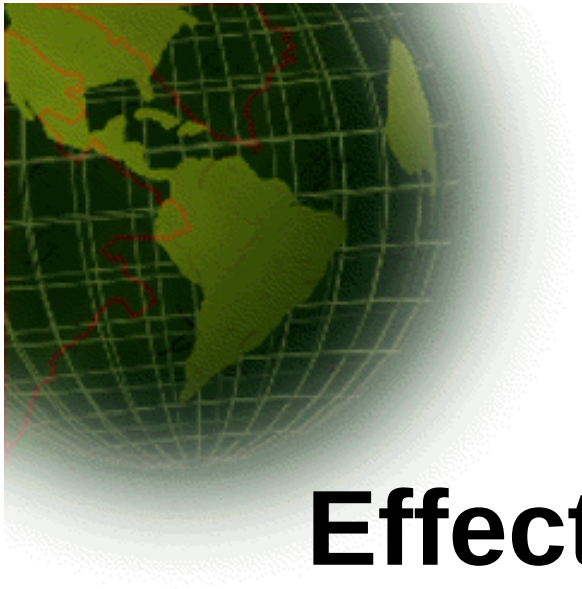

Effects of Deforestation on Land Surface Air Temperature in Eastern China

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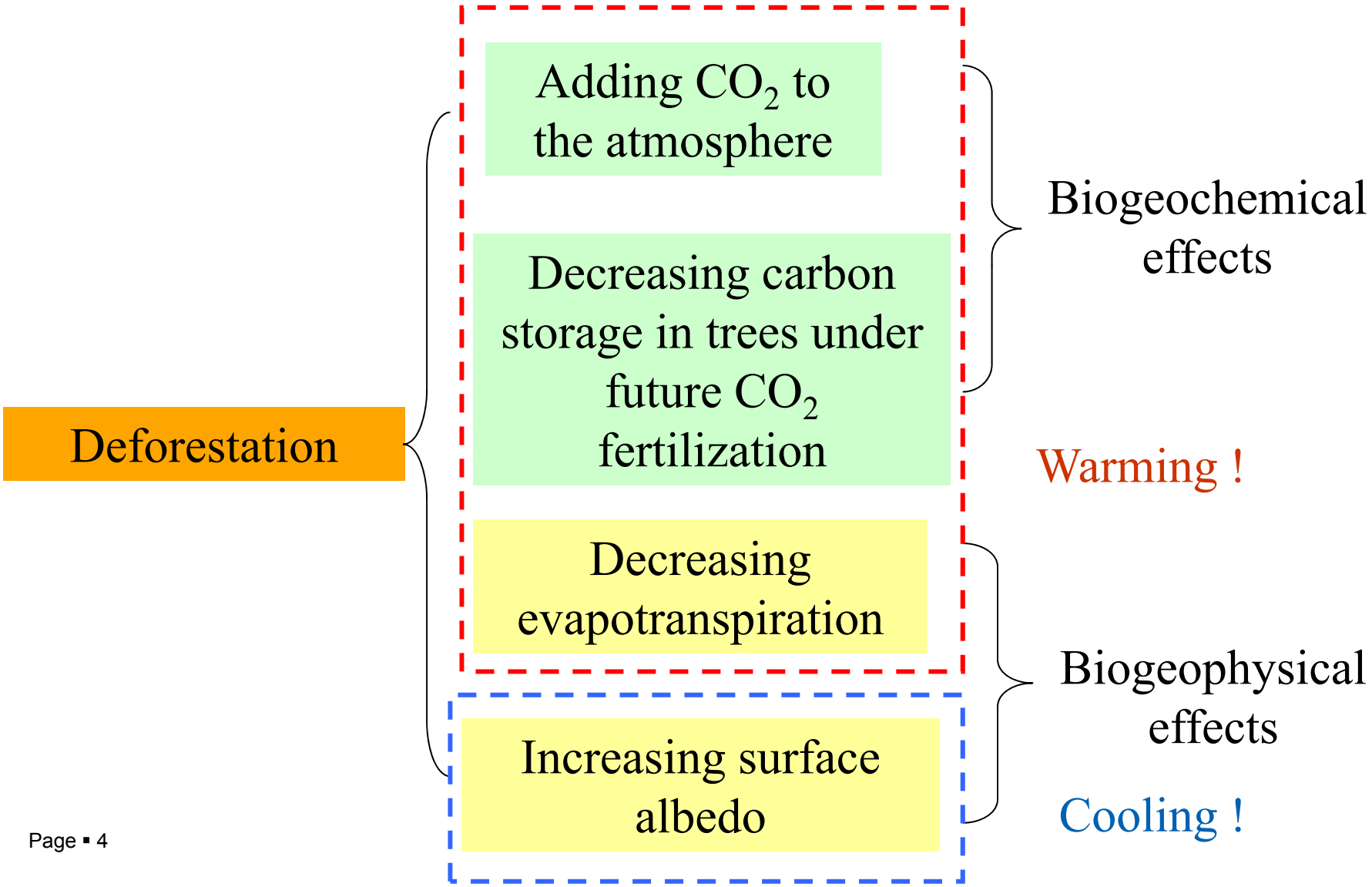
Outline

- Introduction
- Objectives
- Methods
- Results
- Conclusions
- Works in future

1. Introduction

- As one of key climatic variables, surface air temperature can be used to evaluate effects of anthropogenic activities on climate changes, such as land use/cover changes (*Hansen et al., 2006; Pielke et al., 2007; Mildrexler et al., 2011*).
- Deforestation affect land surface air temperature through biogeochemical and biogeophysical processes (*Bonan, 2008*).

