MJO Task Force

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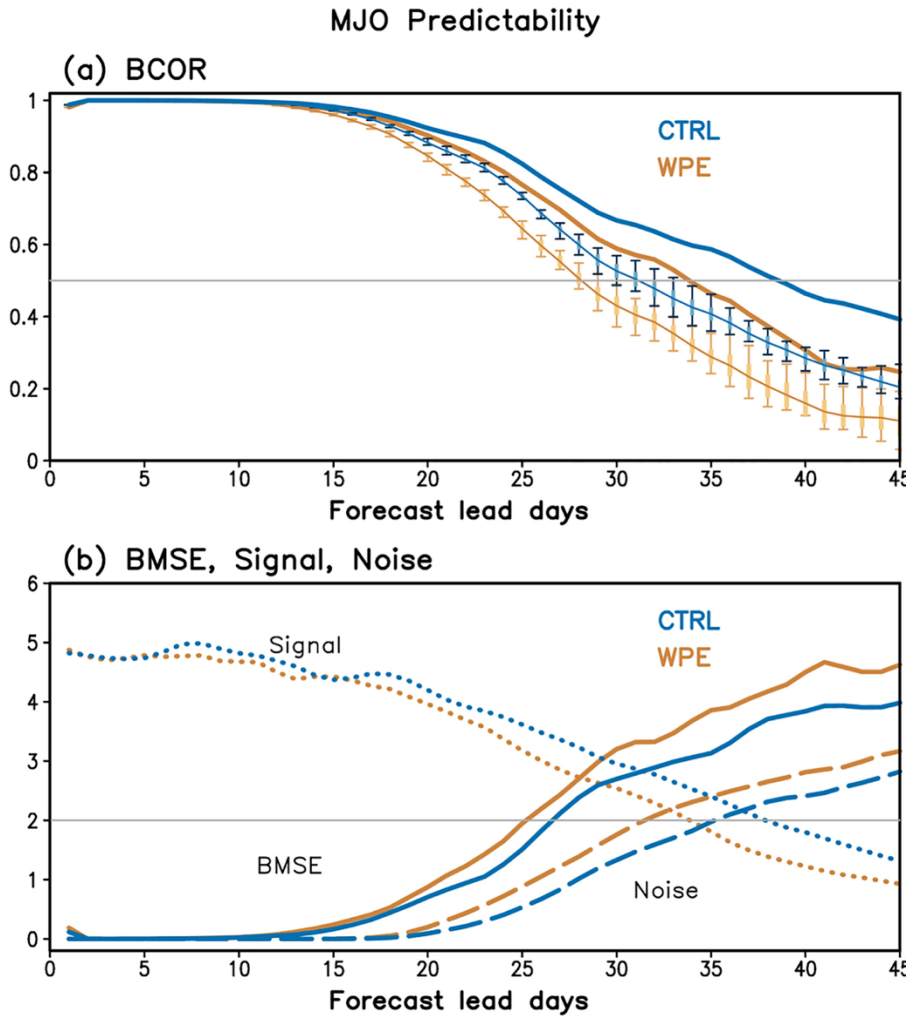
WGNE39-WGSIP25 meeting

