Team Land Report
May 13 (Tue 2025)

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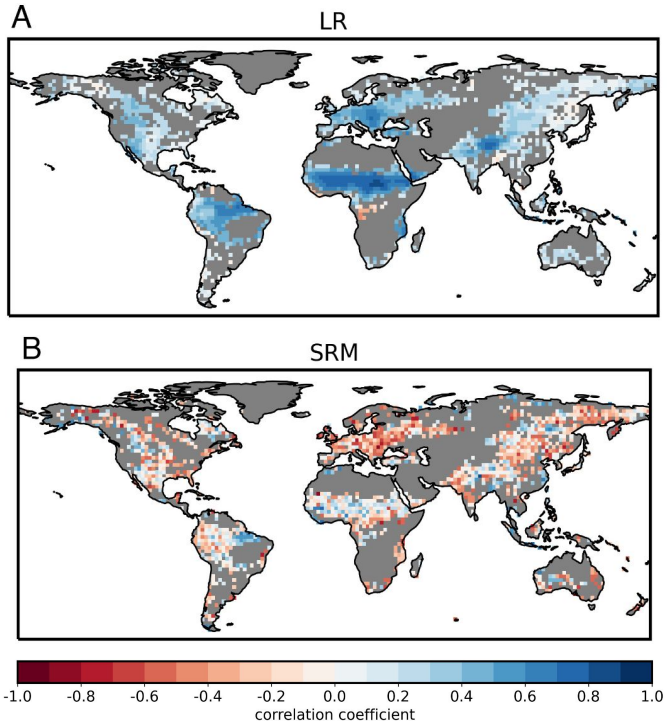
Introduction

- Dry process (Sensible heat flux)
  - Relation between simulated 2 m temperature and sensible heat flux at different resolutions.

- Moist Process (Latent Heat Flux)
  - Weaker SM-P feedback in ICON cloud-resolving model



(Lee et al., 2024)

Scientific Questions

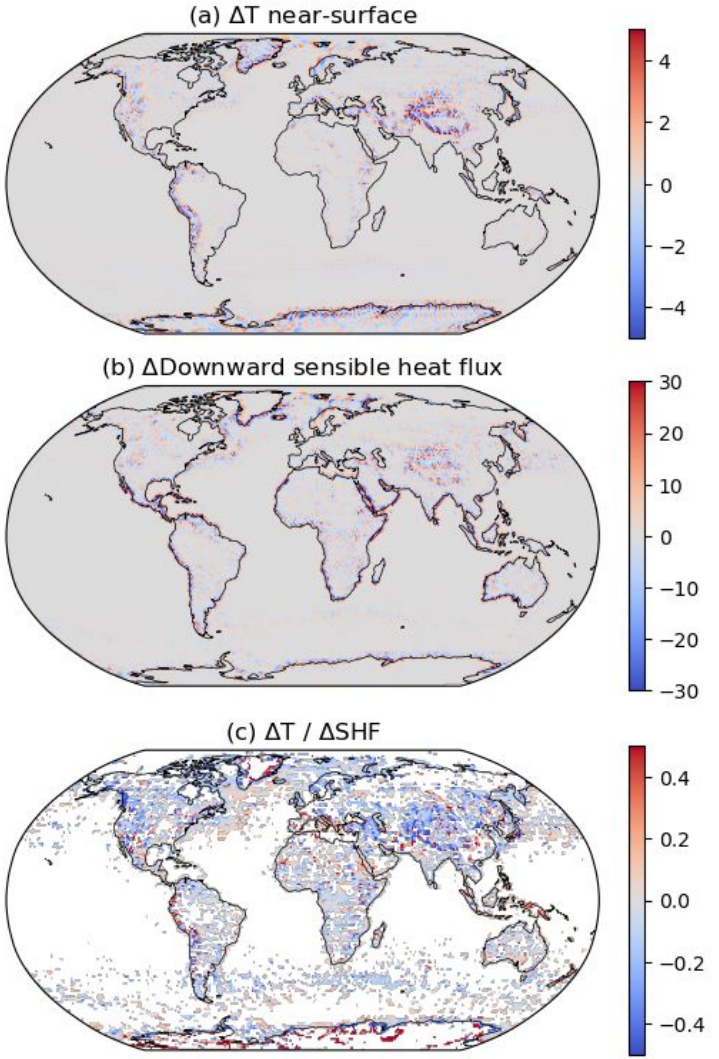
- Dry process
  - T(10 km), SH(10 km) ~ T(20 km), SH(20 km)?
  - T(10) - T(20) = α (SH(10) - SH(20))?
  - What control α?
    - Planetary boundary layer height?
    - Wind speed?
    - …?

