Performances of RegCM4.4 over CORDEX-EA (phase 2) Region

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Outline:

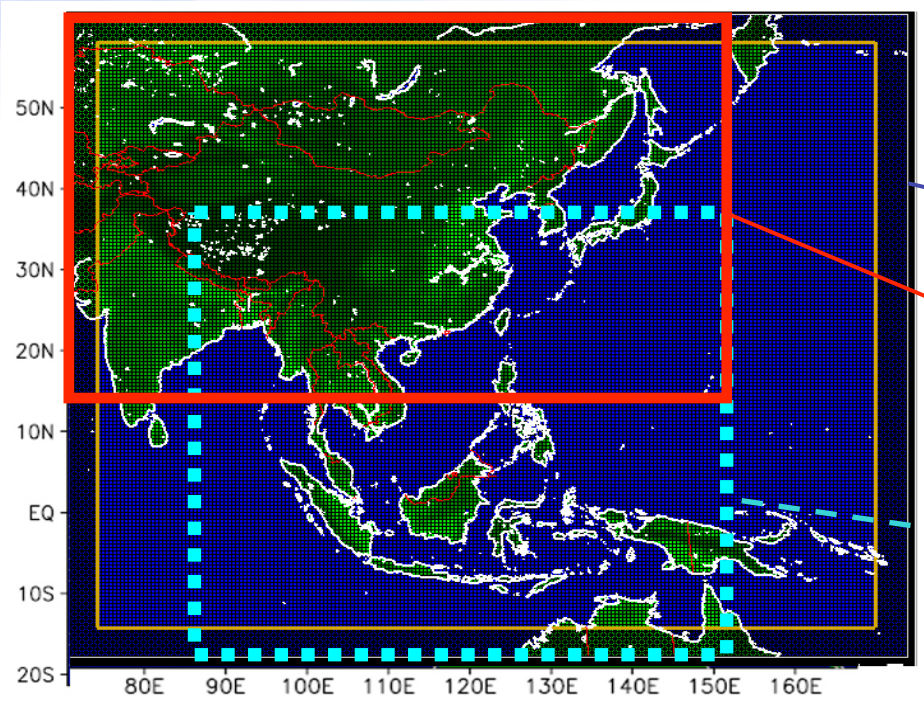
Part I. Configuration of RegCM4.4 over CORDEX-EA (phase 2) Region / China

1. RegCM4 driven by different re-analysis
2. Different convections (BATS)
3. Different convections (CLM)
4. Updated land surface cover

Part II. Simulation for the period of 1990-2005

Part III. Future work plan

Part I. Configuration of RegCM4.4 over CORDEX-EA (phase 2) Region / China



Phase 1 EA

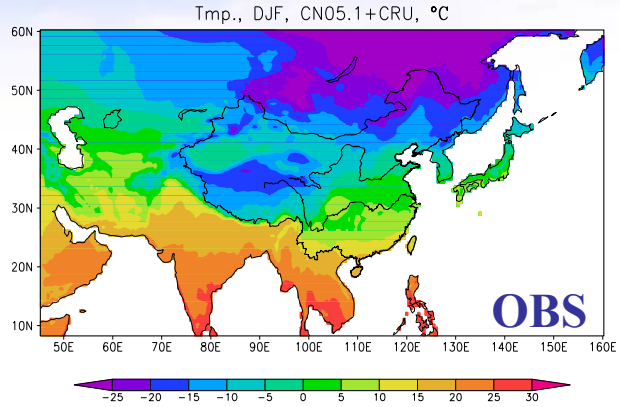
Phase 2 EA

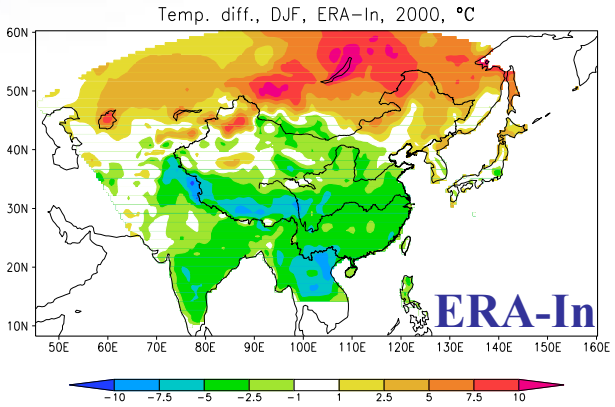
SEA

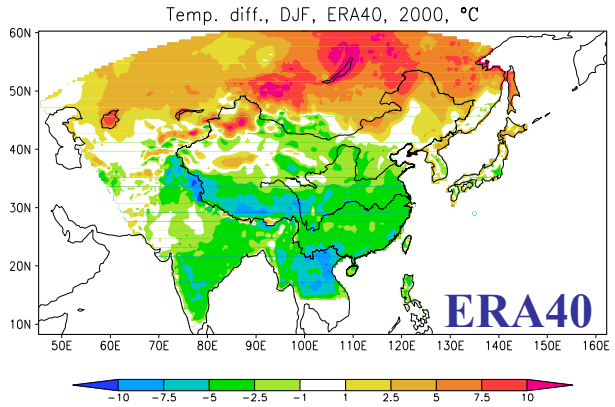
- Version: RegCM4.4-r10, One years simulation (2000)
- Different driving re-analysis
- Different combinations of physics

1. RegCM4 driven by different re-analysis (Grell+BATS)

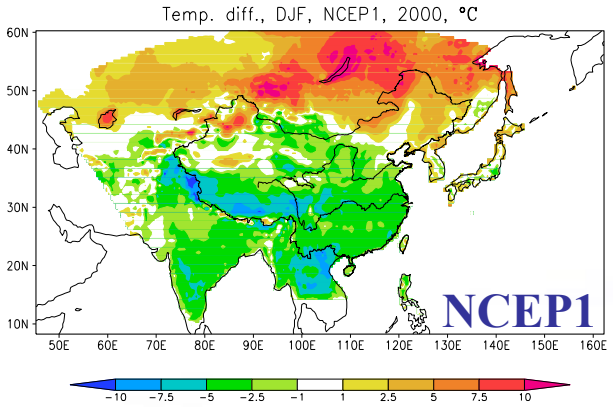
—ERA-Interim（ERA-Interim）， ERA40， NCEP1， NCEP2

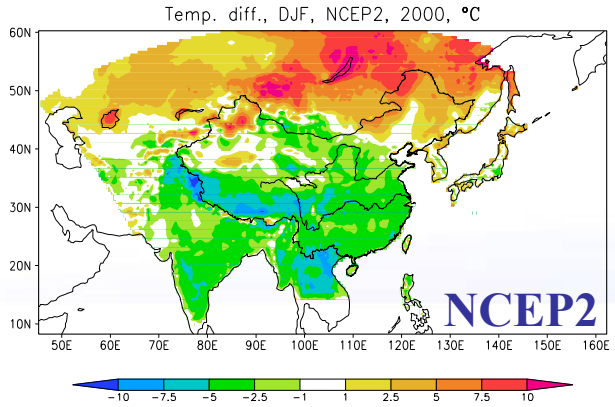




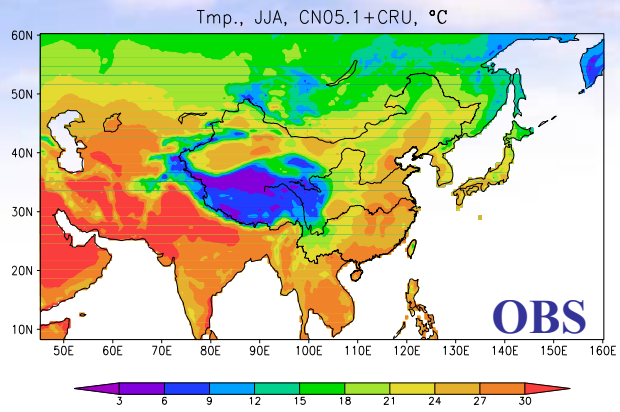


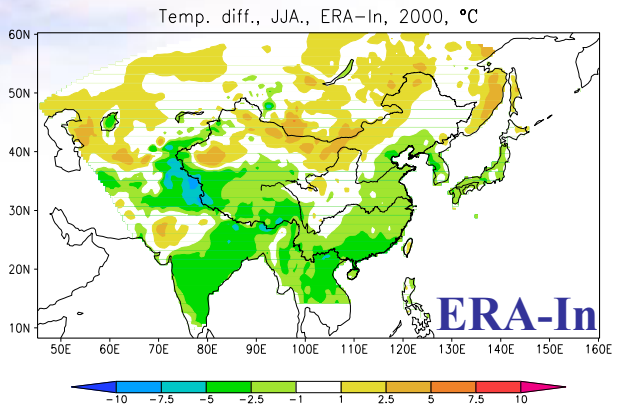
DJF

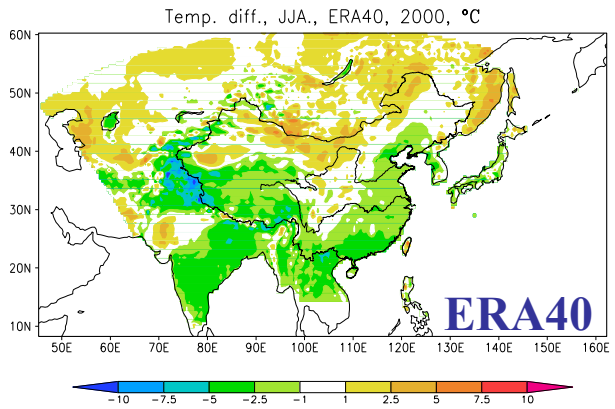




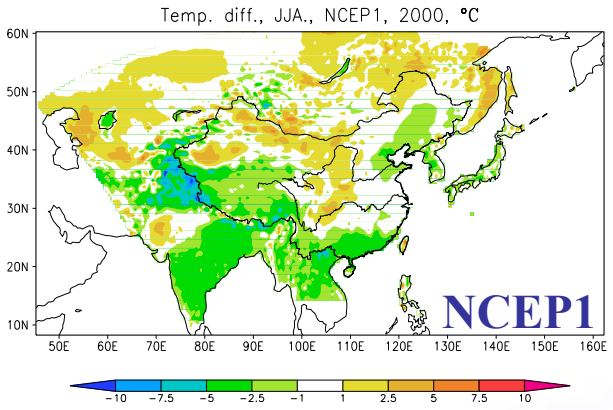
DJF temperature, difference between simulation and observation (ºC)