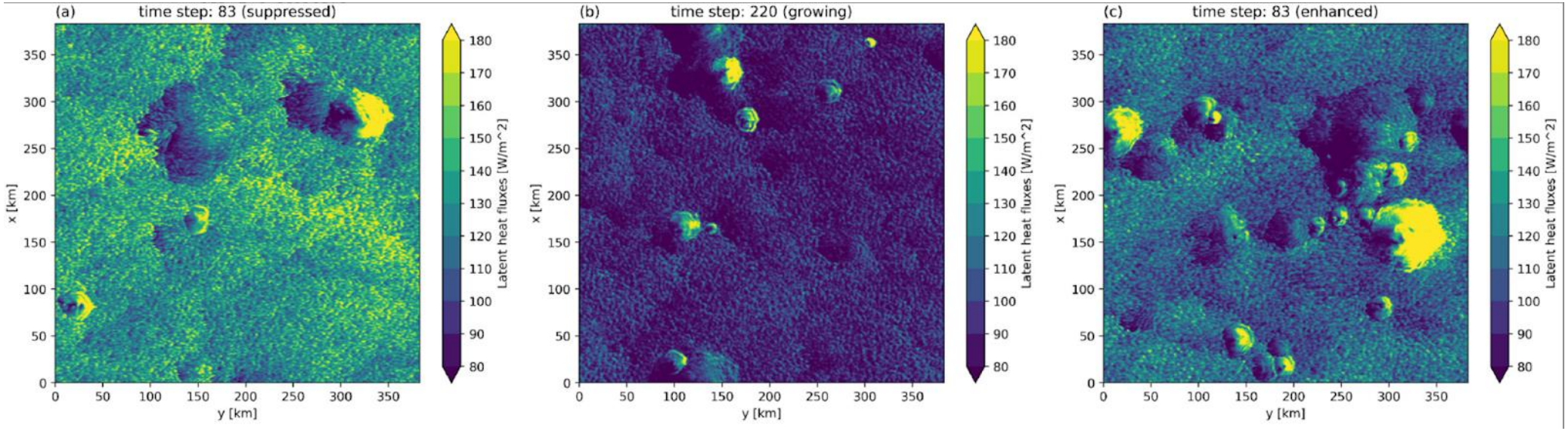
MJO Prediction in a warming world



- A sensitivity experiment was performed using Community Earth System Model 2 aquaplanet with different prescribed sea surface temperatures
- Expanding the Indo–Pacific warm pool makes the Madden–Julian oscillation-like waves less organized
- The warm pool expansion quickens the forecast error increase and predictability decrease

