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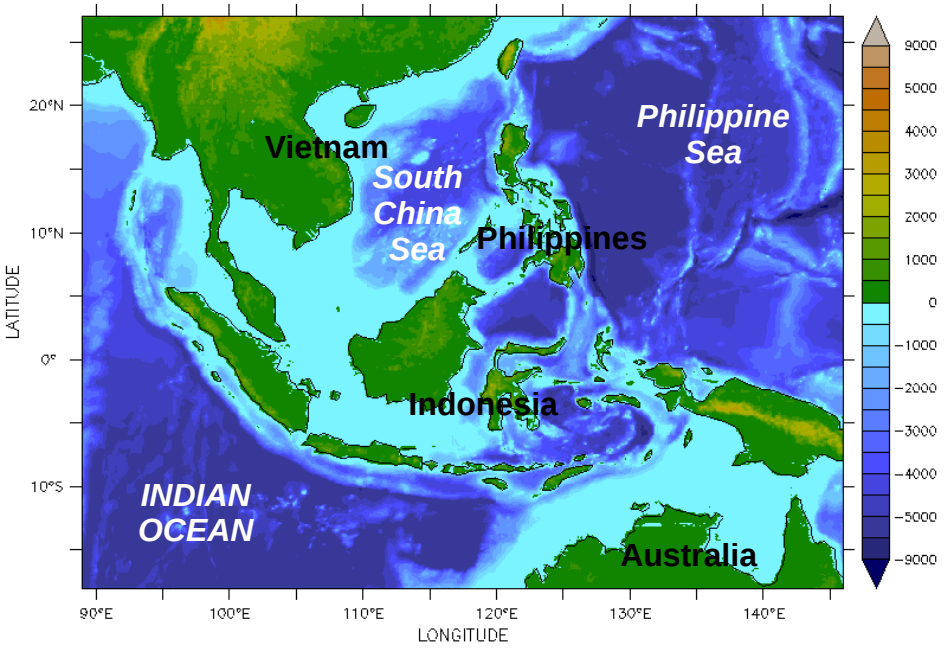
RegCM-OASIS-Symphonie air-sea coupling in Southeast Asia

Development, parameterization and strategy

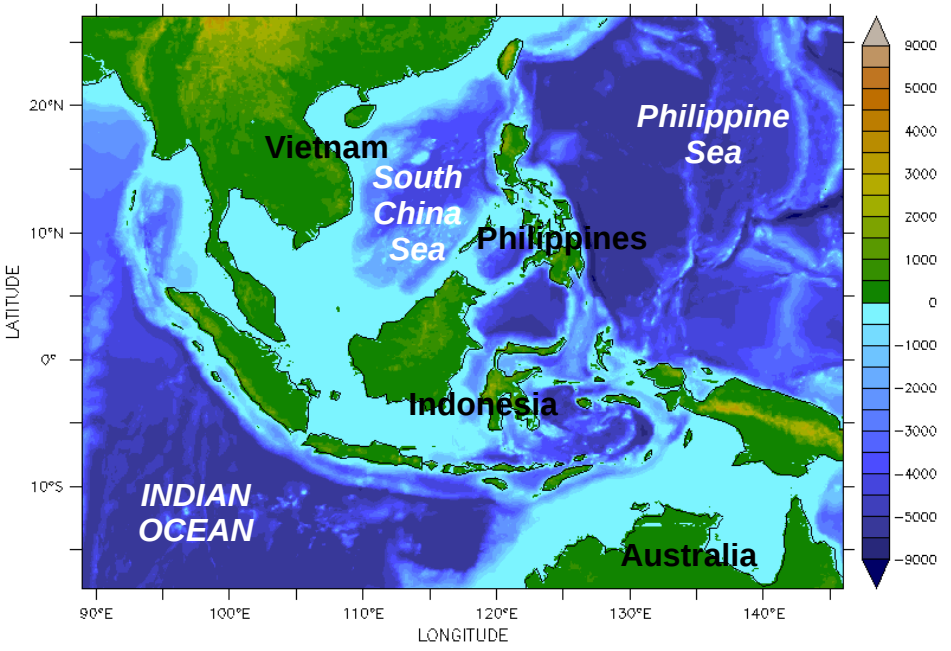
Introduction



Introduction

Atmosphere

- Complex topography

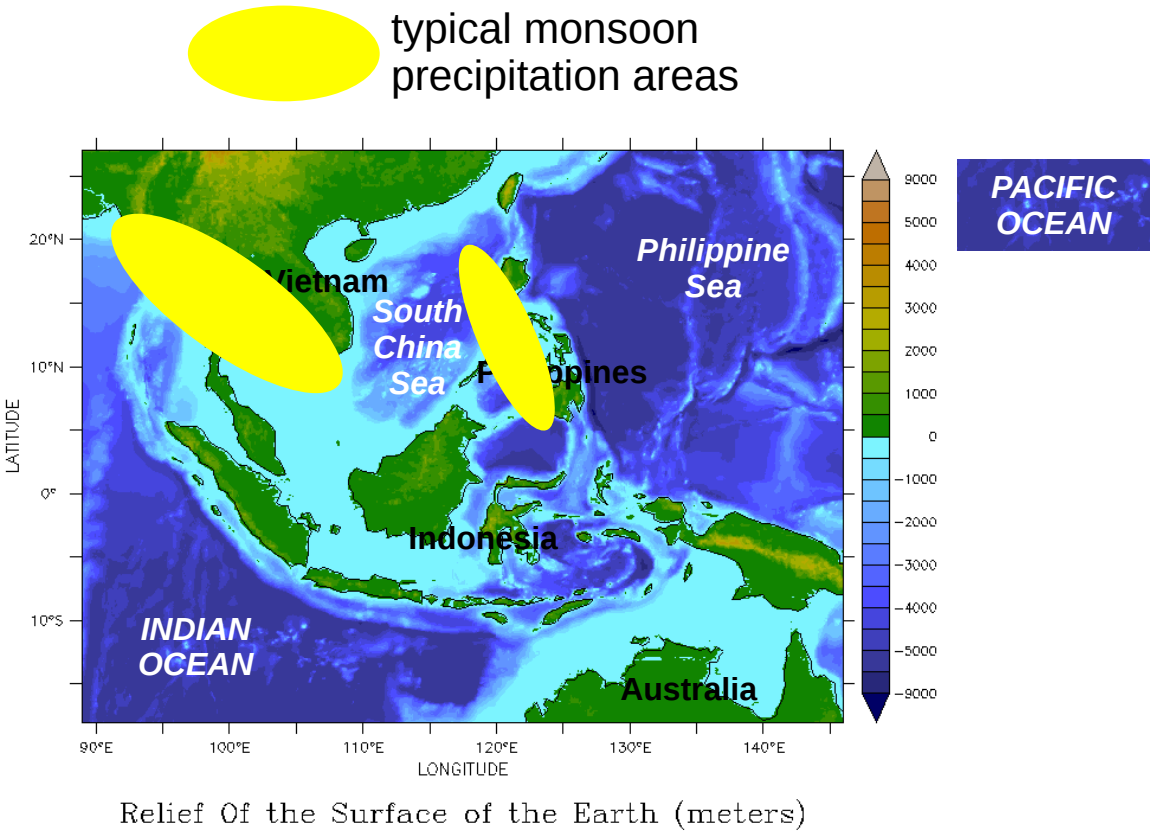


Relief Of the Surface of the Earth (meters)