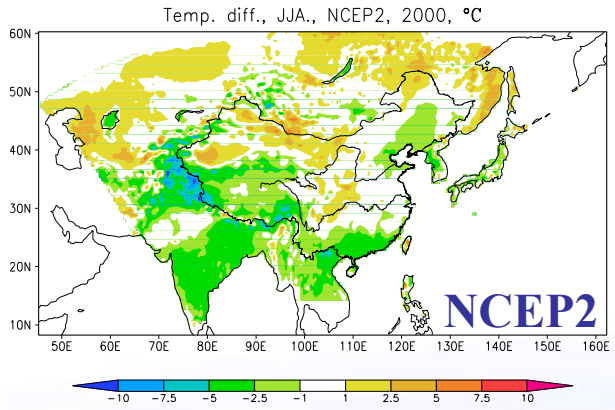




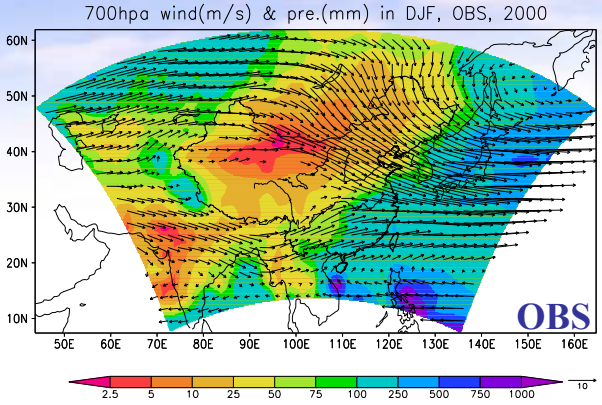


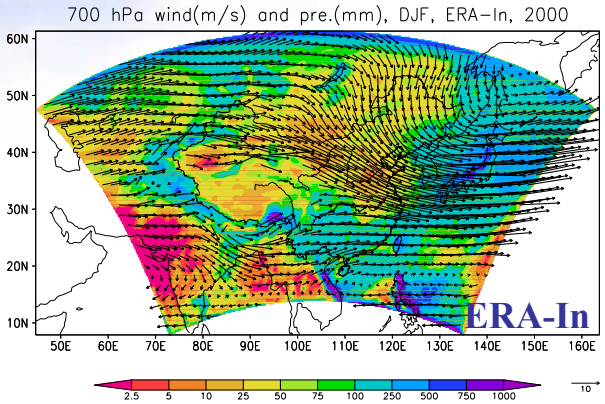
JJA

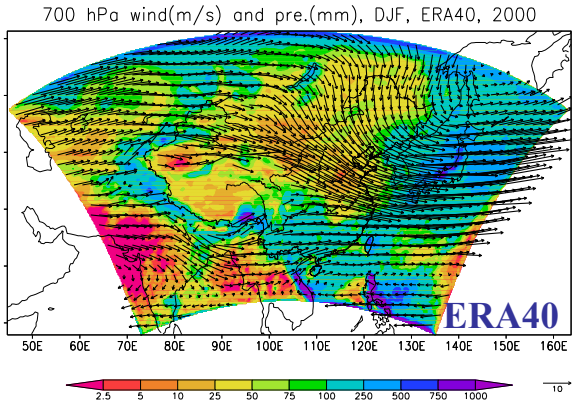




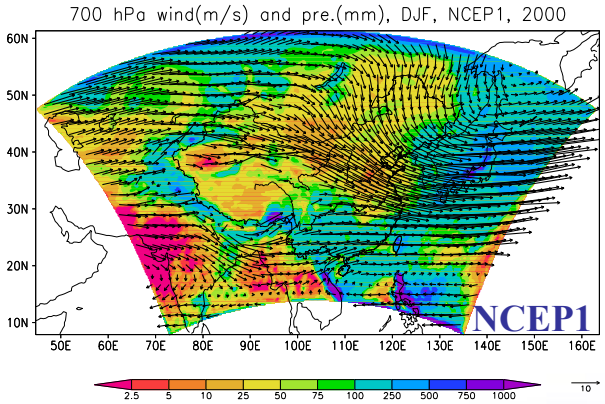
JJA temperature, difference between simulation and observation (ºC)

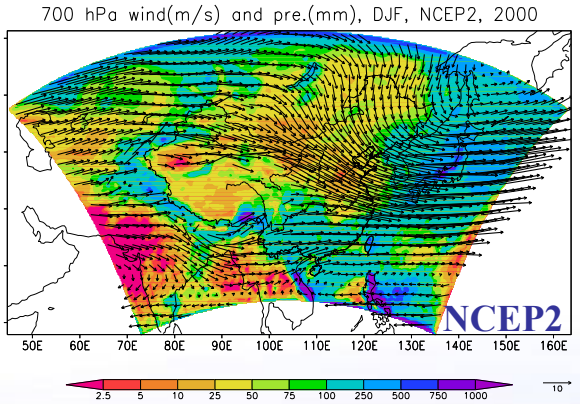




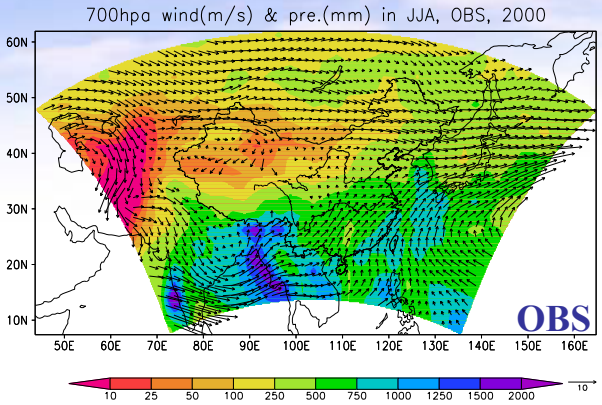


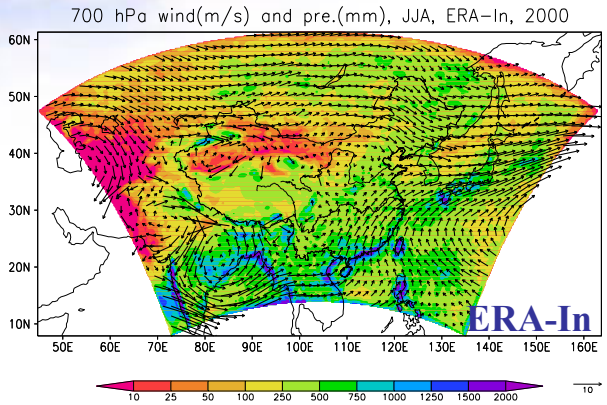
DJF

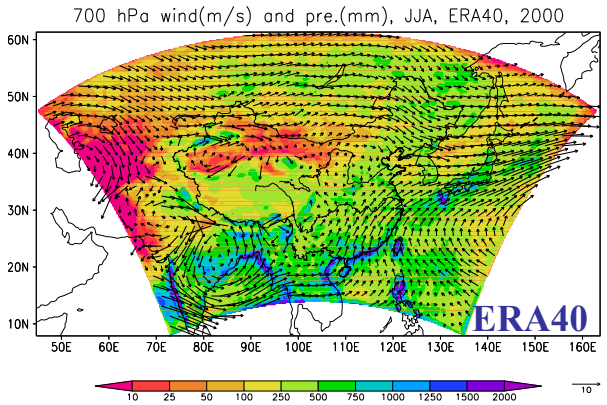




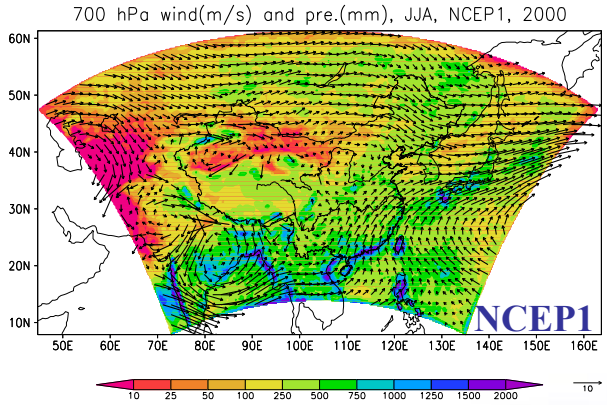
DJF precipitaton and wind in 700hPa (mm and m/s)

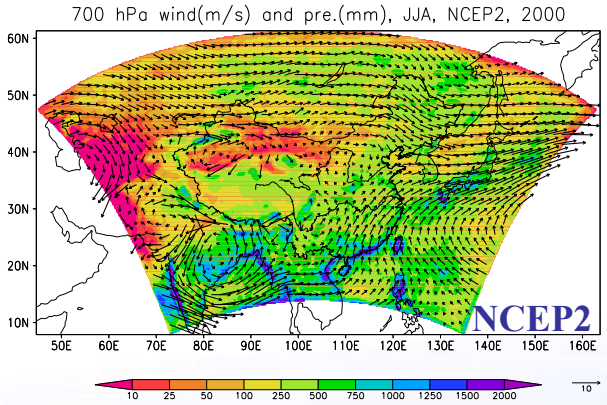






JJA

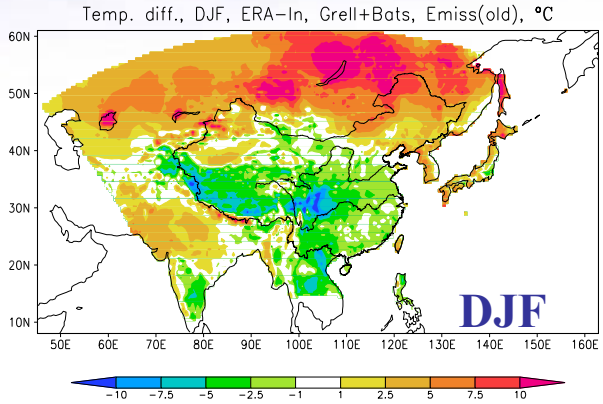


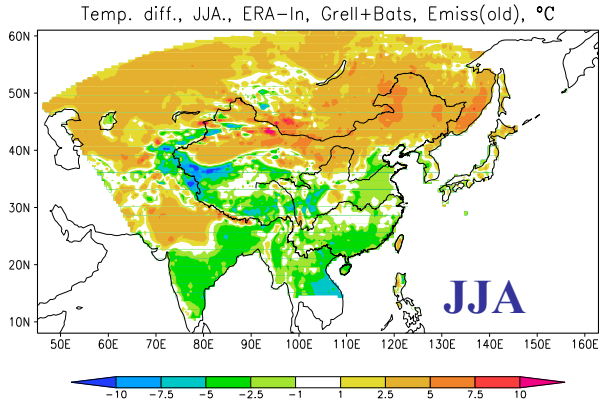


JJA precipitaton and wind in 700hPa (mm and m/s)

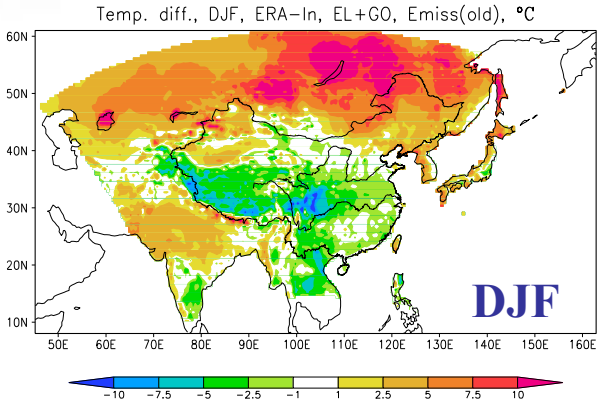
2. Different convections (ERA-Interim, BATS, emissivity)

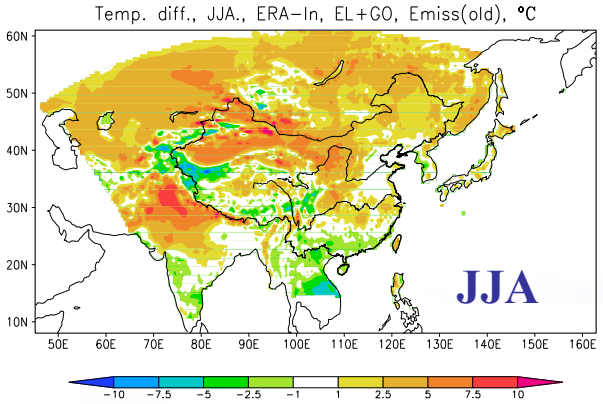
Grell





EL+GO





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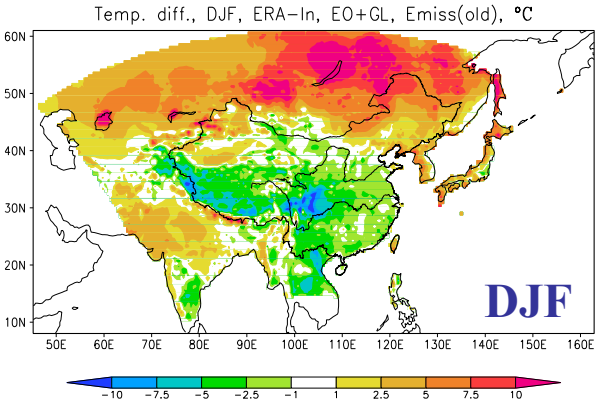
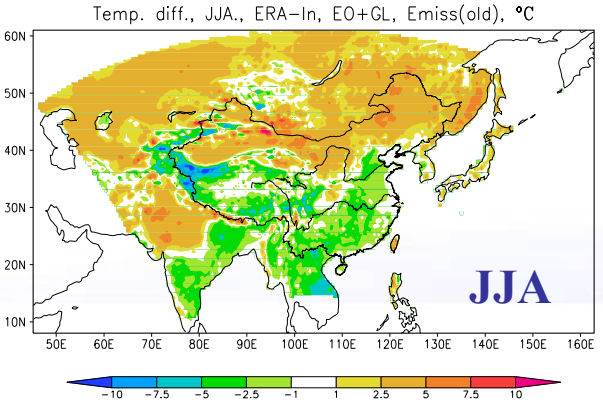
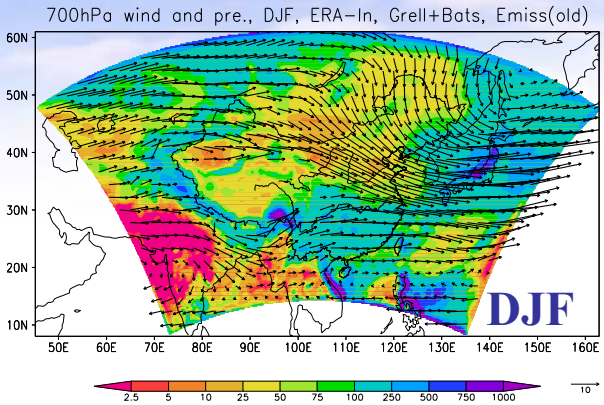
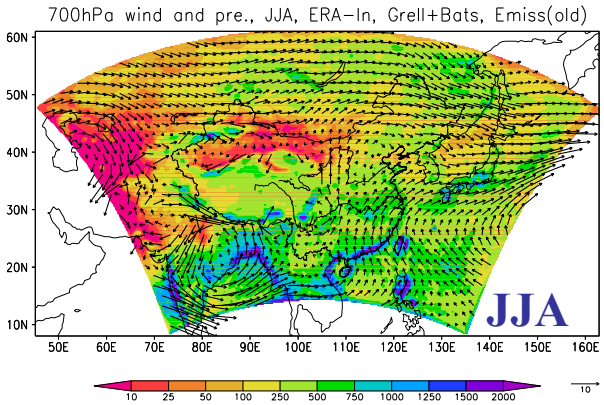