Hyemi Kim 2024

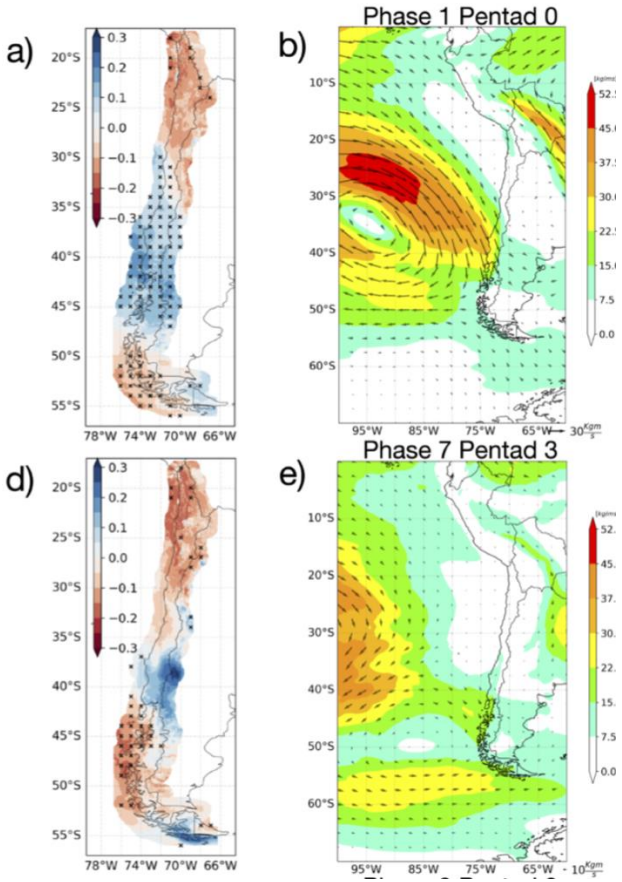
MJO—cold pool interactions



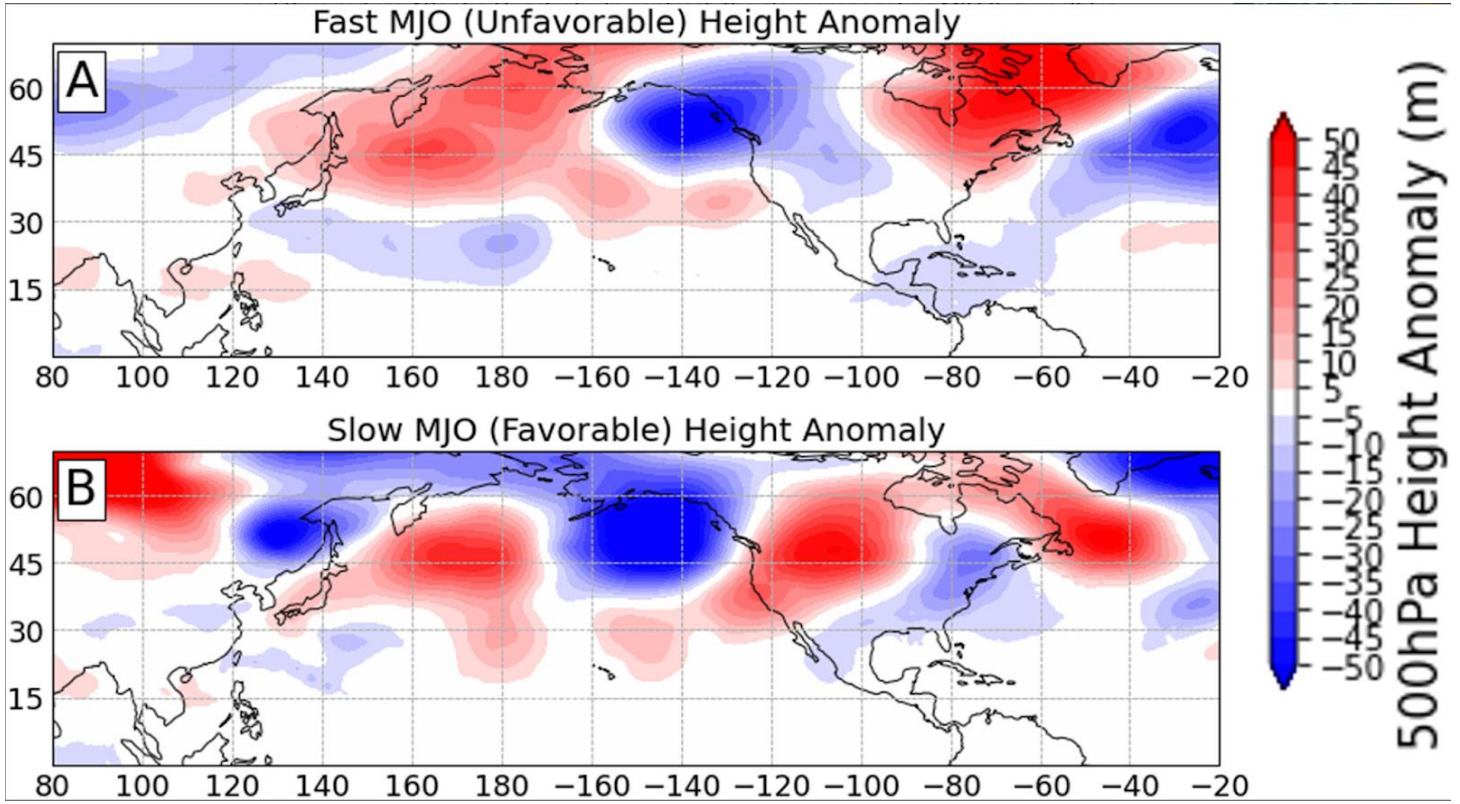
Naoko Sakaeda; Tang et al. 2024

- 256kmx256km 1 km resolution simulation of DYNAMO period
- cold pools are larger and last longer during the mature stages of the MJO
- facilitate the formation of more convective cores and increasing the degree of convective organization

