


Temporal-spatial Characteristics of **Surface Dry/Wet Status** for **Growing Season** in Northeast China **by NCAR/CLM3.5**

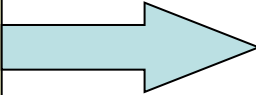
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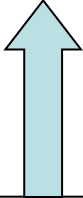
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- **Background**
 - **Data**
 - **Results**
 - **Conclusions**

Research Background

- ✓ **Climate variability**
- ✓ **Regional/Local responses to Global warming**
- ✓ **Human induced Land Use and Land Cover Change(LUCC)**
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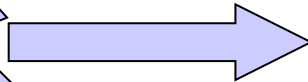
indicating the comprehensive impacts of natural and human factors



Surface Dry/Wet Condition



ET/P
P: precipitation
ET: Evapotranspiration



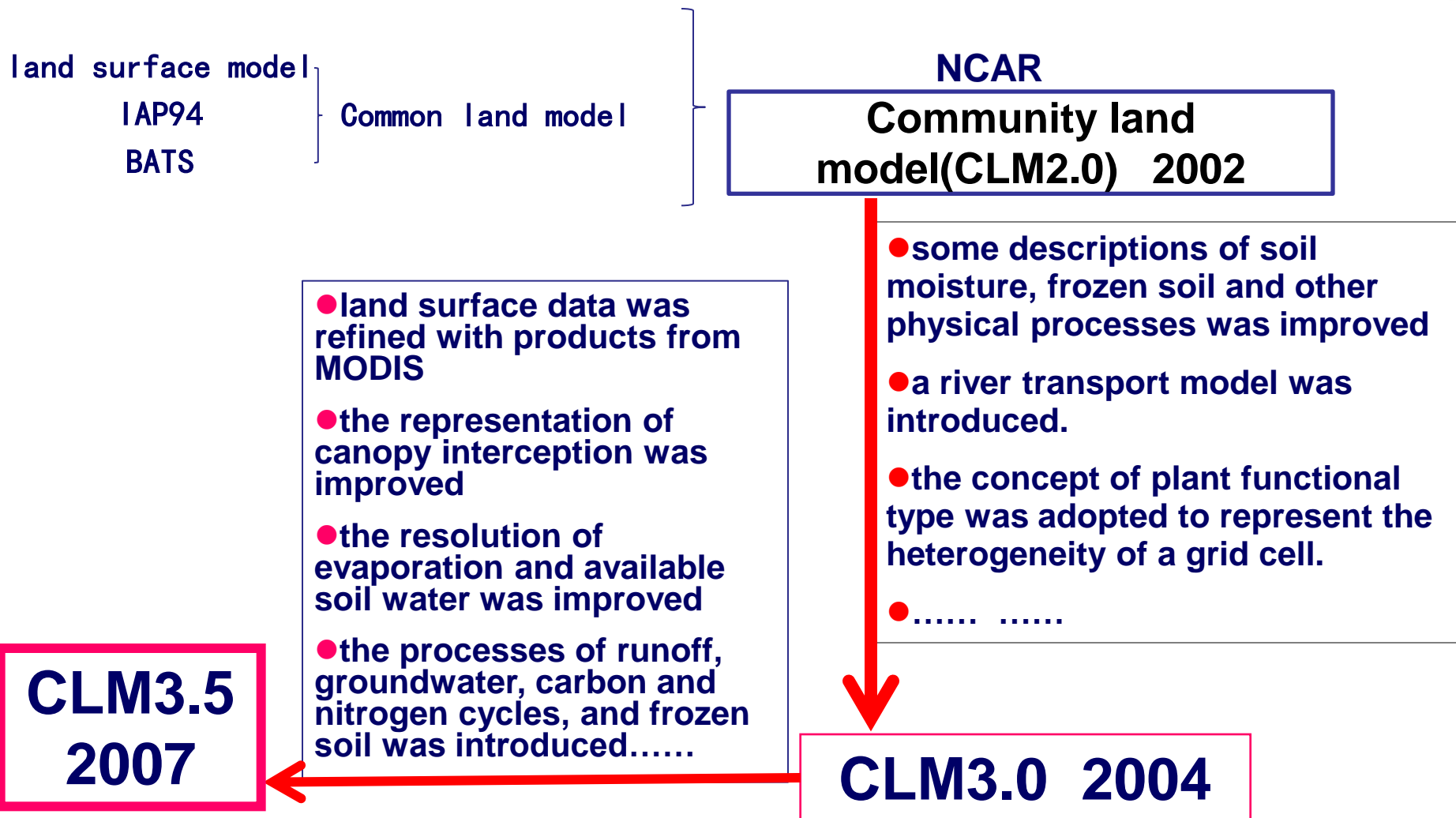
Evapotranspiration

Direct observation: Evaporation Pan,
Weighting Lysimeter...

Indirect observation: Bowen ratio energy
balance method(BREB), Eddy covariance
method(EC)...

Model Estimation: Penman-Monteith model,
Thornthwaite model, Selianinov models...