DJF and JJA temperature, difference between simulation and observation (ºC)

Grell





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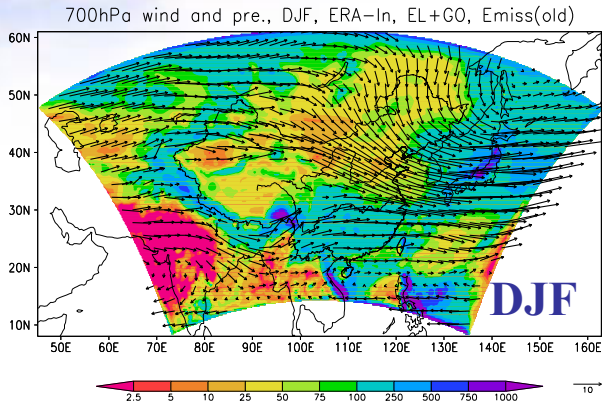

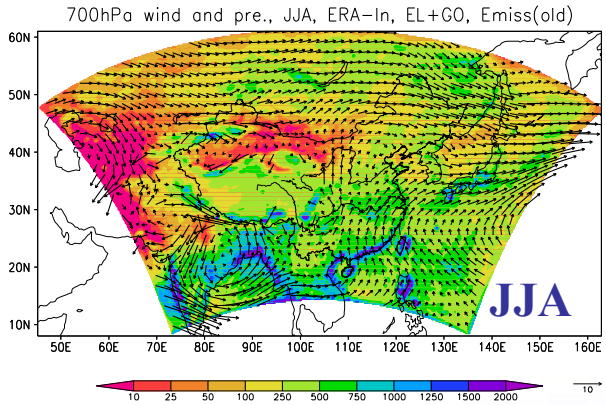

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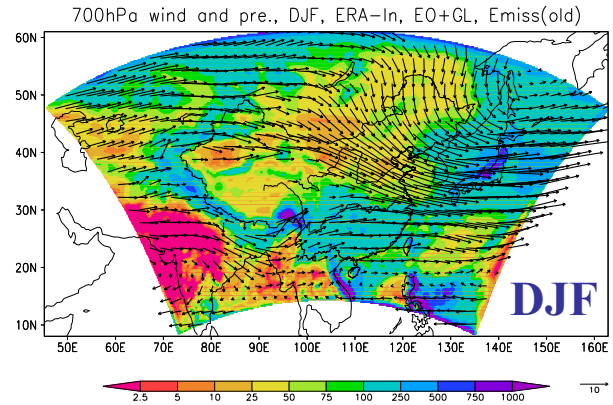
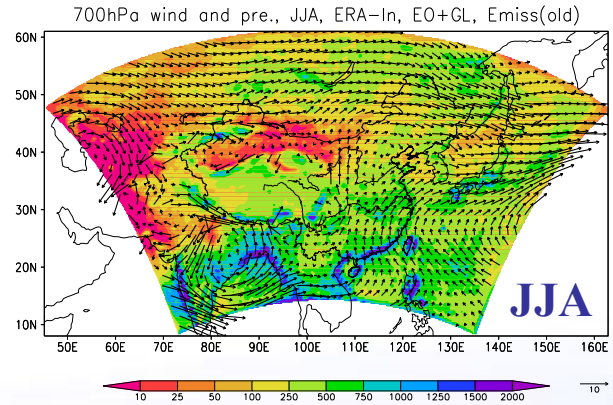
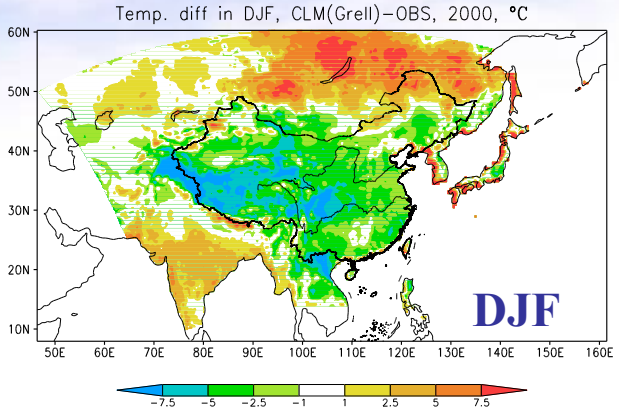


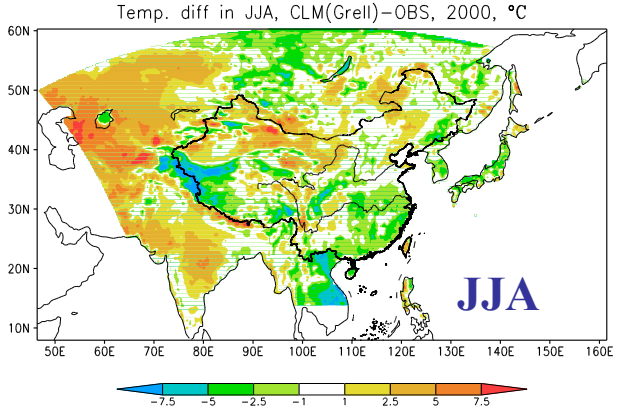


DJF and JJA precipitaton and wind in 700hPa (mm and m/s)

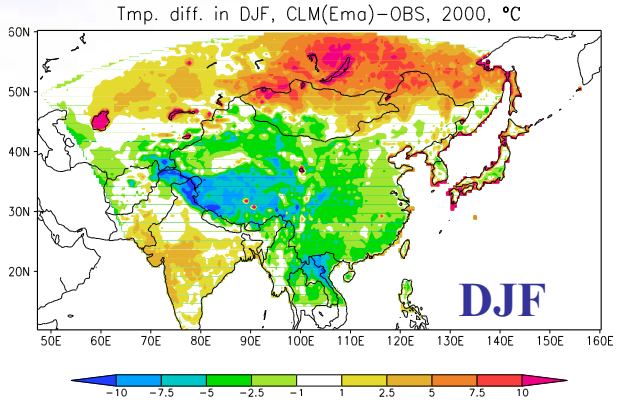
3. Different convections (ERA-Interim, CLM)

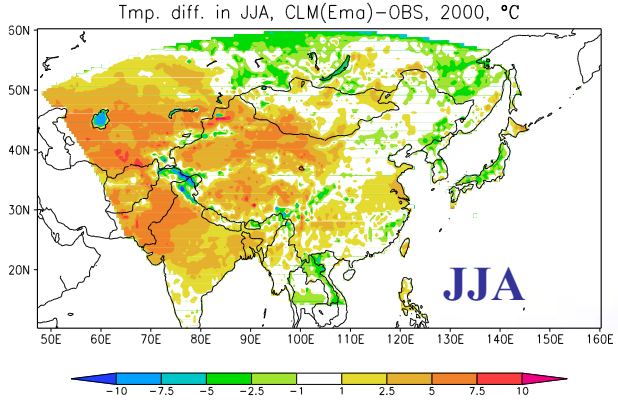
Grell





Emanuel





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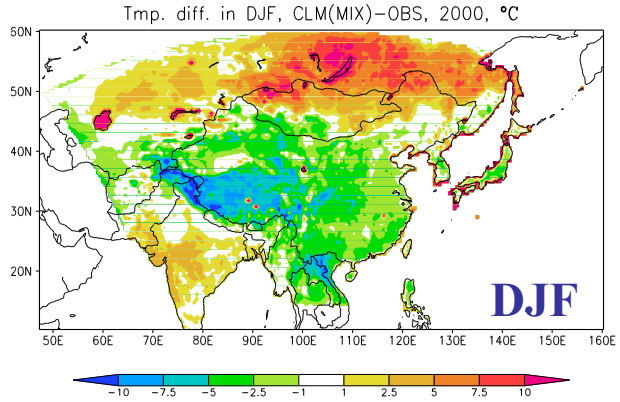
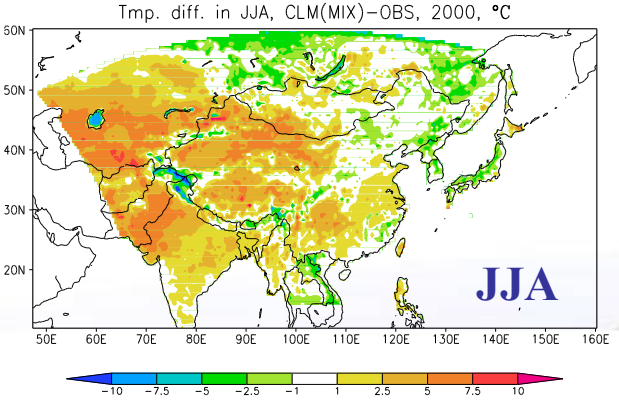
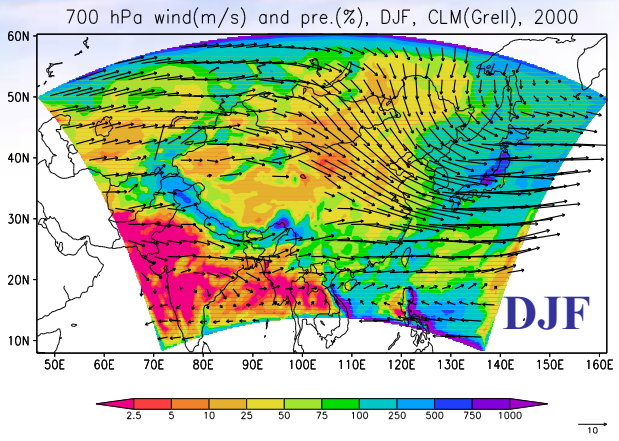
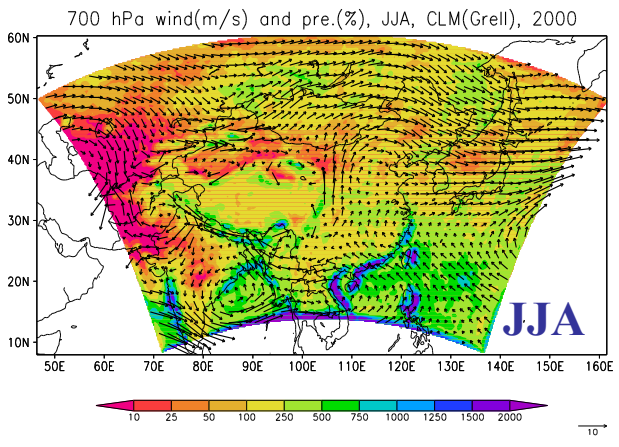