- Moist process
  - How will SM-P feedback represent in NICAM km-scale simulations?

Preliminary Results - Thermal Process

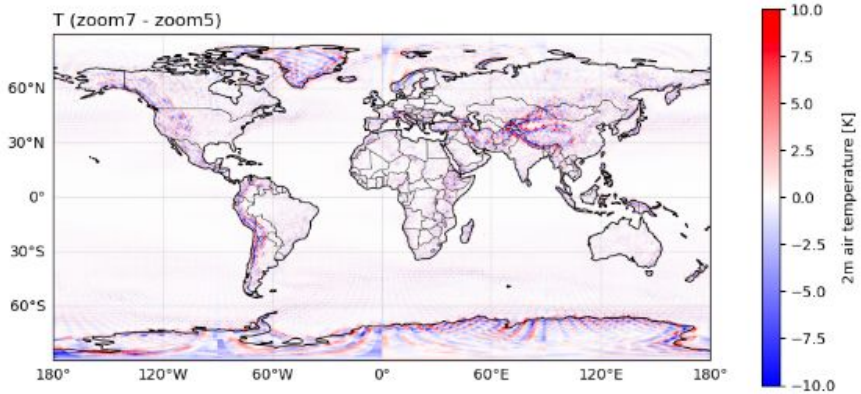
- March monthly mean result, zoom 5 vs 6 ⇒
- Little change on the ocean.
- On land, large ΔT and ΔSH around mountainous area (Andes, Himalayas, Rockies).
- ΔT/ΔSH < 0, in general.

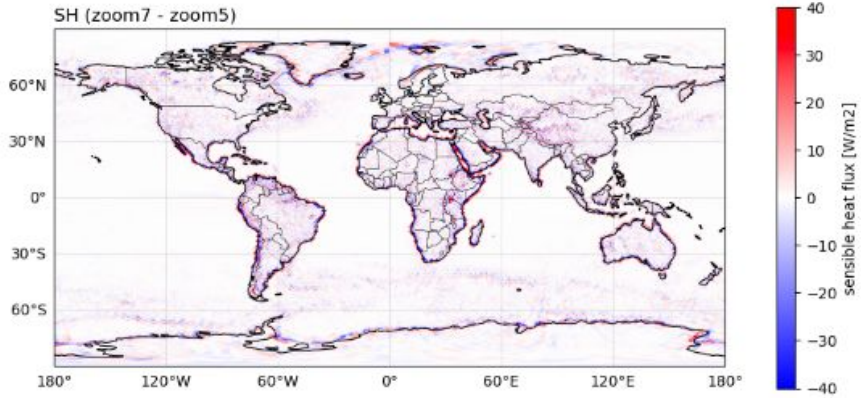
- Further questions:
  - Factors controling ΔT/ΔSH magnitude.
  - Seasonal variation.