Introduction

Atmosphere

- Complex topography
- Summer monsoon

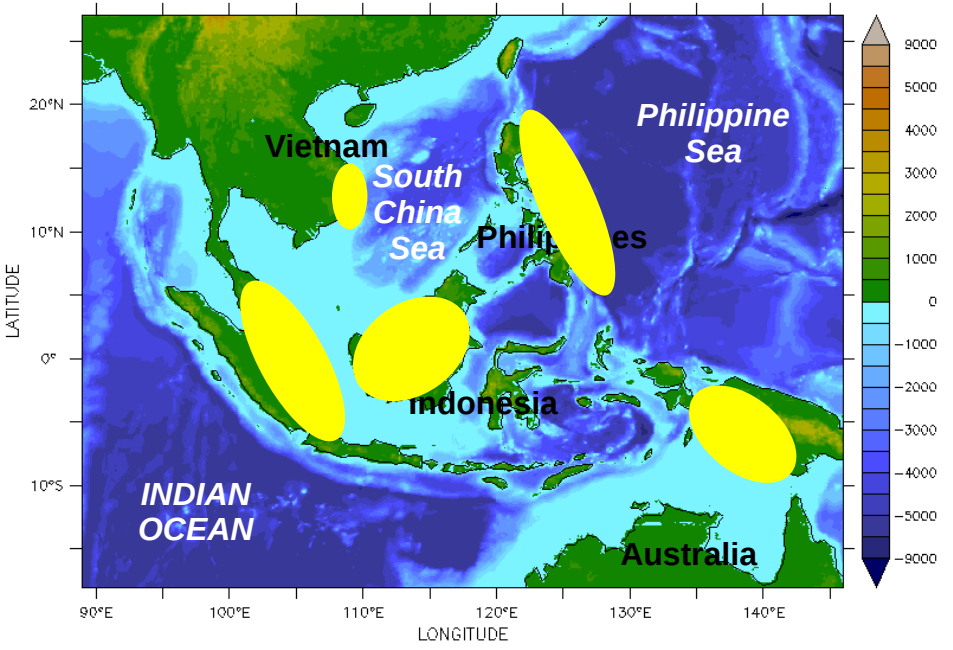


Introduction

Atmosphere

- Complex topography
- Summer monsoon
- Winter monsoon

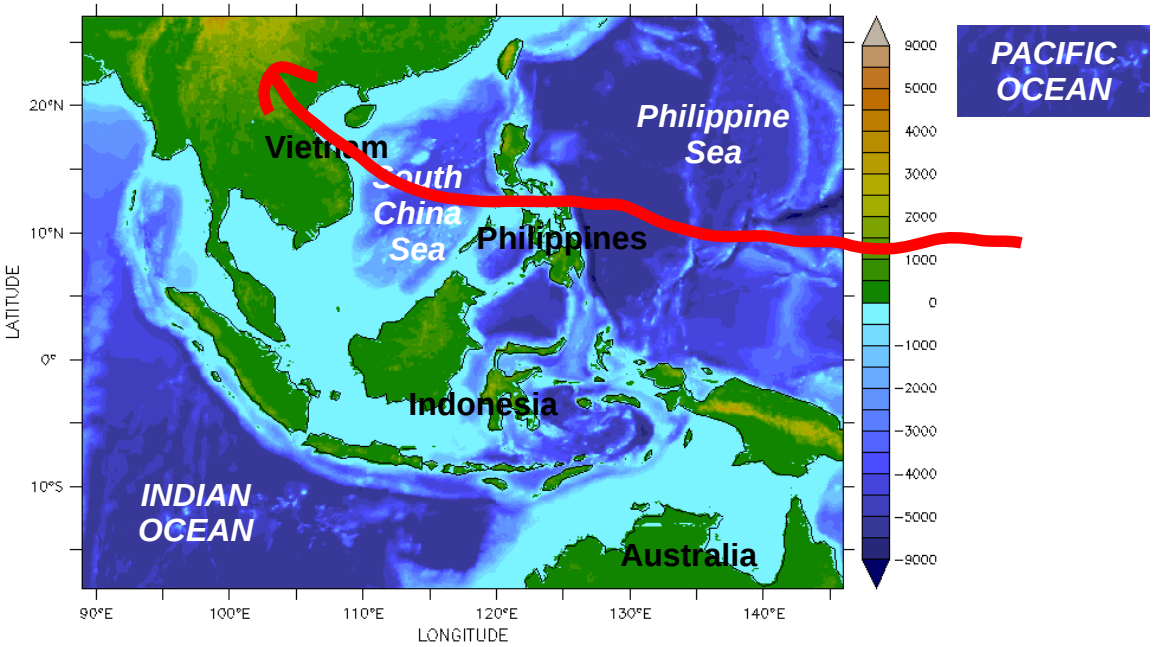
typical monsoon precipitation areas



Introduction

Atmosphere

- Complex topography
- Summer monsoon
- Winter monsoon
- Typhoon tracks



Introduction

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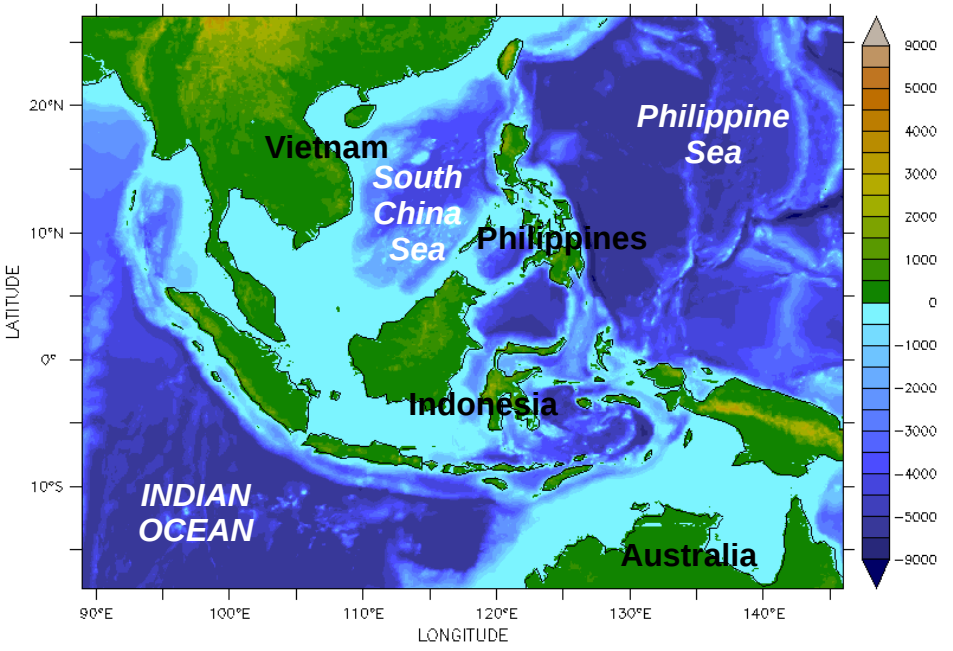
- Complex topography
- Summer monsoon
- Winter monsoon
- Typhoon tracks

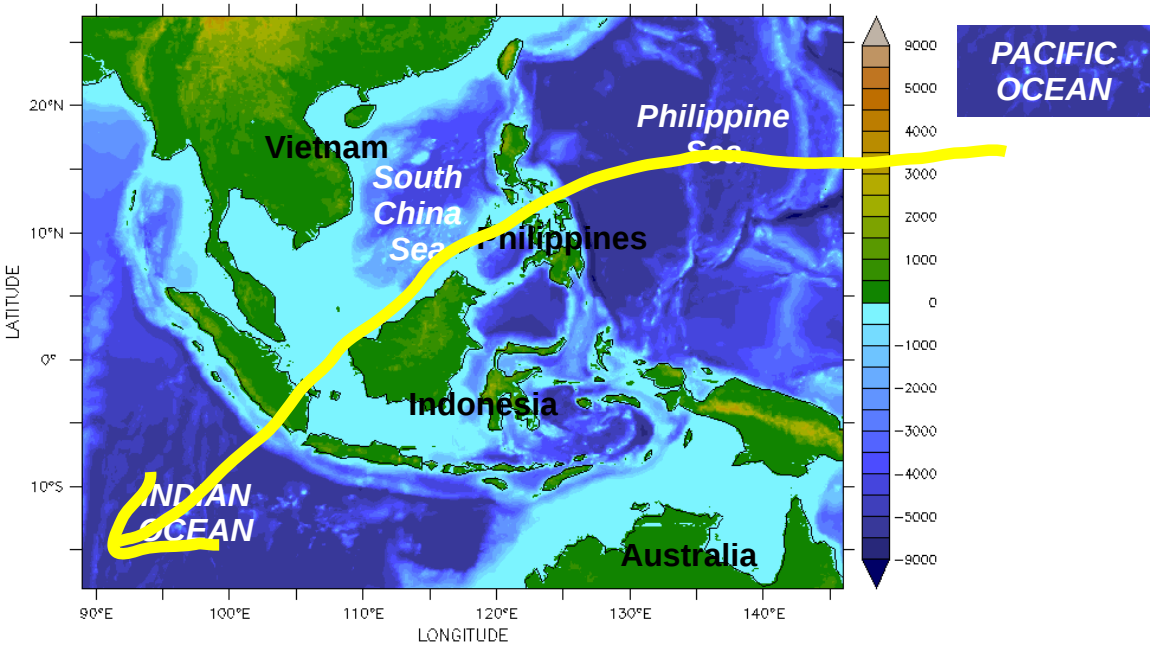
Ocean
- Complex bathymetry



Introduction

Atmosphere
- Complex topography
- Summer monsoon
- Winter monsoon
- Typhoon tracks

Ocean
- Complex bathymetry
- Global thermohaline circulation

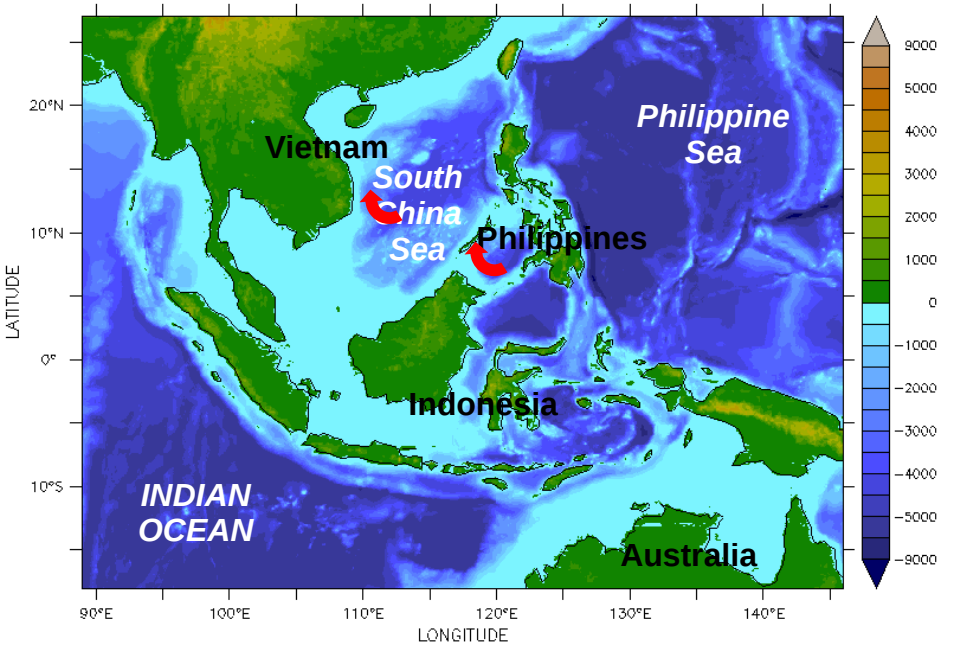


Relief Of the Surface of the Earth (meters)

Introduction

Atmosphere
- Complex topography
- Summer monsoon
- Winter monsoon
- Typhoon tracks

Ocean
- Complex bathymetry
- Global thermohaline circulation
- Upwelling



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Ocean
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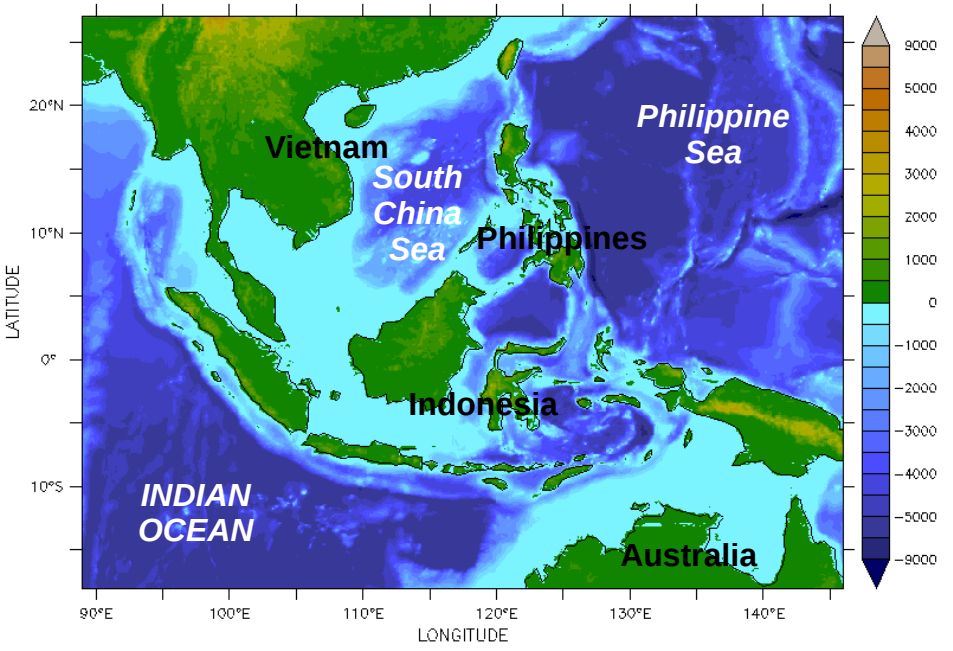
- Global thermohaline circulation
- Upwelling