1. Introduction



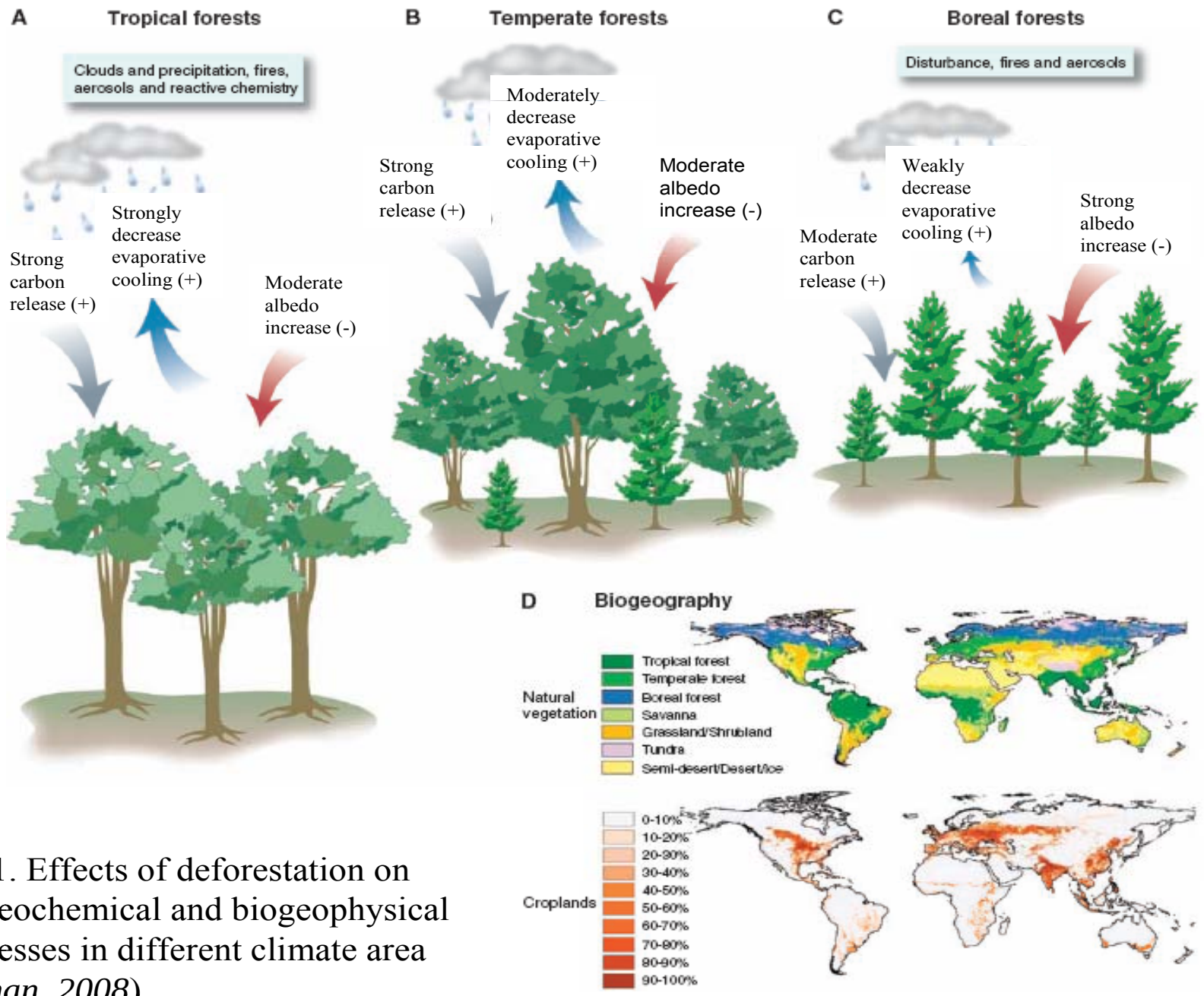


Fig 1. Effects of deforestation on biogeochemical and biogeophysical processes in different climate area (*Bonan, 2008*)

1. Introduction

- The cooling or heating effects of deforestation were verified by field observation (site pairs comparison) in North America .
- And, air temperature difference Δ*T* between forest and adjacent open lands changes with latitude (*Lee et al., 2011*).

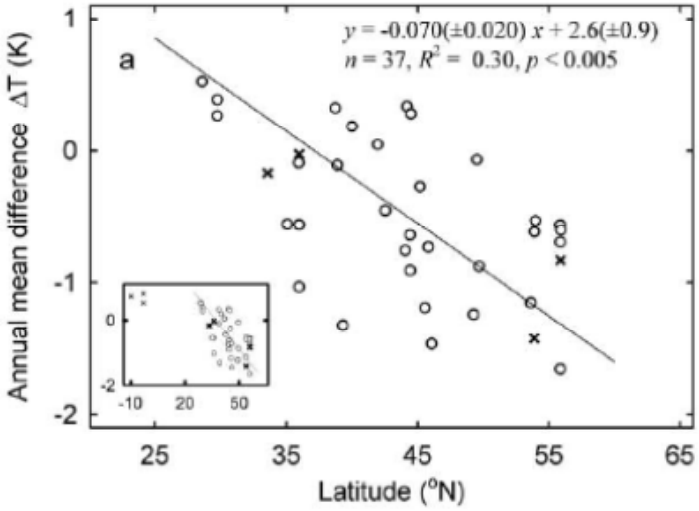


Fig.2 Relationship between Annual mean difference (open land minus forest) in surface air temperature and latitude (*Lee et al., 2011*).

1. Introduction

- Do the cooling or heating effects of deforestation exist in other region?
- Does the change in ΔT with latitude exist in other region?
- The eastern Asian monsoon makes the climate in Eastern China differ from those in Europe and North America. A vegetation sequence exists along the North-South Transect of Eastern China (NSTEC) from the north to the south (Yu et al., 2008)

2. Objectives

- Test the effects of deforestation on land surface air temperature at local-scale in Eastern China.
- Uncover changes in ΔT with latitude in Eastern China.
- How does Δ*T* vary seasonally in different climate area?
- How does diurnal temperature range (DTR) Change?