Preliminary Results - Thermal Process

- Annual Results





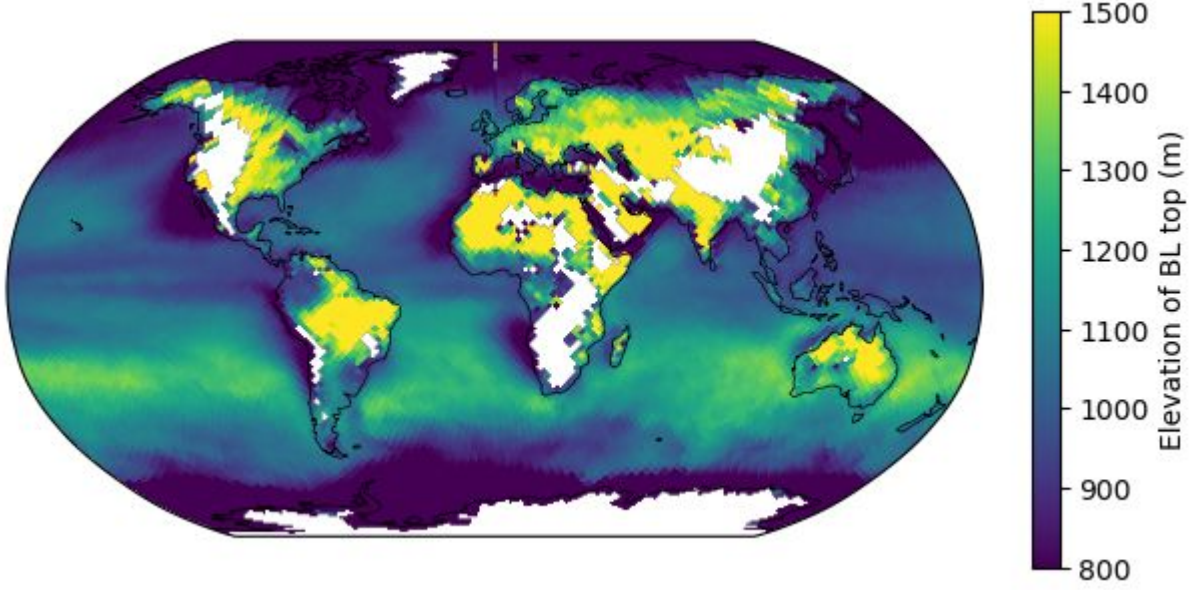
Preliminary Results - Diagnostic PBLH

Boundary layer height is diagnosed to investigate the impact to other parameters.

Method : Using the potential temperature profile

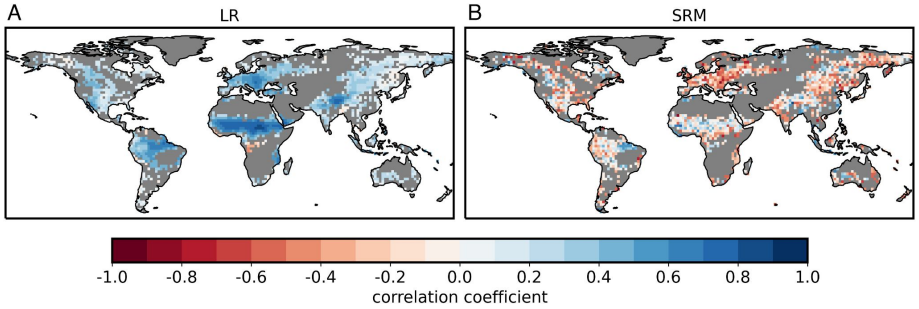
<- Olson et al.(2019)’s method for convective boundary layers

(But it doesn’t seems useful for stably stratified layers)

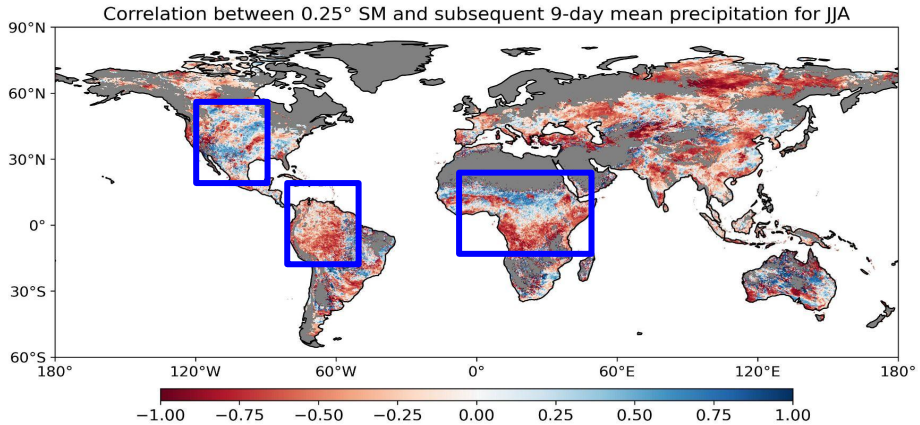


Preliminary Results - Moist Process

ICON 5km (Lee et al. 2024)

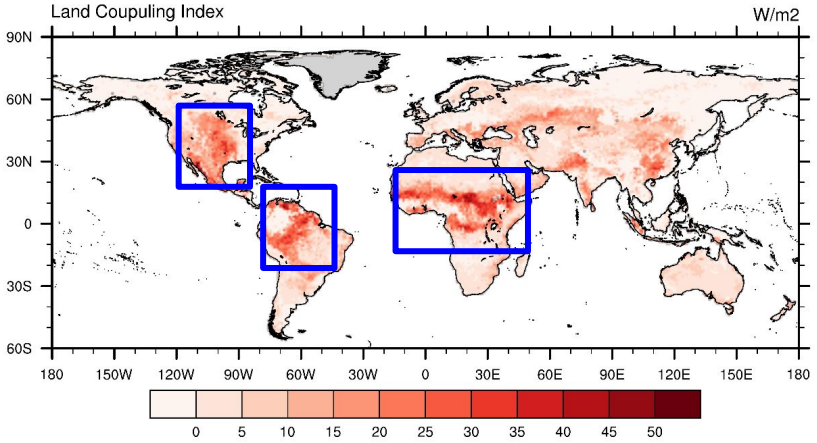


NICAM 25km



Km-scale simulations show similar results!

