# Sensitivity analysis of SOC of arable land to temperature raising and the impacts of climate change on its stock in China

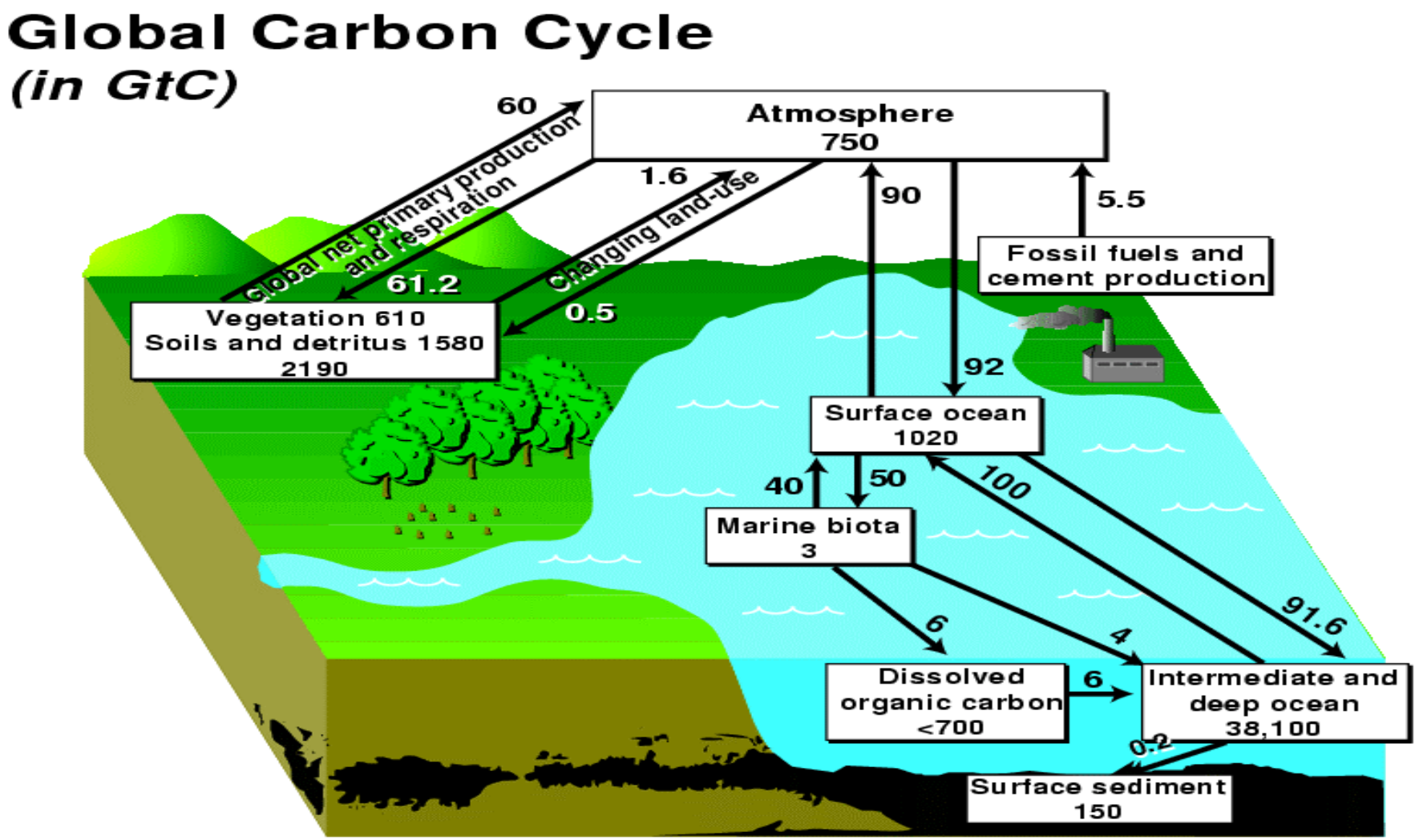
**Chengyi Zhang**
National Climate Centre
China Meteorological Administration
2008.4.15

中国气象局 国家气候中心
National Climate Center
China Meteorological Administration

# Objectives:

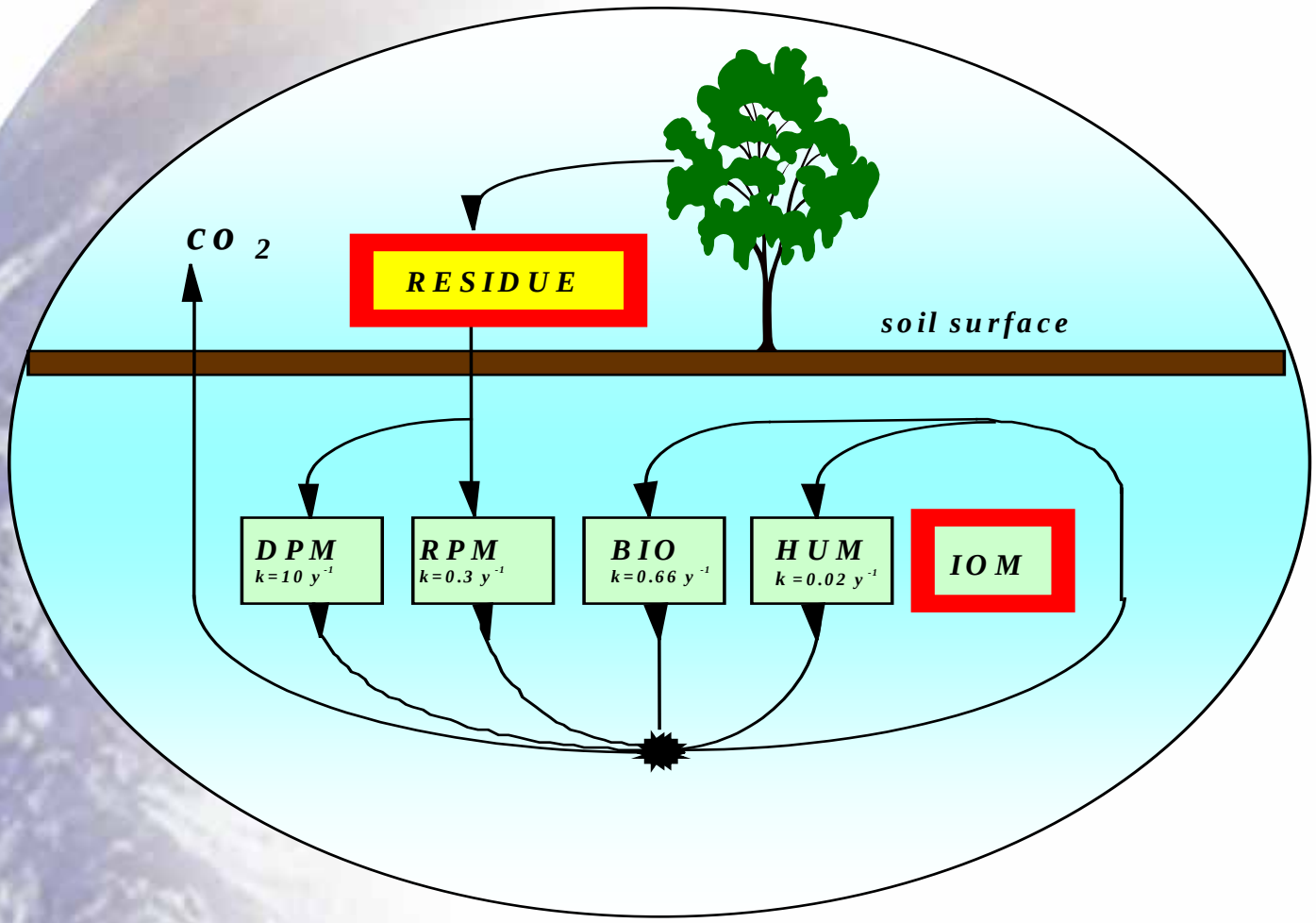
- Sensitivity of Organic Carbon of Arable Soil to Temperature Raising
- Impacts of Climate Change on SOC Stock of Arable Land in China and its feedback

- Exchange between atmosphere and terrestrial ecosystems



- Carbon exchanges between atmosphere and land will be strongly influential in determining future climate change
- The strength of the exchange is very uncertain relevant to its storage
- Human activity has a very much perturbation upon the exchange in both directions