+ direct influence of wider-scale oscillations (ENSO, IPO, etc)

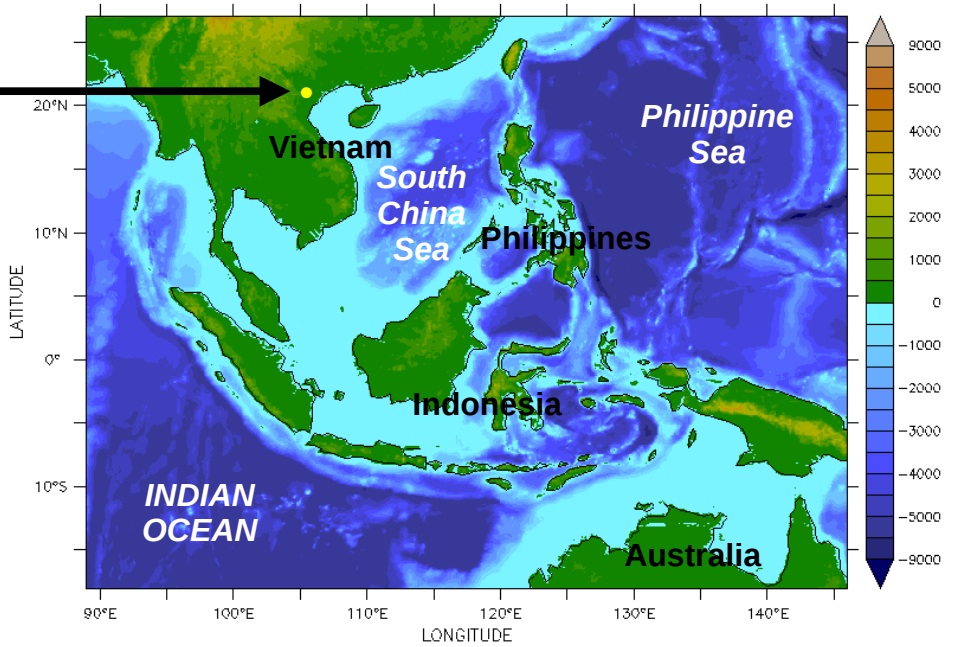


Introduction

Marine Herrmann
Toulouse, France

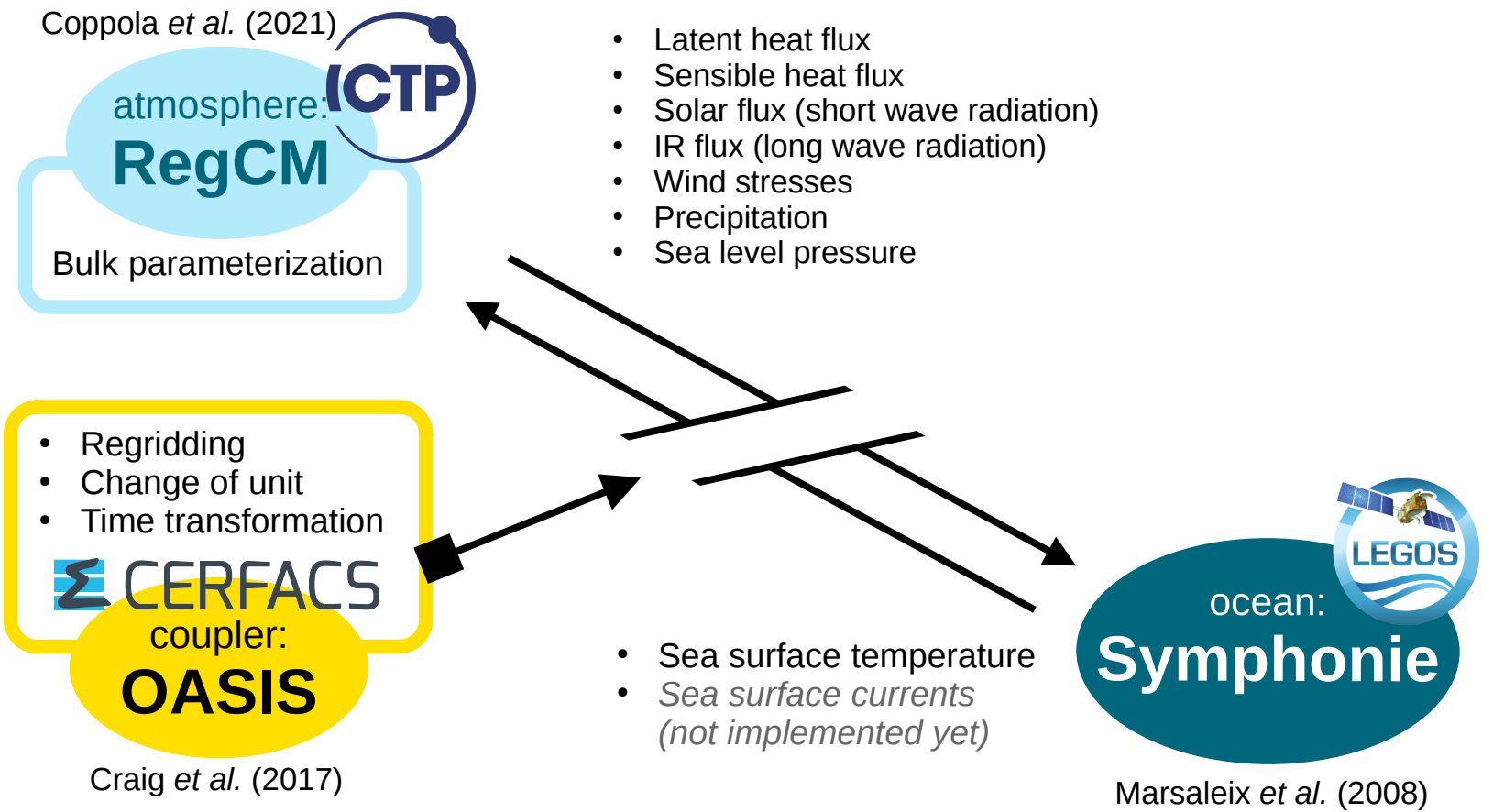
Thanh Ngo-Duc
Hanoi, Vietnam

PhD project:
An air-sea regional coupled model
for a novel approach
of the Southeast Asian climate



Relief Of the Surface of the Earth (meters)

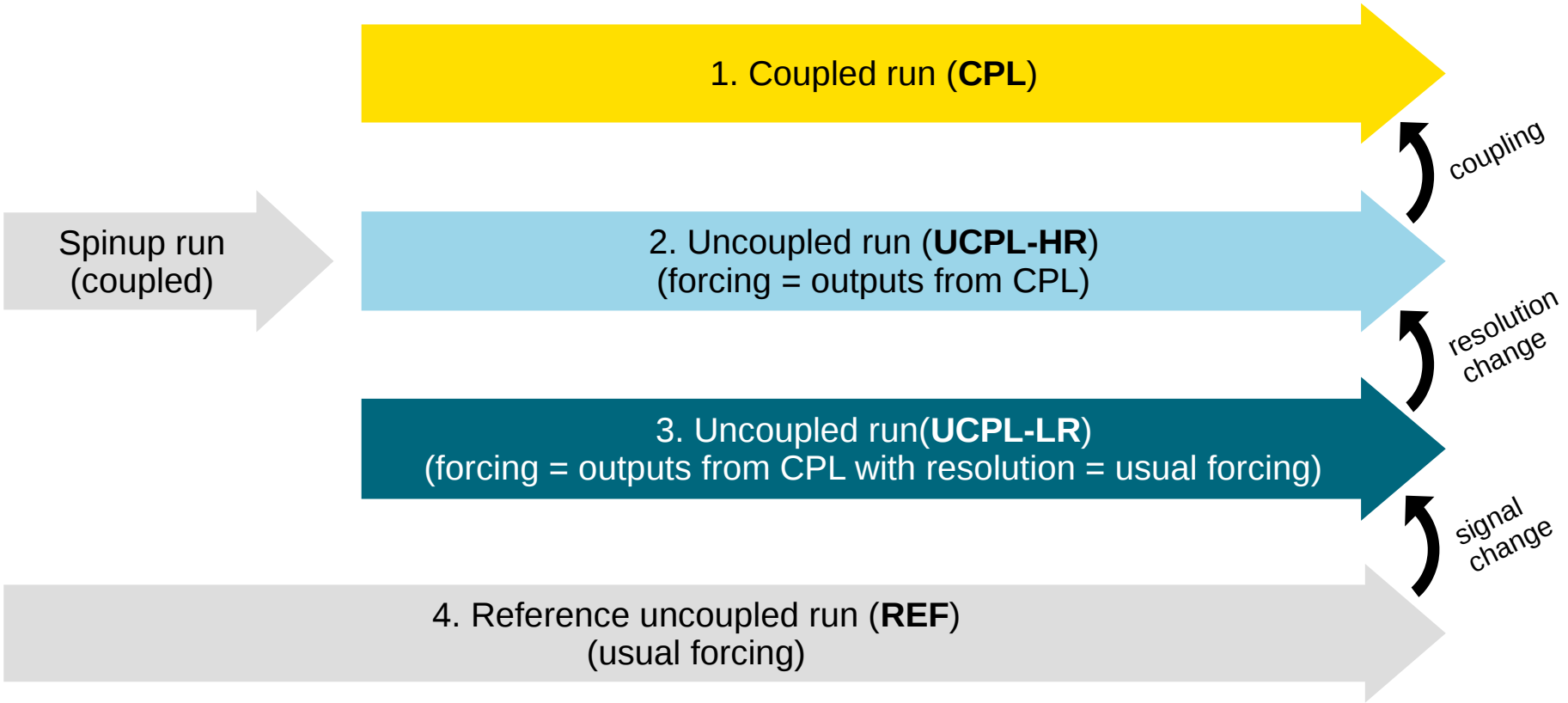
Step 1: Technical development



Step 2: Parameterization & validation

I’ll come back to it
in a minute!

