

Monitoring Drought and Desertification by Remote Sensing in China and Central Asia

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➤ **Drought Monitoring by Remote Sensing in China**

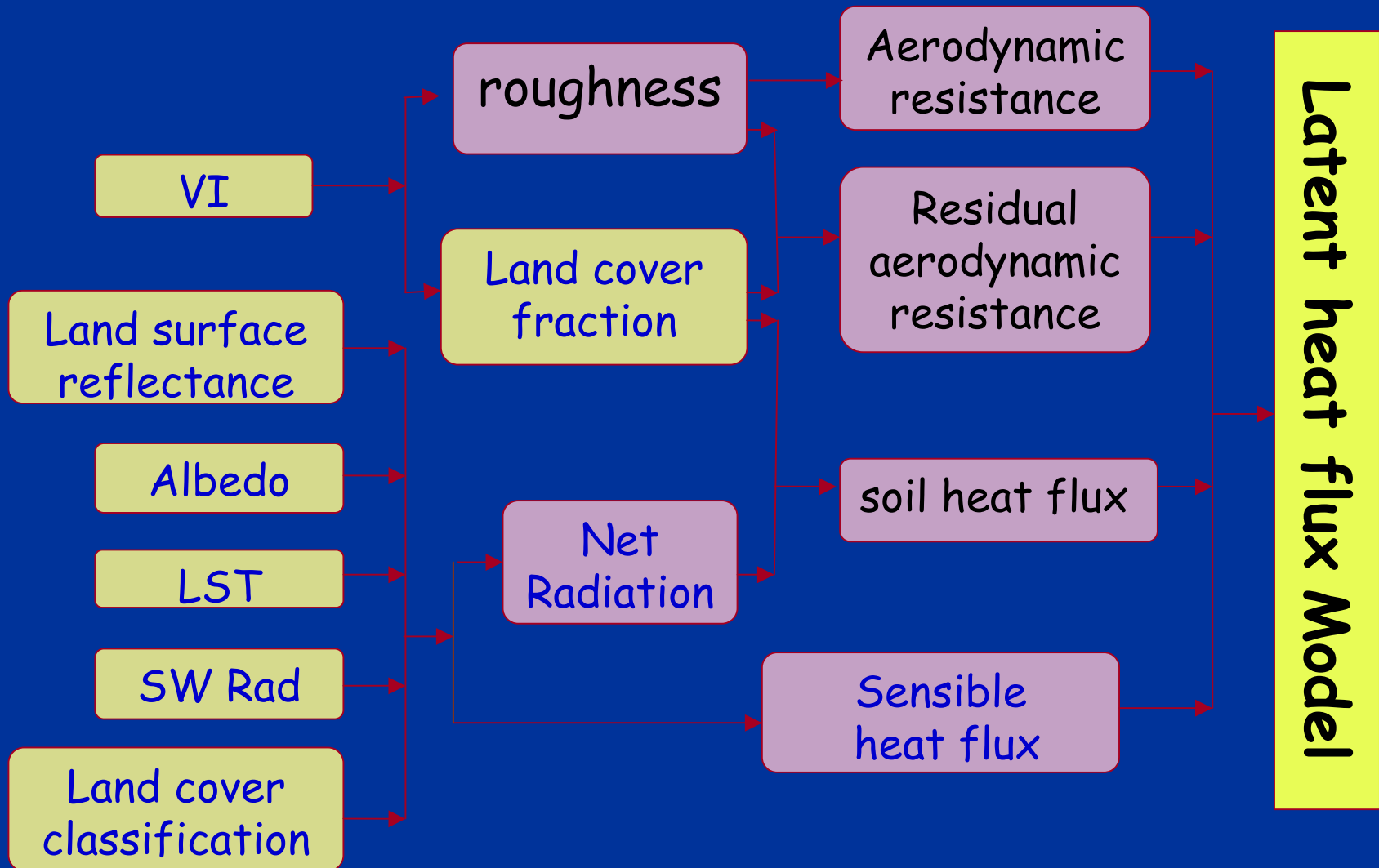
➤ **Desertification Evaluation by Remote Sensing in China and Central Asia**

Water resources is the basis of sustainable development of society and economy. Support social-economic benefits from drought monitoring with Remote Sensing. Protect and monitor water resources.

