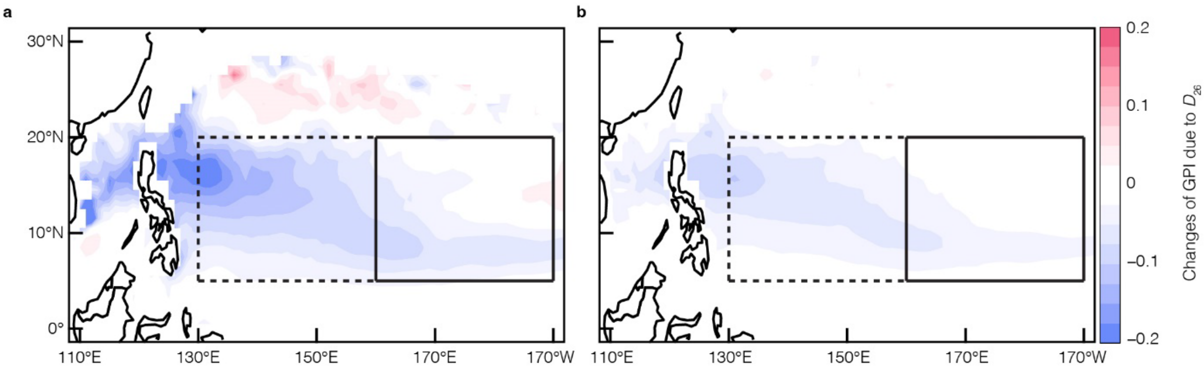
Supplementary Fig. S4 | The differences of tropical cyclone genesis potential index (GPI) due to two atmospheric variables. **a** The impacts of absolute vorticity at 1000 hPa (η_{1000}) on tropical cyclone genesis during El Niño. **b** Same as **a** but for the net long wave radiation at the sea surface (F).



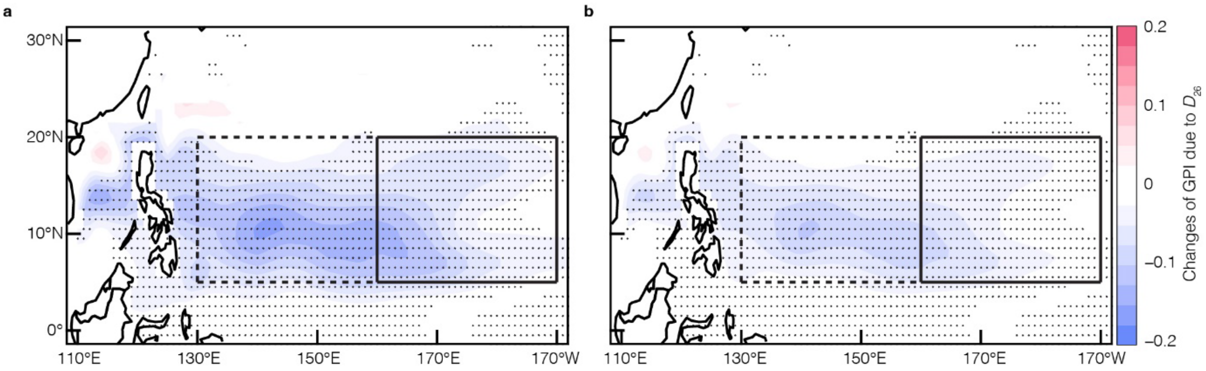
Supplementary Fig. S5 | The differences of the upper mixed layer ($\overline{T}$) and 26ºC isotherm depth (D_{26}) are independent of the types of El Niño. **a** The difference of $\overline{T}$ between Central-Pacific (CP) El Niño and La Niña. **b** The difference of $\overline{T}$ between Eastern-Pacific (EP) El Niño and La Niña. **c** Same as **a** but for D_{26}. **d** Same as **b** but for D_{26}.