Step 3: Characterization of the added value

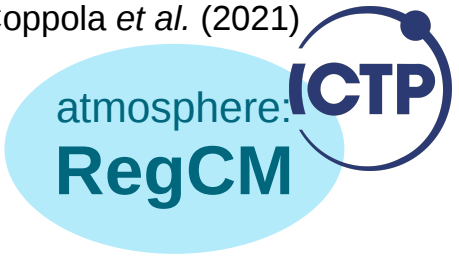


Step 2: Parameterization & validation

Here we are :)

Uncoupled reference configurations

Coppola *et al.* (2021)



Marsaleix *et al.* (2008)

Uncoupled reference configurations

Coppola *et al.* (2021)

25 x 25 km
18 σ-levels

atmosphere:
RegCM

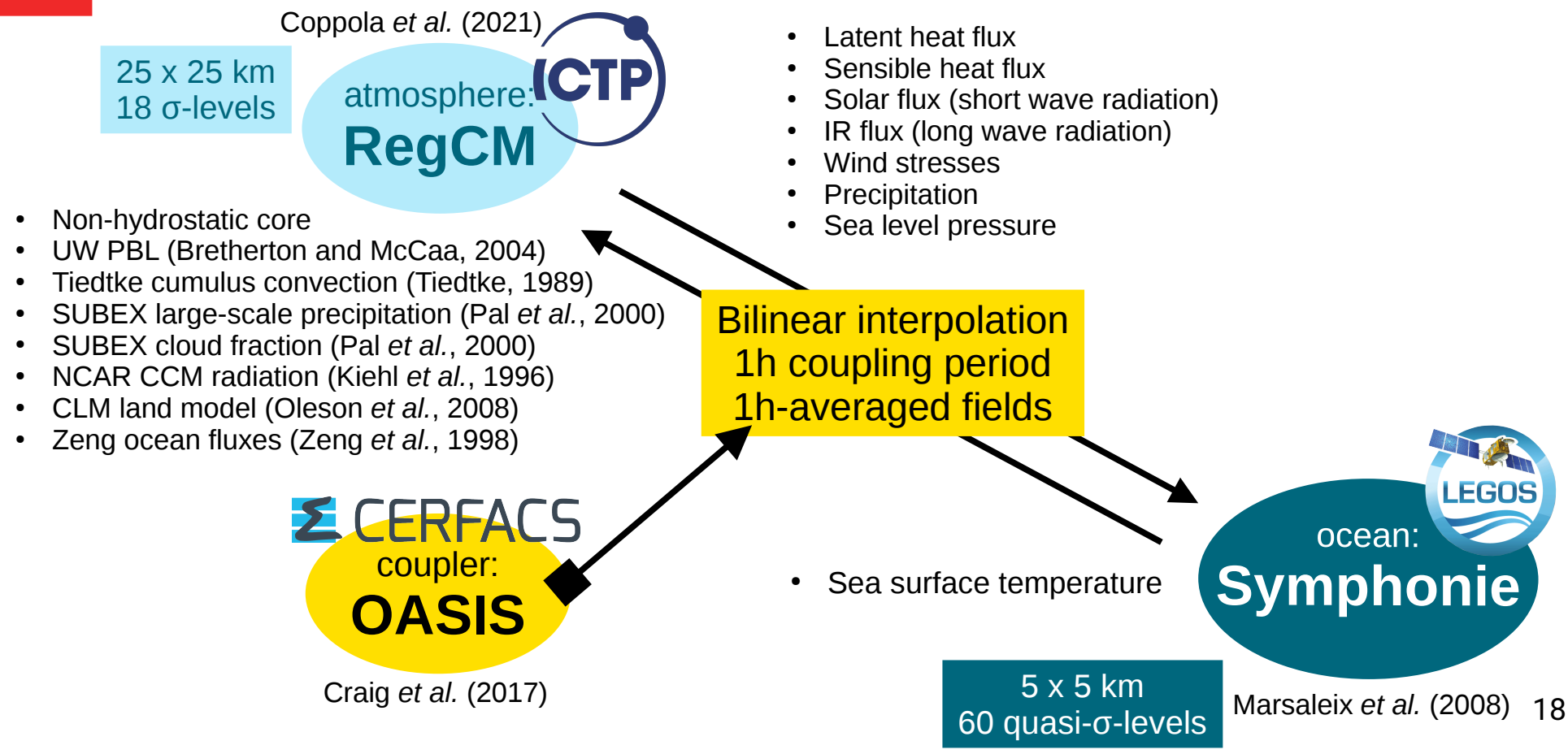
- Non-hydrostatic core
- UW PBL (Bretherton and McCaa, 2004)
- Tiedtke cumulus convection (Tiedtke, 1989)
- SUBEX large-scale precipitation (Pal *et al.*, 2000)
- SUBEX cloud fraction (Pal *et al.*, 2000)
- NCAR CCM radiation (Kiehl *et al.*, 1996)
- CLM land model (Oleson *et al.*, 2008)
- Zeng ocean fluxes (Zeng *et al.*, 1998)

ocean:
Symphonie

5 x 5 km
60 quasi-σ-levels

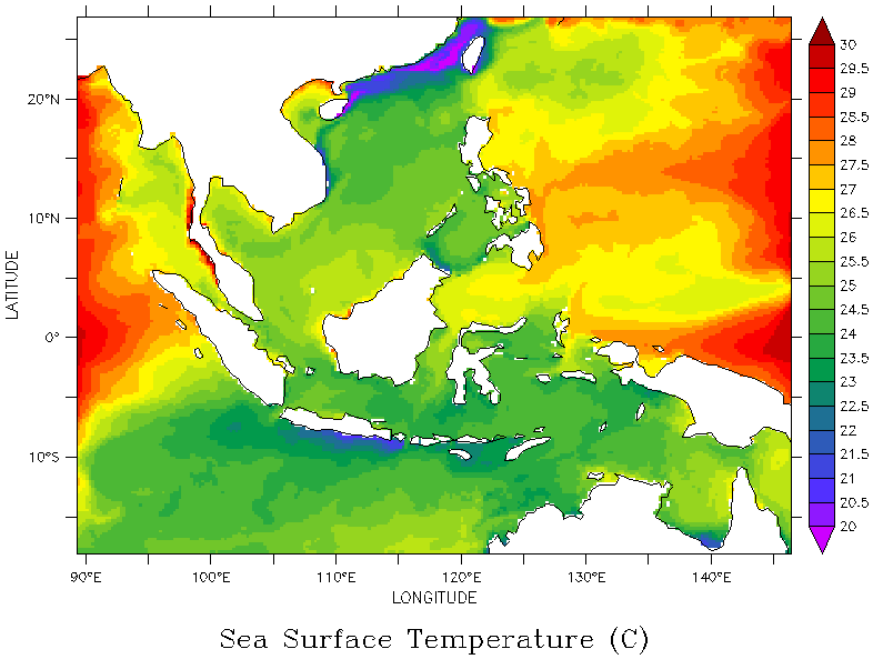
Marsaleix *et al.* (2008)