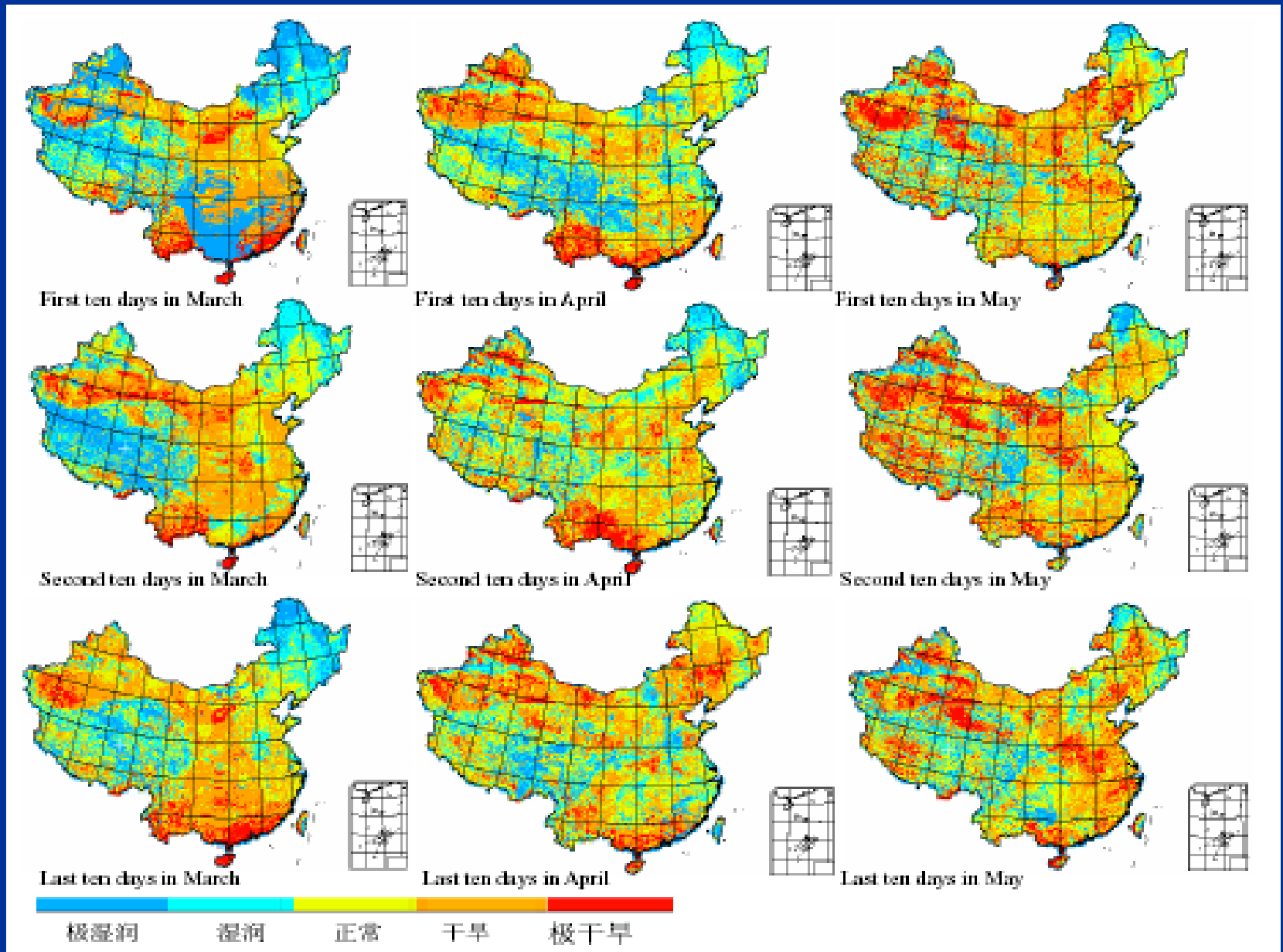
Drought Monitoring

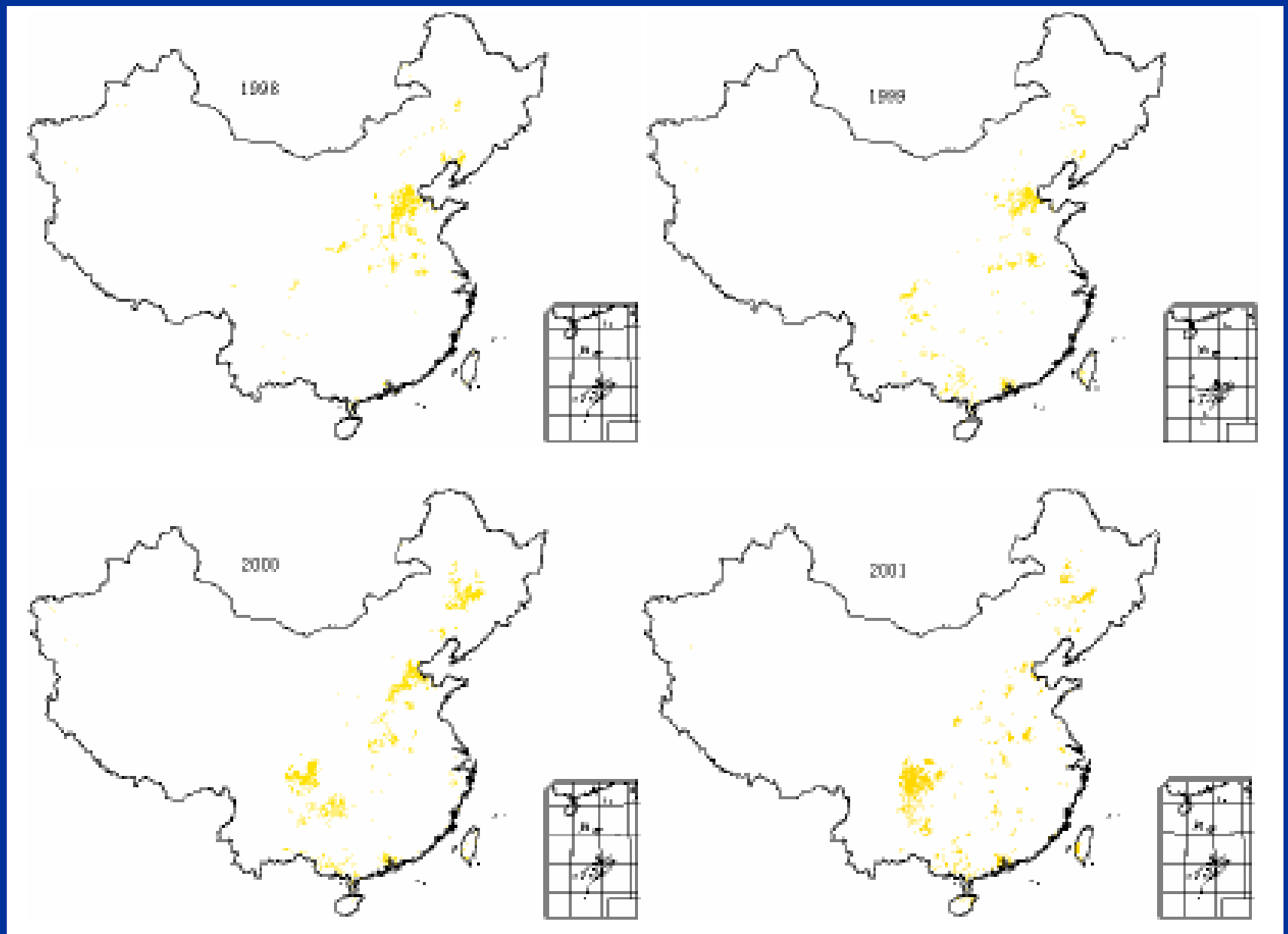


Model system for soil moisture retrieving