MJO—teleconnections

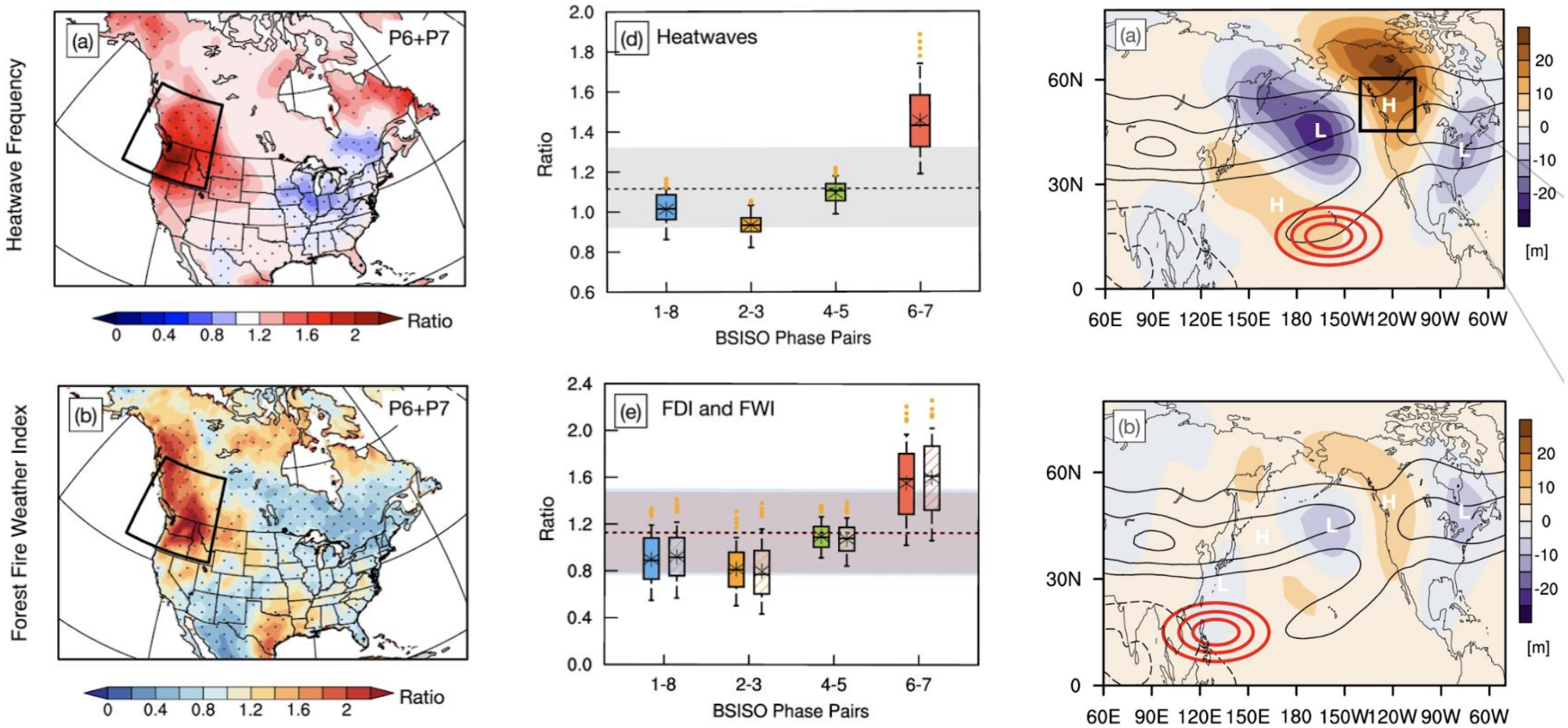


Stephanie Henderson: Chilean precipitation modulated by MJO (Matus et al. 2024)



Matthew Janiga: Compared to fast MJO, slow MJO propagation in Phase 2 favors Atlantic TC development by reducing shear in TC development region (Hansen et al. 2024)

MJO—teleconnections



Samson Hagos: The frequency of boreal summer heatwaves and forest fire weather in western North America are strongly enhanced during MJO phases 6-7. Linear barotropic model illustrates importance of MJO forcing in central Pacific for the strong response.

Zonal shifts of Eastern Edge of the Warm Pool (EEWP)