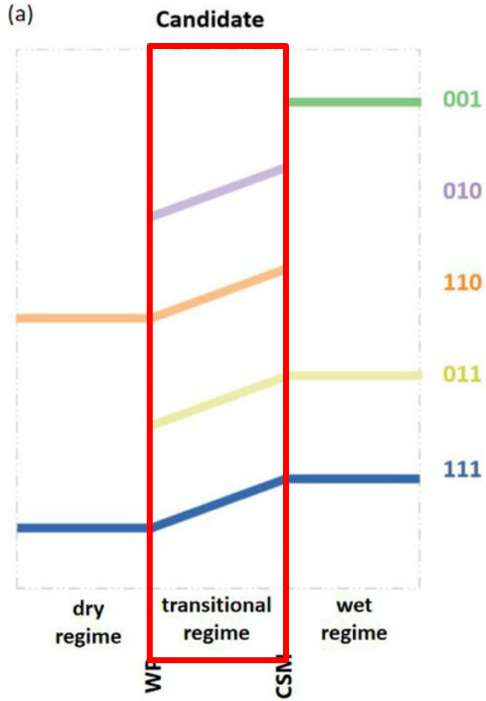
Land Coupling Index = corr(SM, ET) * std(SM)

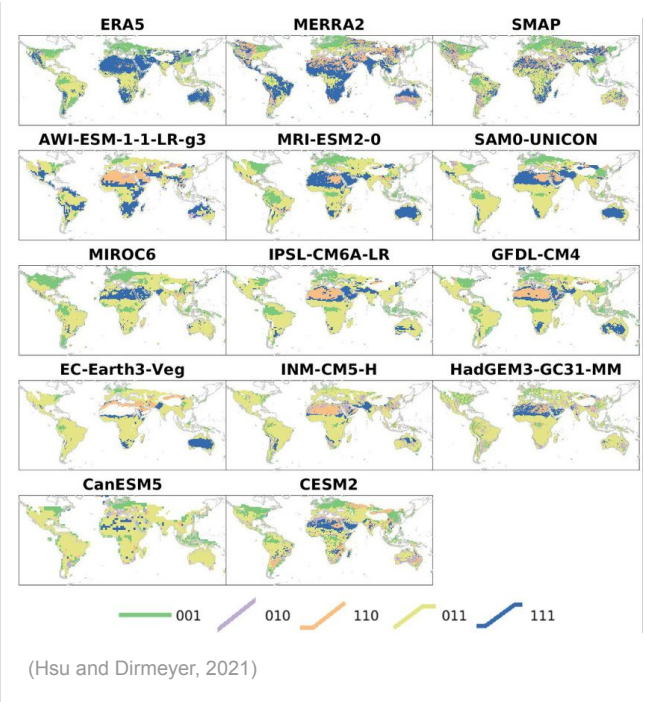


String LCI in Mid-America, Northern Amazon and Sahel regions

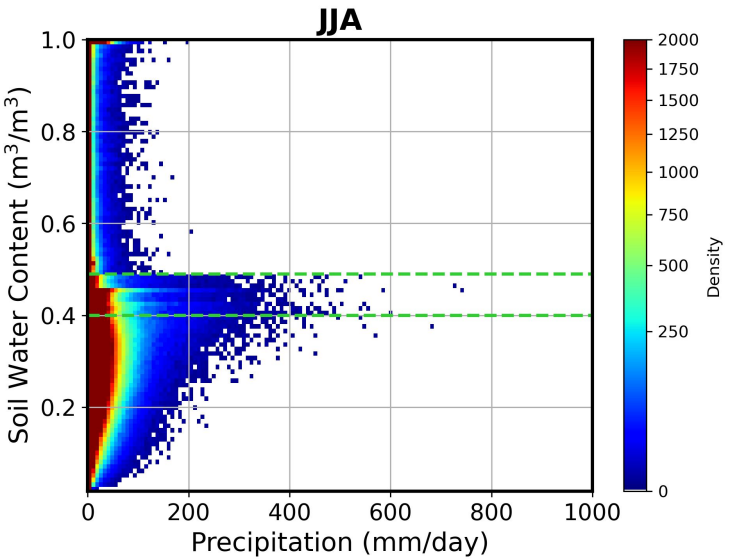
Ongoing Works - Moist Process

- Examine the relationship between SM and ET
- SM-P Feedback in coarser resolution of NICAM