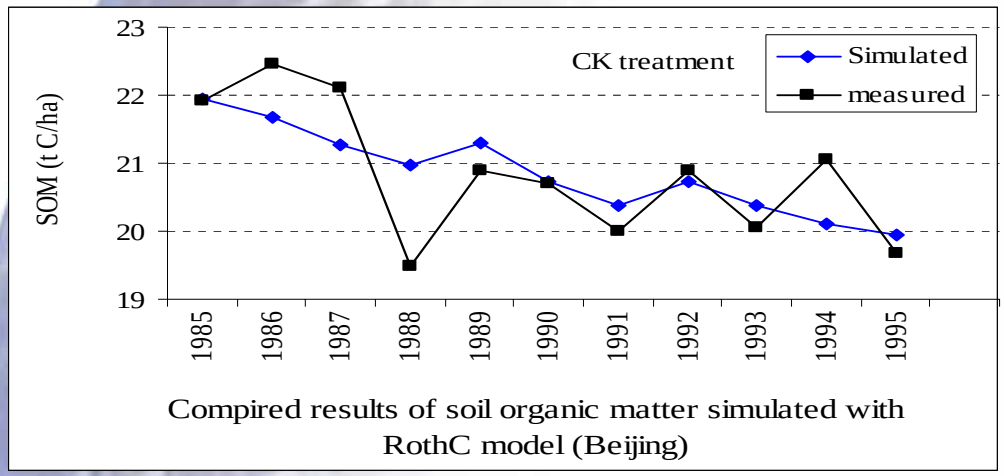
# Carbon Exchange between Soil and Atmosphere




Sensitive to Climate change ?

# Calibration of RothC model in northern China

## Purpose: Verifying the fitness of simulations

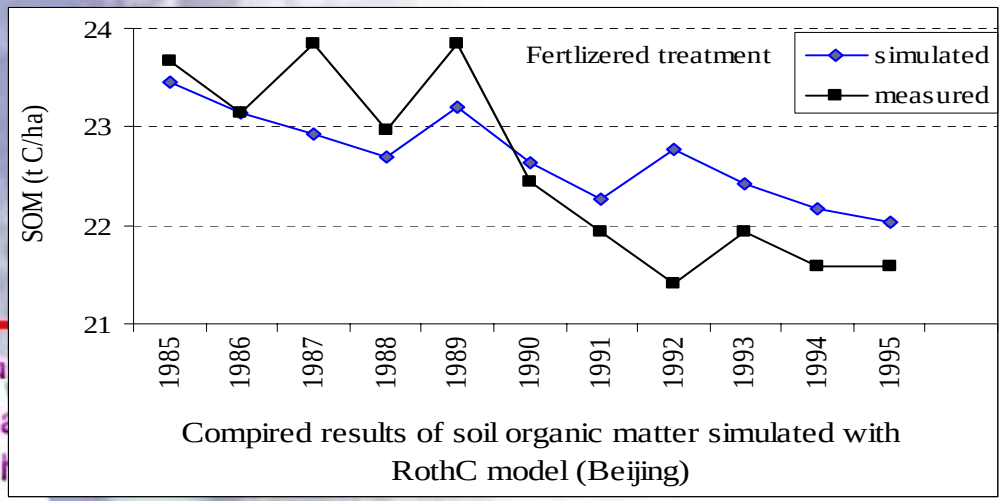



Compired results of soil organic matter simulated with RothC model (Beijing)

r =0.7174*, t = 3.0891

No fertilizer or manure applied

($r_{0.05}$=0.423, $t_{0.05}$=2.09)




Compired results of soil organic matter simulated with RothC model (Beijing)

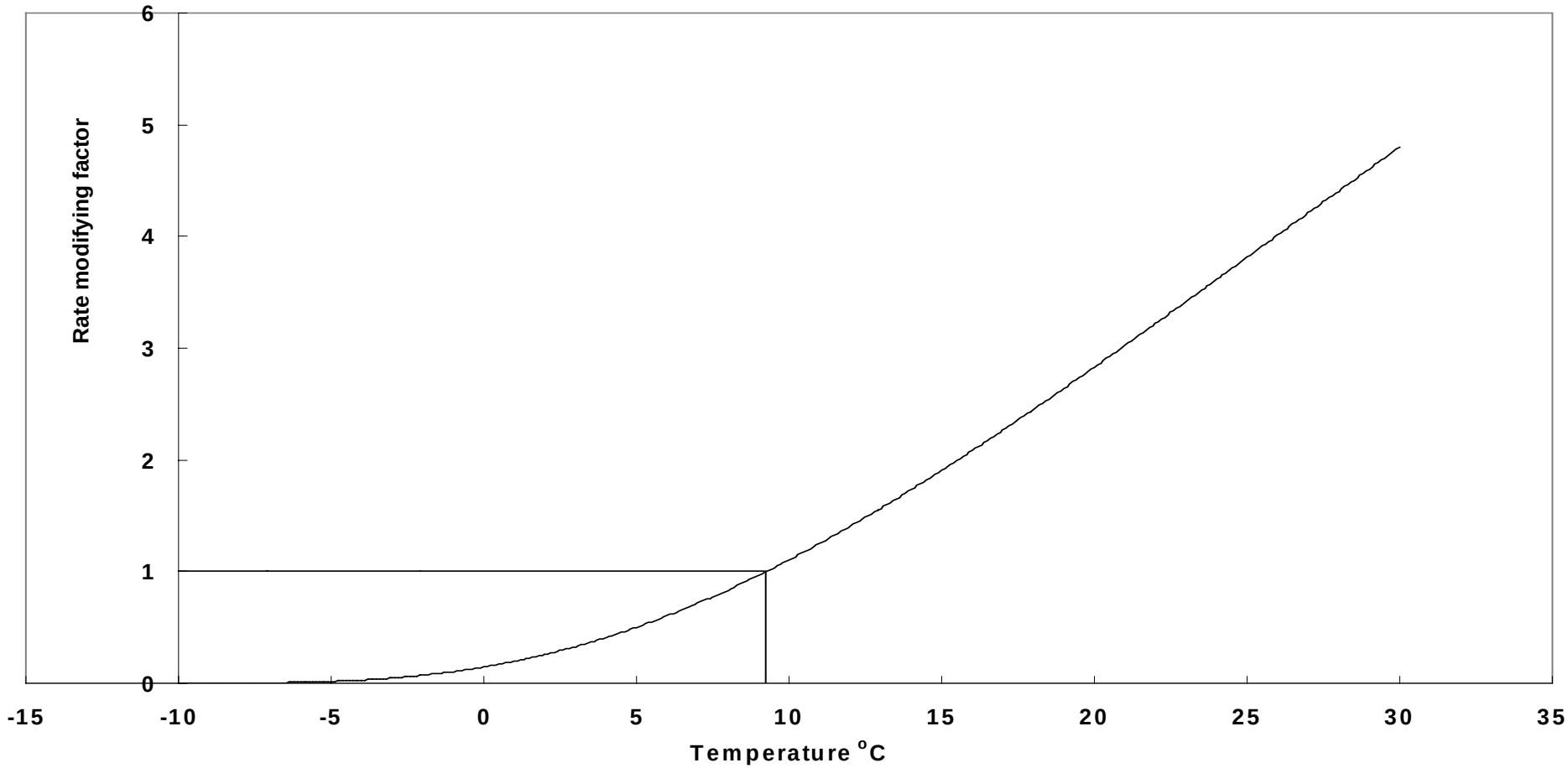
r =0.8251*, t = 1.3626

fertilizers applied

(r 0.05=0.423, t 0.05=2.09 )

