Different influencing mechanisms of two ENSO types on the interannual variation in diurnal SST over the Niño 3 and 4 regions

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Introduction

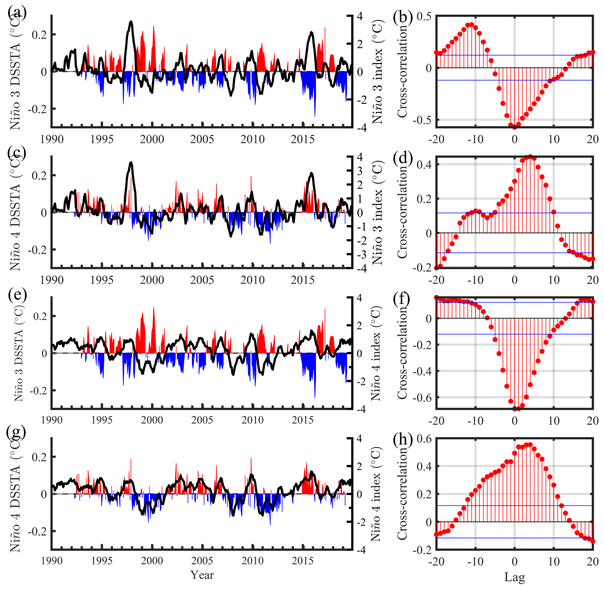
- The study of the diurnal SST variation (DSST) and its variations is very important and will contribute to a better understanding of the air-sea interaction in tropical regions.
- Long-term interannual variation in the DSST has not been studied using observations yet.
- In this study, the different effects of the eastern equatorial Pacific (EP) and central equatorial Pacific (CP) El Niño-Southern Oscillation (ENSO) events on interannual variation in the diurnal sea surface temperature (SST) are explored in both the Niño 3 (5°N-5°S, 150°W-90°W) and Niño 4 (5°N-5°S, 160°E-150°W) regions.

Data and methods

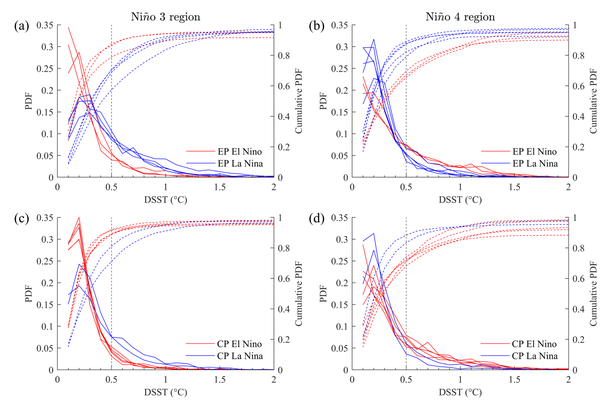
- TAO/TRITON buoy data: SST
- ERA5: SWR, LWR CCMP: Wind
- Time period: 1990-2018
- $\Delta T_w = \frac{I_S^{\frac{3}{2}}}{I_\tau} \times const = \frac{(\int(\delta S_w - Q)dt)^{\frac{3}{2}}}{\int \frac{\tau}{\rho} dt} \times const$,

$$const = \frac{2(\alpha g)^{\frac{1}{2}}}{(2\mathrm{Ric})^{\frac{1}{2}}(\rho \mathrm{Cp})^{\frac{3}{2}}}$$