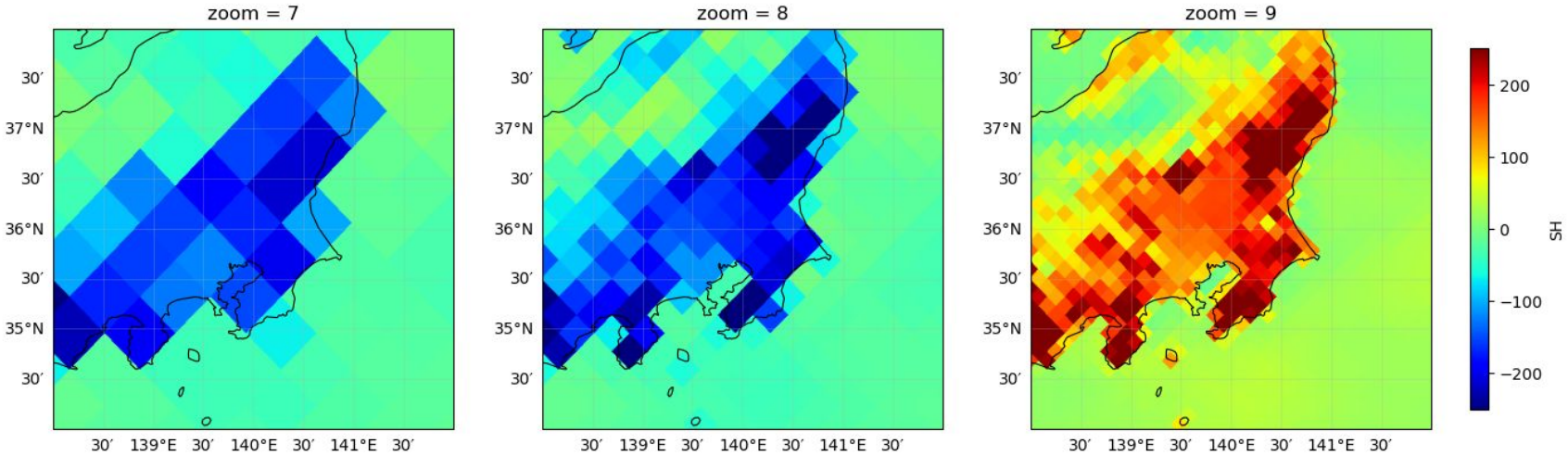


(Hsu and Dirmeyer, 2021)