$$Y_t = Y_0 \quad (1-e^{(-abckt)})$$

**The rate modifying factor for temperature**



# Monte Carlo Method (1)

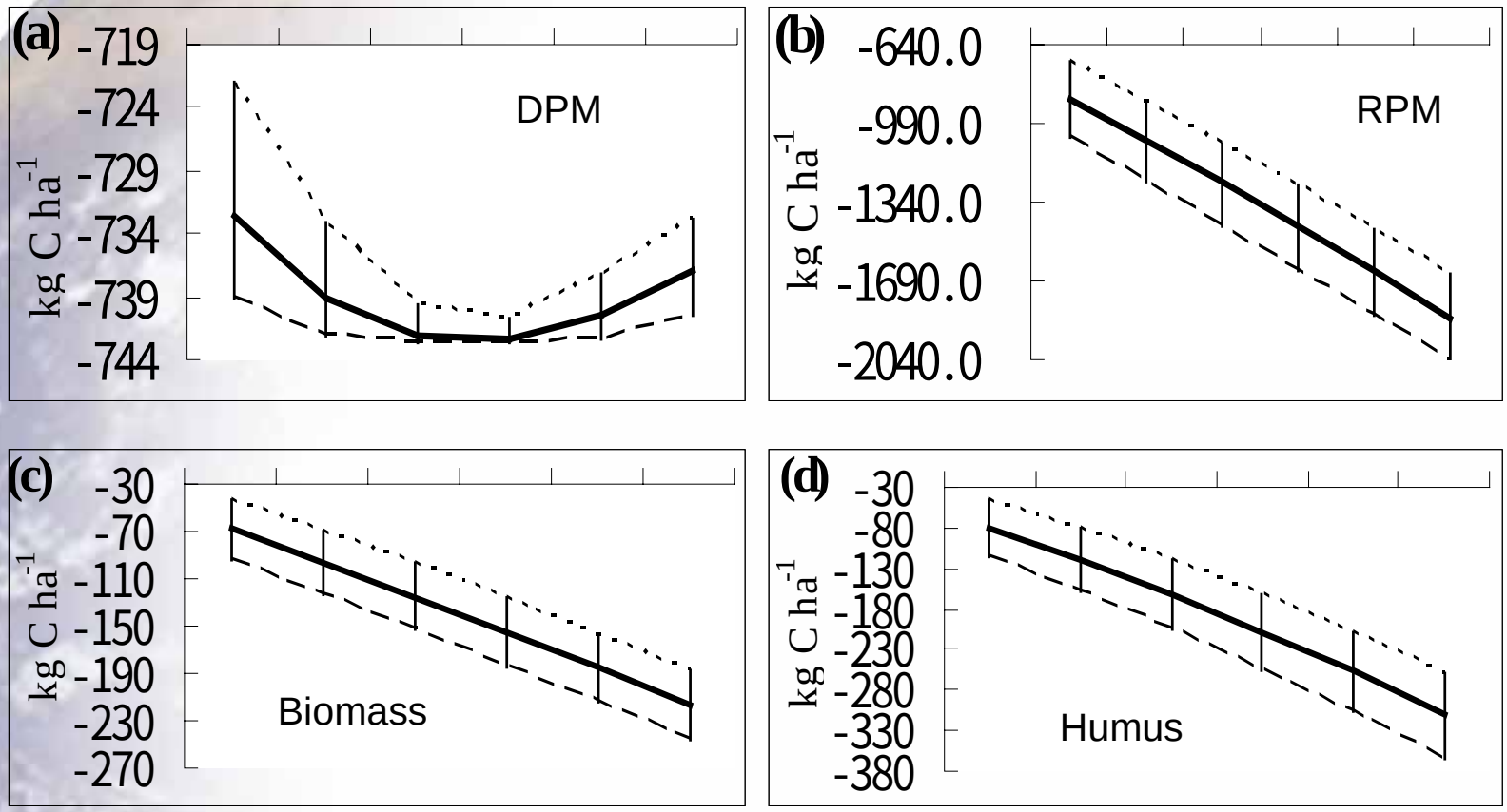
- The uncertainty is the range in which the output variable is distributed, caused by the distribution in the input factor(s).
- The sensitivity is the spread of the output distribution in relation to the spread of input distribution.
- A wide distribution in the output, caused by a low width in the input would suggest a high sensitivity; a narrow spread caused by a wide spread in the input would suggest a less sensitive input factor.

# Monte Carlo Method (2)

- Sampling method: (Latin Hypercube)
- Sampling size: (500 runs)
- Confidence leave: 95%
- Sensitivity coefficient:  SPEA