DJF and JJA temperature, difference between simulation and observation (ºC)

Grell





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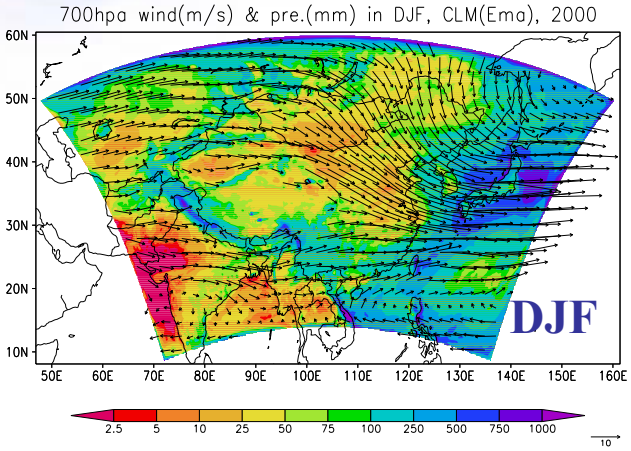

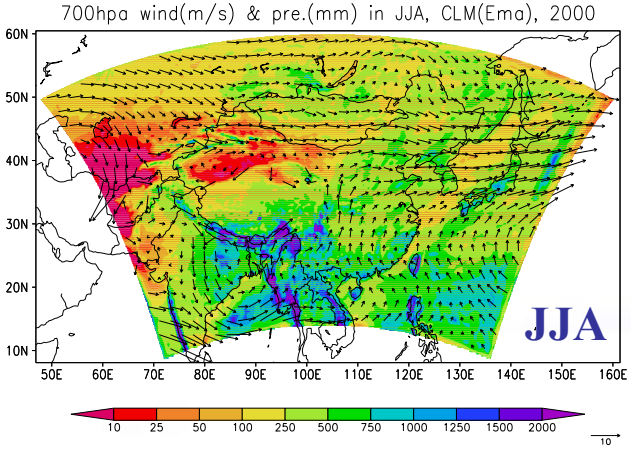

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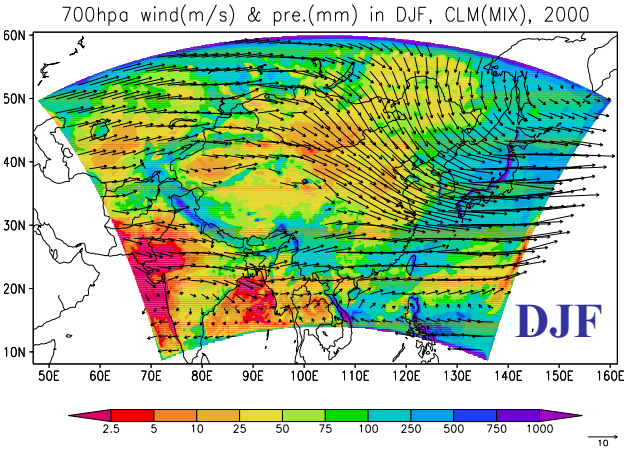
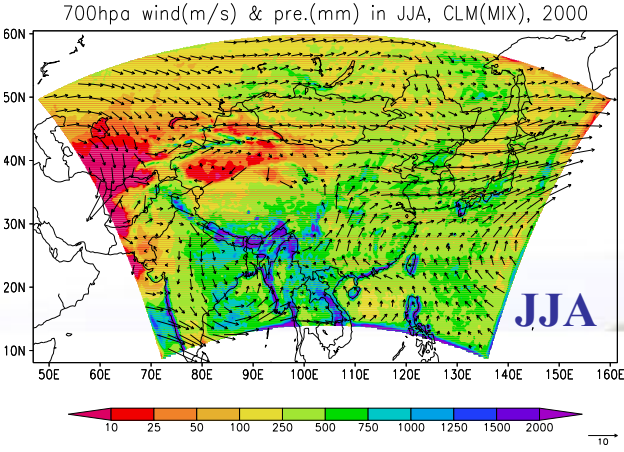
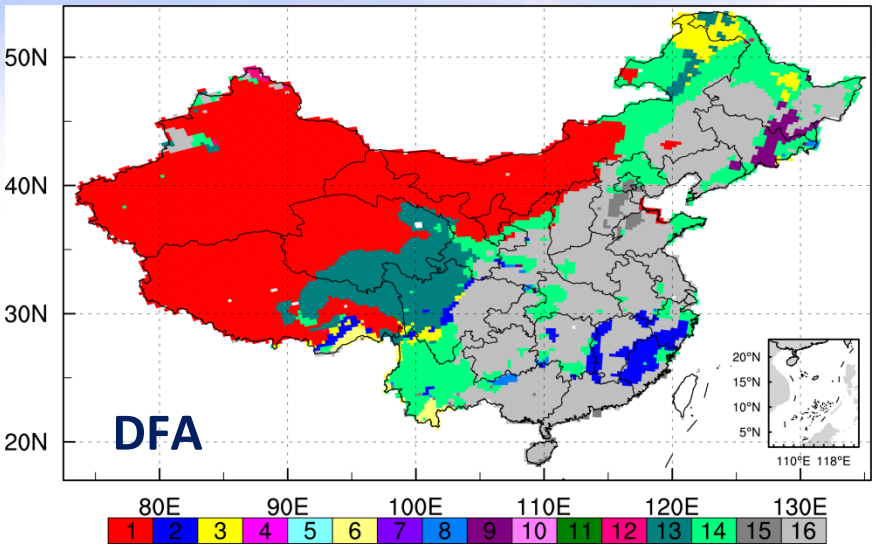




DJF and JJA precipitaton and wind in 700hPa (mm and m/s)

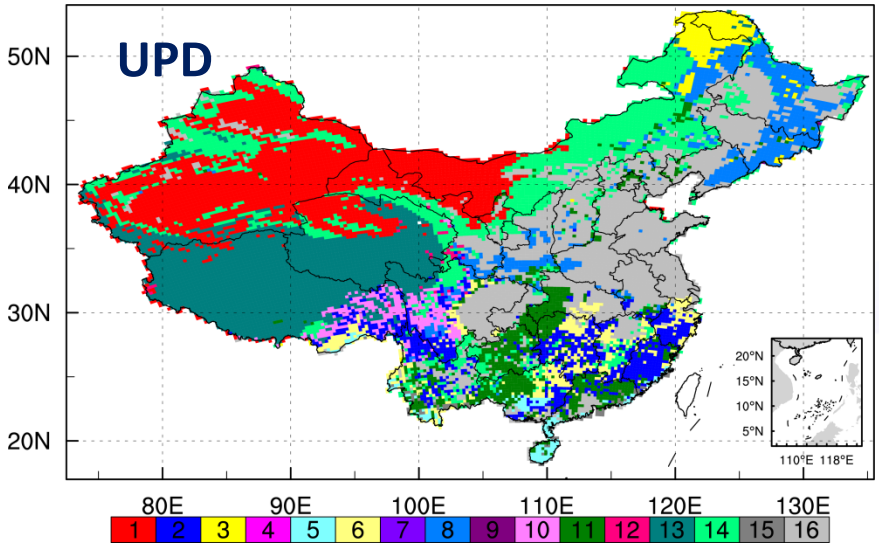
4. Updated land surface cover



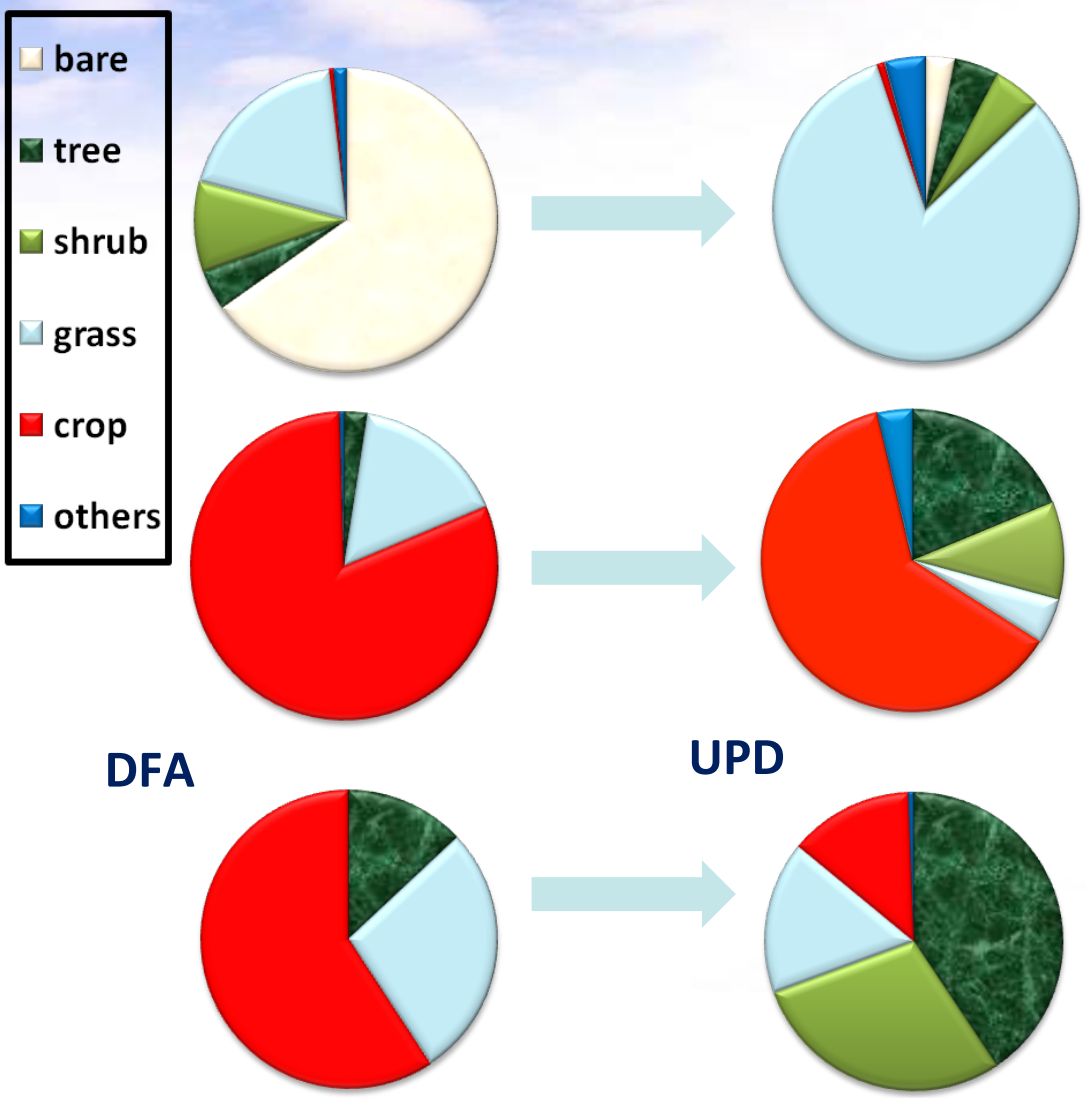
- ✓ The default LC has a lower resolution of 0.5°×0.5°, with bias compared to the dataset developed in China as well as common knowledge
- ✓ The LC is updated to the dataset based on the vegetation map of China

Dominant LC in the model grids

1 Bare	4 NDT Bor	7 BDT Tro
2 NET Tem	5 BET Tro	8 BDT Tem
3 NET Bor	6 BET Tem	9 BDT Bor
10 BES Tem	13 C3 arc	16 Crop
11 BDS Tem	14 C3 grass	
12 BDS Bor	15 C4 grass	