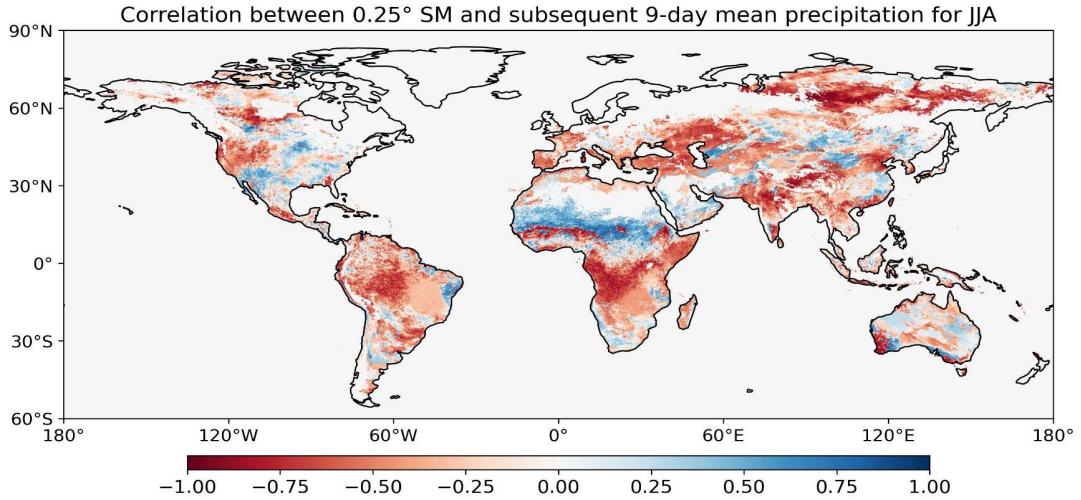


Technical Problem

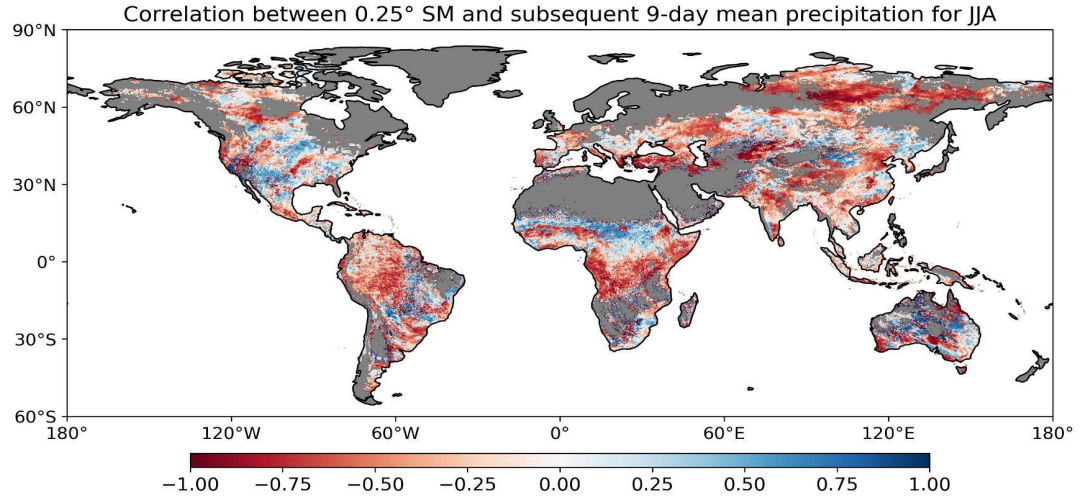
- Opposite SH direction in zoom = 9



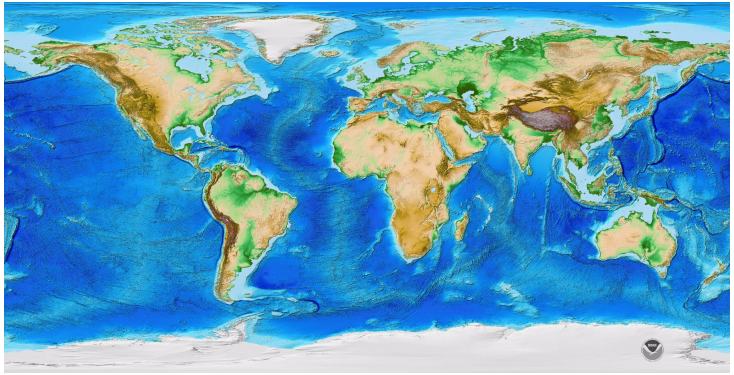