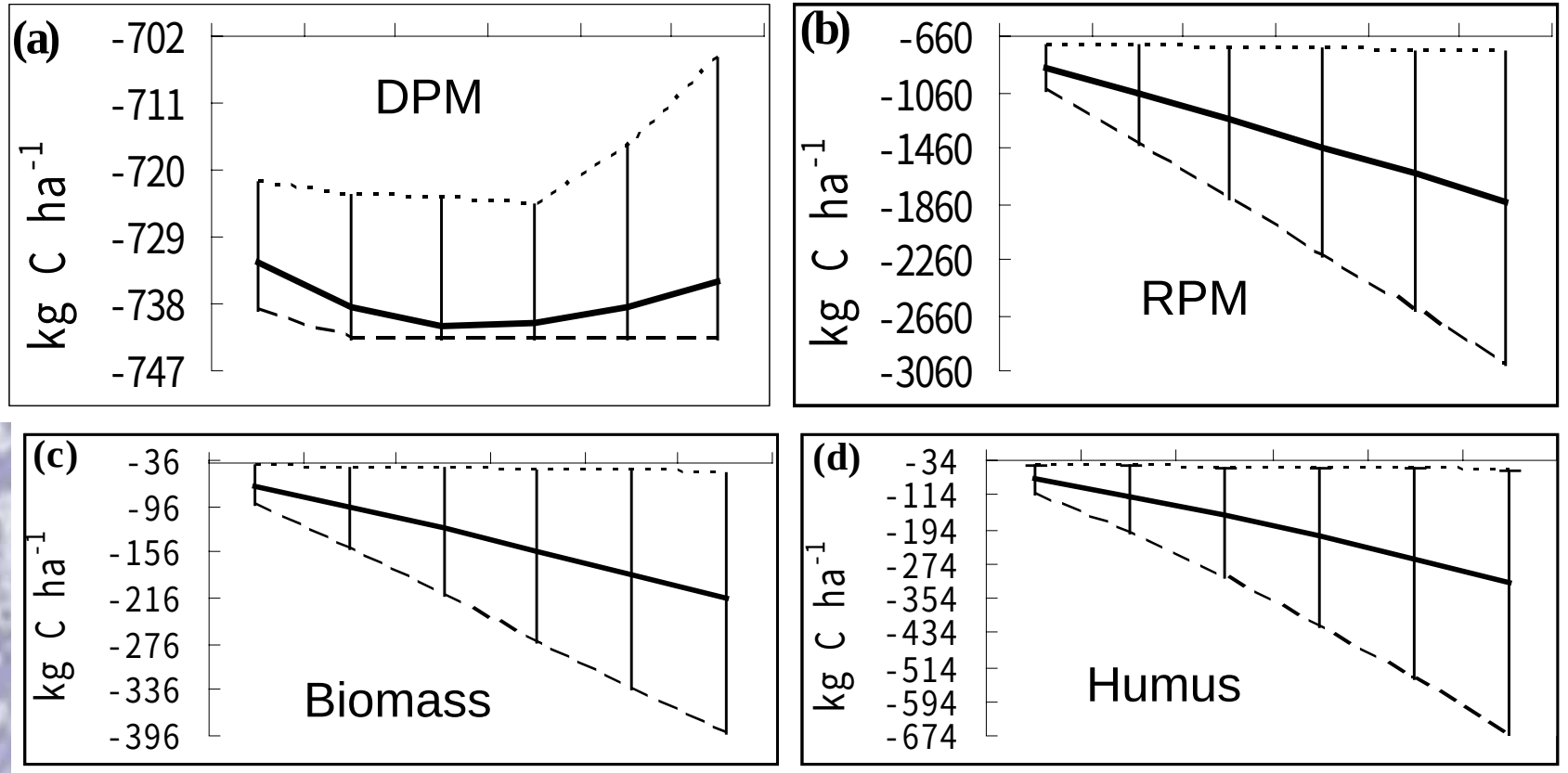
# Results (3) without variance

Winter Wheat



# Results (4) By enlarged variance

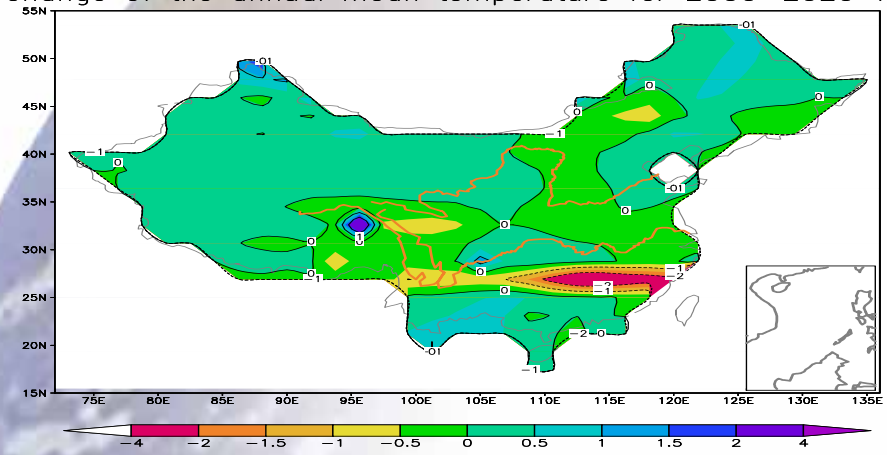
Winter Wheat



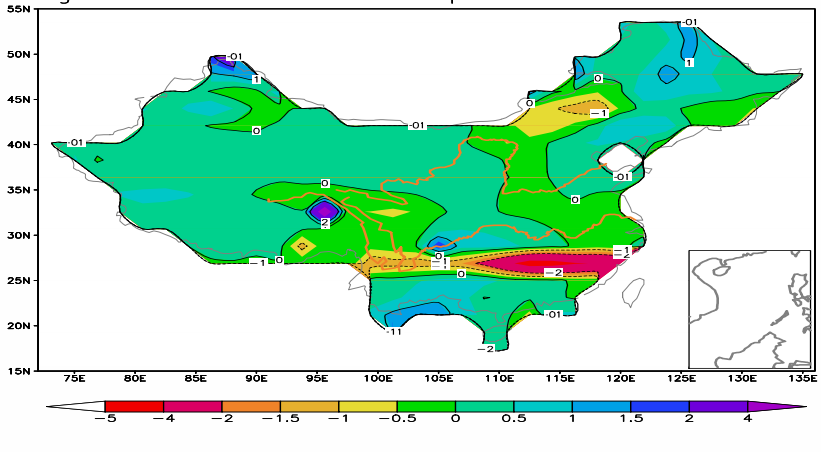
- Impacts of Climate Change on SOC Stock of Arable Land in China

# Temperature Changes for A2 Scenario

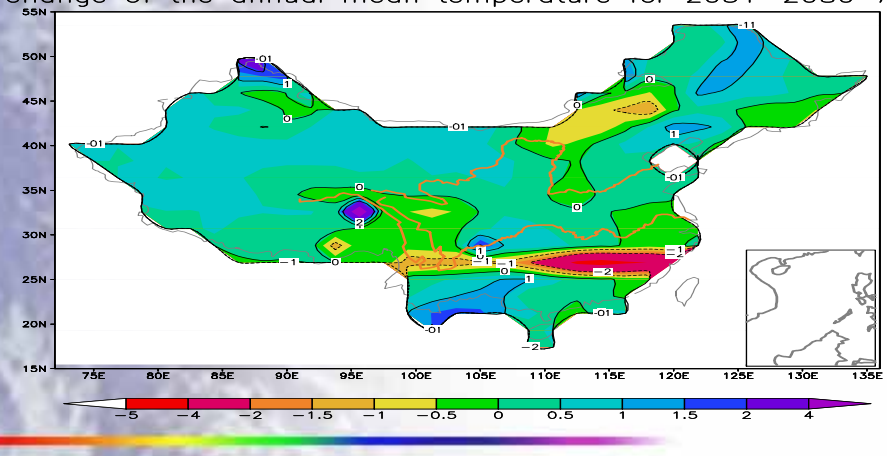
change of the annual mean temperature for 2000−2020−A2



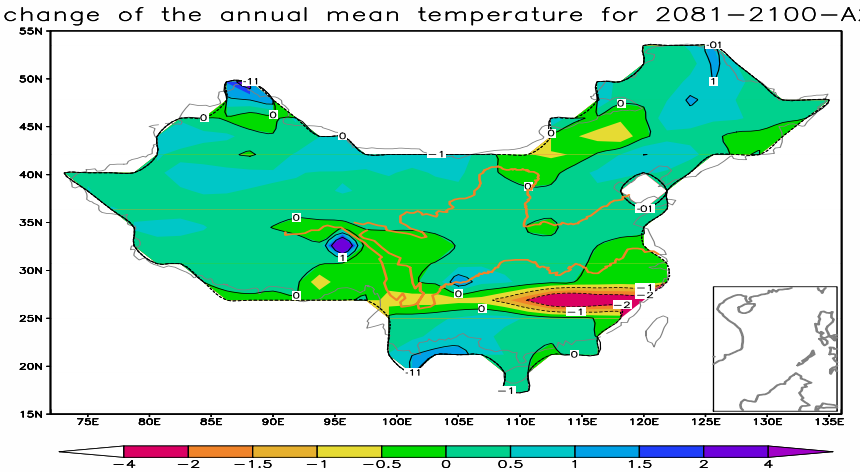

change of the annual mean temperature for 2021−2050−A2




change of the annual mean temperature for 2051−2080−A2

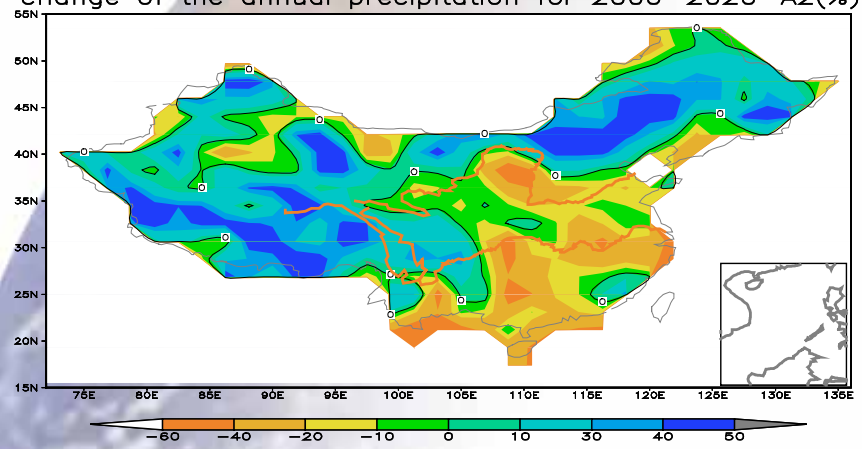



change of the annual mean temperature for 2081−2100−A2

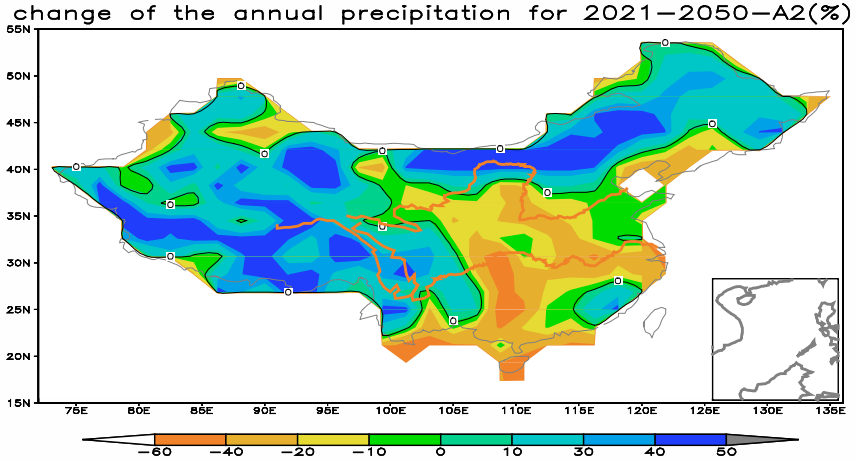


# Precipitation Change for A2 Scenario

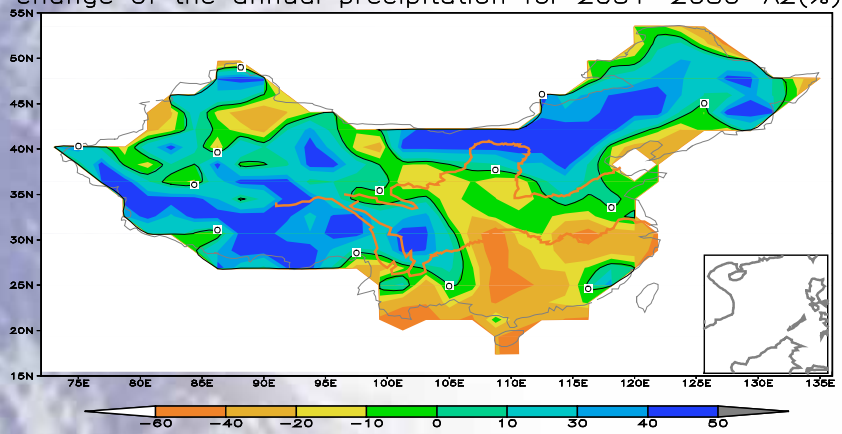
change of the annual precipitation for 2000—2020—A2(%)



