Influence of Subsurface Tropical Instability Waves on Ocean Temperatures in the Tropical Atlantic

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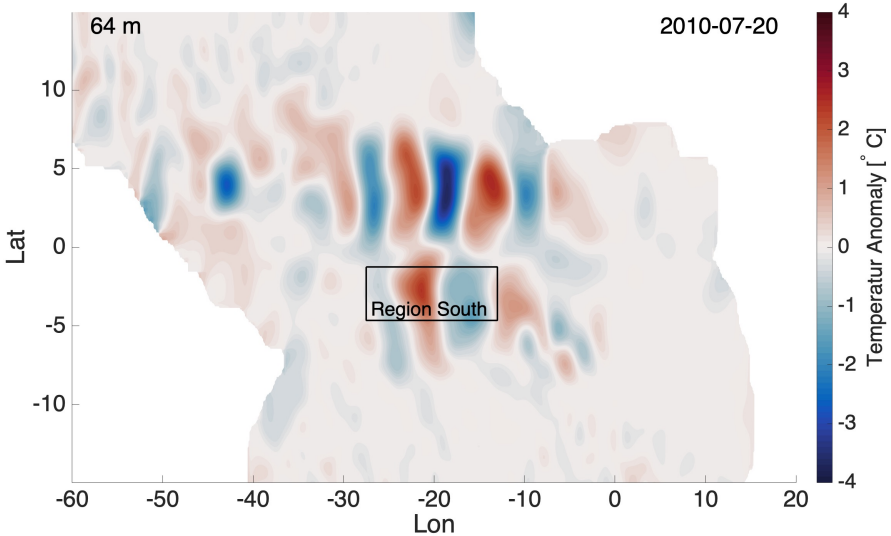
Background

- Tropical instability waves (TIWs) lead to **sea surface temperature (SST) cooling** due to enhanced mixing and heat fluxes
- TIWs mainly cause cooling at the Equator and north of it



Subsurface TIWs (subTIWs) frequently occur in the **Southern Hemisphere** as well

➡ Focus on Region South

HYPOTHESIS:
SubTIWs influence subsurface mixing and thereby induce changes in ocean temperature.

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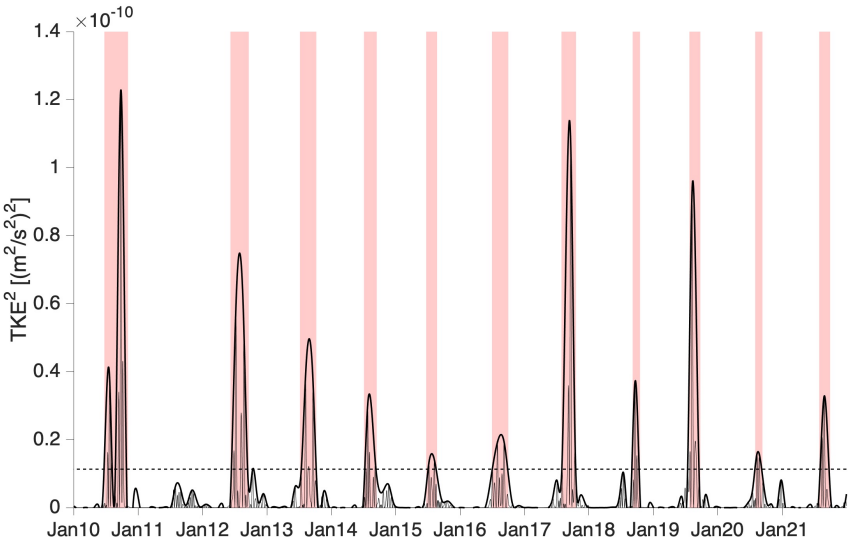
Identifying SubTIWs in the Tropical Atlantic

Data - ICON-Ocean model

- Global ocean only setup
- 10 km horizontal resolution
- 128 vertical levels
- Forced by hourly ERA5 data from Jan 2010 to Jan 2022
- Heat Budget terms explicitly calculated

SubTIW Characteristics

- **Period:** 24 to 55 days
- **Wavelength**: 600 to 1200 km
- **Depth**: Lower thermocline, most pronounced around 64 m
- Occurrence both **north and south of the Equator**