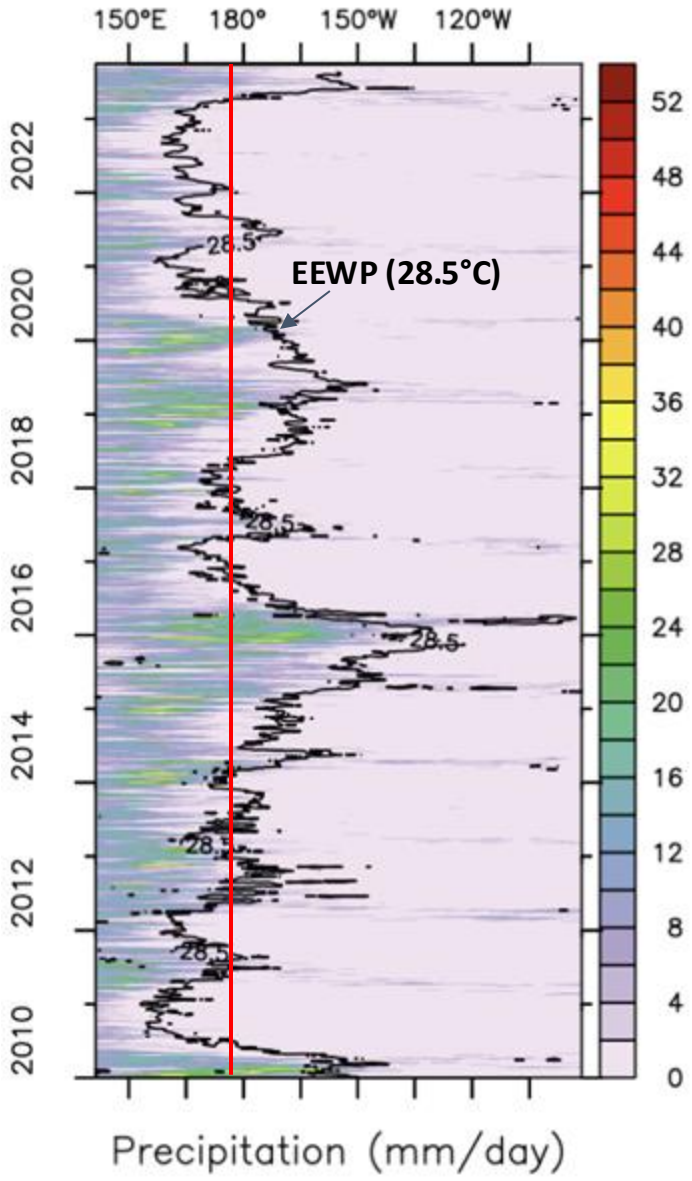
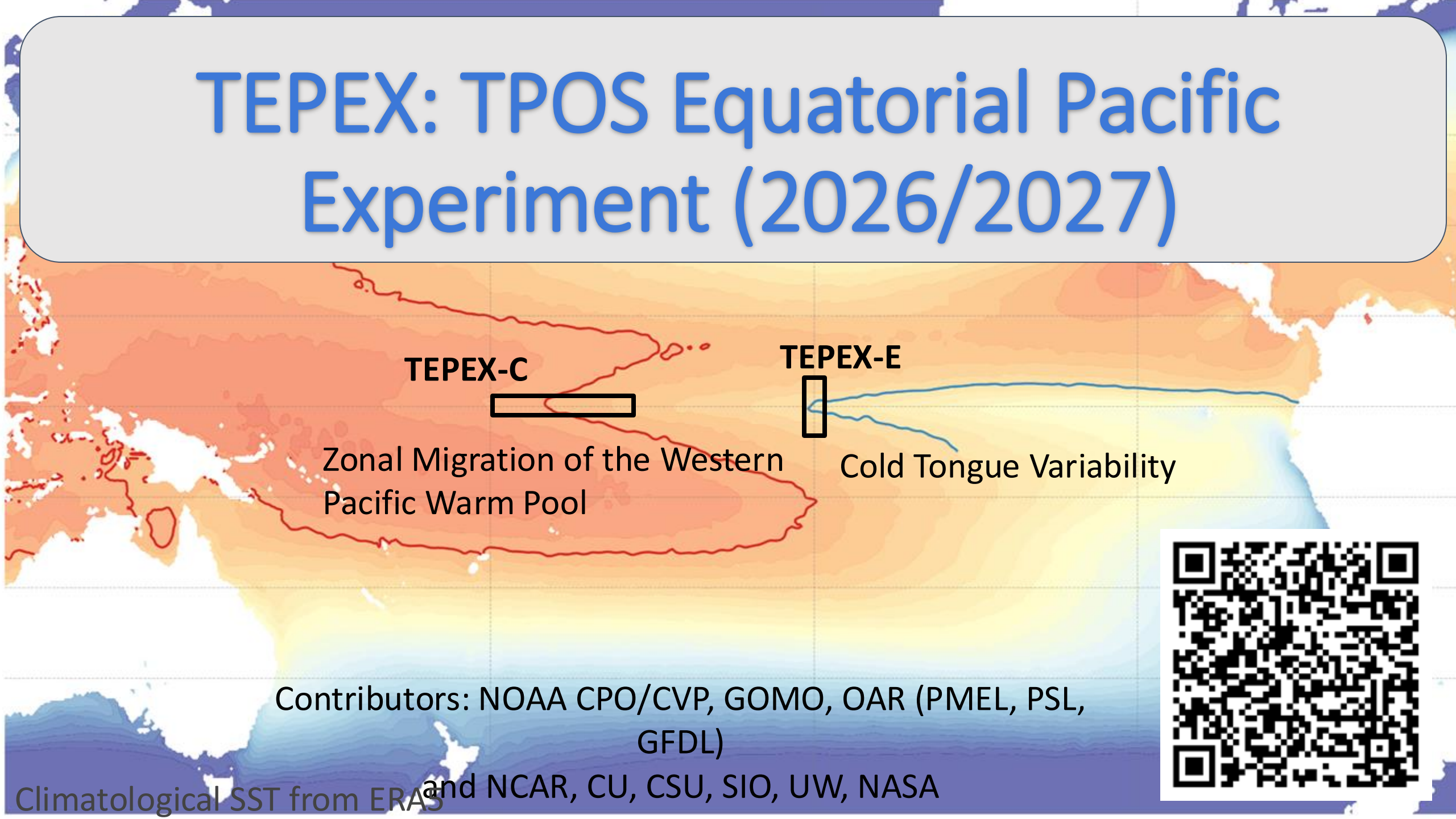