3. Methods

3.1 Sites information

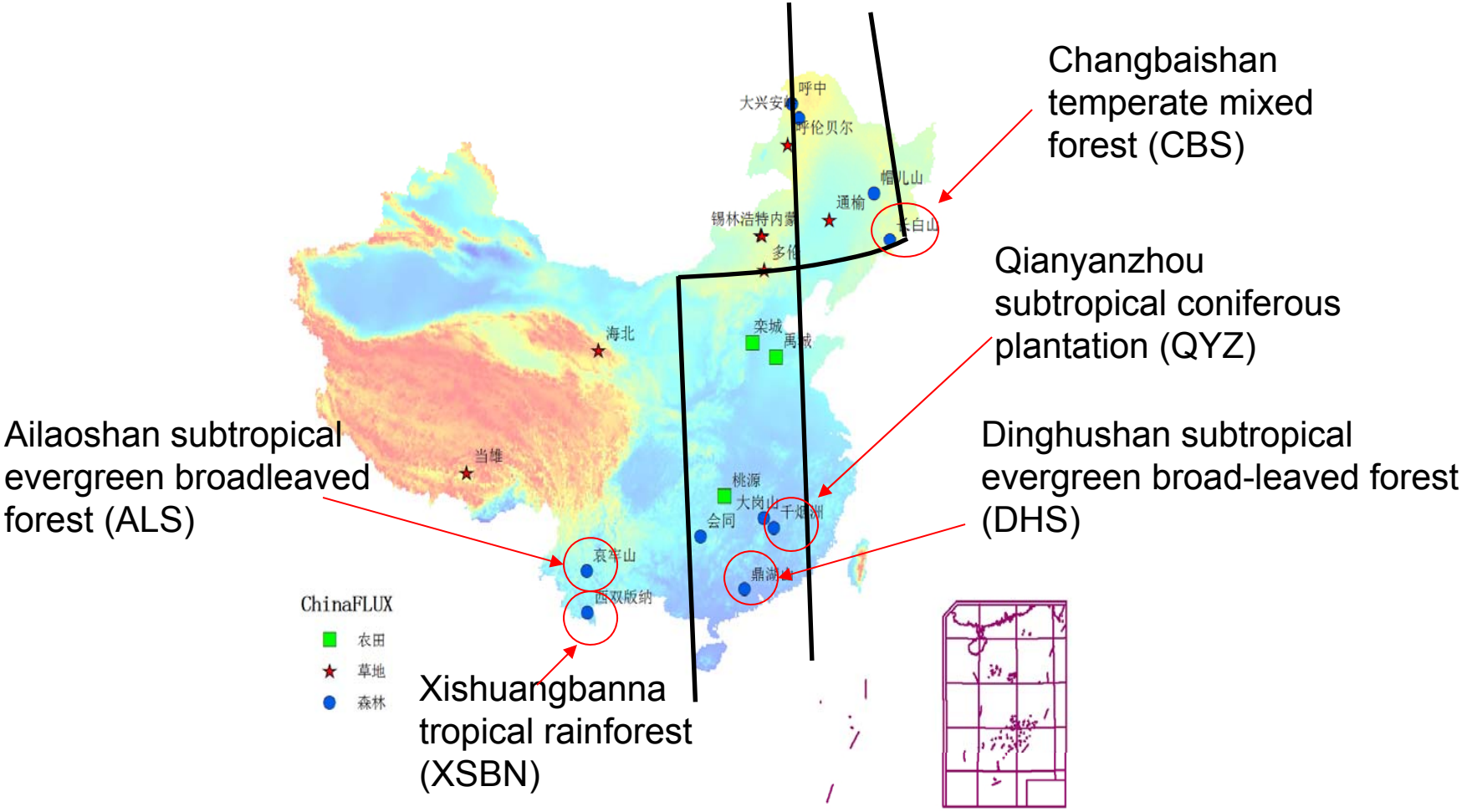


Fig.3 Sites distribution

3.1 Sites information

- Comparison is made of the surface air temperature measured by the forest towers and that in the adjacent surface weather stations (CERN)

Table1 Sites information

	CBS		QYZ		DHS		ALS		XSBN	
	Flux tower	Surface station	Flux tower	Surface station	Flux tower	Surface station	Flux tower	Surface station	Flux tower	Surface station
Location	42°24′N 128°05′E	42°23′N 128°06′E	26°44′N 115°03′E	26°26′N 115°02′E	23°10′N 112°34′E	23°10′N 112°33′E	24°32′N 101°01′E	24°32′N 101°01′E	21°30′N 101°21′E	21°55′N 101°15′E
Altitude(m)	738	738	102	76	240	105	2476	2481	750	560
MAT(℃)	3.6		17.9		21.0		11.3		21.5	
P(mm)	695		1485		1956		1840		1493	

3.2 Field Measurements

- Two Sources of data

➢ ChinFLUX forest flux tower—surface air temperature of forest.

Air temperature measured above canopy

➢ CERN weather station—surface air temperature of open land.

Air temperature measured 1.5m above the ground level.

3.2 Field Measurements

- At CBS, QYZ, DHS, and XSBN, data for analysis measured from 2003 to 2006.

- At ALS, data for analysis measured in 2010.

3.3 Data processing

- Statistics of daily data

✓T_{max} : daily maximum air temperature.

✓T_{min}: daily minimum air temperature.

✓T: daily mean air temperature.

✓ΔT: daily mean temperature difference between forest and in the adjacent open land (open land minus forest).

✓DTR : diurnal temperature range (T_{max} minus T_{min}).

3.3 Data processing

- Eliminating the effect of altitude difference

✓ lapse rate of 0.65℃ per 100m elevation

4. Results

4.1 Variations in surface air temperature difference

4.2 Variations in diurnal difference of air temperature

4.3 Impact factors of surface air temperature difference

4.1 Variations in surface air temperature difference

- Latitude changes of ΔT

•In temperate region (high latitude), surface air temperature is lower in open land than in forest.

•The cooling effect of deforestation decreases with decrease of latitude.

•When latitude is lower than 25° N, cooling effect changes into heating effect.

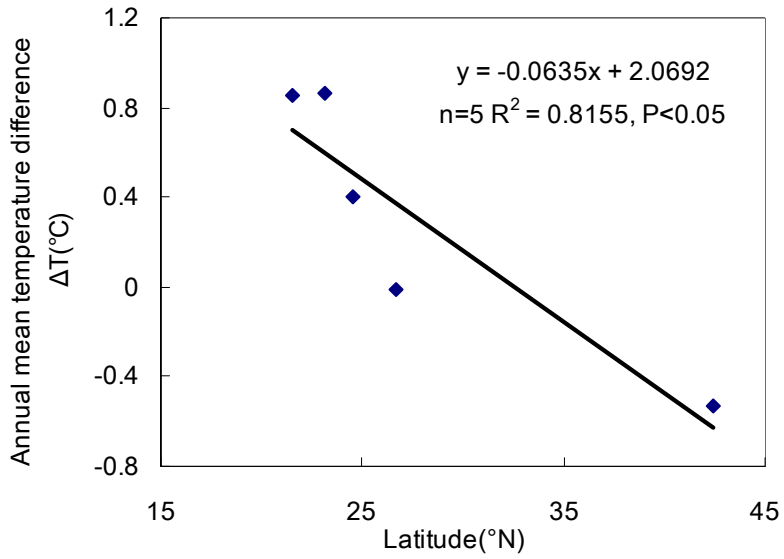


Fig.4 Change in ΔT with Latitude

4.1 Variations in surface air temperature difference

- Seasonal variations of ΔT

•In summer, surface air temperature is lower in forest than in open land at the five sites.