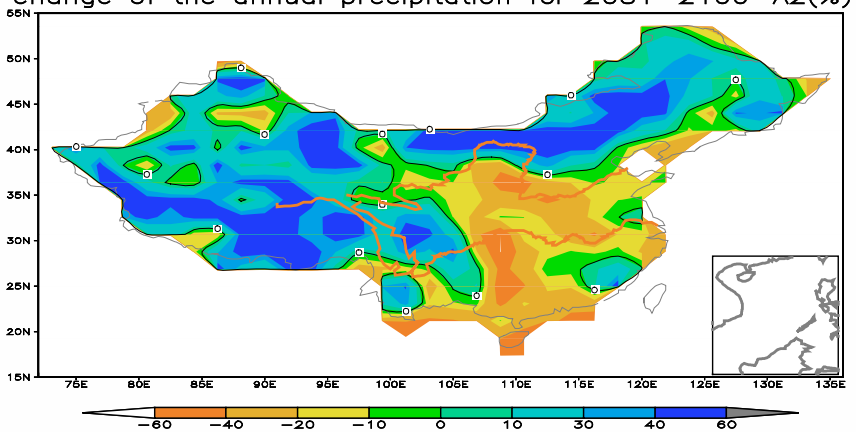

change of the annual precipitation for 2021—2050—A2(%)




change of the annual precipitation for 2051—2080—A2(%)

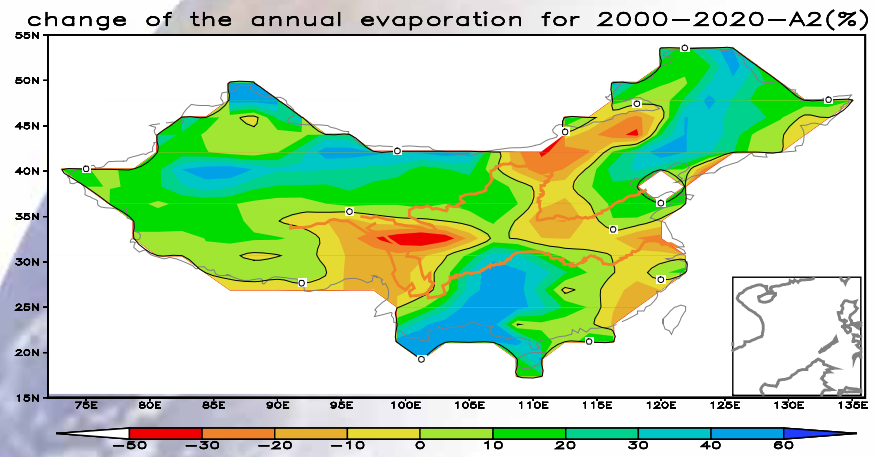


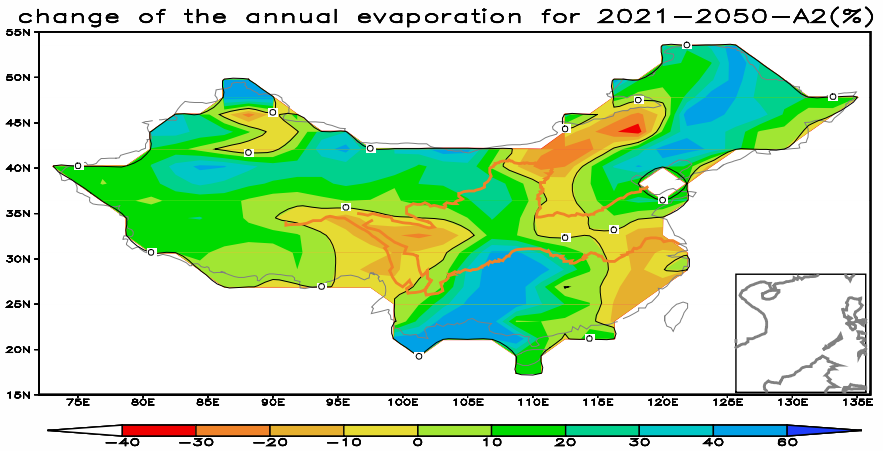

change of the annual precipitation for 2081—2100—A2(%)