- Correlation with raw data

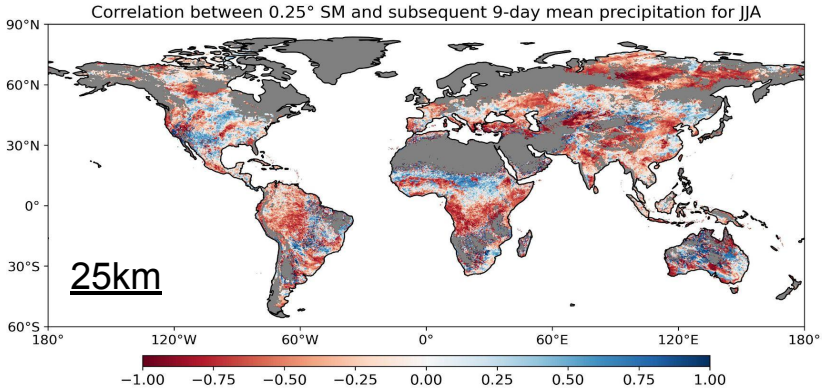


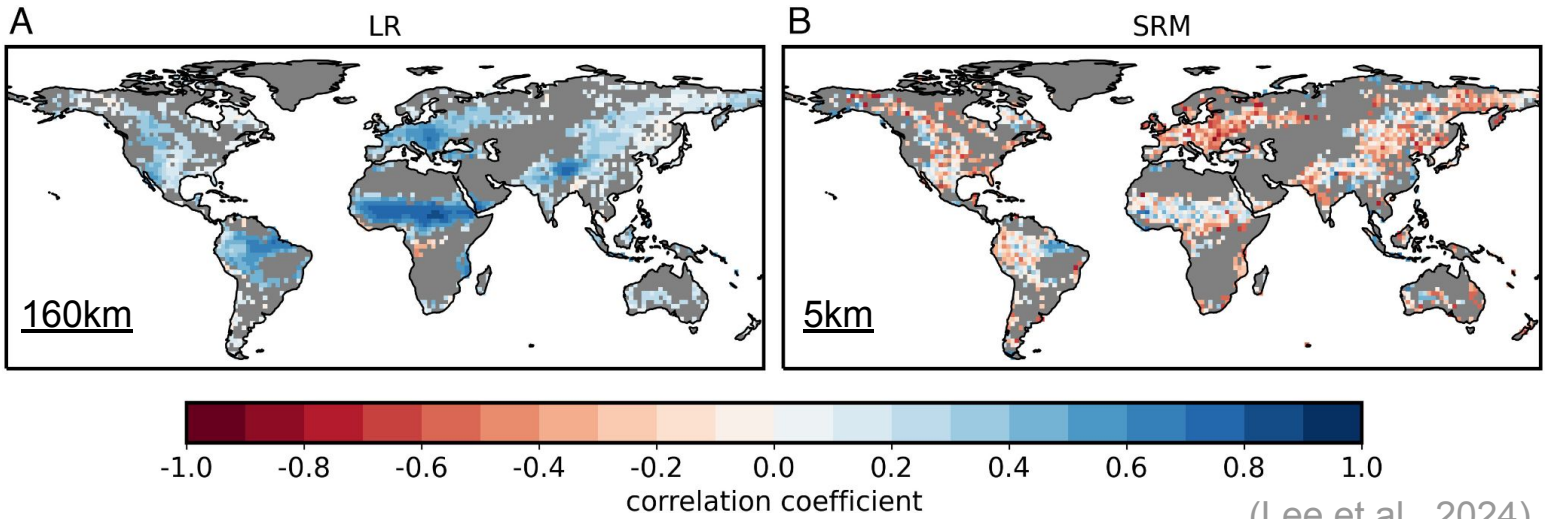
- Correlation excluding areas where prcp is smaller than 0.1 mm/d (grey).