•At CBS, cooling effect of deforestation increases in autumn and winter.

•At ALS and XSBN, heating effect of deforestation decreases in winter and spring, but in autumn and winter at DHS .

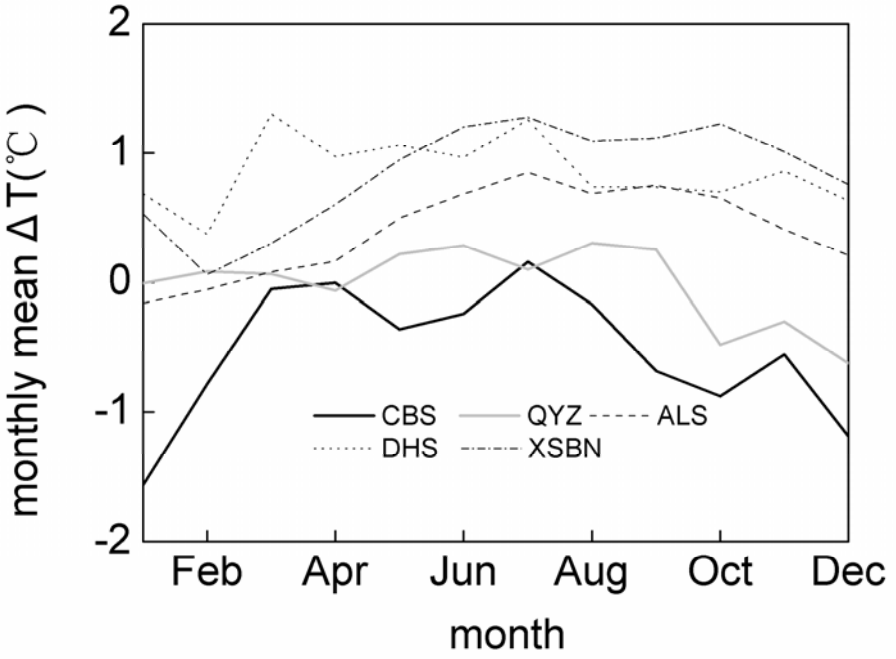


Fig.5 Seasonal variations of ΔT(℃) in five sites

4.2 Variations in diurnal difference of air temperature

- Seasonal variations of T_{max} and T_{min}

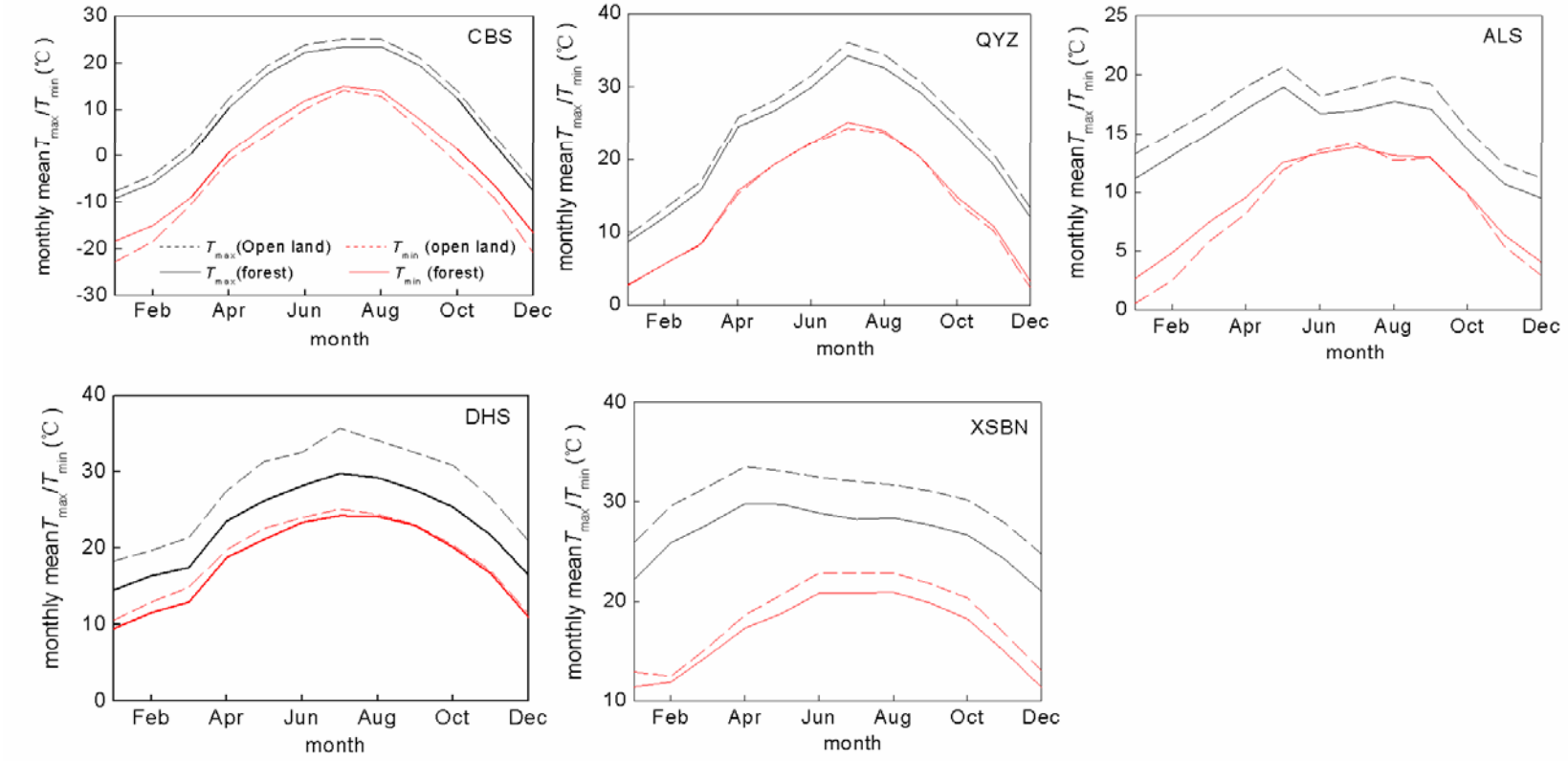


Fig.6 Seasonal variations of T_{max} and T_{min} in five sites

4.2 Variations in diurnal difference of air temperature