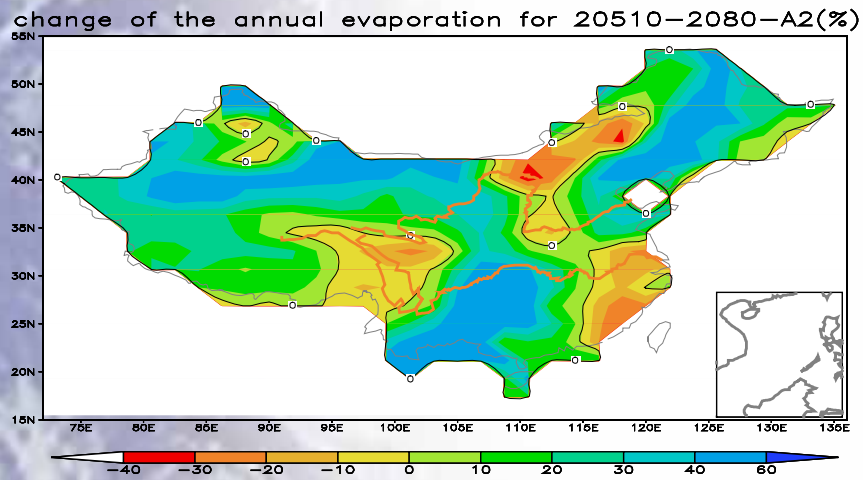


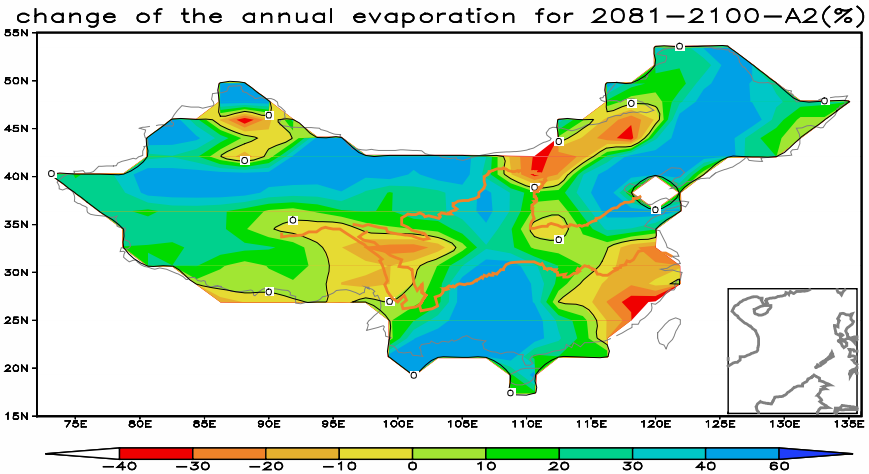

中国气象局 国家气候中心
National Climate Center
China Meteorological Administration

# Evapotranspiration Change for A2 Scenario



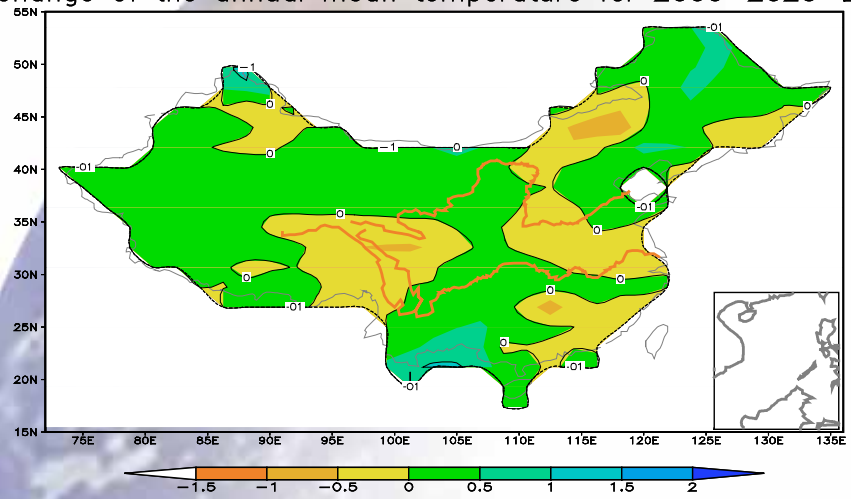



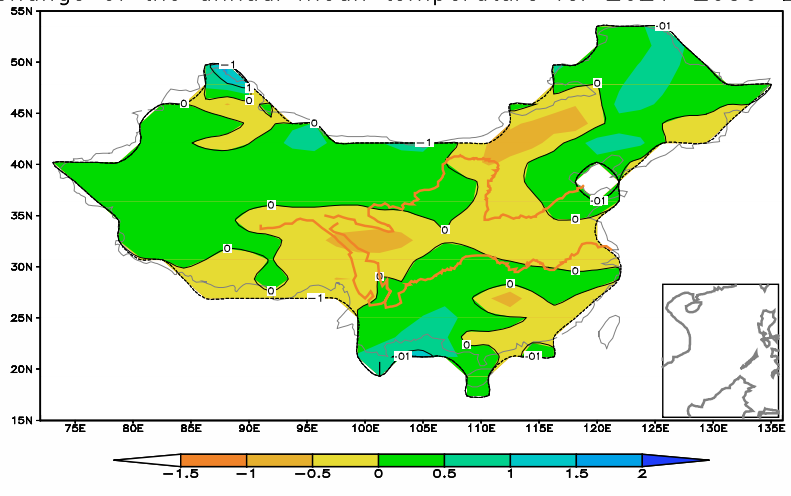



# Temperature Change for B1 Scenario

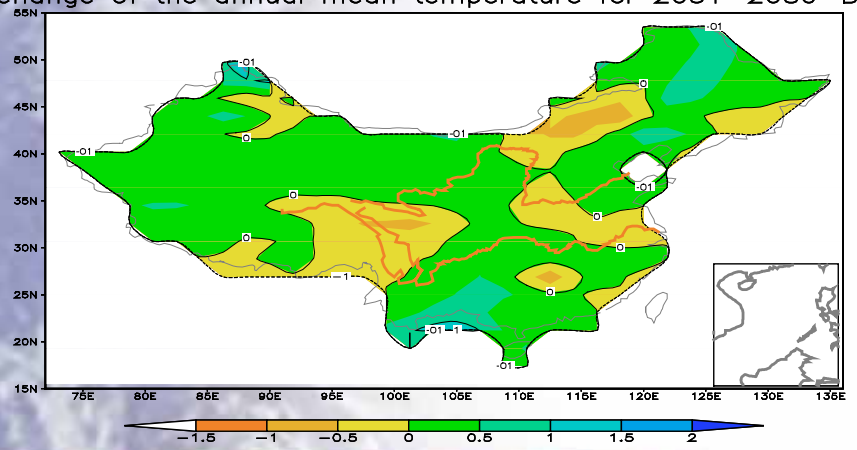
change of the annual mean temperature for 2000–2020–B1



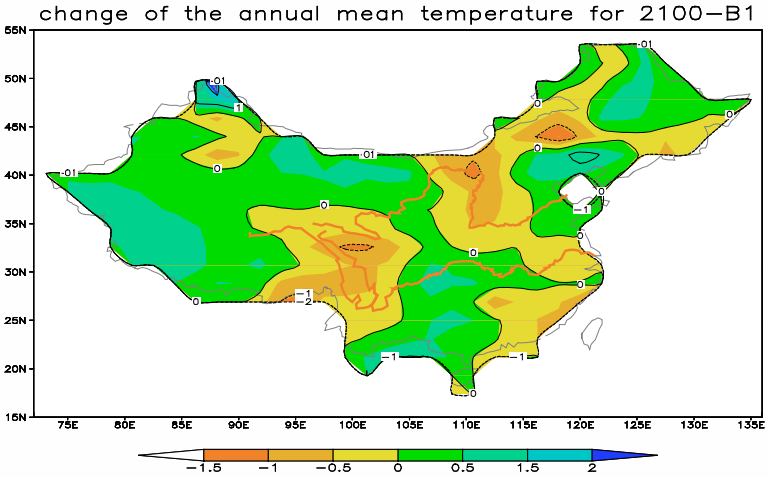

change of the annual mean temperature for 2021–2050–B1




change of the annual mean temperature for 2051–2080–B1



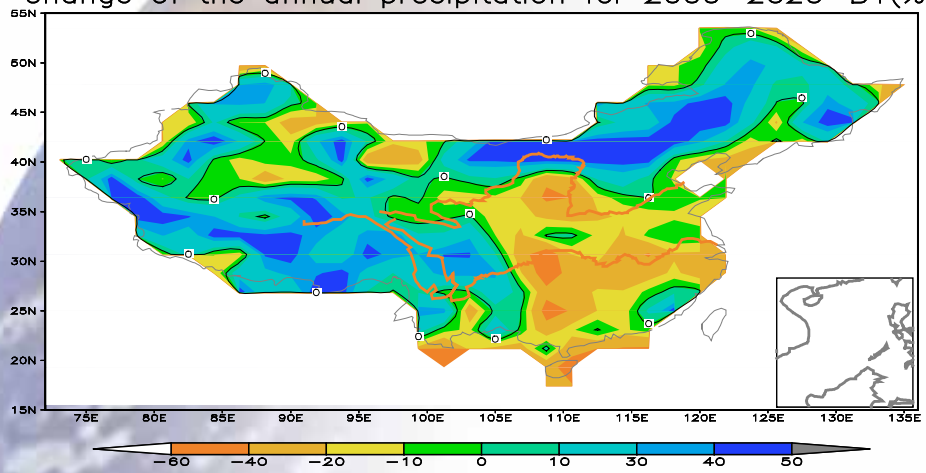

change of the annual mean temperature for 2100–B1



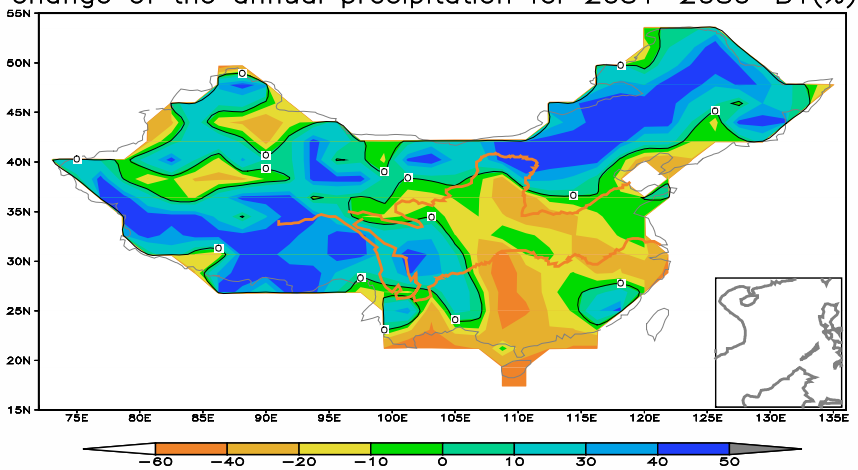

中国气象局 国家气候中心
National Climate Center
China Meteorological Administration

# Precipitation Change for B1 Scenario

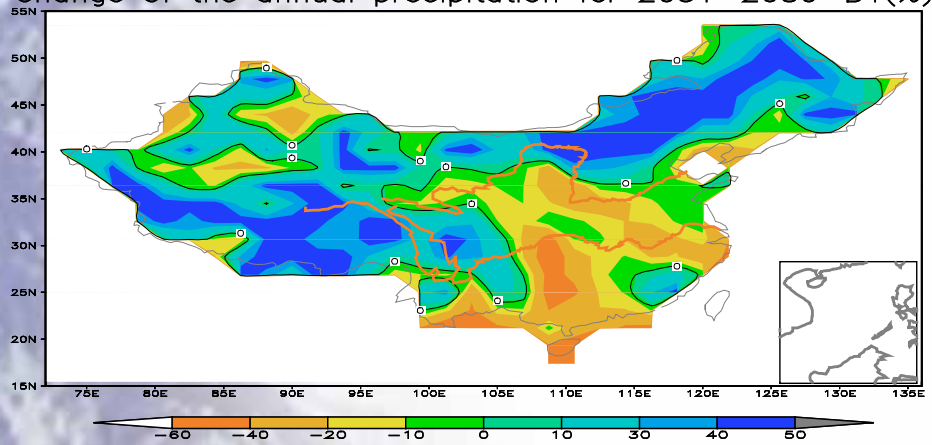
change of the annual precipitation for 2000—2020—B1(%)