Uncoupled reference configurations

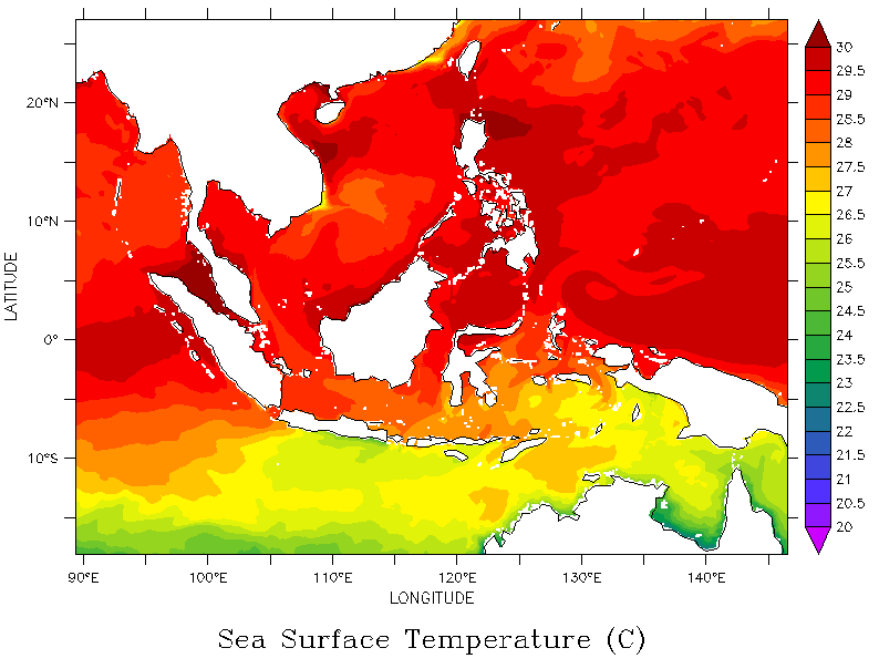


First coupled run

JJA average

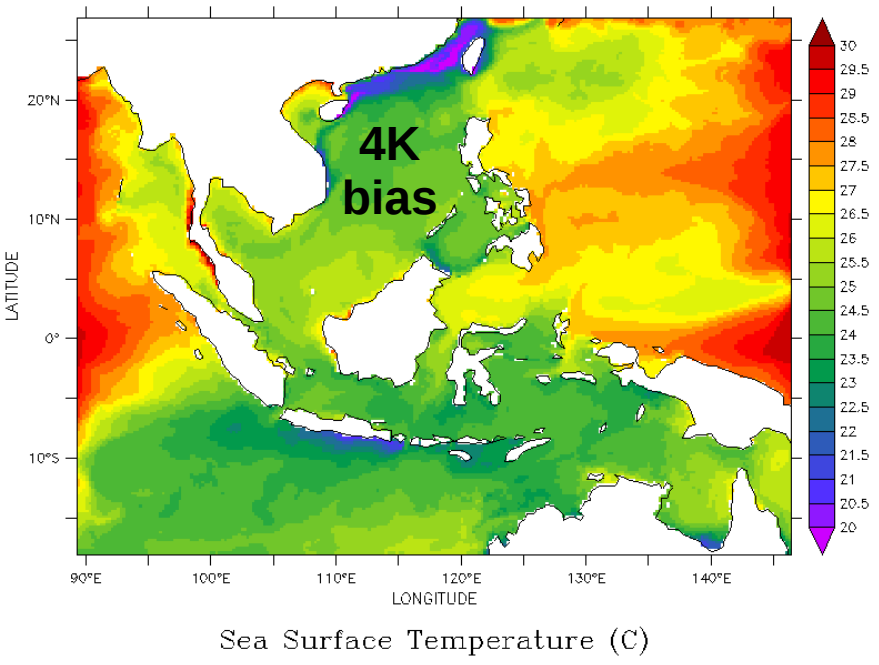


JJA average: COPERNICUS

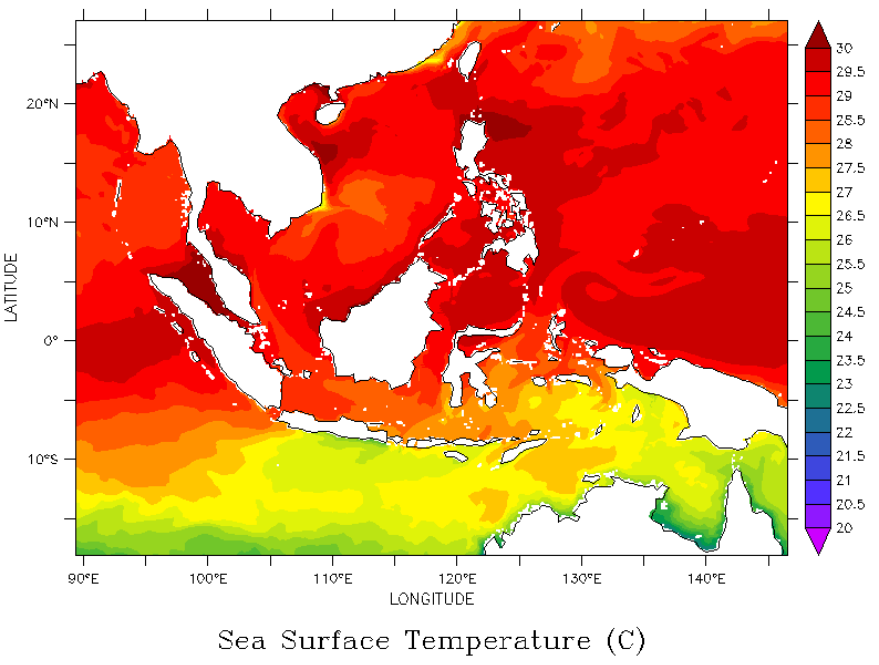


First coupled run

JJA average

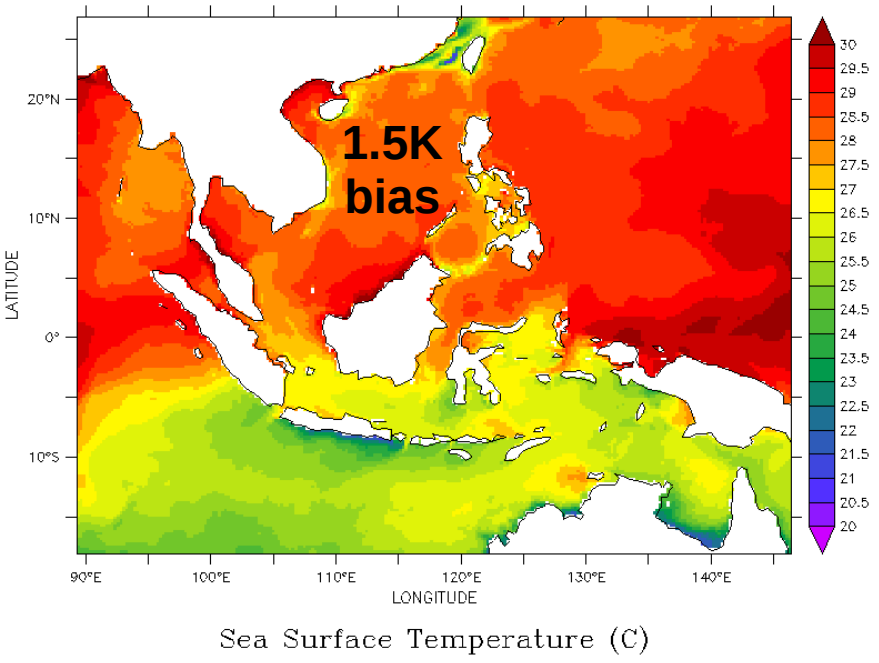


JJA average: COPERNICUS

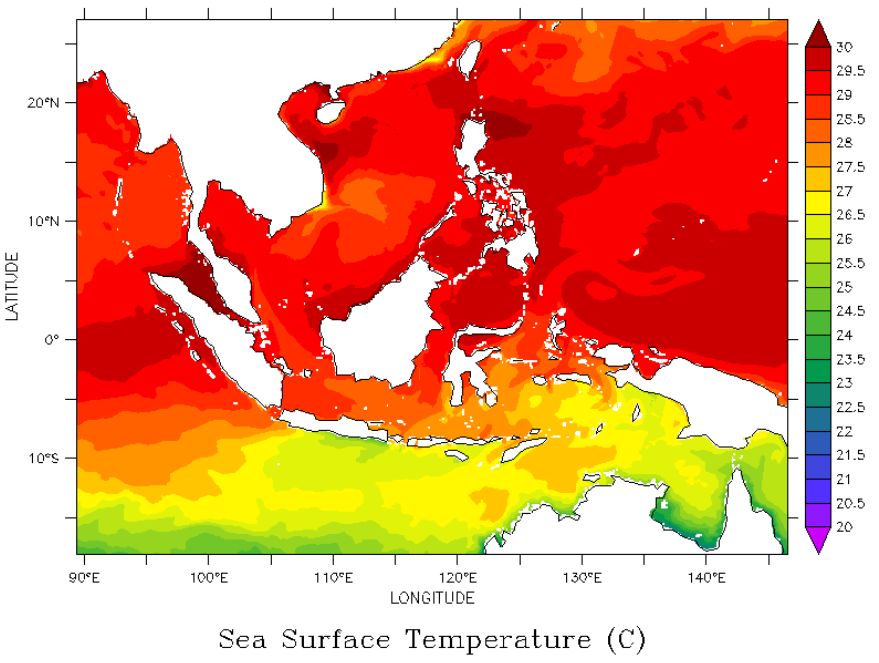


Second attempt

JJA average

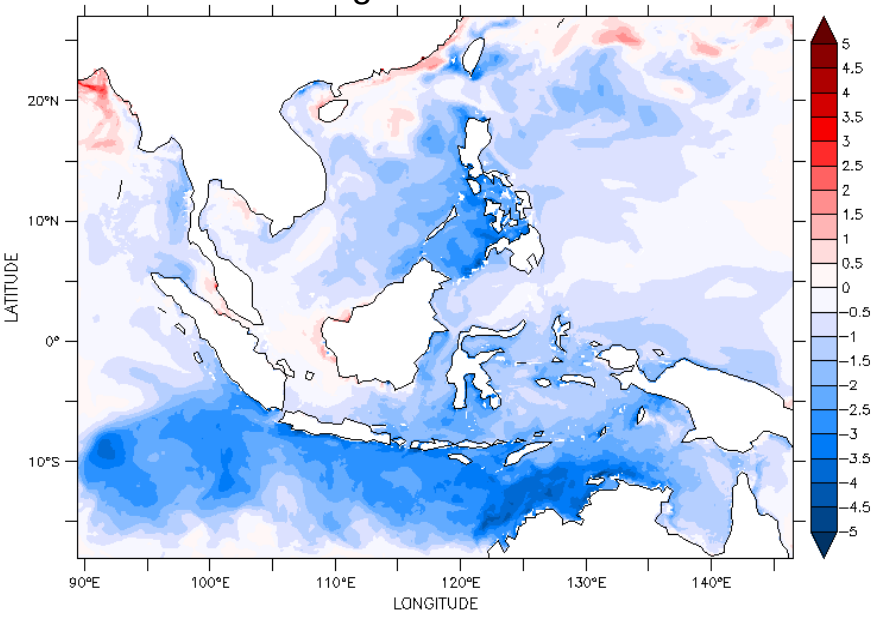


JJA average: COPERNICUS



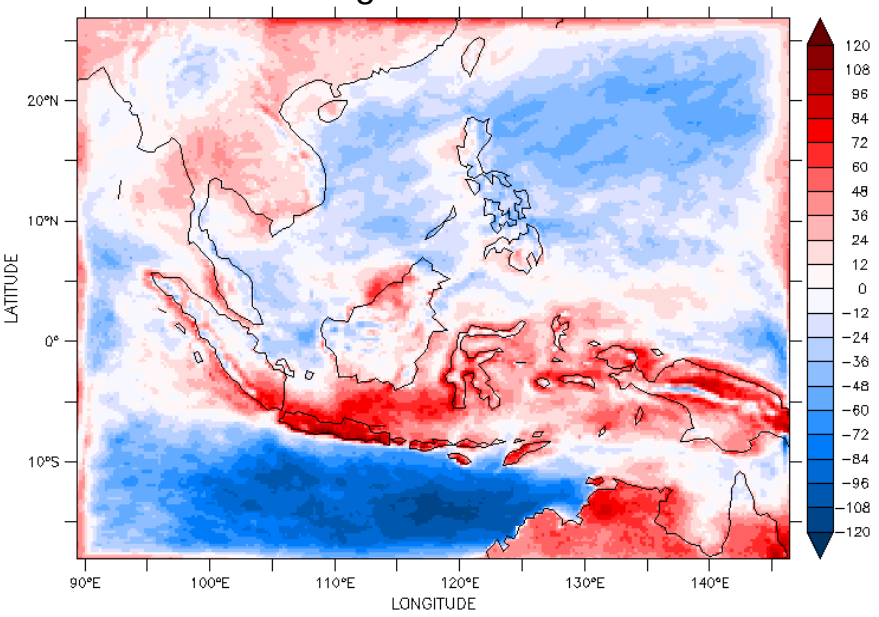
Second attempt

December average



sst: run2018−COPERNICUS (Kelvin)

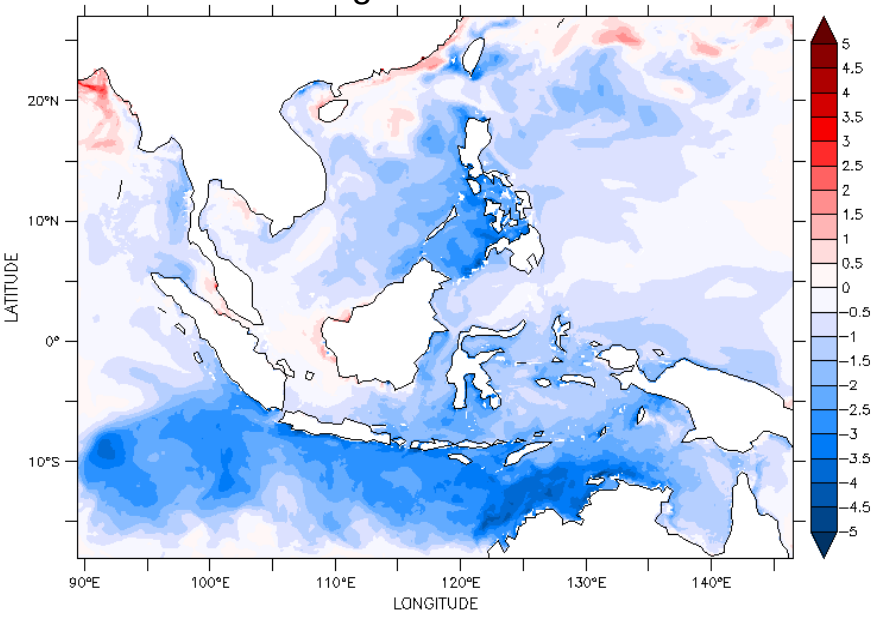
December average



rsns: run2018−ECMWF (W/m2, downward)