- Seasonal variations of DTR

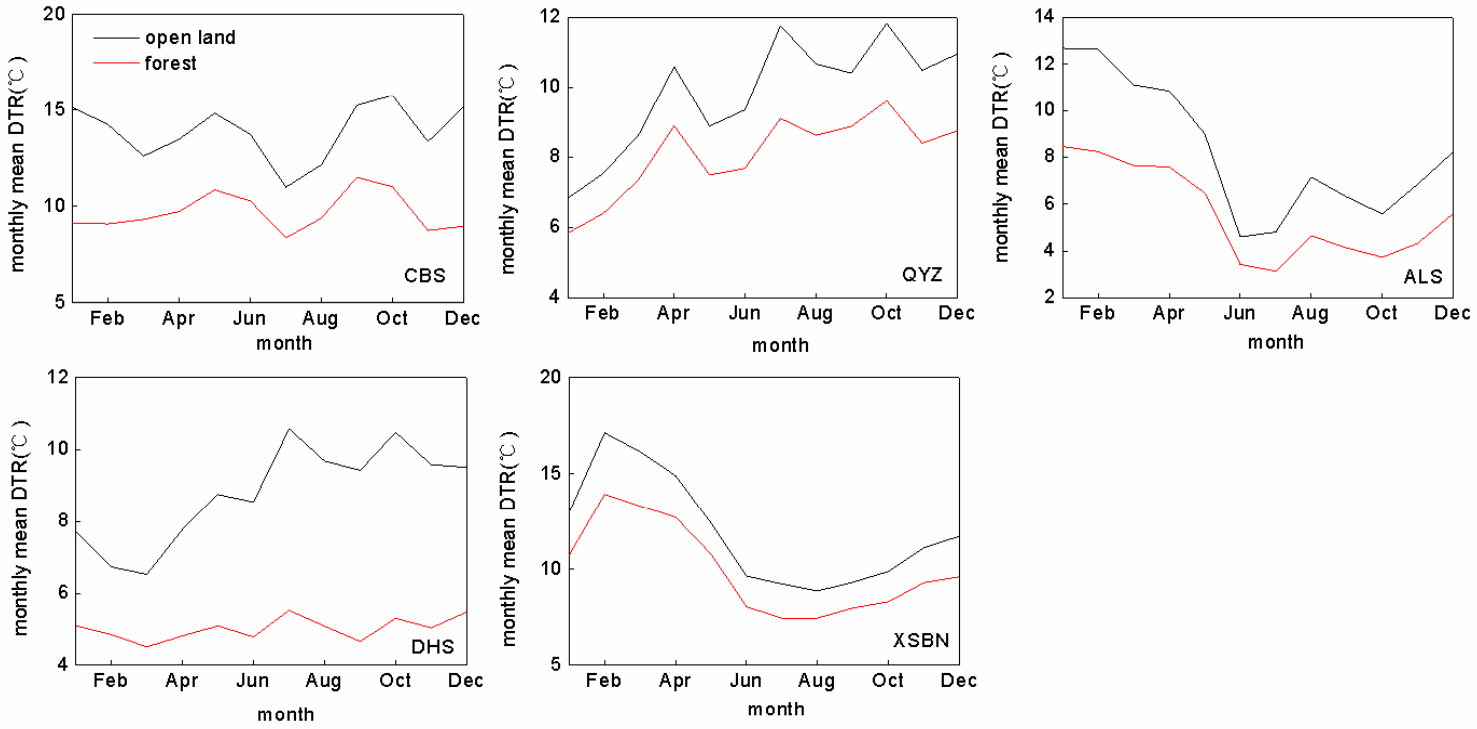


Fig.7 Seasonal variations of DTR in five sites

4.3 Impact factors of surface air temperature difference

- Changes in ΔT with Precipitation

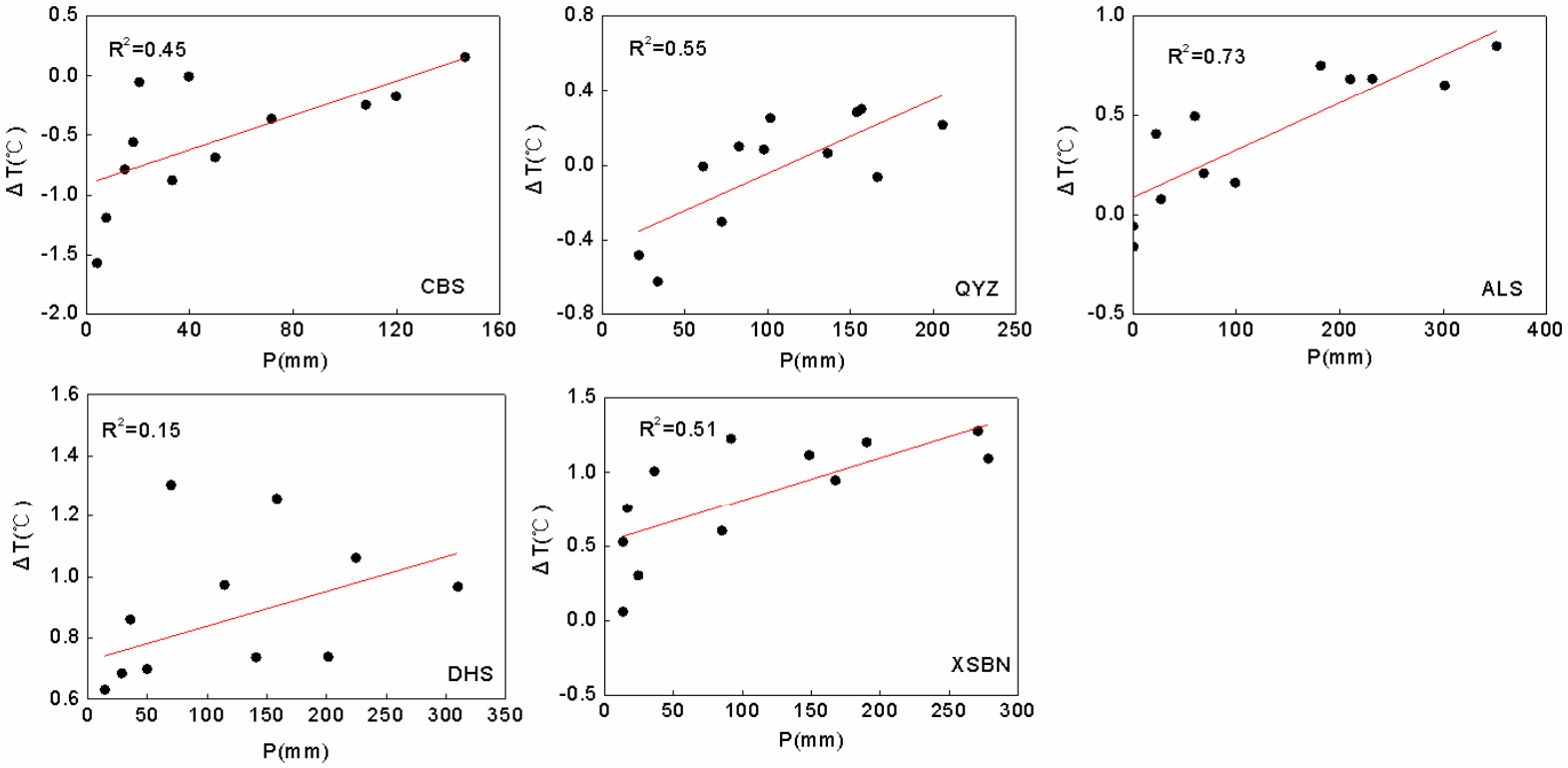


Fig.8 Relationship between ΔT and precipitation in five sites

4.3 Impact factors of surface air temperature difference

- Changes in DTR of open land with Precipitation

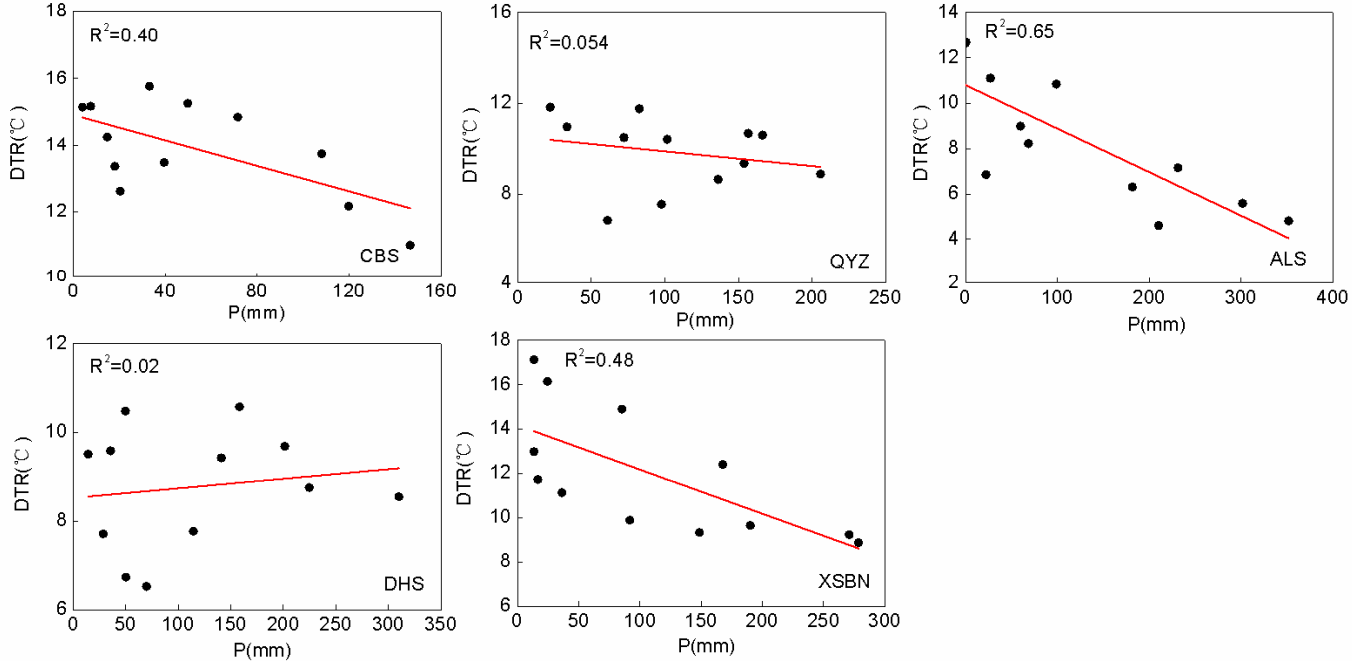


Fig.9 Relationship between DTR of open land and precipitation in five sites

