The Role of Clouds in Shaping Tropical Pacific Sea Surface Temperature Pattern in Response to Extratropical Forcing

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Northern Hemispheric differential heating leads to La Niña-like responses on decadal timescales

Effects of delayed warming in the Southern Ocean (Hwang et al., 2017)

Idealized Warming in the Northern Atlantic and Pacific (Hsiao et al., under revision)

A feedback loop established by cloud feedbacks, surface wind adjustments & evaporation, and Hadley Cell adjustments:

Climatology control on connecting meridional and zonal sea surface temperature gradients

Evidence

(a) hNA-SOM cloud effect $\Delta T$ mean: 0.09 K

(b) CESM fully coupled (control run, 50 yrs)

(c) OISST - CERES (2000/03-2018/03)

Key points

- Spatial variations of tropical SST change are insensitive to the heating structures in the extratropics on decadal timescales.
- Clouds are essential in forming tropical SST response pattern through their coupling with circulation and surface energy fluxes.
- The climatological rainbow position in the tropics determines how clouds shape the tropical responses to extratropical forcing.

Reference