Percentage of LC over 3 regions



Too many bare soil and crop and too few shrub in DFA

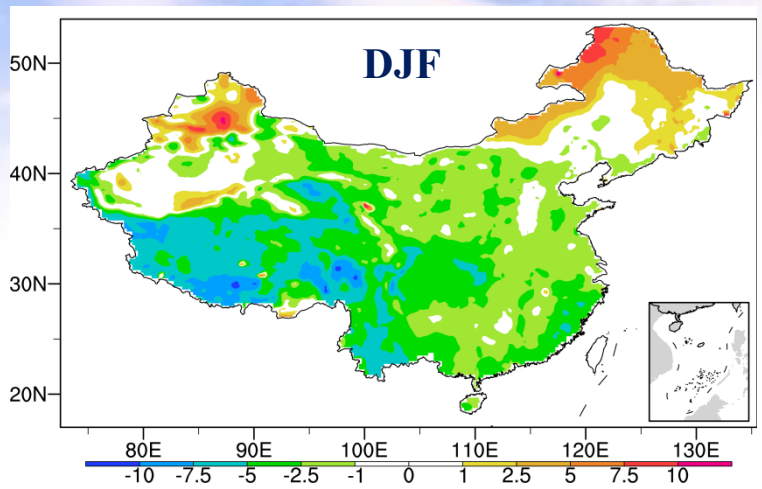
Tibetan
80E~95E, 25N~35N

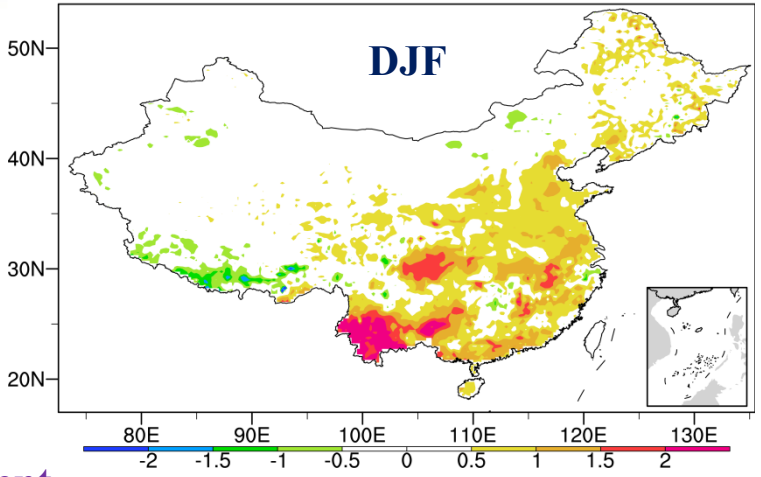
Central China
105E~120E, 30N~35N

South China
95E~120E, 20N~25N

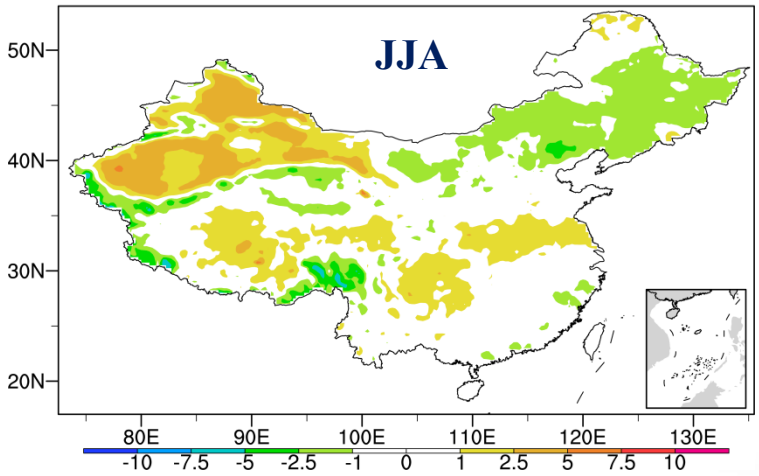
DFA-OBS

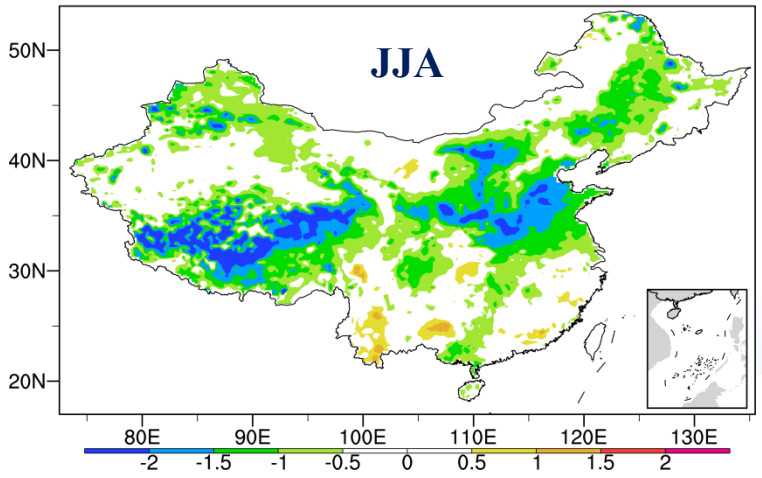
UPD-DFA



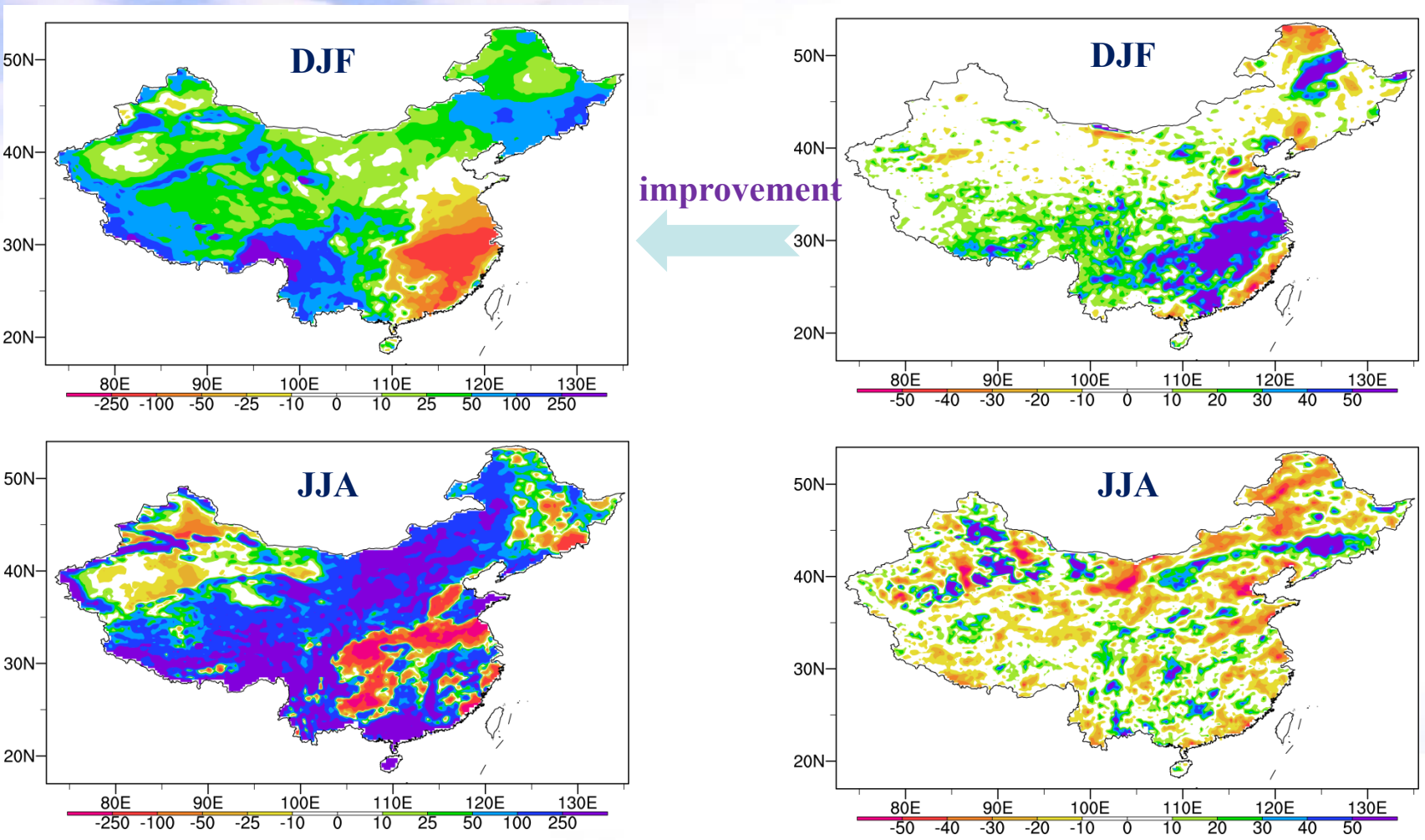


improvement





DJF and JJA temperature (ºC)

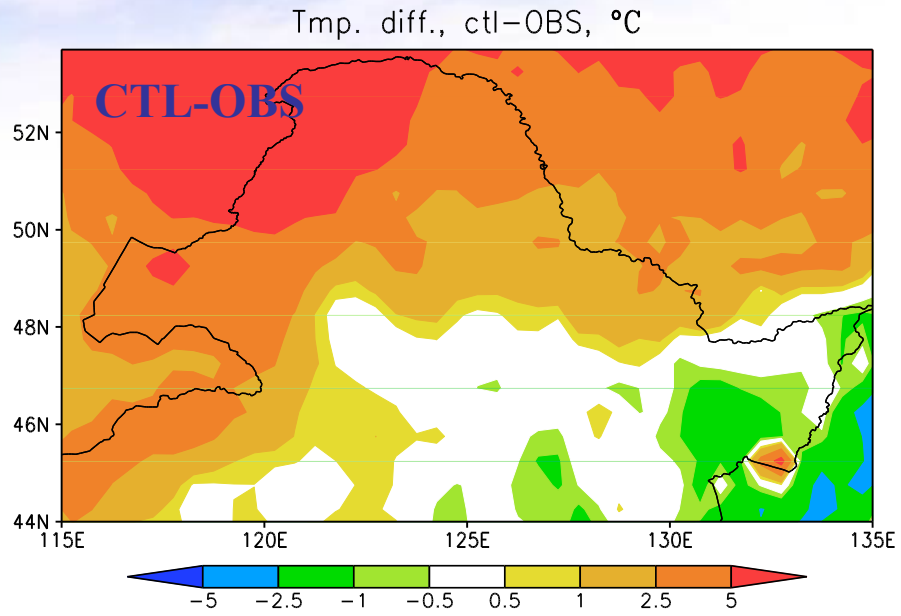


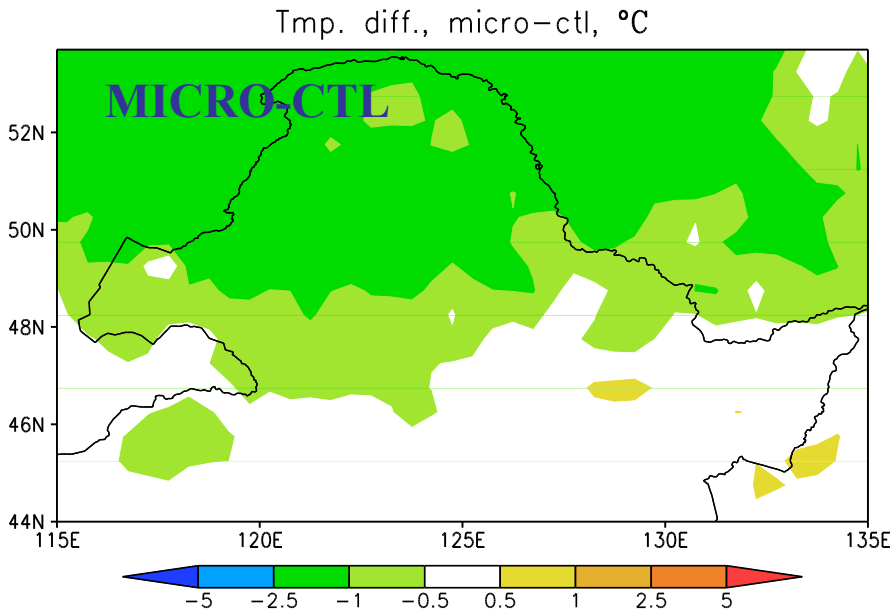
DJF and JJA precipitation (%)

4. Updated land surface cover

	Convection	BATS or CLM	Large pr	Cloud fraction	PBL	Driving field
CTL	Emanuel	CLM	SUBEX(Pal)	Bsaed on RH (Pal)	Hotslag	ERA-Interim
micro	-	-	Micro cloud physics	Baed on RH&cloud water (Xu)	-	-