4.3 Impact factors of surface air temperature difference

- Changes in DTR of forest with Precipitation

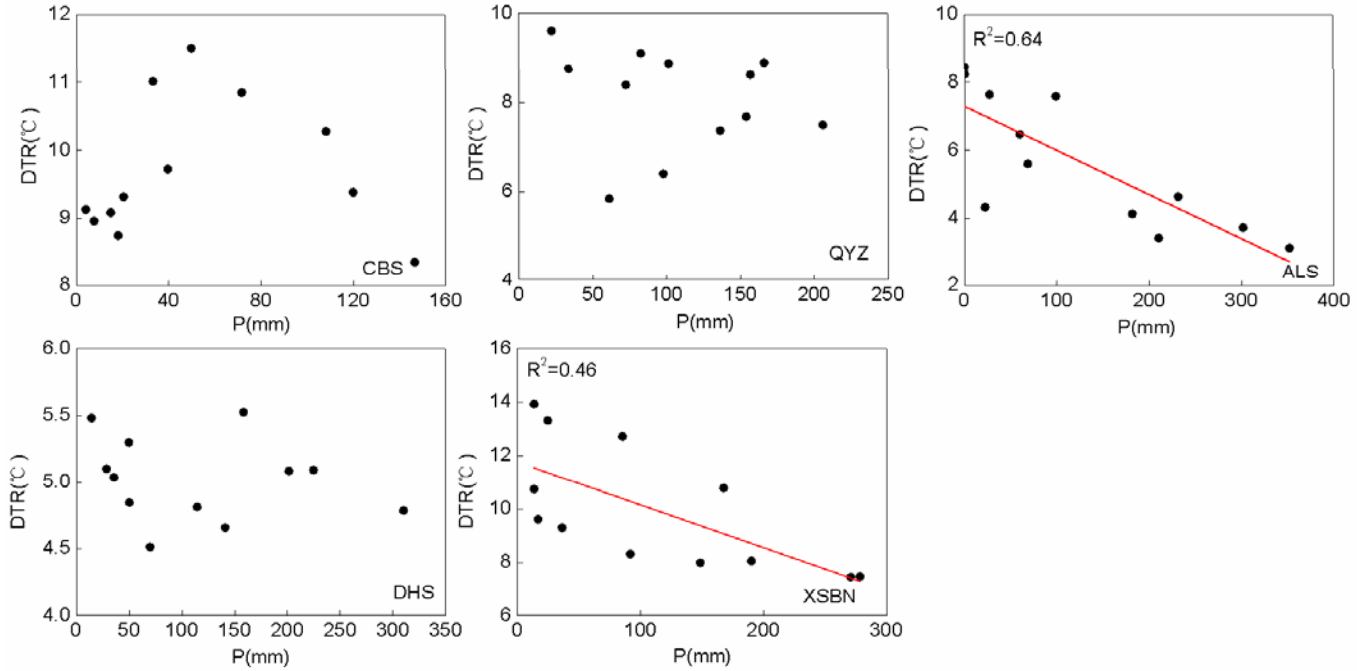


Fig.10 Relationship between DTR of forest and precipitation in five sites

5. Conclusions

- In Eastern China, the cooling effect of deforestation decreases with decrease of latitude, and changes into heating effect in subtropical and tropical area.
- The heating effect of deforestation increases in summer in different climate area.