Figure by Meghan Cronin

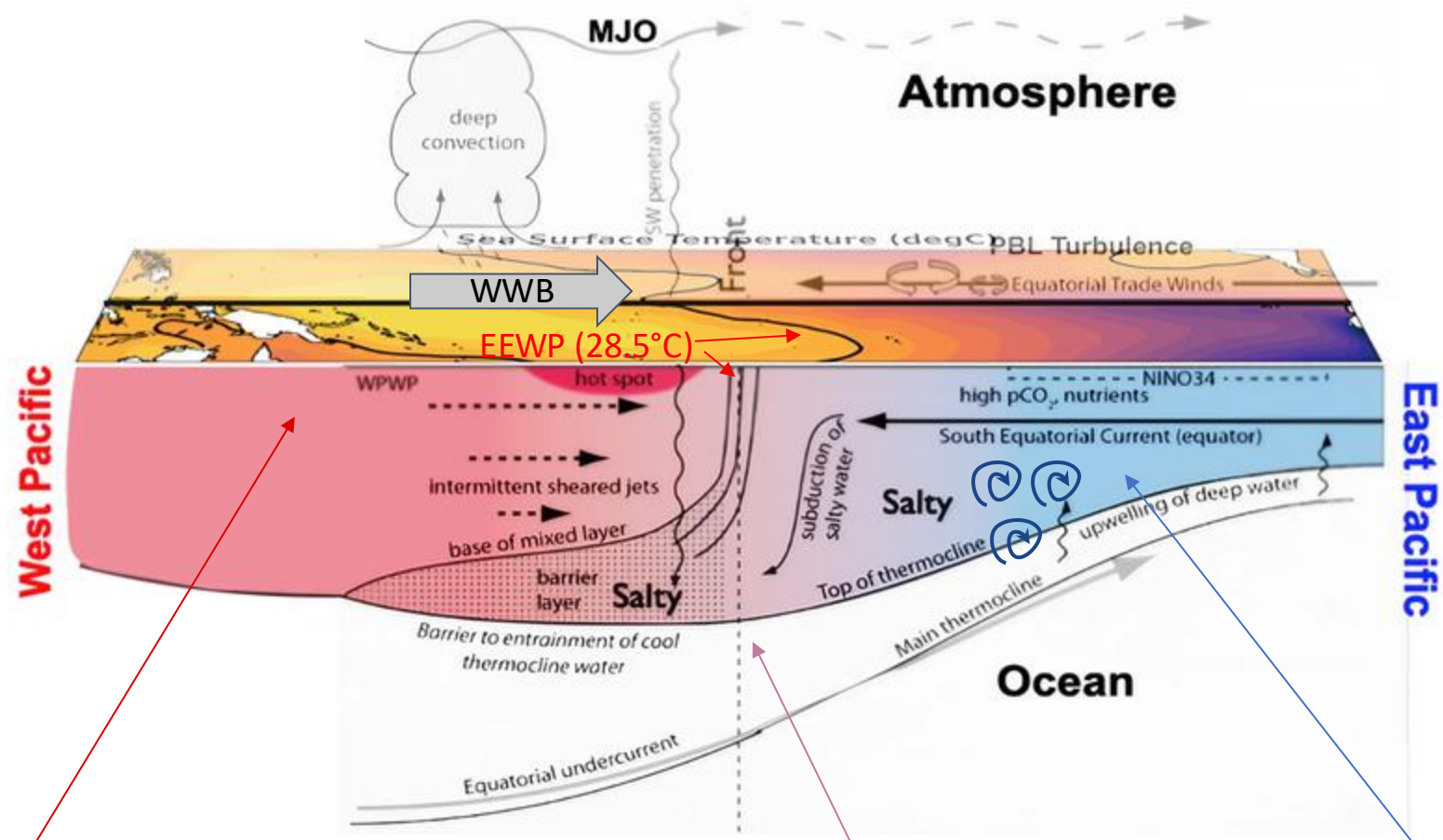
- EEWP expands and contracts zonally:
  - …on intraseasonal timescales
  - …on interannual timescales
- EEWP is a hotspot for:
  - Ocean-atmosphere coupling
  - Scale interactions
  - ENSO cycles
- EEWP zonal shifts affect tropical-extratopical teleconnections:
  - Landfalling atmospheric rivers
  - Tropical cyclones
  - Blocking patterns
  - Hot and cold extremes
  - Flooding and drought

TEPEX: TPOS Equatorial Pacific Experiment (2026/2027)



Contributors: NOAA CPO/CVP, GOMO, OAR (PMEL, PSL, GFDL)
and NCAR, CU, CSU, SIO, UW, NASA