- **Smaller domain**
- **one DJF test (200611-200703)**

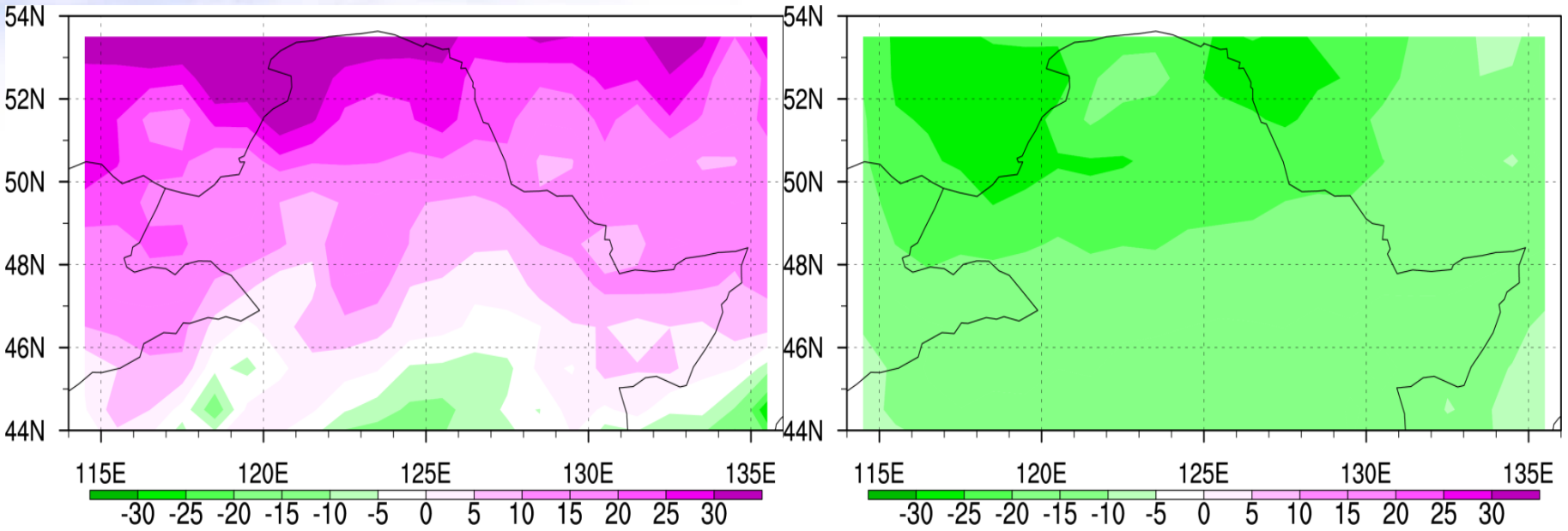




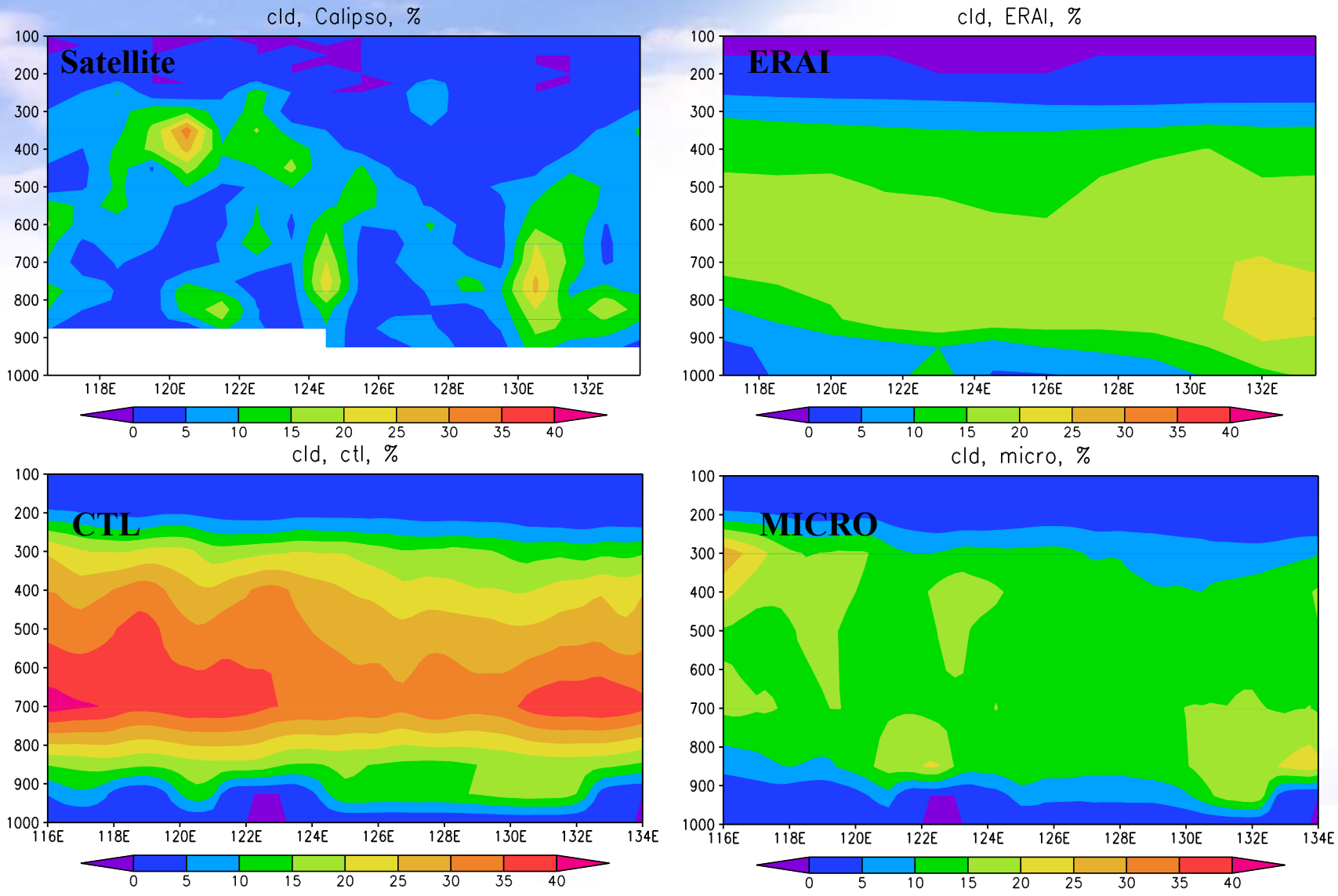
DJF temperature: CTL-OBS (left) and Micro-CTL (right) (°C)

CTL-OBS

MICRO-CTL



Downward long-wave radiation in DJF: CTL-OBS (left) and Micro-CTL (right) (°C)



Cloud fraction along 52°N

Part 2. Simulation for the period of 1990-2005

Final Configuration:

- Version: RegCM4.4-r10
- Land surface: CLM
- Convection: Emanuel
- PBL: Hotslag
- Updated land cover over China
- Resolution: 25km
- etc.