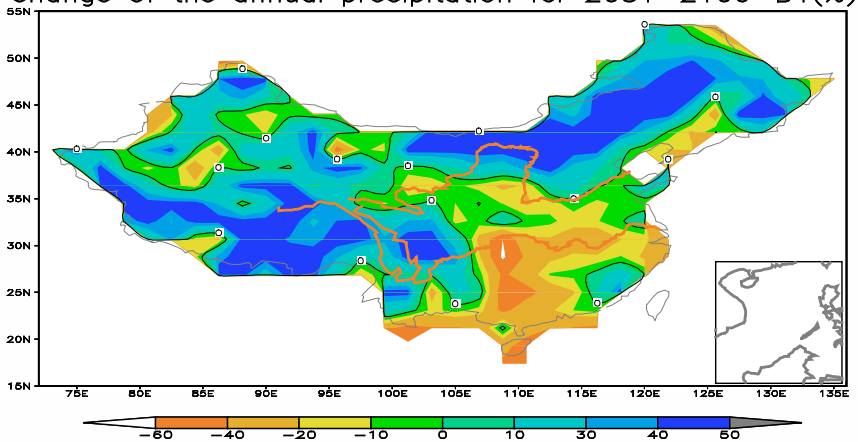

change of the annual precipitation for 2051—2080—B1(%)



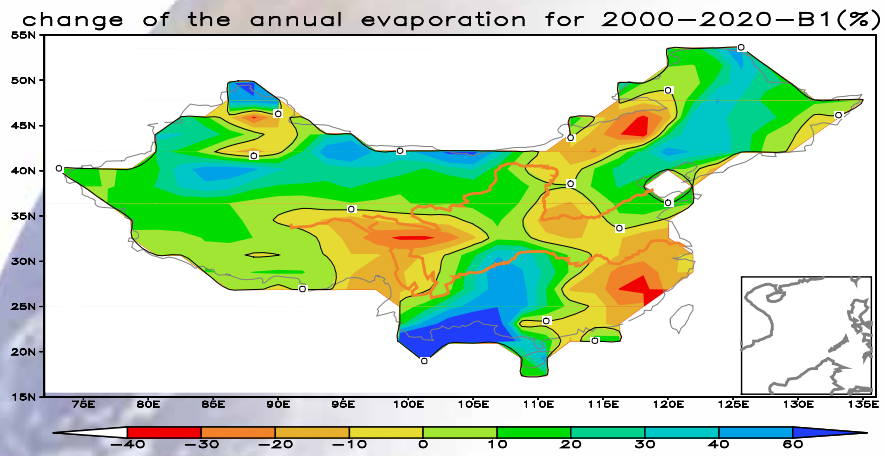

change of the annual precipitation for 2051—2080—B1(%)

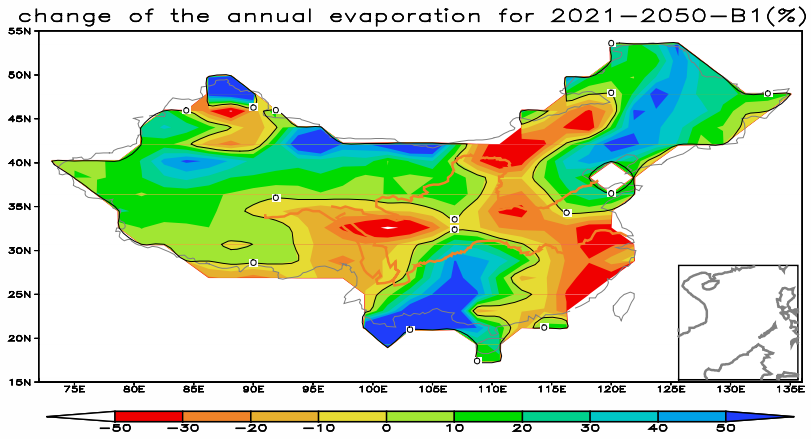


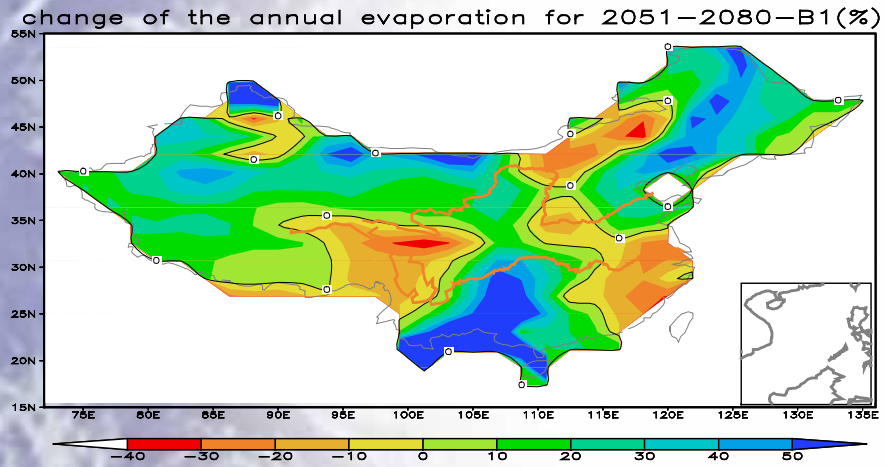

change of the annual precipitation for 2081—2100—B1(%)