Effects of two types of ENSO events on interannual variations in DSST



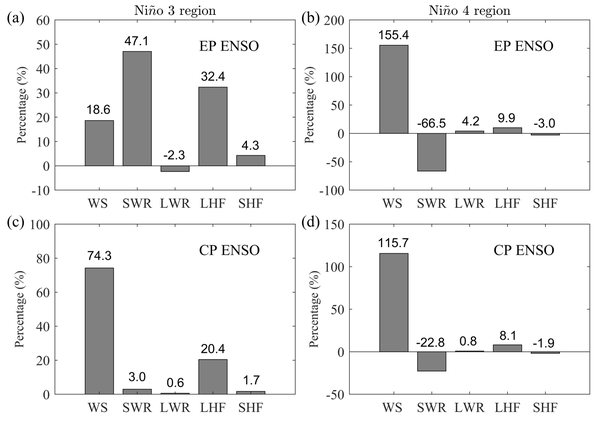
- The DSSTA in the Niño 3 region was negatively correlated with the Niño 3 SST index (cc: -0.57) and Niño 4 SST index (cc: -0.69) with zero lag.
- In the Niño 4 region, the DSSTA was positively correlated with the Niño 3 SST index (cc: 0.44) and Niño 4 SST index (cc: 0.55) with a 3- to 4-month lead.



- In the Niño 3 region, the probabilities of a large DSST (>0.5°C) were significantly lower in EP/CP El Niño years (less than 12.63%/8.62%) than in the EP/CP La Niña years (more than 24.31%/16.97%).
- In the Niño 4 region, the probabilities were obviously higher in the EP/CP El Niño years (more than 22.83%/15.80%) than in the EP/CP La Niña years (less than 17.80%/14.03%).

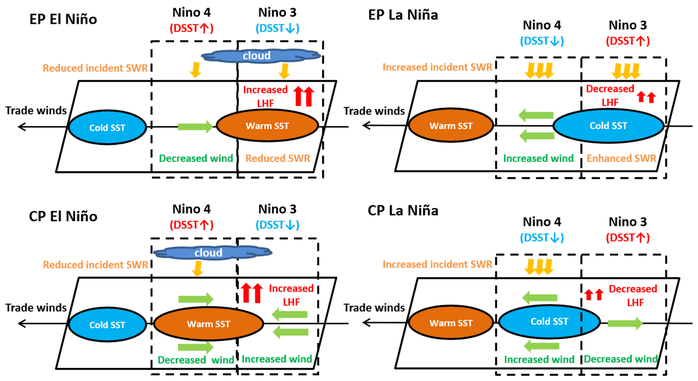
Causes of interannual variation in DSST during different types of ENSO events

	Surface fluxes				
	SWR	WS	LWR	LHF	SHF
CTRL	I	I	I	I	I
EXP_SWR	I	C	C	C	C
EXP_WS	C	I	C	C	C
EXP_LWR	C	C	I	C	C
EXP_LHF	C	C	C	I	C
EXP_SHF	C	C	C	C	I



- In the Niño 3 region, in EP ENSO, the dominant role is the SWR(47.1%). Moreover, the LHF (32.4%) and WS (18.6%) also contributes to the changes. In CP ENSO, the WS (74.3%) plays a key role, while the second most effective factor is the LHF (20.4%).
- In the Niño 4 region, in both two types of ENSO, WS is the dominant factor (155.4% and 115.7%, respectively). However, the SWR (-66.5% and -22.8%, respectively) causes inverse effects.

Mechanism analysis



- In the Niño 3 region, the decreased/increased SWR and the increased (decreased) LHF lead to the negative (positive) DSSTA in EP El Niño (La Niña) years. In addition, the enhanced (reduced) WS and the increased (decreased) LHF cause the negative (positive) DSSTA in CP El Niño (La Niña) years.
- In the Niño 4 region, the reduced (enhanced) trade wind plays a key role in producing in the positive (negative) DSSTA, while the decreased (increased) SWR has an opposite effect that reduces/increases the range of the DSSTA during both EP and CP El Niño (La Niña) events.

Conclusion

- In the Niño 3 region, the diurnal SST anomaly (DSSTA) is negative during both EP and CP El Niño events and becomes positive during both EP and CP La Niña events. However, the DSSTA in the Niño 4 region is positive in El Niño years and negative in La Niña years, which is opposite to that in the Niño 3 region.
- This study suggests that the interannual variations in DSST are caused mainly by different WS, SWR and LHF behaviors during different types of ENSO events.

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