- DTR in open land is higher than it in adjacent forest.
- No matter in forest or in adjacent open land, DTR is the lowest in summer at CBS, ALS, and XSBN, but is the highest in June and August at QYZ and DHS.

6. Works in future

- Is the Latitude change of ΔT in Eastern Asia same to that in North America?

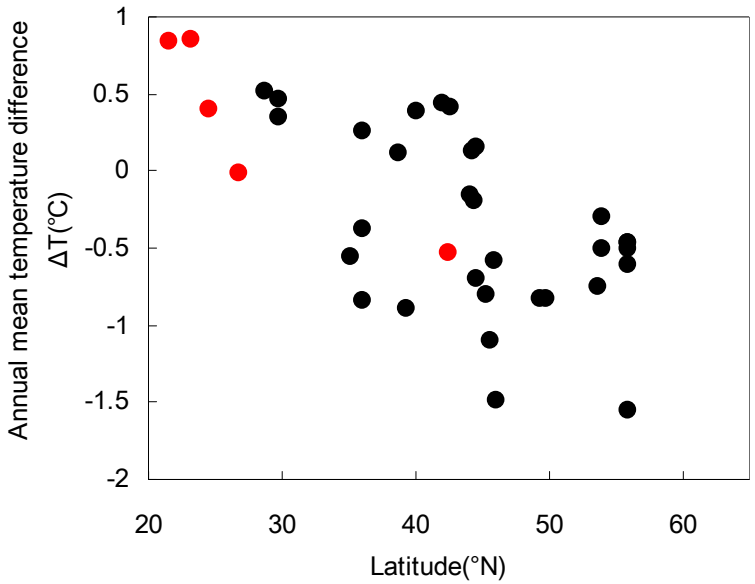


Fig. 11 Change in ΔT with Latitude in North America (black circle) and Eastern China (red circle).

6. Works in future

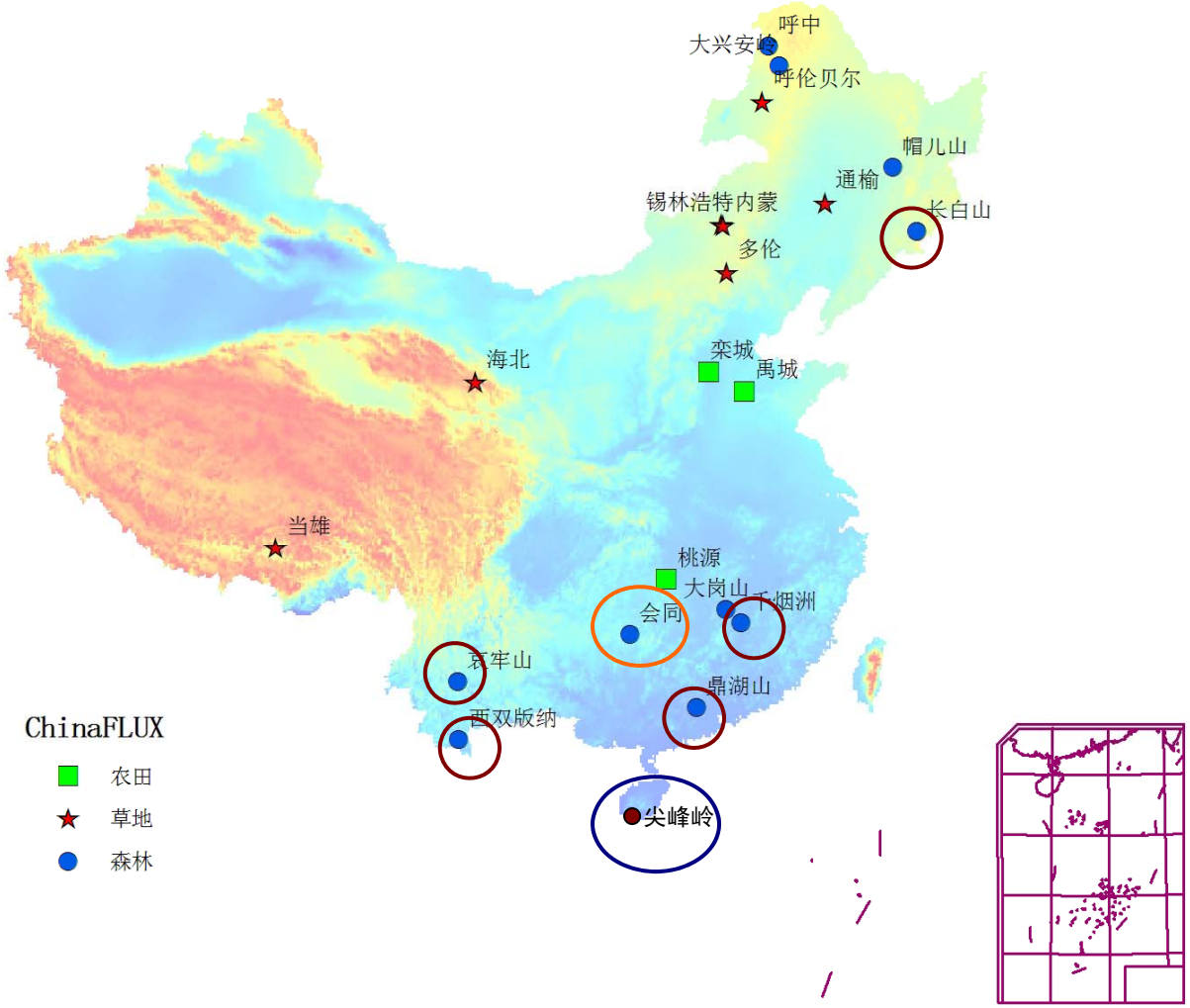


Fig.12 Sites distribution in China.