Simulation of ET by Land Surface Model



**Surface
observation from
weather stations
over Northeast
China**

**NCAR/
CLM3.5**

**High-resolution
(time, space)
atmospheric forcing
datasets**

drive

**Land Surface
Model**

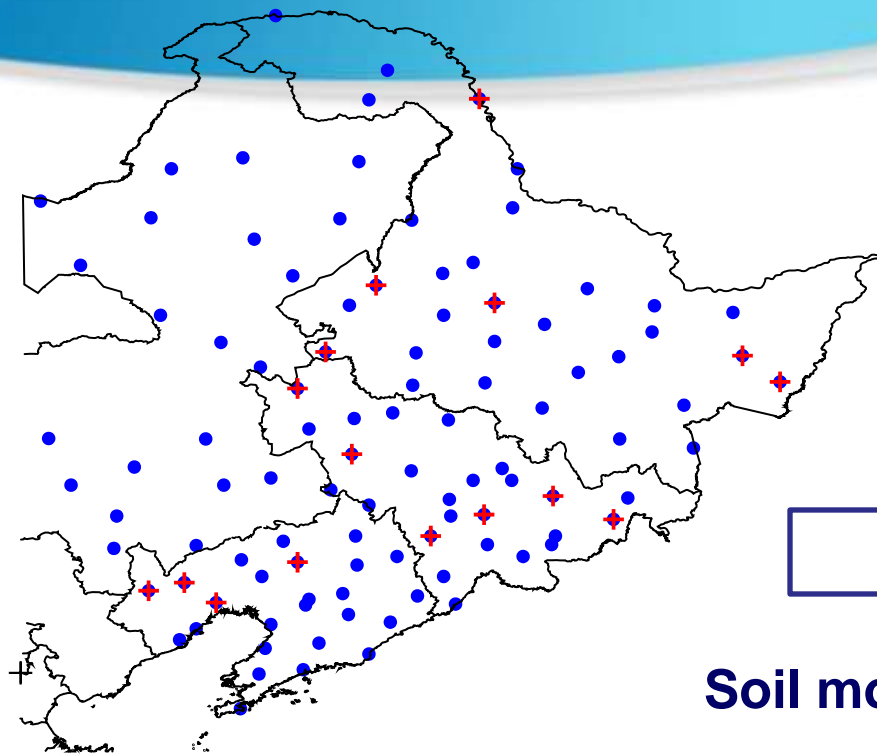
**Simulated historical land
surface products**

output

**Simulated
Evapotranspiration**

Original Data

102 stations in Northeast China (51-06)



Northeast China

Temperature

humidity

pressure

wind speed

Precipitation

0000, 0006,
0012, 0018UTC
daily max and
min

0000, 0012UTC

16 SM stations

Soil moisture generally on the 8th, 18th and 28th
of each month (1983-2002)

Forcing data

3-hourly and 0.25° resolution,
1951-2006

Princeton's
dataset with
1° resolution

downward solar radiation
(0.25°)

land surface data:

The **default data released in CLM3.5**, which includes:

- ✓ topography
- ✓ soil properties
- ✓ plant functional types
- ✓ a vegetation physiological parameter
- ✓ land use

Surface Water Surplus (SWS, unit: mm) :

$$SWS = P - ET$$

ET: evapotranspiration (mm) from model output;