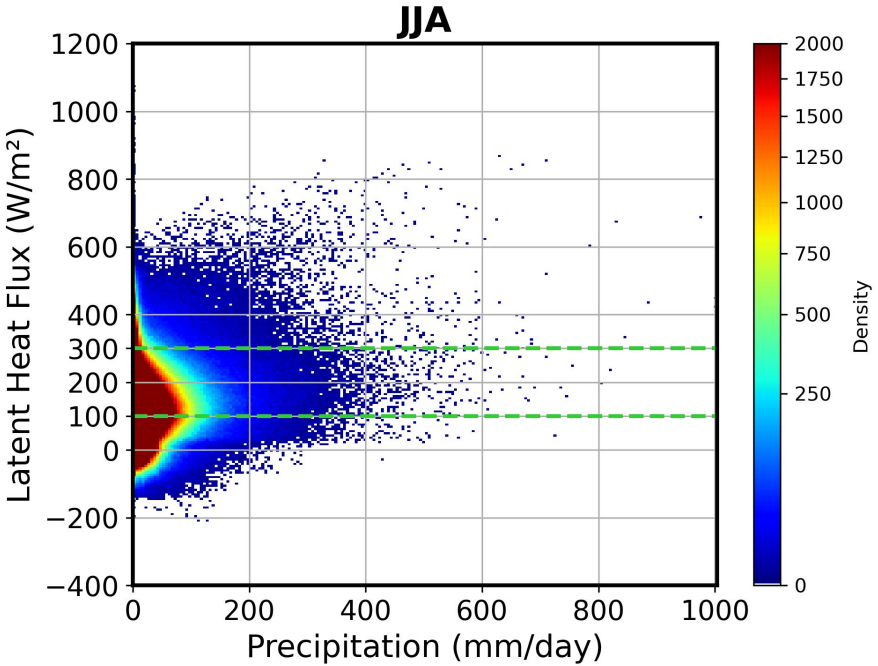
NOAA global topography map

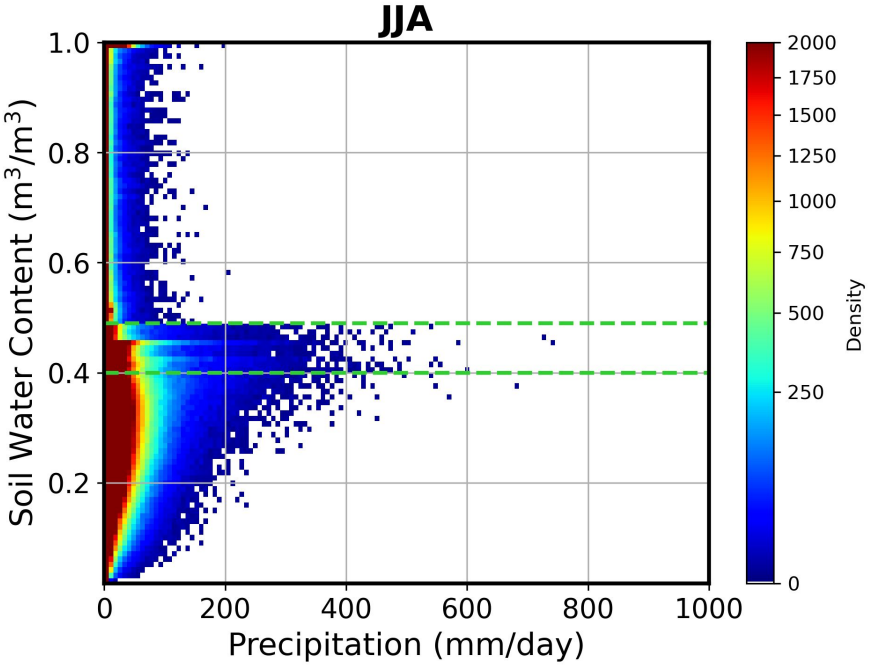




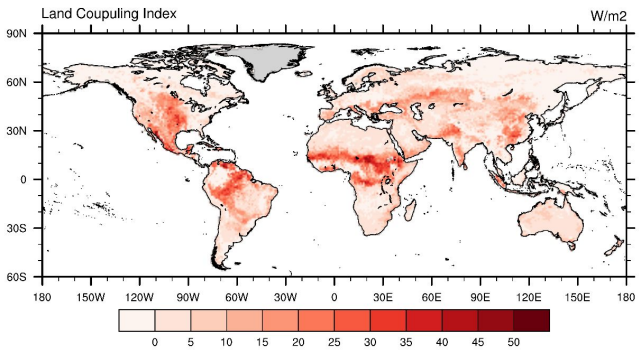


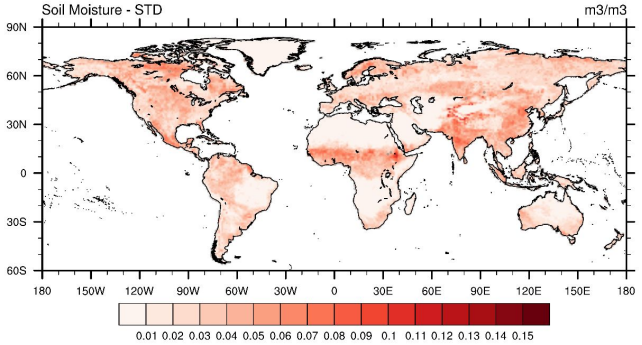
(Lee et al., 2024)

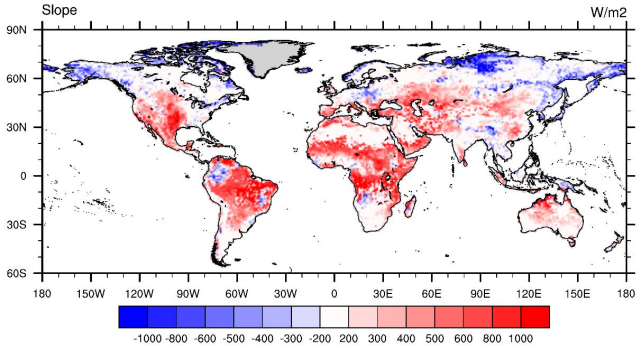

JJA
Latent Heat Flux (W/m²)
Precipitation (mm/day)
Density
1200
1000
800
600
400
300
200
100
0
−200
−400
0
200
400
600
800
1000
2000
1750
1500
1250
1000
750
500
250
0


JJA
Soil Water Content (m³/m³)
Precipitation (mm/day)
Density
1.0
0.8
0.6
0.4
0.2
0
200
400
600
800
1000
2000
1750
1500
1250
1000
750
500
250
0

LCI (ET, SM)


Land Coupuling Index
W/m2
90N
60N
30N
0
30S
60S
180 150W 120W 90W 60W 30W 0 30E 60E 90E 120E 150E 180
0 5 10 15 20 25 30 35 40 45 50


Soil Moisture - STD
m3/m3
90N
60N
30N
0
30S
60S
180 150W 120W 90W 60W 30W 0 30E 60E 90E 120E 150E 180
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1 0.11 0.12 0.13 0.14 0.15


Slope
W/m2
90N
60N
30N
0
30S
60S
180 150W 120W 90W 60W 30W 0 30E 60E 90E 120E 150E 180
-1000 -800 -600 -500 -400 -300 -200 200 300 400 500 600 800 1000