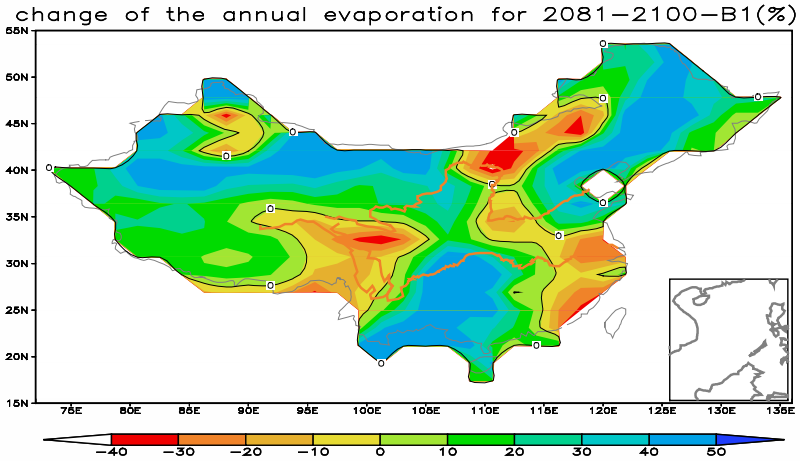


# Evapotranspiration Change for B1 Scenario



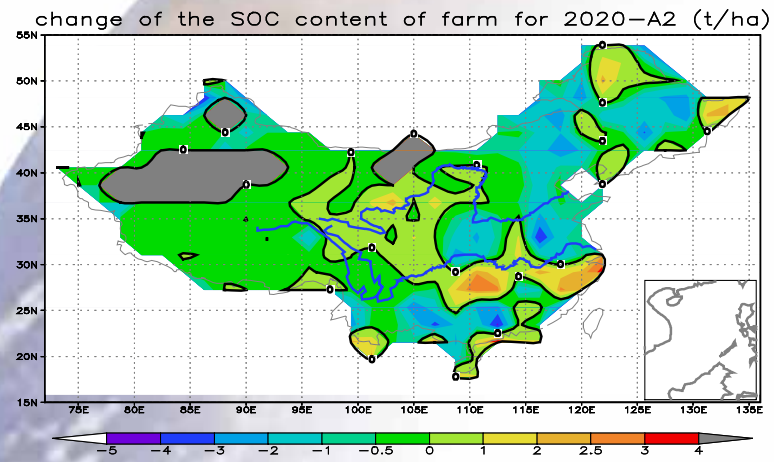



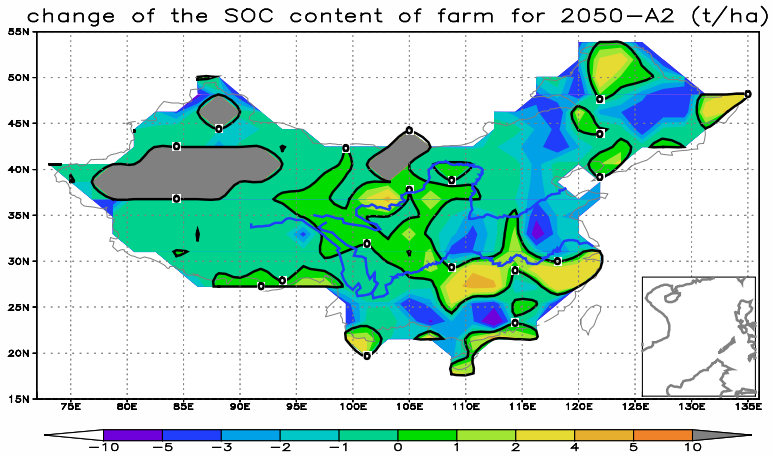

中国气象局 国家气候中心
National Climate Center
China Meteorological Administration

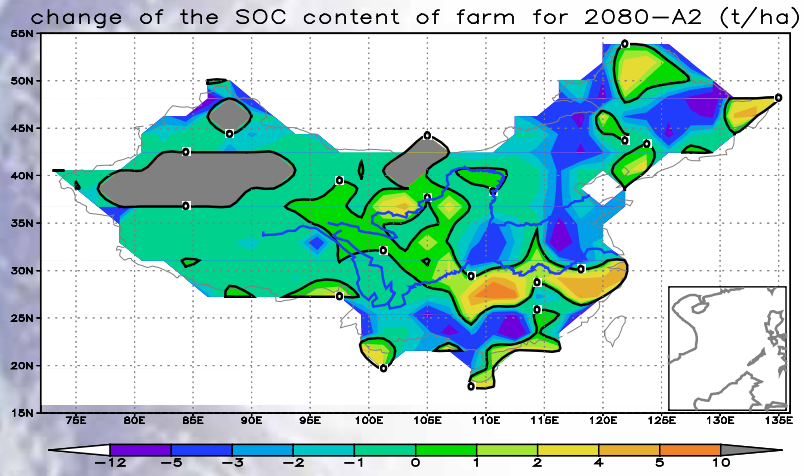
# Data of SOC content, Clay content, Bulk density are from Second National Soil Resource Survey of China

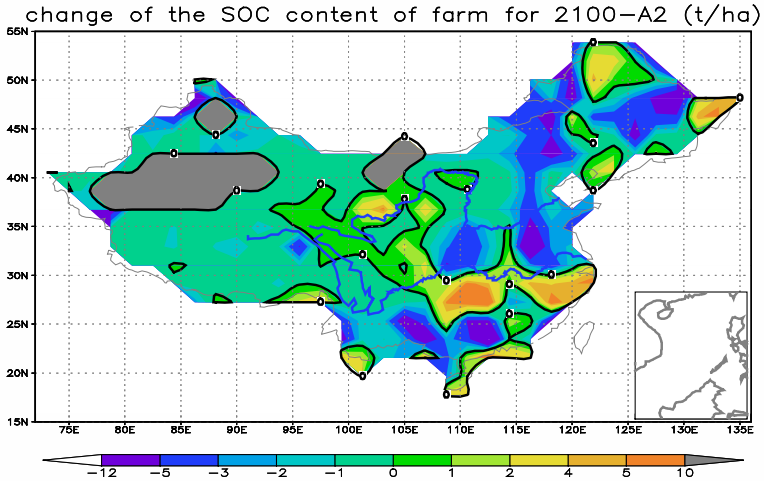
中国气象局 国家气候中心
National Climate Center
China Meteorological Administration

# SOC Change for A2 Scenario



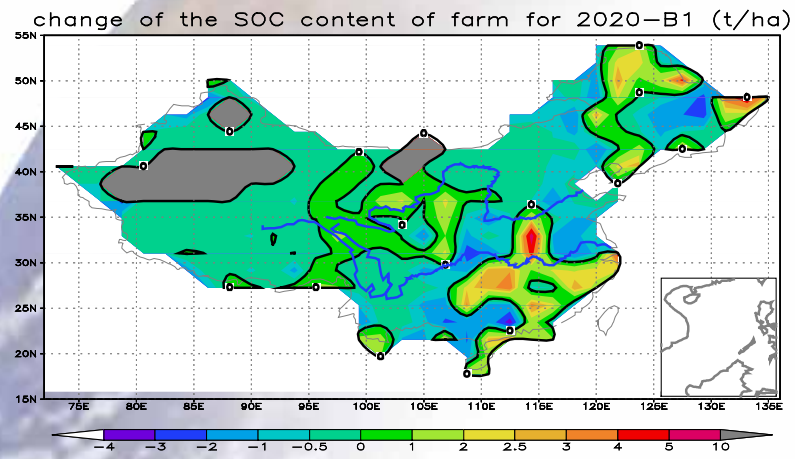



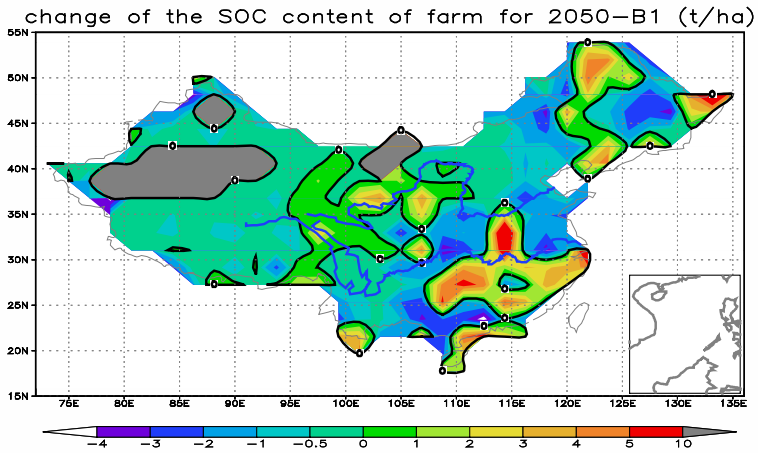



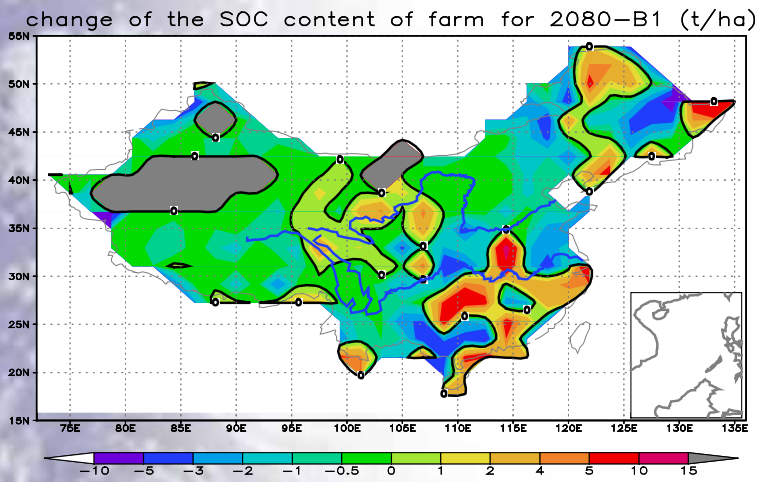



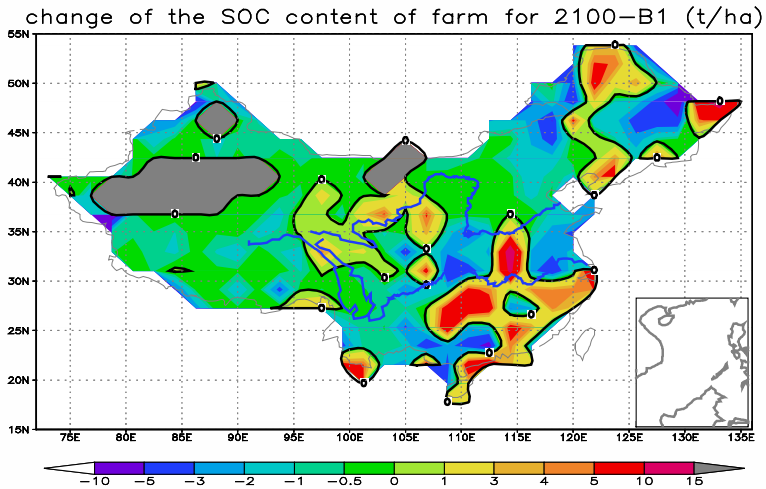

中国气象局 国家气候中心
National Climate Center
China Meteorological Administration

# SOC Change for B1 Scenario




中国气象局 国家气候中心
National Climate Center
China Meteorological Administration

# THANK YOU VERY MUCH

中国气象局 国家气候中心
National Climate Center
China Meteorological Administration