P: precipitation (mm) from observation.

sws↑ water reservation on the surface for redistribution ↑ **surface wetter**

sws↓ water reservation on the surface for redistribution ↓ **surface dryer**

soil water storage (Q_i , unit: mm):

$$Q_i = W_i \times D_i \times H$$

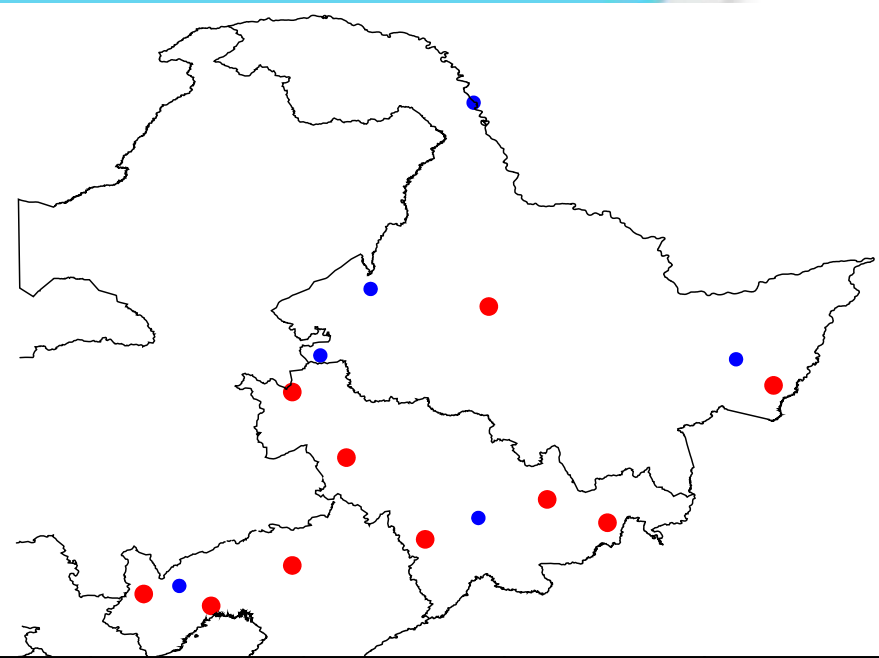
W_i : soil moisture (%) ;

D_i : soil bulk density (g/cm³) ;

H : soil thickness (mm) ;

i : soil layer from 0-50 cm.