6. Works in future

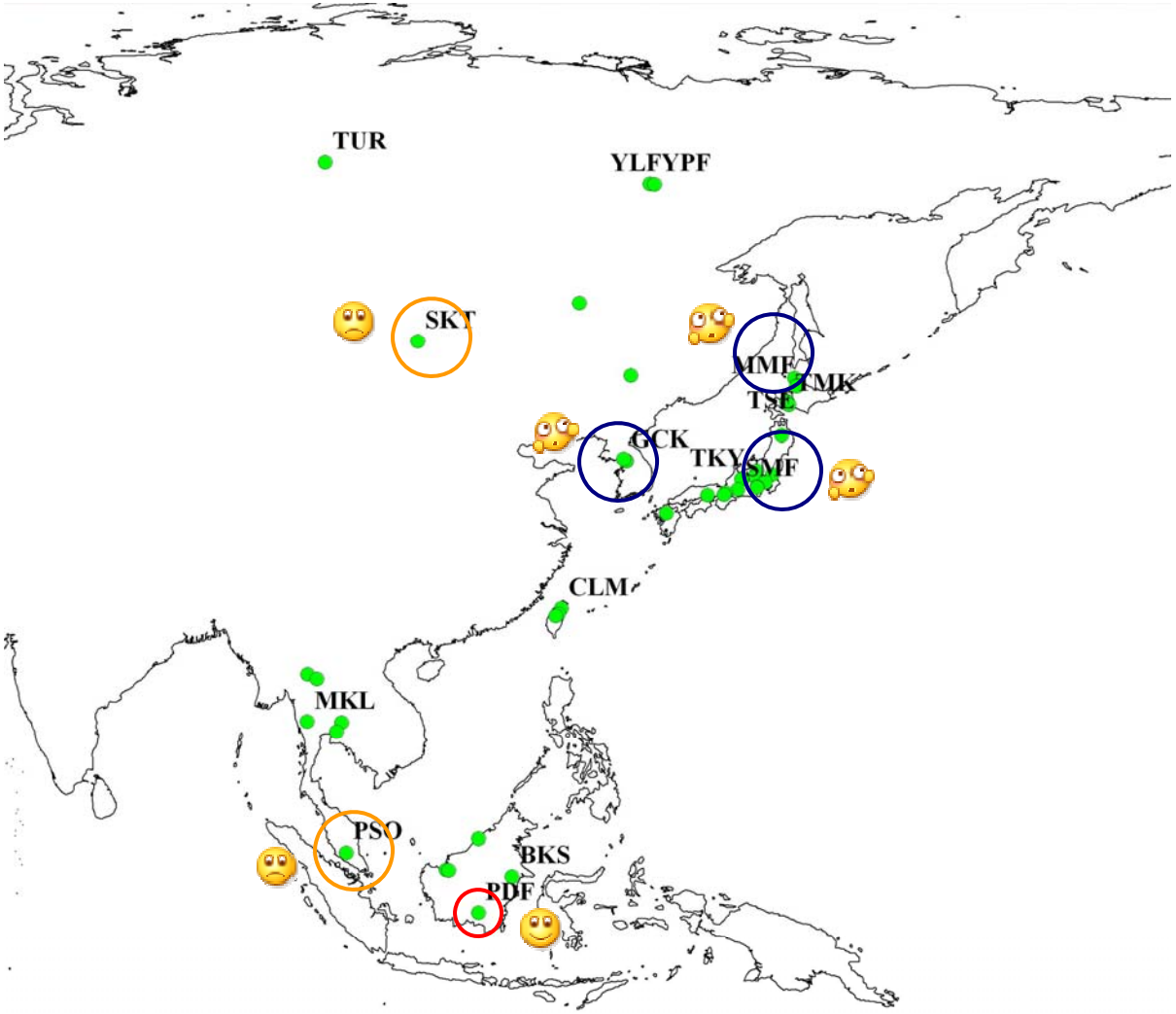


Fig.13 Forest sites distribution in Eastern Asia

6. Works in future

- What is the intrinsic feedback mechanism that would be uncover by difference between model simulation and field observation?

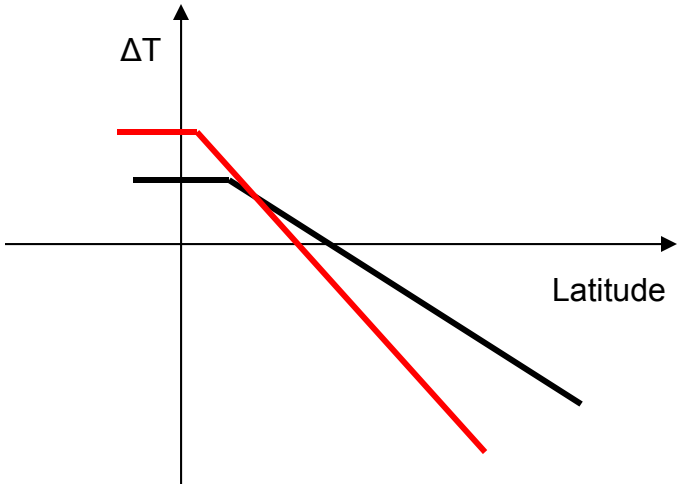


Fig.14 Schematic figure of comparison between model simulation (red line) and field observation (black line)

6. Works in future

- Is the effect of deforestation in coniferous forest same to broadleaved forest?

- How does difference of DRT between forest and in adjacent open land vary with Latitude?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