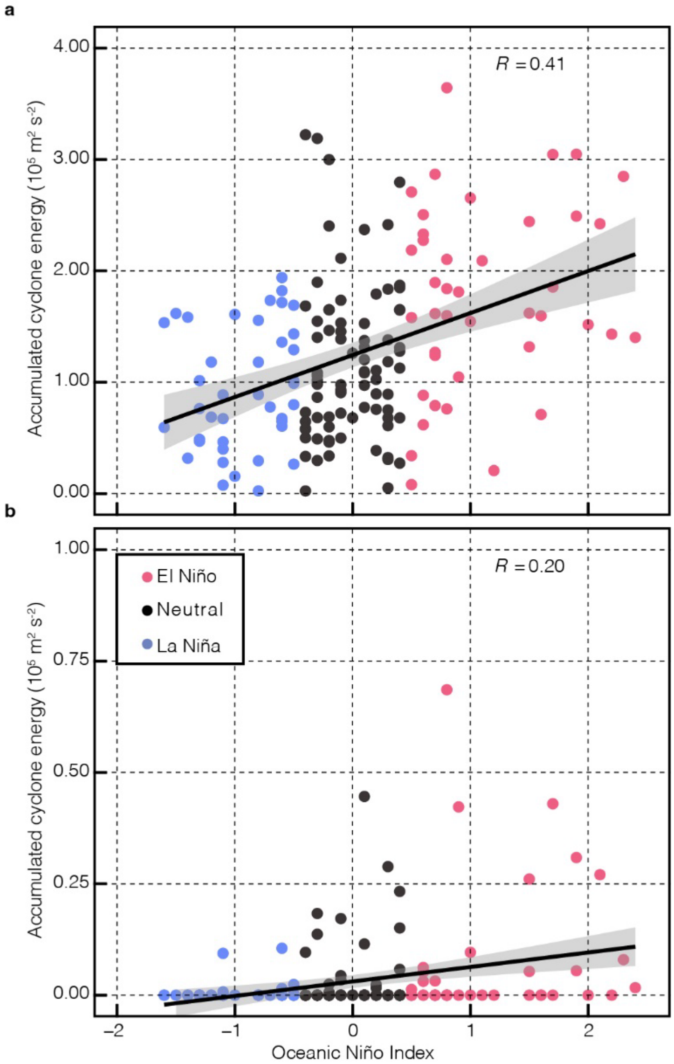
Supplementary Fig. S6 | Weakening of the North Pacific Subtropical High during El Niño. The red solid and dashed lines are the contours of 1560 and 1530 geopotential height (in meters) for El Niño, respectively. The blue lines are the same as the red lines but for La Niña. The vectors delineate 10-m wind anomalies just as in Fig. 5a.



Supplementary Fig. S7 | The impacts of 26°C isotherm depth (D_{26}) on tropical cyclone genesis potential index (GPI) derived from 10 HighResMIP models. a The impact based on GPI_{ocean}. **b** The impact based on $GPI_{atm\text{-}ocean}$.



Supplementary Fig. S8 | The impacts of 26°C isotherm depth (D_{26}) on tropical cyclone genesis potential index (GPI) derived from observations. a The impact based on GPI_{ocean}. **b** The impact based on $GPI_{atm\text{-}ocean}$. **a** is the replication of Fig. 3d for the convenience of comparison with **b**.



Supplementary Fig. S9 | The accumulated cyclone energy increases during El Niño. a The tropical western north Pacific (dashed box in Fig. 3). **b** The central-north Pacific (solid box in Fig. 3).

Supplementary Table S1 | El Niño and La Niña cases.

El Niño cases		La Niña cases	
1982 JASO	1986 SO	1983 SO	1984 O
1987 JASO	1991 JASO	1985 JA	1988 JASO
1994 SO	1997 JASO	1995 ASO	1998 JASO
2002 JASO	**2004 JASO***	1999 JASO	2000 JASO
2006 SO	**2009 JASO**	2007 JASO	2010 JASO
2014 O	2015 JASO	2011 JASO	2016 ASO
2018 SO		2017 O	
41 months		40 months	

* The bold years and months represent CP El Niño cases, such as 2004 JASO.

Supplementary Table S2 | Suite of HighResMIP models analyzed in this study.

	Model Name	Ensemble Member	Atmos Nominal Resolution	Ocean Nominal Resolution
1	CNRM-CM6-1	r1i1p1f2	250 km	100 km
2	EC-Earth3P	r1i1p2f1	100 km	100 km
3	EC-Earth3P-HR	r1i1p2f1	50 km	25 km
4	ECMWF-IFS-HR	r1i1p1f1	25 km	25 km
5	ECMWF-IFS-LR	r1i1p1f1	50 km	100 km
6	HadGEM3-GC31-HM	r1i1p1f1	50 km	25 km
7	HadGEM3-GC31-LL	r1i1p1f1	250 km	100 km
8	HadGEM3-GC31-MM	r1i1p1f1	100 km	25 km
9	MPI-ESM1-2-HR	r1i1p1f1	100 km	50 km
10	MPI-ESM1-2-XR	r1i1p1f1	50 km	50 km