A variety of ocean-atmosphere processes drive equatorial Pacific variability



- deep clouds
- heavy rainfall
- westerly wind bursts
- deep thermocline
- barrier layers

- zonal shifts of **eastern edge of Warm Pool** (**EEWP**; 28.5C contour)
- equatorial fresh jets
- strong ocean-atmosphere coupling

- shallow clouds
- scant rainfall
- easterly trade winds
- shallow thermocline
- sub-mixed-layer-mixing

TEPEX-C: Observations are needed to…

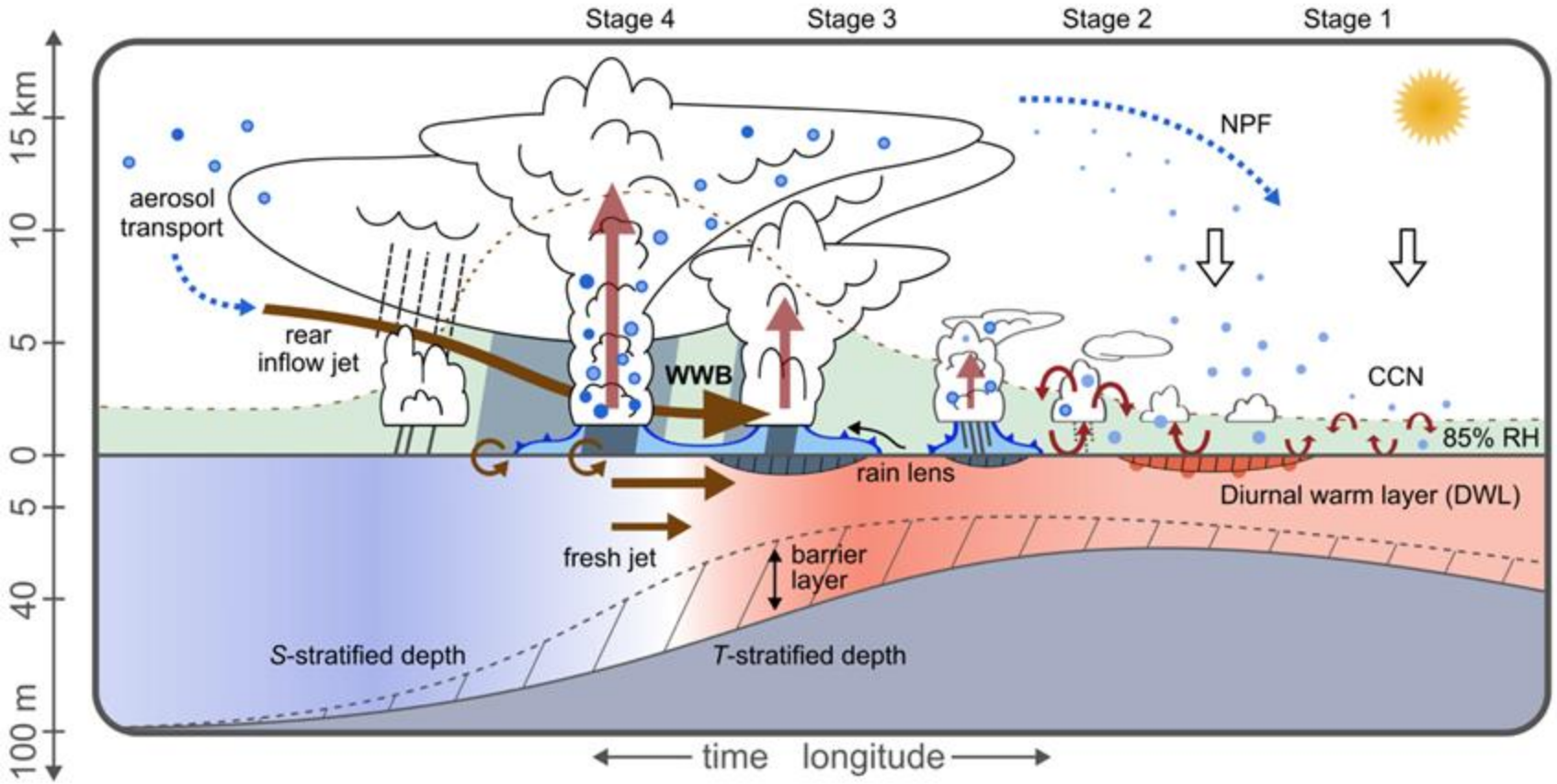
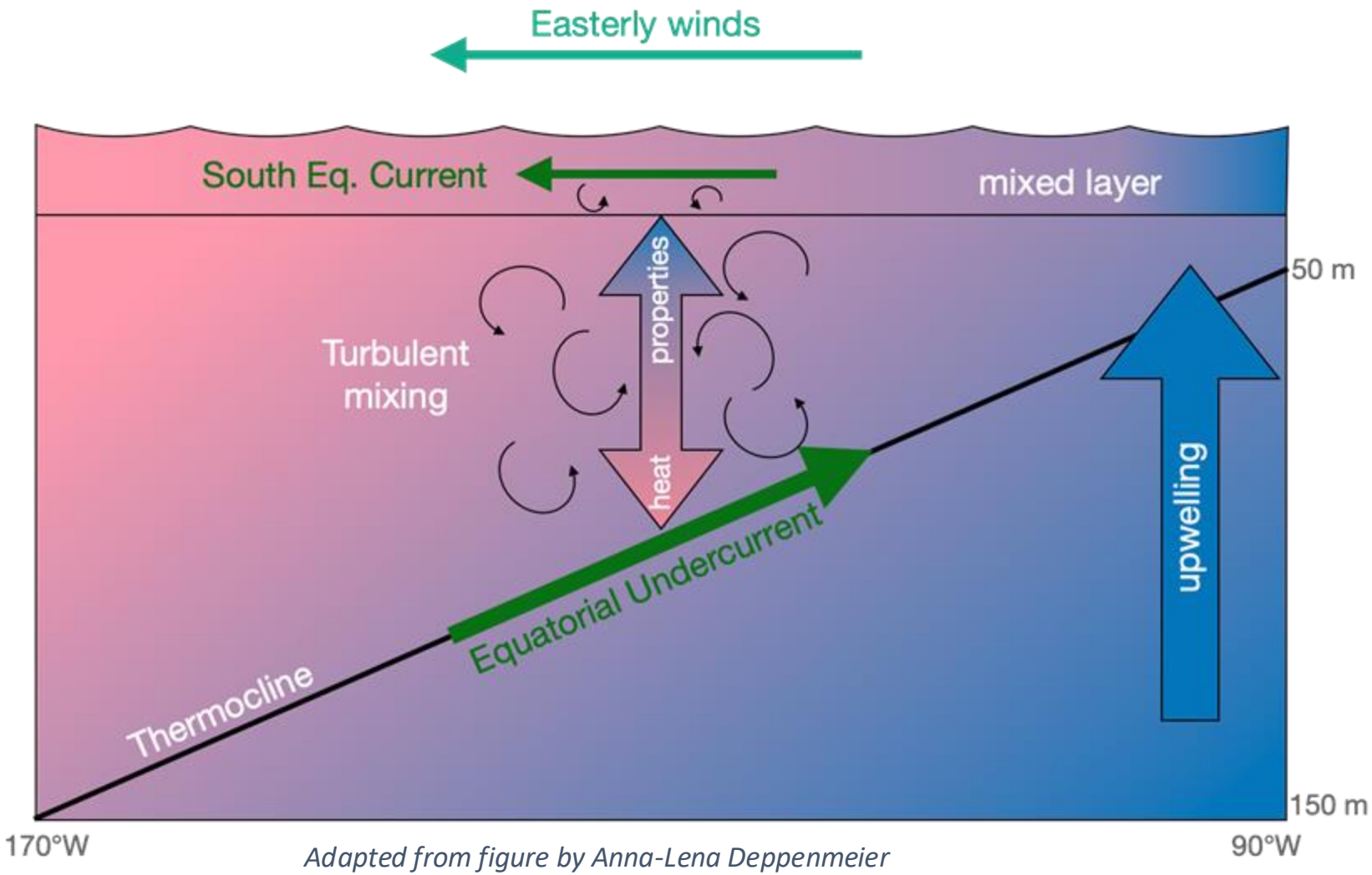


Figure by James Ruppert and Charlotte DeMott

- Improve process understanding of EEWP variability:
  - What sustains **equatorial zonal currents**? **SST gradients**?
  - Role of **barrier layers**?
  - Role of **convective organization** and **aerosol interactions**?
- Develop model test cases

~2 yr ground observations; intensive observations from ships, A/C, land sites, UxS

TEPEX-E: Observations are needed to…



Adapted from figure by Anna-Lena Deppenmeier

- Characterize mixing as a function of large-scale variability:
  - Annual cycle
  - TIWs
- Understand atmospheric response to ocean mixing
- Develop model test cases

2 ship cruises to enable a 1-year deployment of moorings on/near the Equator, UxS


Thank you