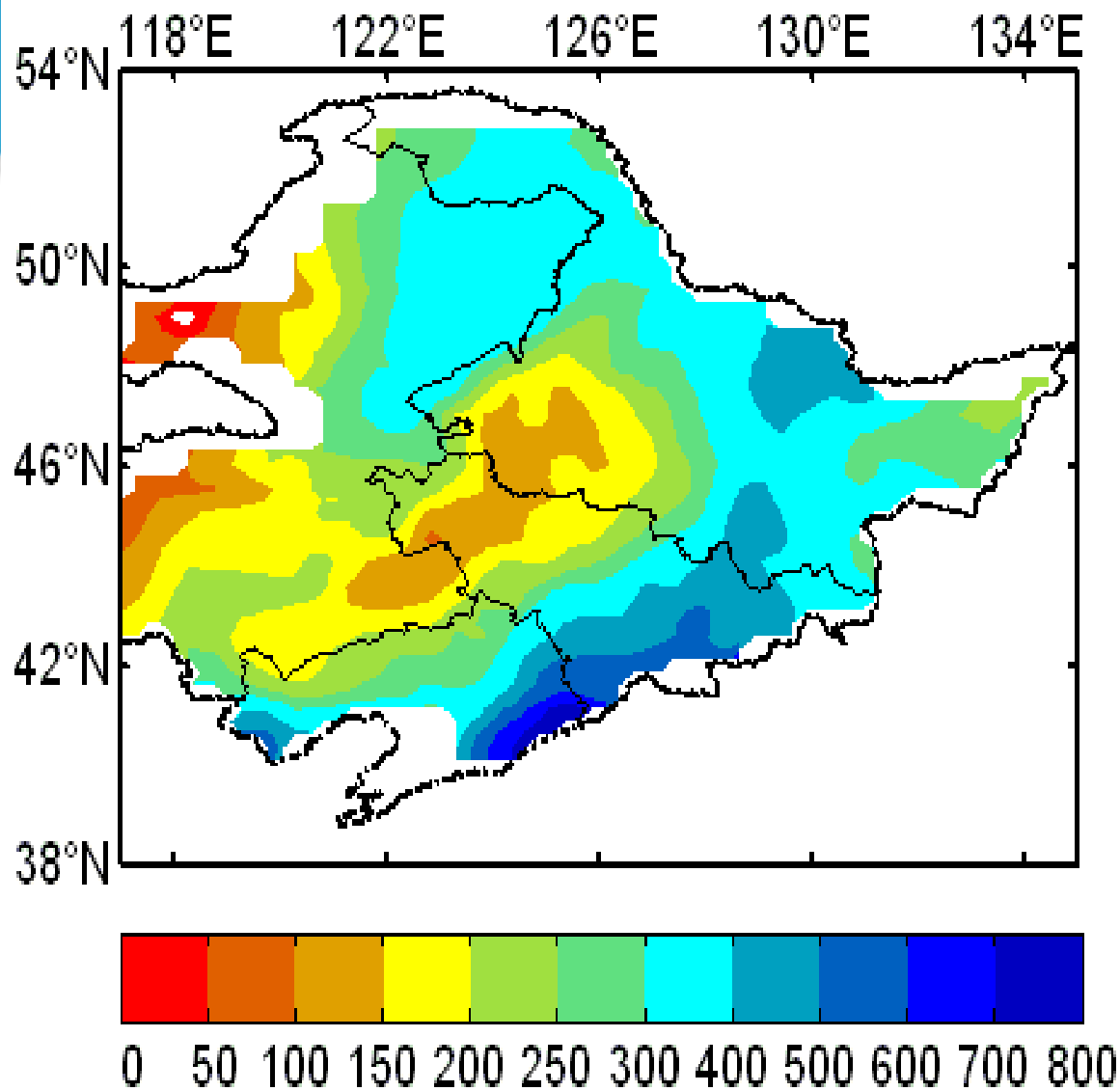
Correlation between Surface Water Surplus (SWS) in growing season (May to Sep.) and soil water storage (0-50cm) (red is above 95% confidence level)