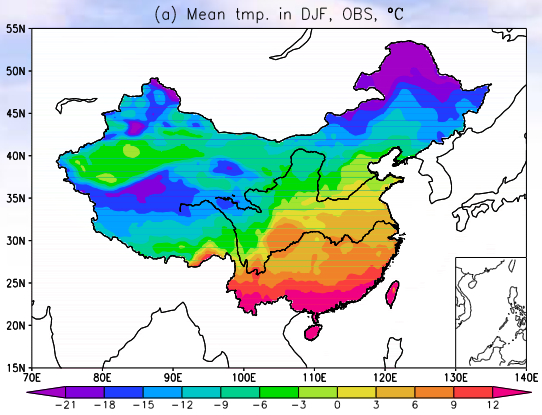
DJF

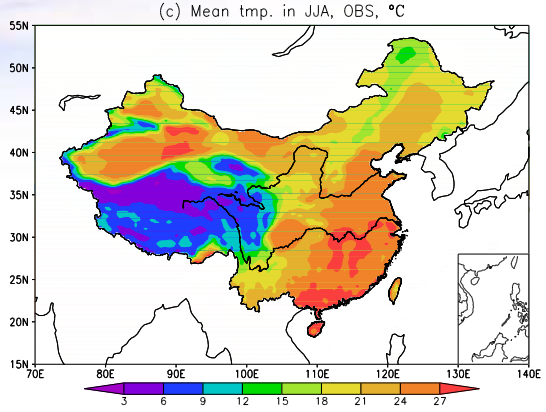
JJA

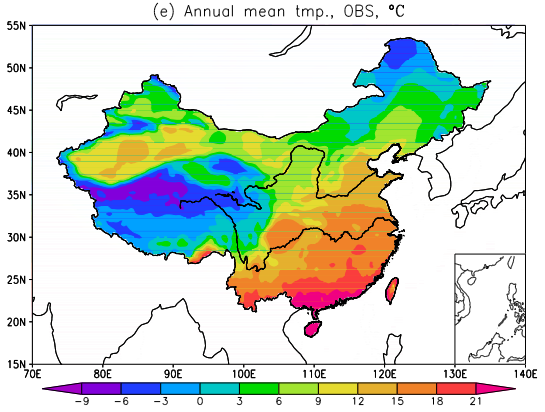
Annual

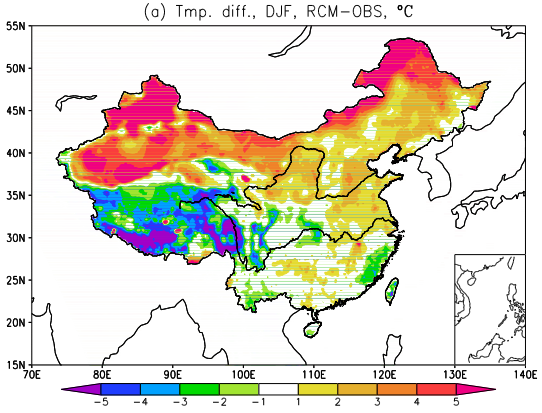
OBS

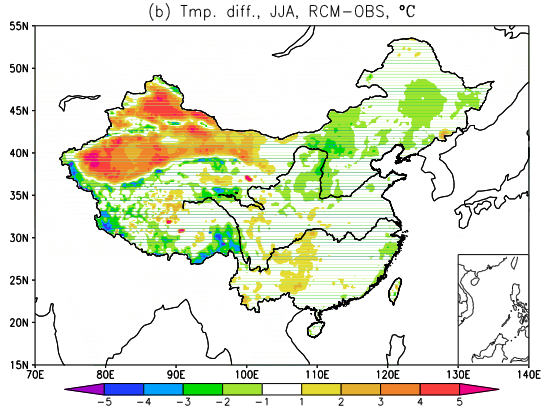
RCM

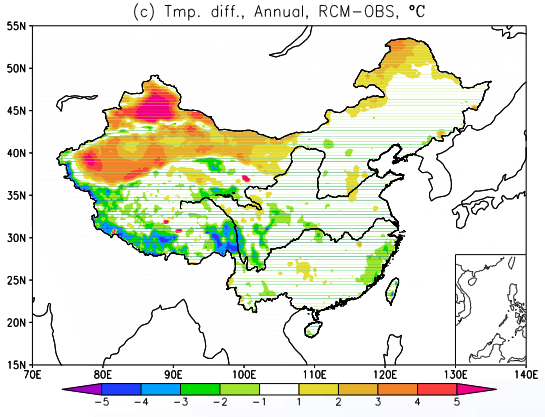








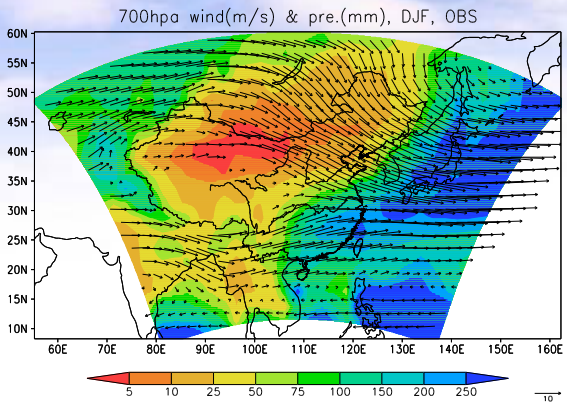


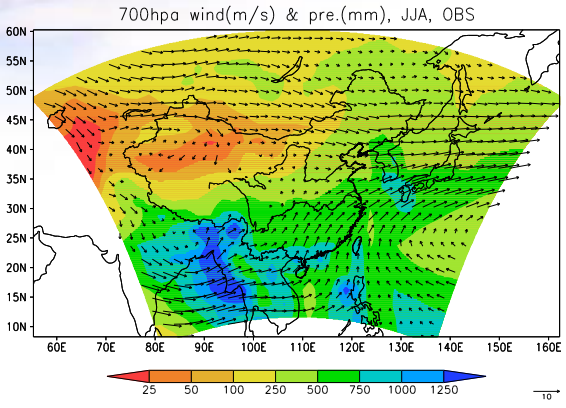


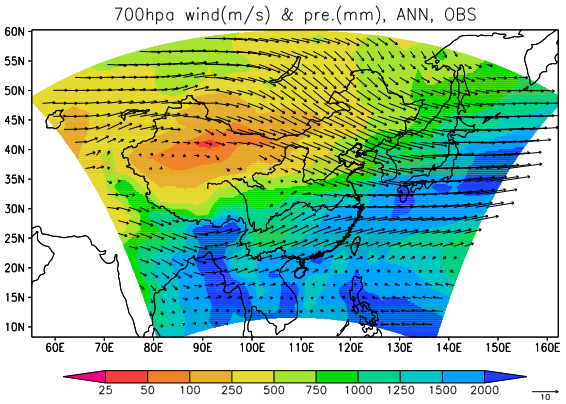
The observed and simulated DJF, JJA, and annual mean temperature for 1990-2005 (°C)

DJF JJA Annual

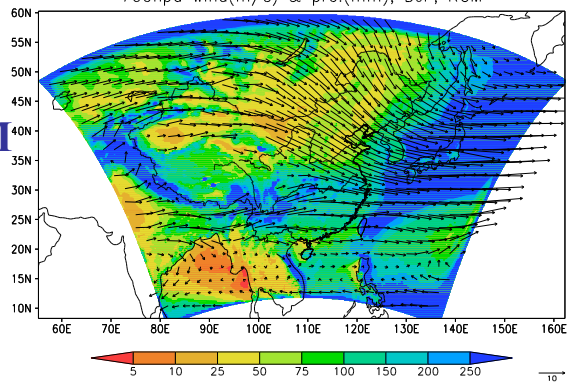
OBS

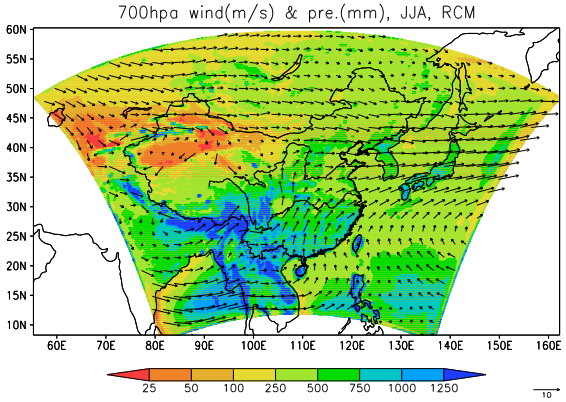


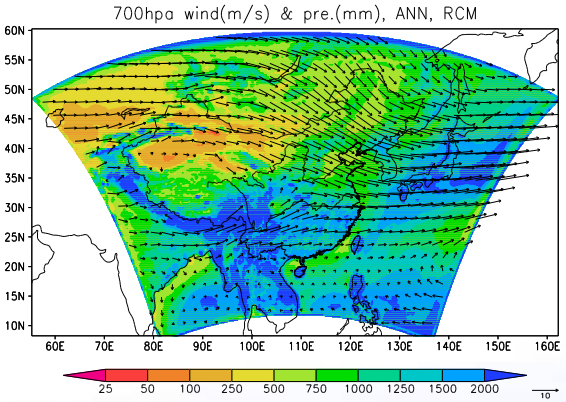




RCM



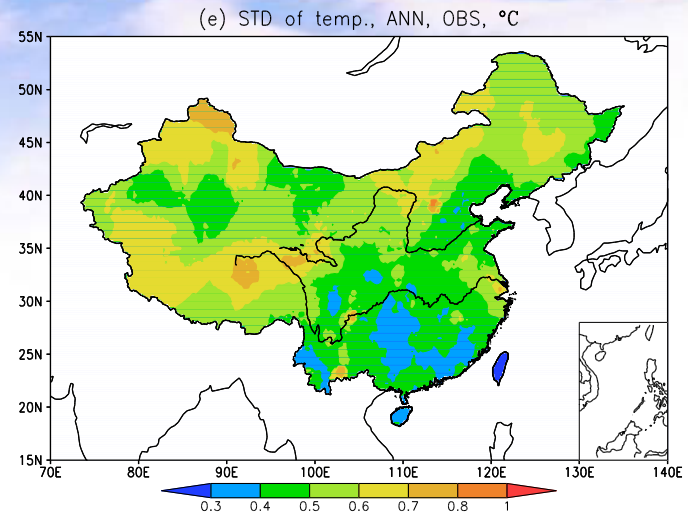


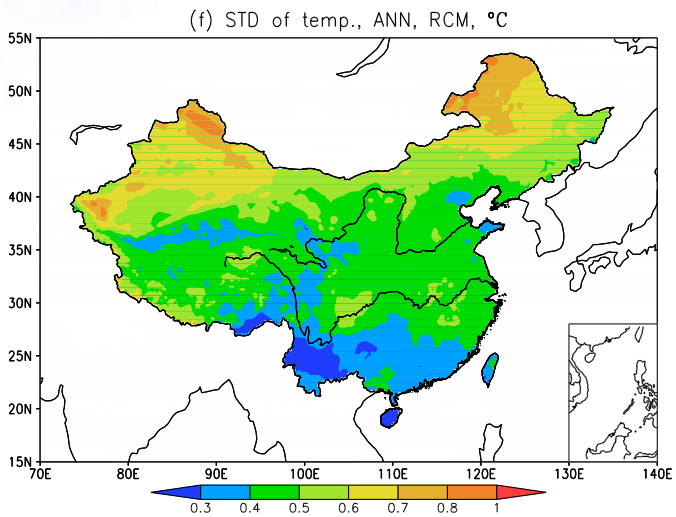


The observed and simulated DJF, JJA, and annual mean precipitation and 700hPa wind for 1990-2005 (mm and m/s)

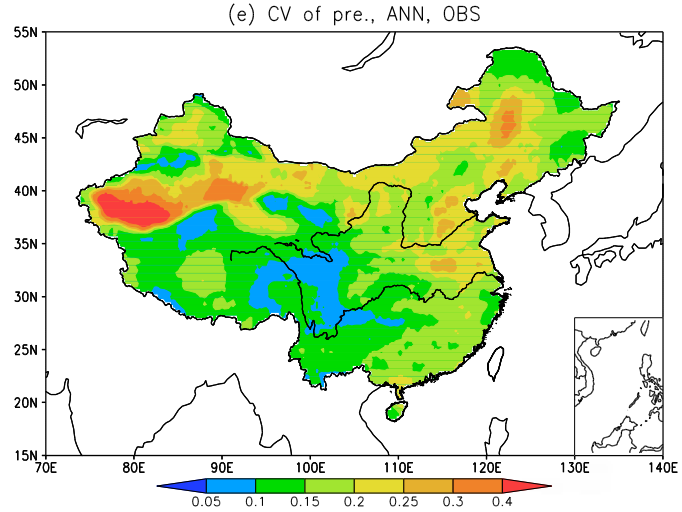
OBS **RegCM**

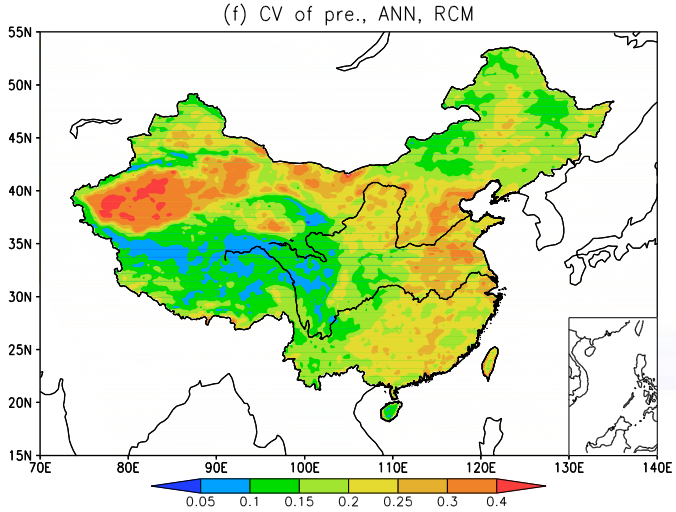
Ts





Pr

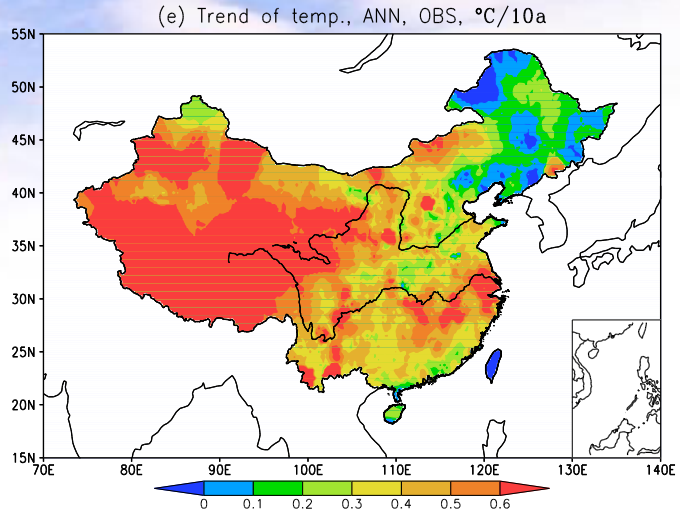


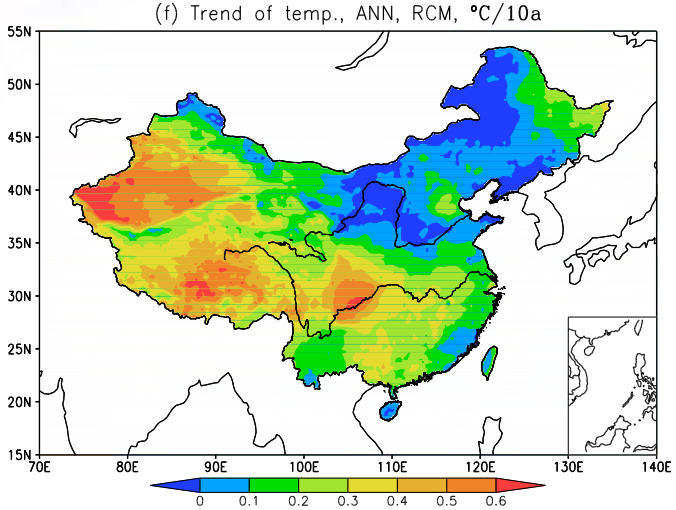


Inter annual variability of temperature and precipitation

OBS **RegCM**

Ts





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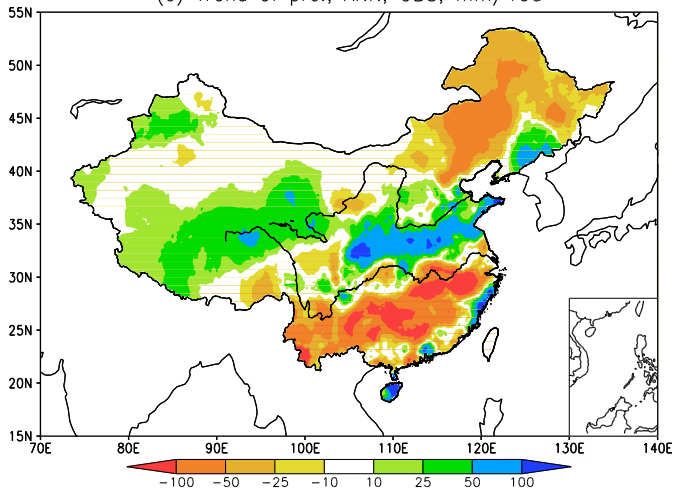
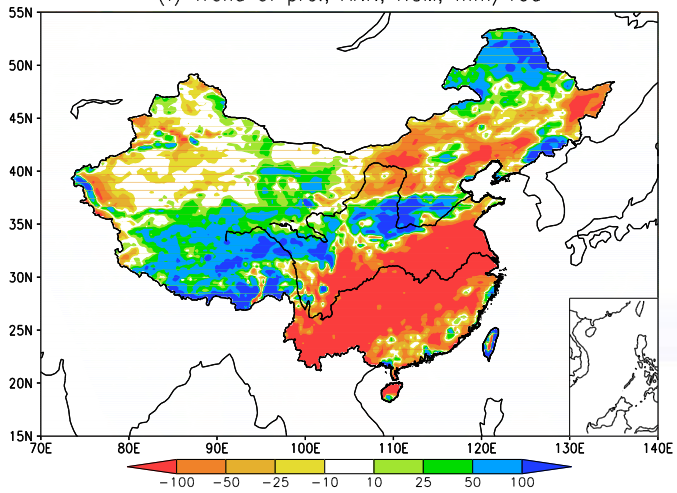