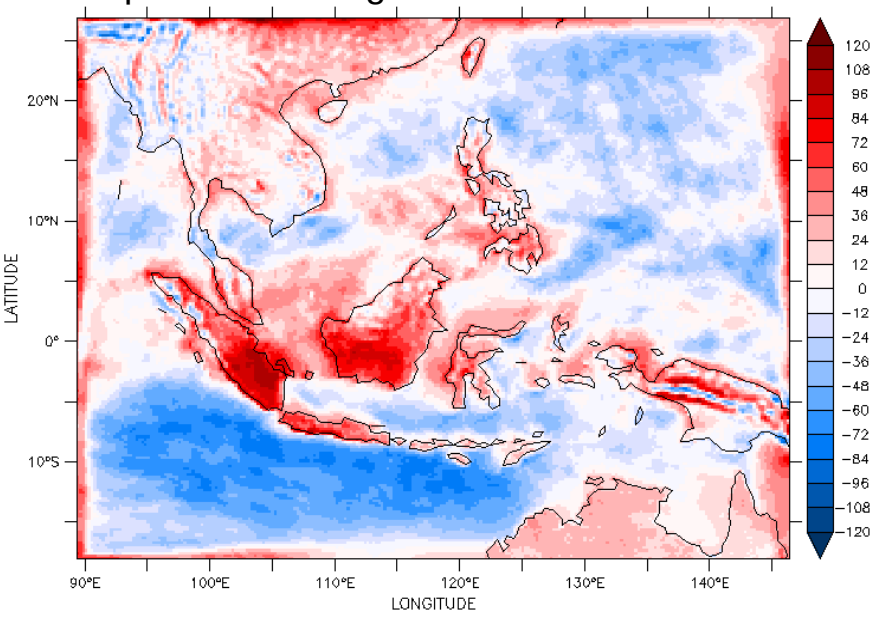
Second attempt

December average



sst: run2018-COPERNICUS (Kelvin)

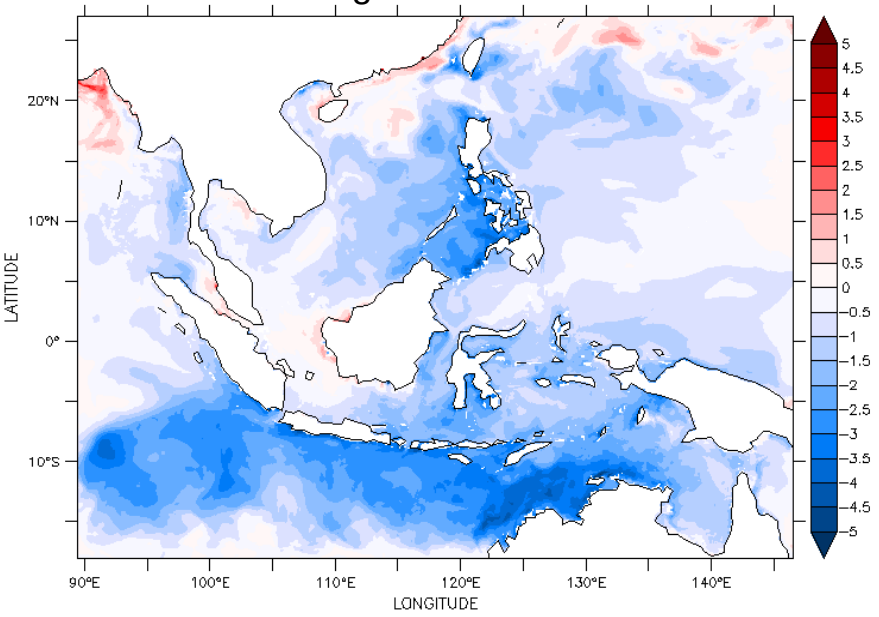
September average



rsns: run2018-ECMWF (W/m2, downward)

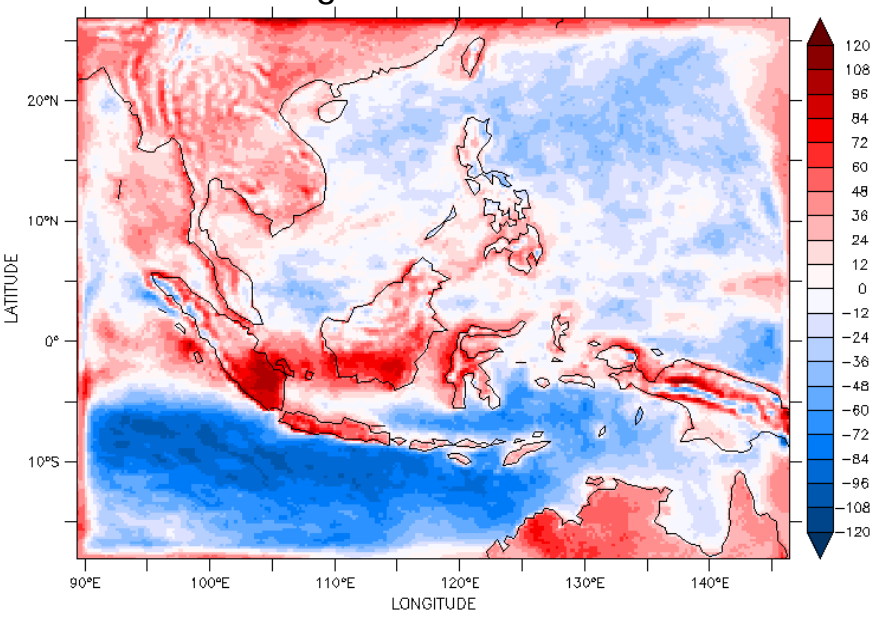
Second attempt

December average



sst: run2018−COPERNICUS (Kelvin)

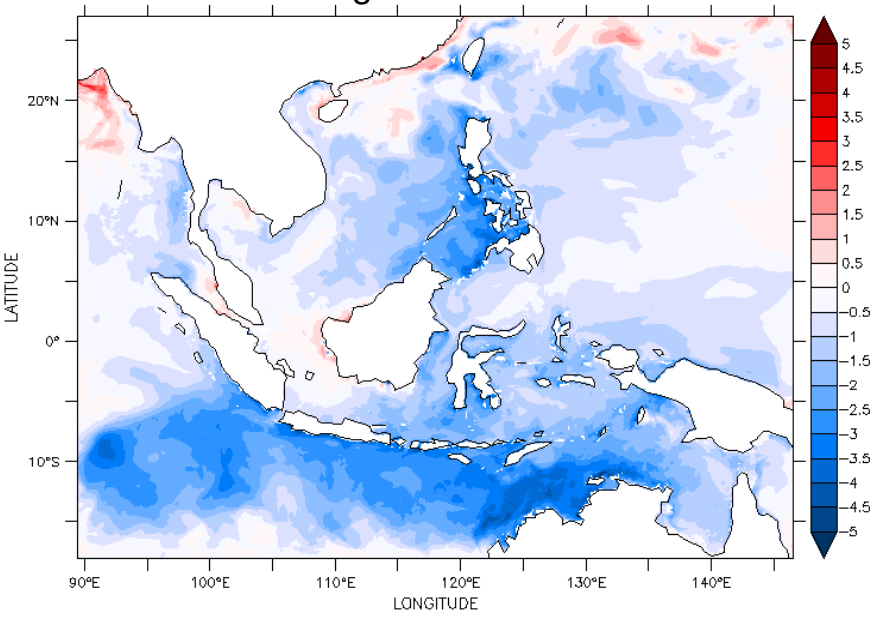
October average



rsns: run2018−ECMWF (W/m2, downward)

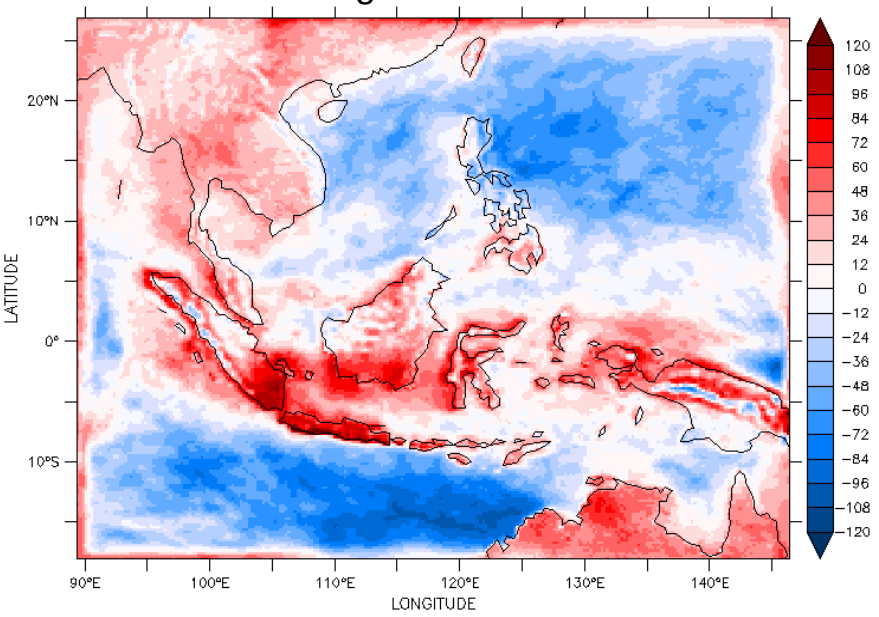
Second attempt

December average



sst: run2018−COPERNICUS (Kelvin)

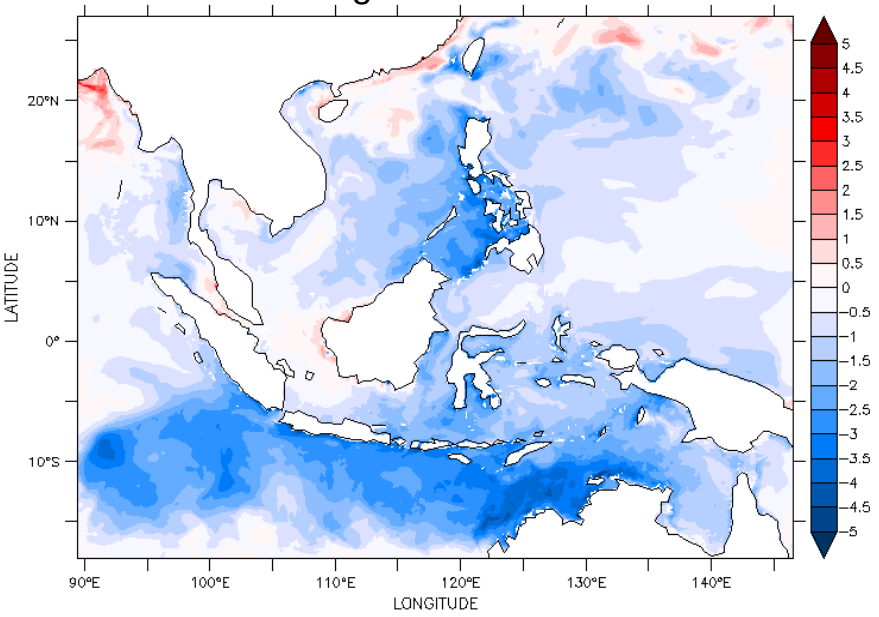
November average



rsns: run2018−ECMWF (W/m2, downward)