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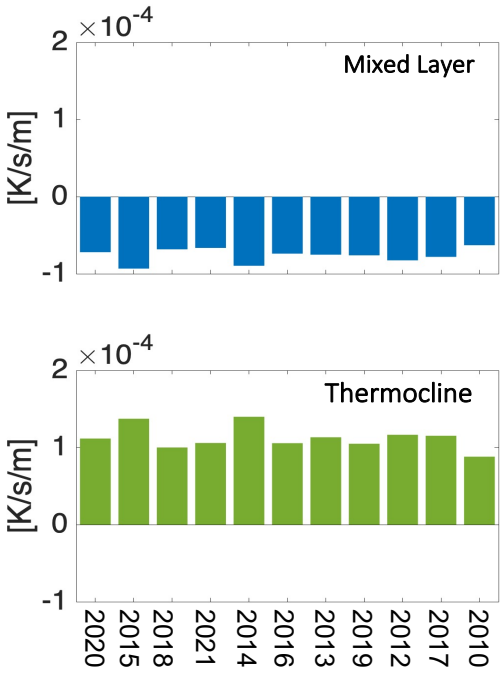
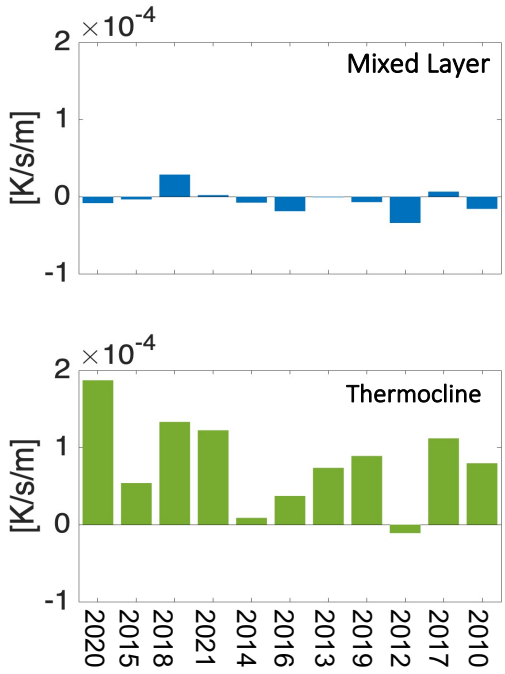
Effect of SubTIW Induced Mixing on the Heat Budget

Vertical diffusion/mixing



Vertical diffusion/mixing leads to warming in the thermocline and cooling within the mixed layer

Total temperature tendency



Warming below the mixed layer during subTIW occurrence

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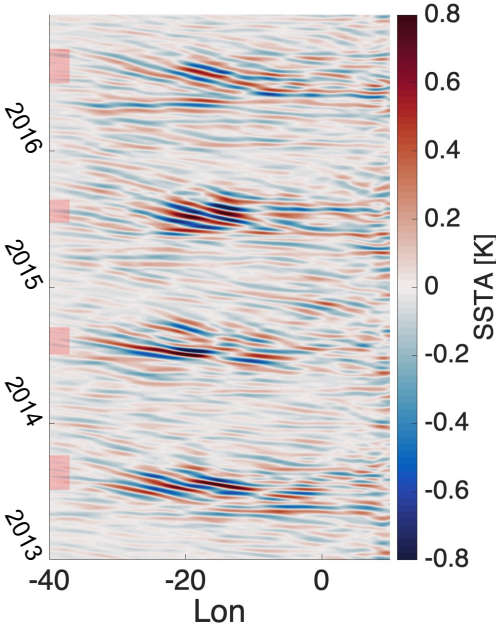
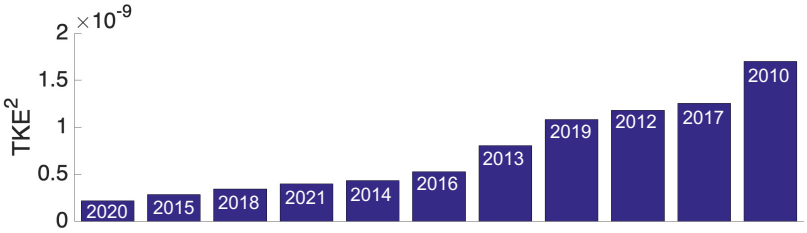
Do SubTIWs Influence the SST?

Hovmöller diagram of SSTA

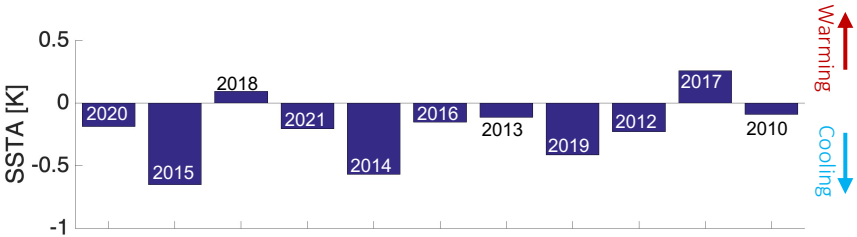


clear wave pattern visible in SSTA

a) TKE integrated over each subTIW period, sorted in ascending order



b) SST anomaly in Region South



No obvious connection between the strength of subTIWs and a surface cooling/warming

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Summary

- SubTIW induced vertical mixing leads to a temperature increase below the mixed layer
- Why do we not see a clear, long lasting influence of subTIWs on SST?
- First results indicate an imprint of subTIWs on the local SST in the Southern Hemisphere, visible as a wave pattern with strong SST fronts

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