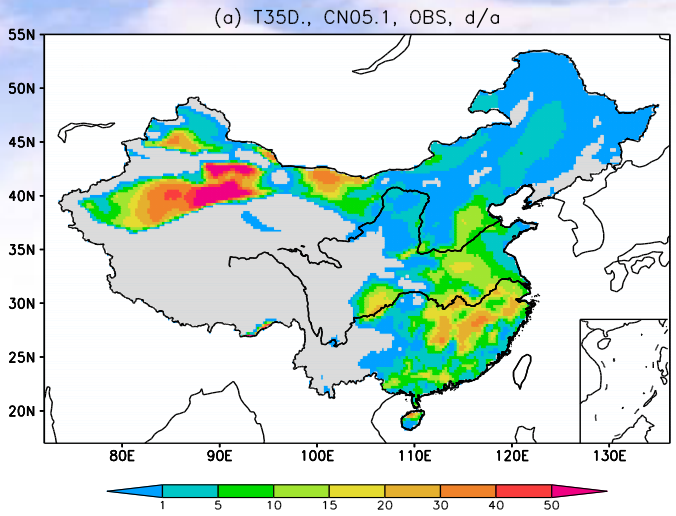


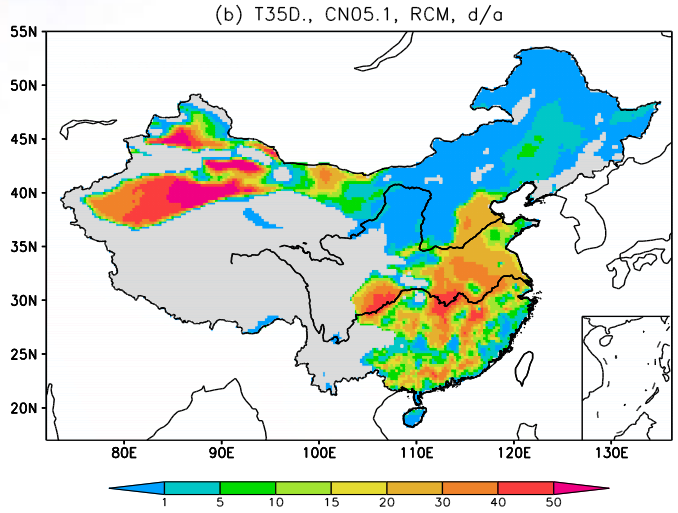
Trend of temperature and precipitation (1991-2005, °C/d, mm/10a)

OBS

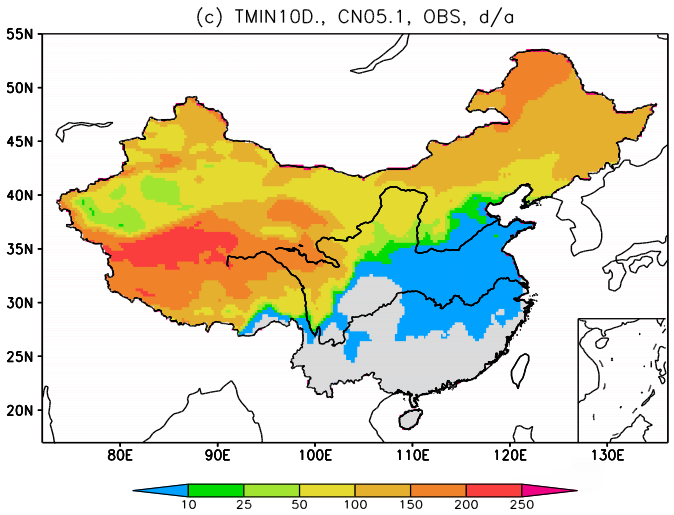
RegCM

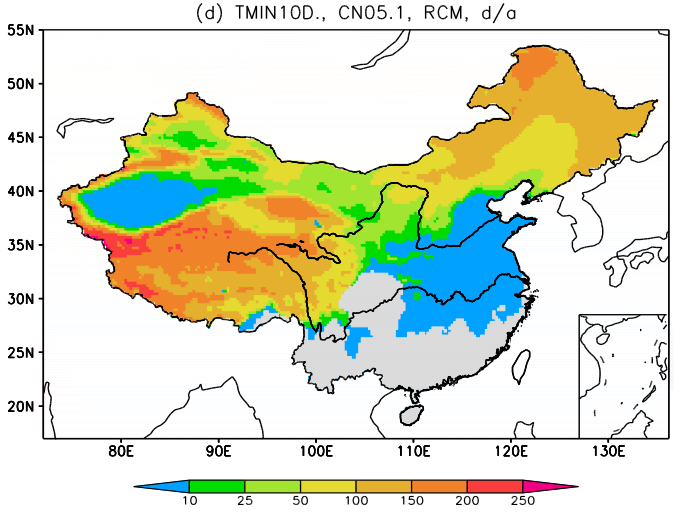
T35D





TM10D





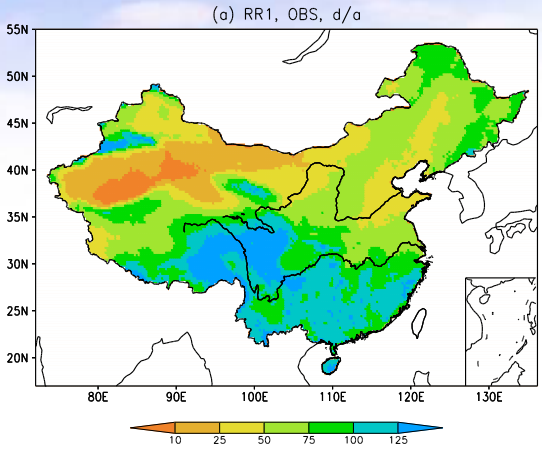
Hot (Tmax ≥35°C) and Cold days (≤-10°C)

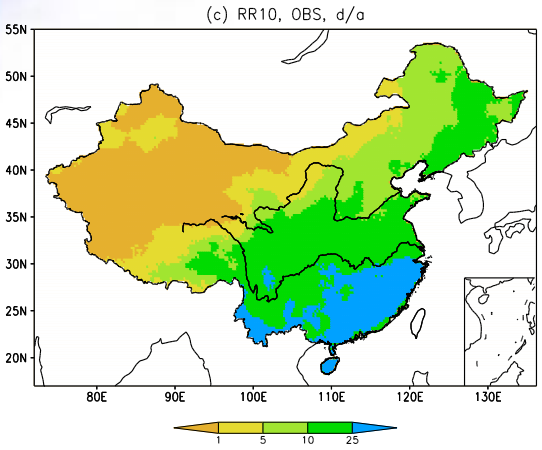
Light

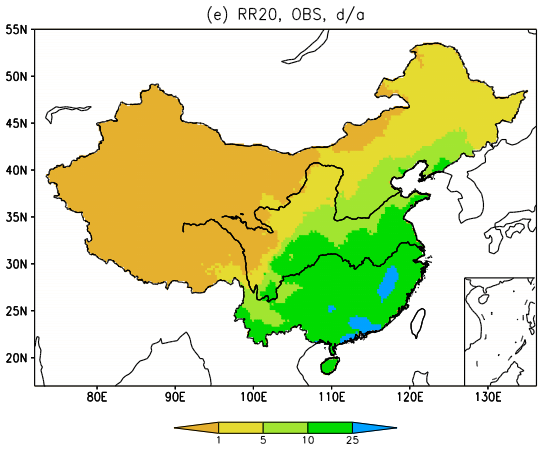
Moderate

Heavy

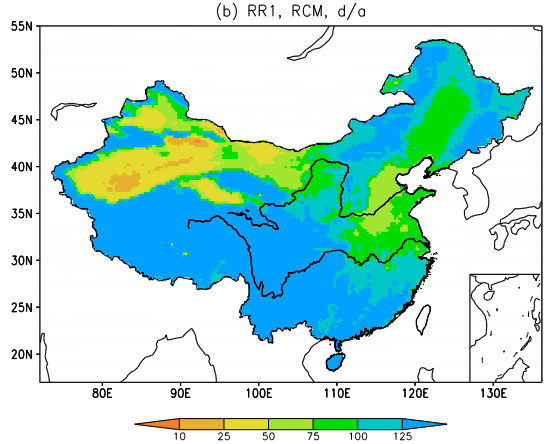
OBS

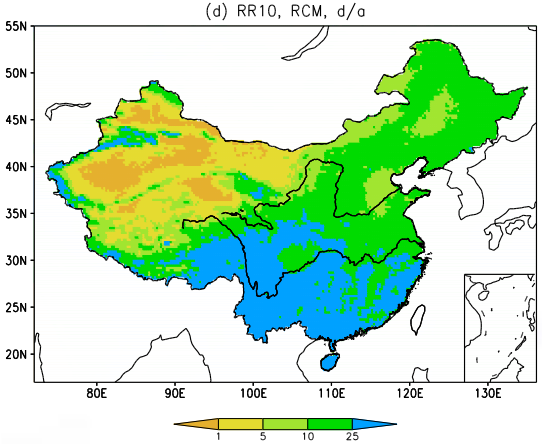


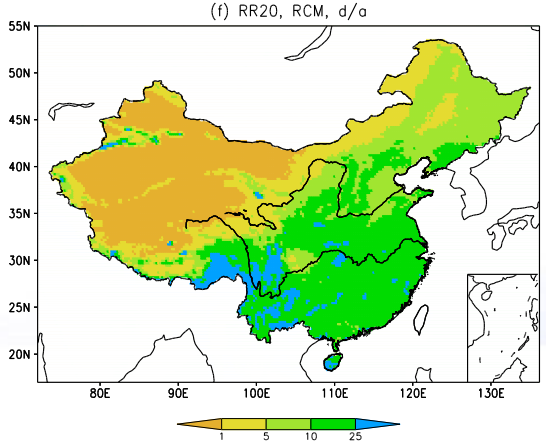




RegCM







Light (1-10mm), Moderate (10-20mm) and Heay (>20mm) rain days

Part 3. Discussion and future work plan

- **Usual discrepancies with observation exist**
  - ✓ **Grell+Bats and Emanuel+CLM perform best**
  - ✓ **Warm bias over high latitudes in cold seasons (potentially can be improved by the micro-cloud physics)**
  - ✓ **Not enough rain in southern China (rainy areas)**
  - ✓ **Too much of rainfall in north (drier areas)**
  - ✓ **Too warm over deserts**
  - ✓ **Tests of new versions, and further development and tuning**

- **Climate change simulations under RCP-CMIP5**
- **Comparison with other RCMs under CORDEX to address the uncertanties**
- **Small ensemble of RegCM: different physics**
  - ✓ **Grell+Bats**
  - ✓ **Emanuel+CLM**


Thanks!