Second attempt

December average



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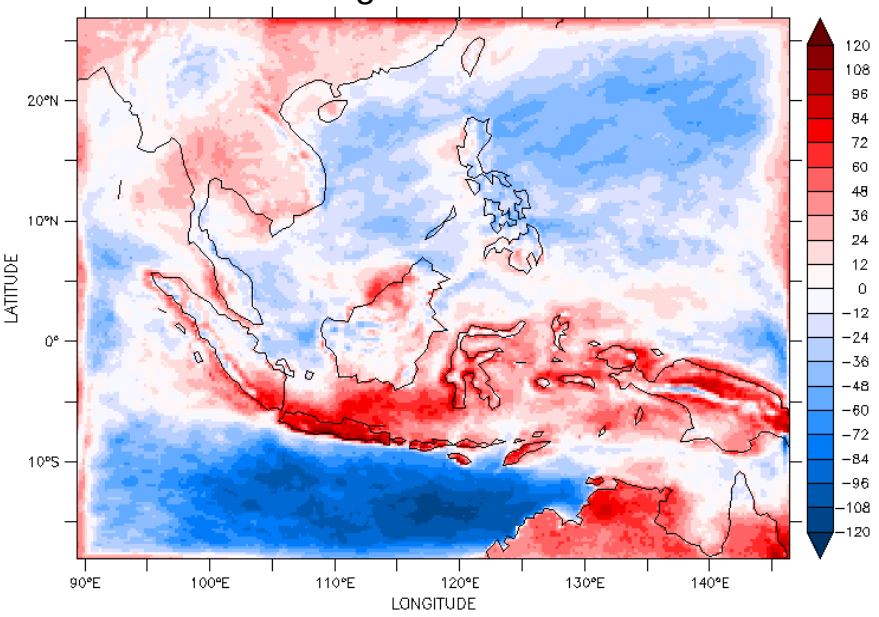
December average



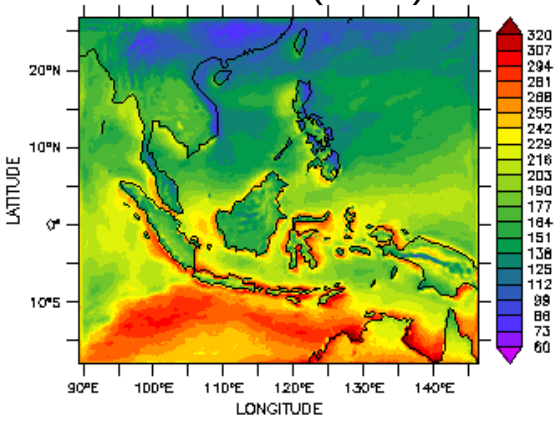
rsns: run2018−ECMWF (W/m2, downward)

Second attempt

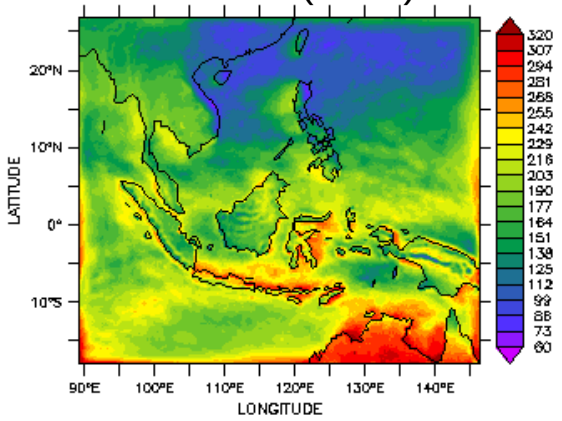
COPERNICUS	Sea surface temperature	bias ~ -0.7K on average lower biases locally
ECMWF	Latent heat	strong bias extremes bias < 0 on average
ECMWF	Sensible heat	~ no bias over oceans
ECMWF	Long wave	bias < 0 though not significant
ECMWF	Short wave	bias < 0 down to -120 W/m^2
CRU CPC	2-m temperature (land)	bias ~ -1.15K on average good correlation
ECMWF	Precipitation	wet bias for the summer monsoon dry bias on average
ERA5	850-hPa wind	~ +8% bias wind speed good direction / correlation

Sensitivity to cumulus schemes

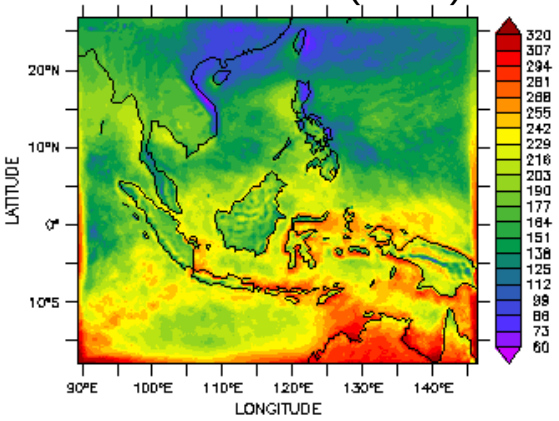
Emanuel (1991)



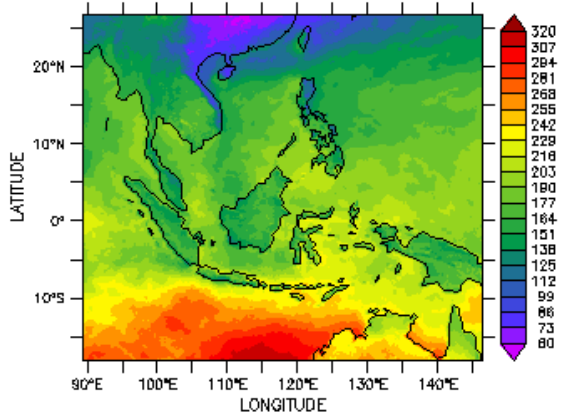
Tiedtke (1989)



Kain & Fritsch (1990)



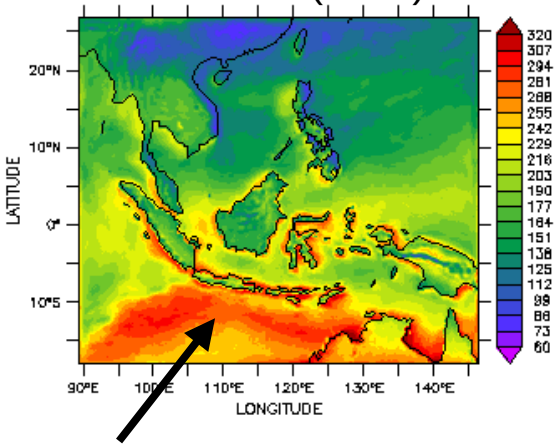
ECMWF



→ Short wave patterns [W/m^2]
(December average)

Sensitivity to cumulus schemes

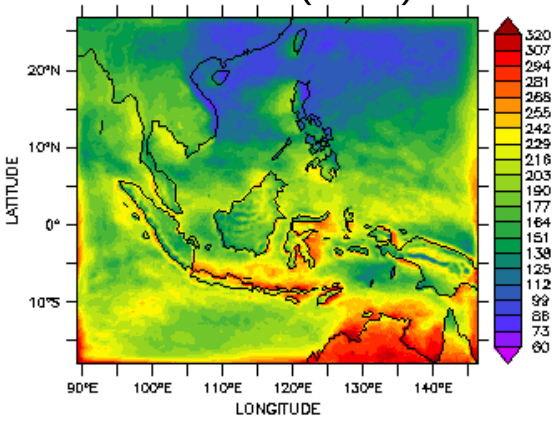
Emanuel (1991)



Worst precipitation: -40%
Worst 2-m temperature: -1.4K

→ Short wave patterns [W/m^2] (December average)

Tiedtke (1989)



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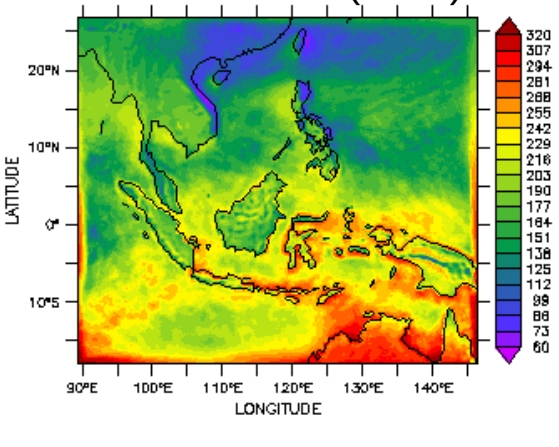
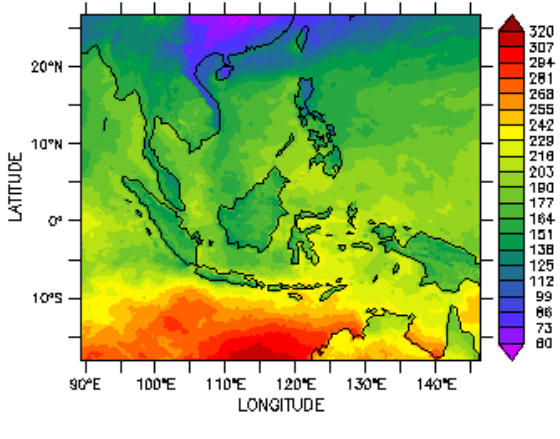