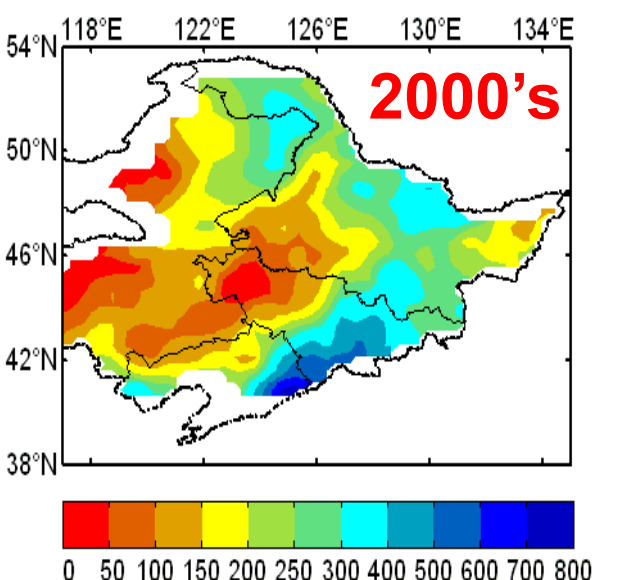
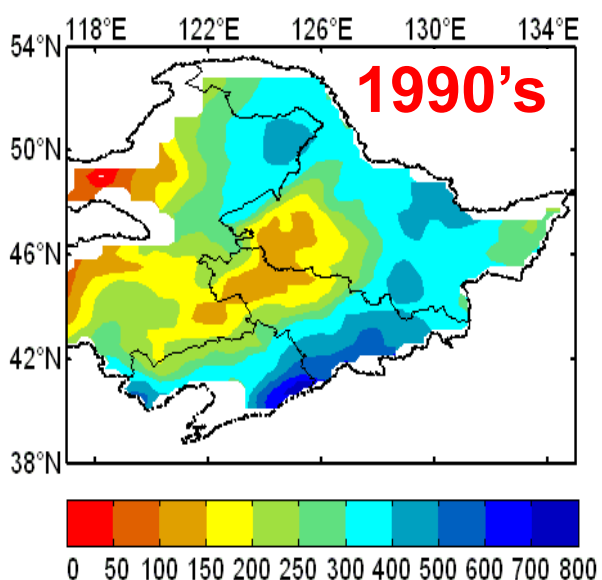
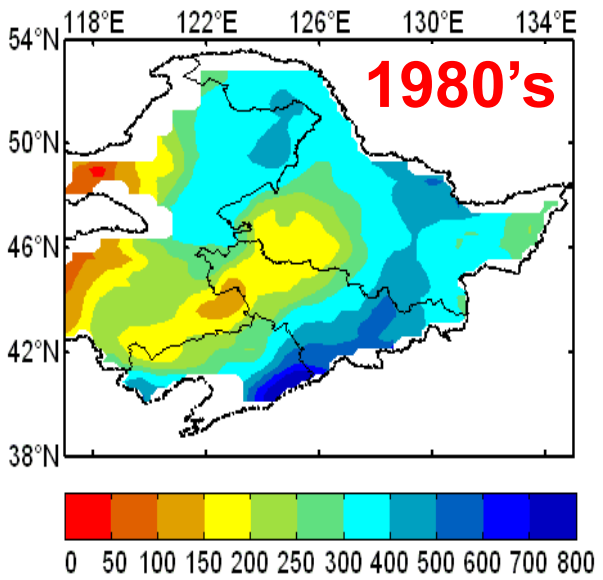
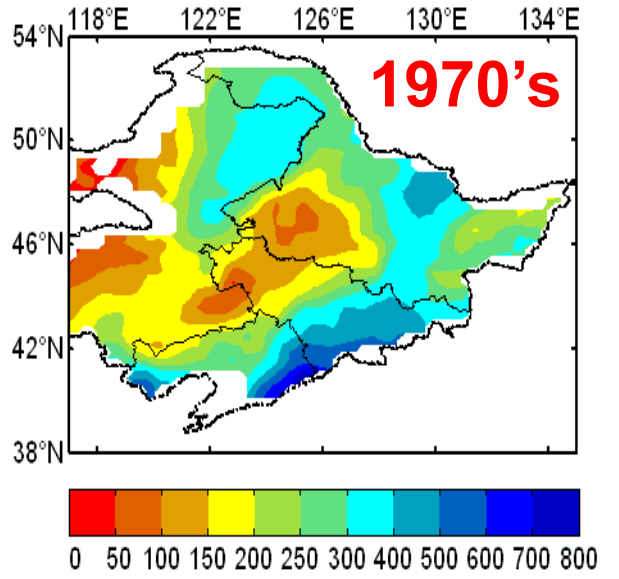
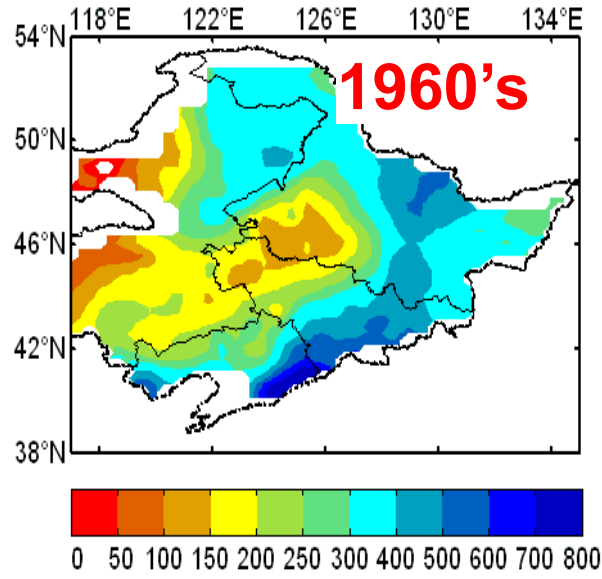
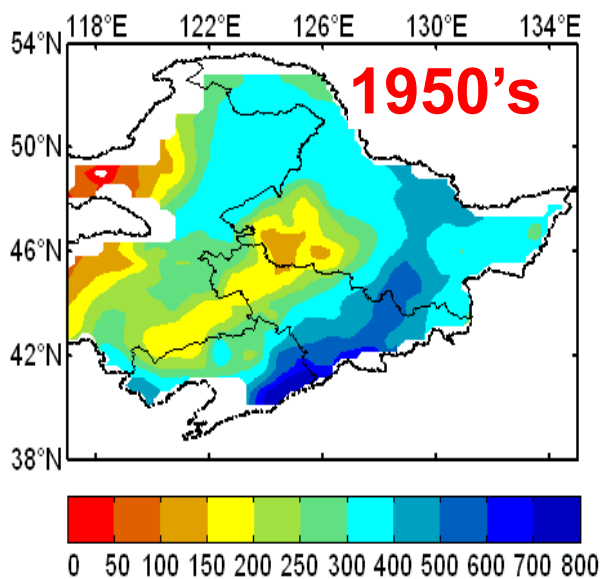
Ratio: 10/16