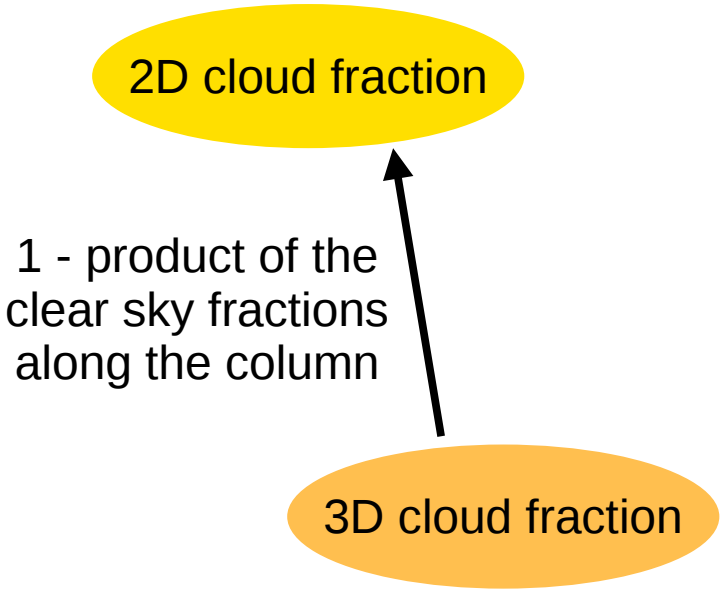
ECMWF



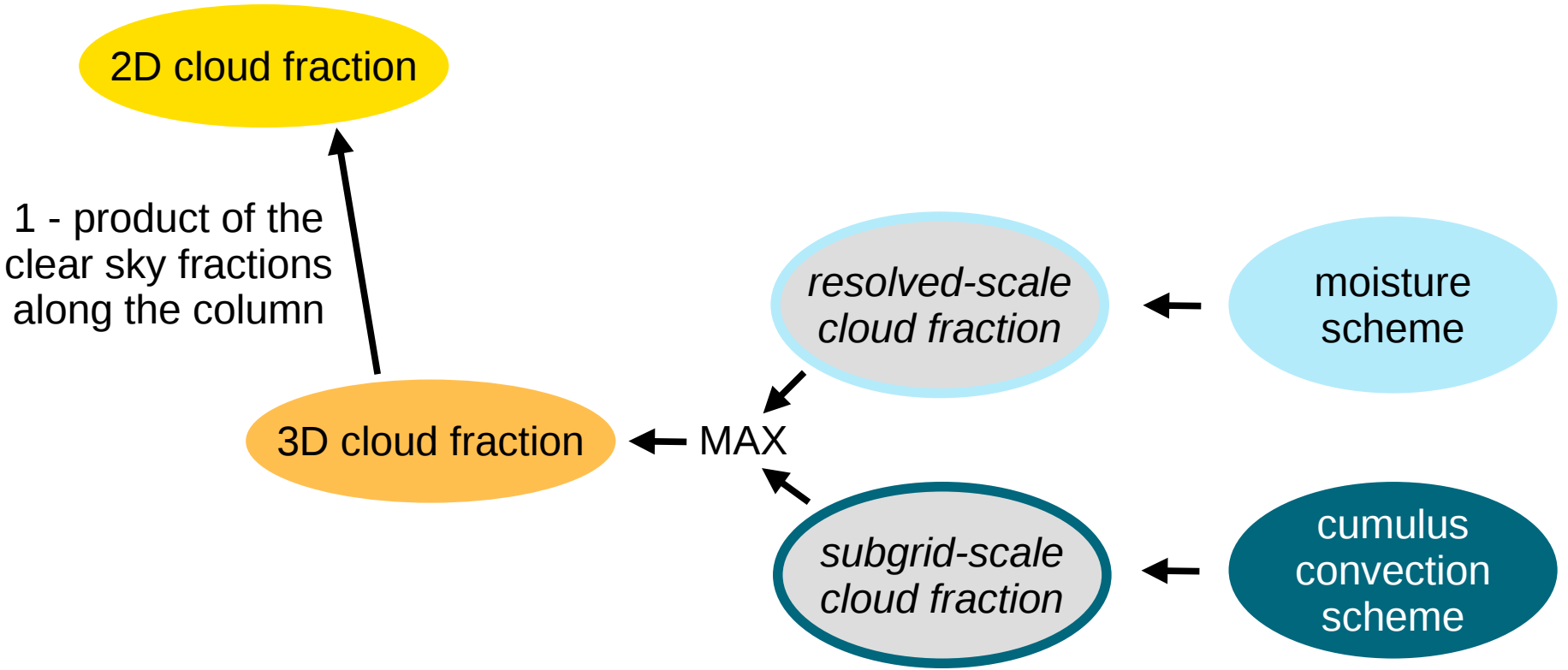
Cloud fraction?

2D cloud fraction

Cloud fraction?



Cloud fraction?



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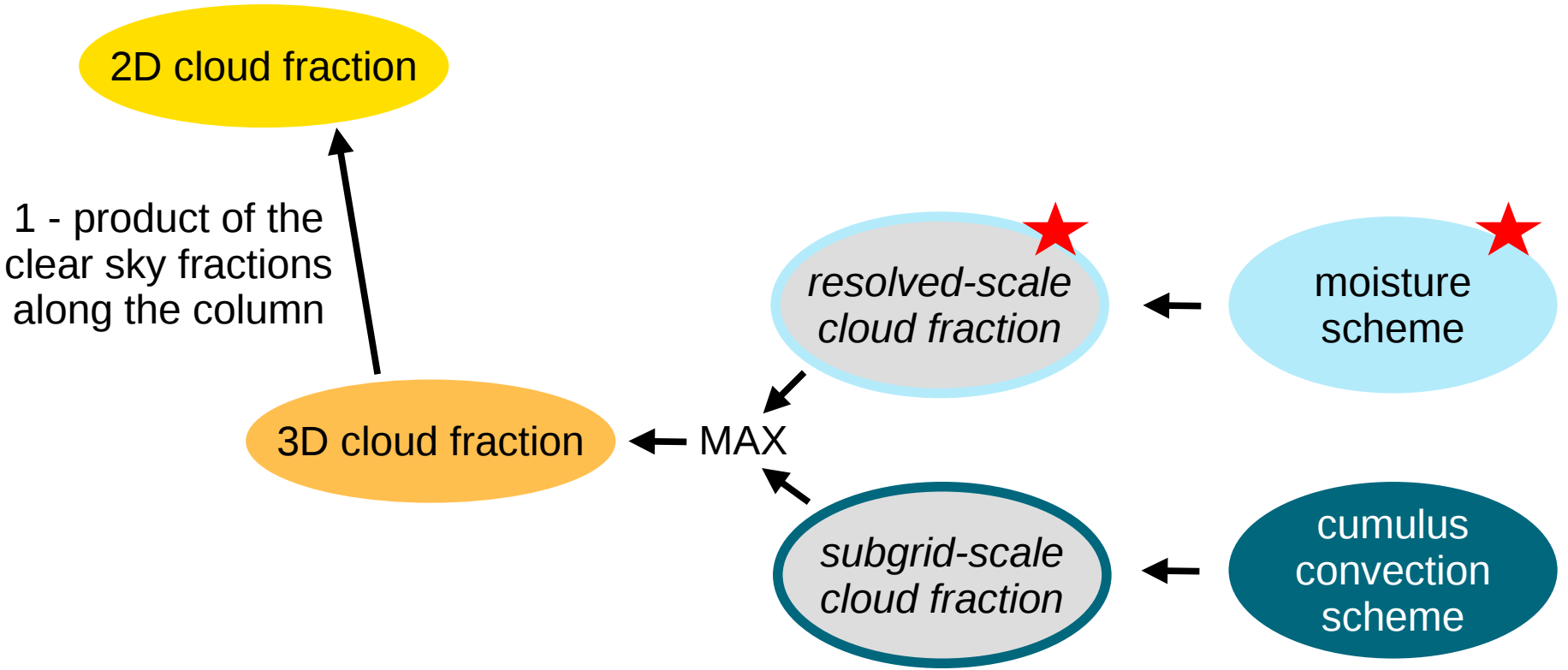
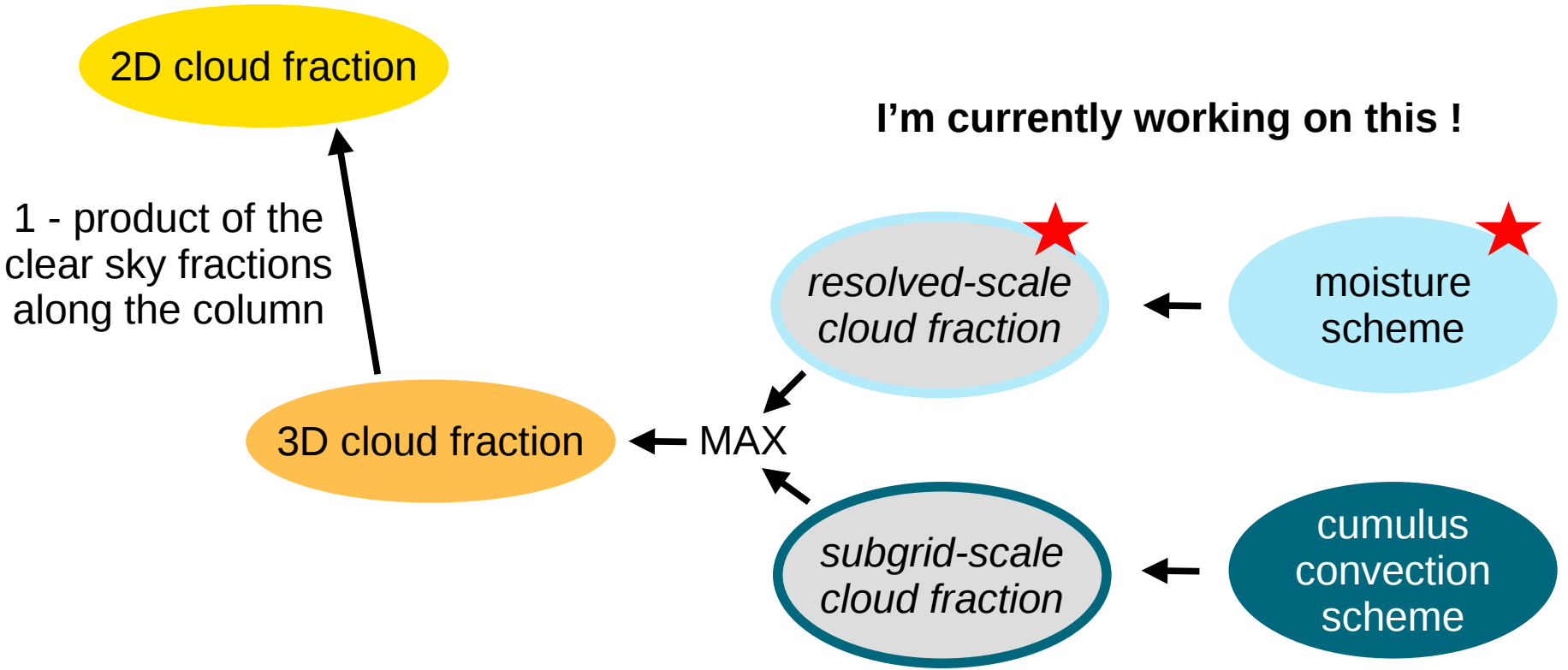


Cloud fraction?



Conclusion

A validated regional coupled model soon?

Conclusion

Thank you for your attention!

Questions, remarks, advises?