Station NO.	50936 白城	54049 长岭	54186 敦化	54266 梅河口	54273 桦甸	54292 延吉	54324 朝阳	54326 叶柏寿
May-Sep.	0.5018	0.4577	0.5277	0.5004	0.4136	0.6768	0.3156	0.5536
Station NO.	54333 新民	54337 锦州	50353 呼玛	50742 富裕	50756 海伦	50844 泰来	50888 宝清	50983 虎林
May-Sep.	0.6609	0.6238	0.3042	0.1914	0.5264	0.0267	0.3645	0.7942

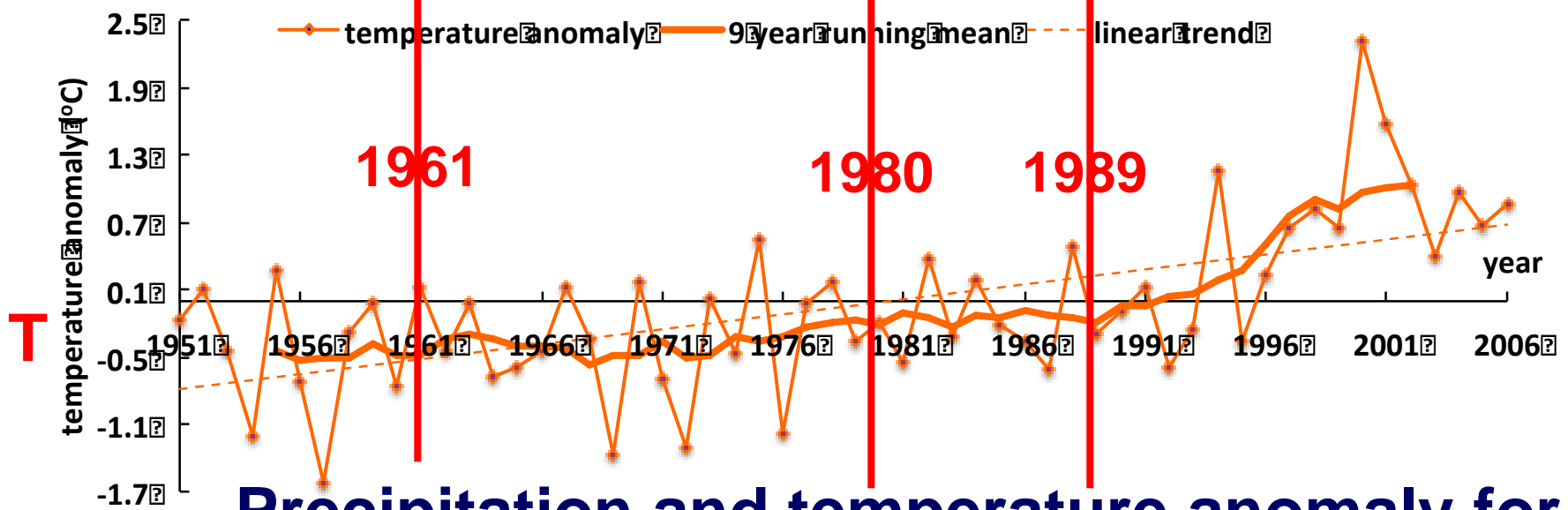
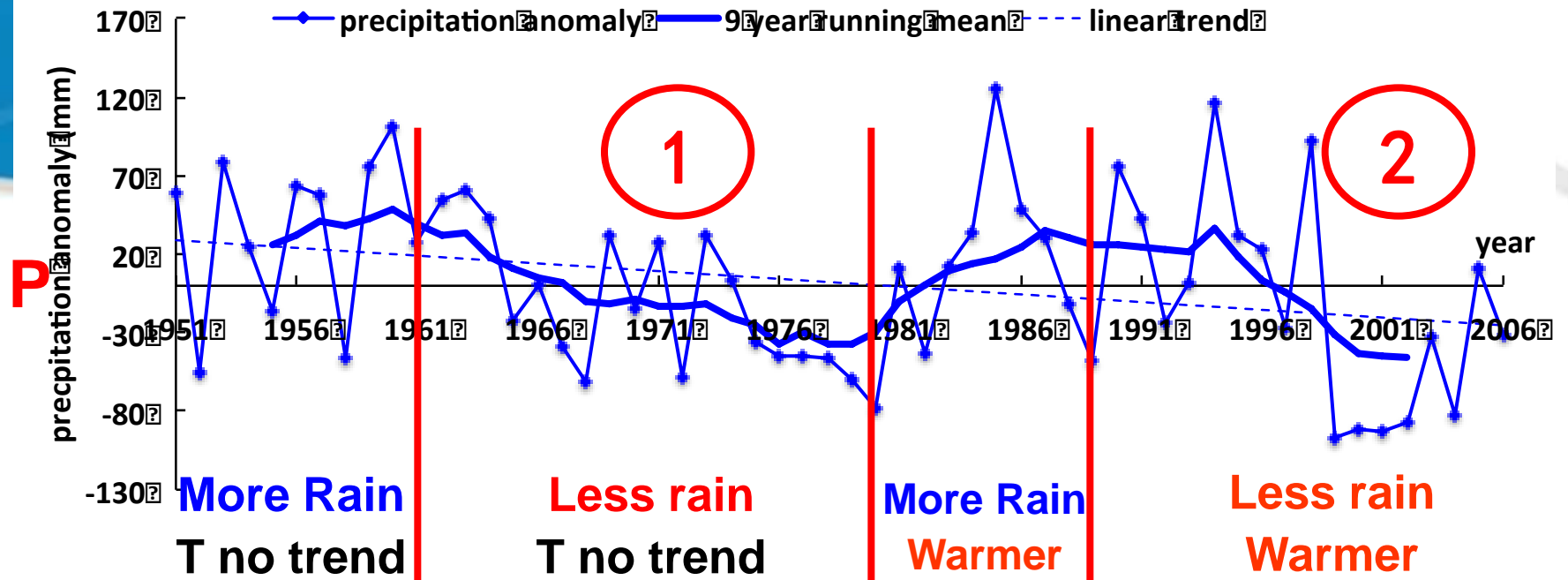
SWS (P-ET) can indicate the surface dry/wet condition for growing season in some extend



The spatial distribution of mean SWS (mm) in growing season in 1971-2000 over Northeast China



SWS change in growing season (May-Sep) in each decade of 1951-2006 over Northeast China



Precipitation and temperature anomaly for growing season in 1951-2006

- **By using the simulated ET in CLM 3.5, P-ET (SWS) can be used to represent the surface dry/wet condition in Northeast China**
- **In growing season, 30 year (1971-2000) averaged SWS has relatively large spatial difference. Higher SWS (wet) is located over eastern, southern and northern parts of northeast China dominated by forest and grassland; Lower SWS(dry) is located in central and western part, which is the traditional agriculture areas**
- **The declining of SWS showing the clear drying trend of surface condition in past 50 years in Northeast China. Comparing the drying periods of 1970's and 2000's, temperature is becoming the key factor influencing the surface condition of the region after 2000.**



Thank you!