The drought level for China every ten days in March, April and May, 2000 based on TVDI



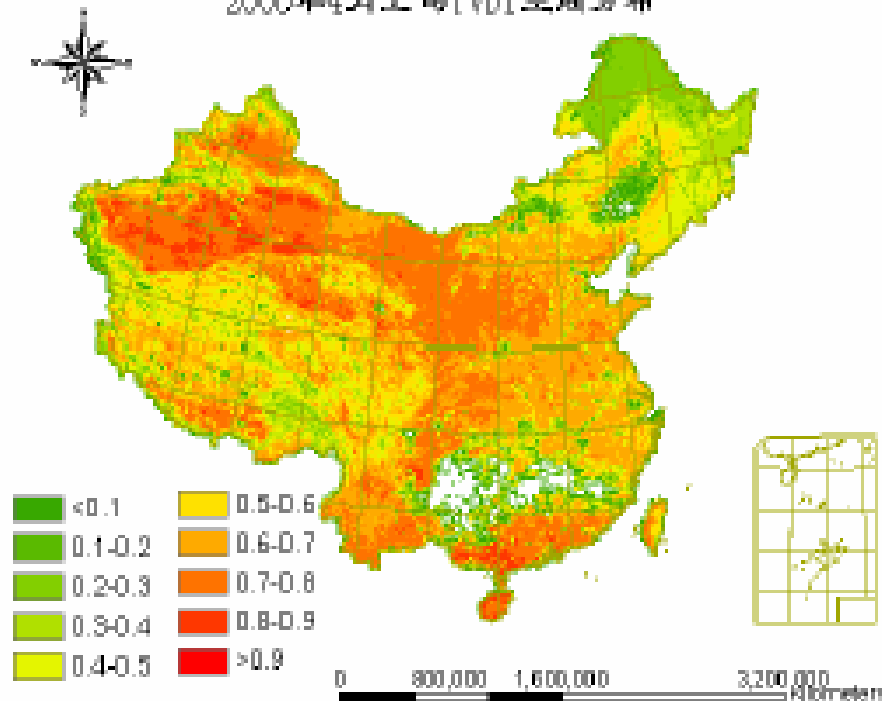


Crop Water Deficit in 1998,1999,2000 and 2001 from AVHRR

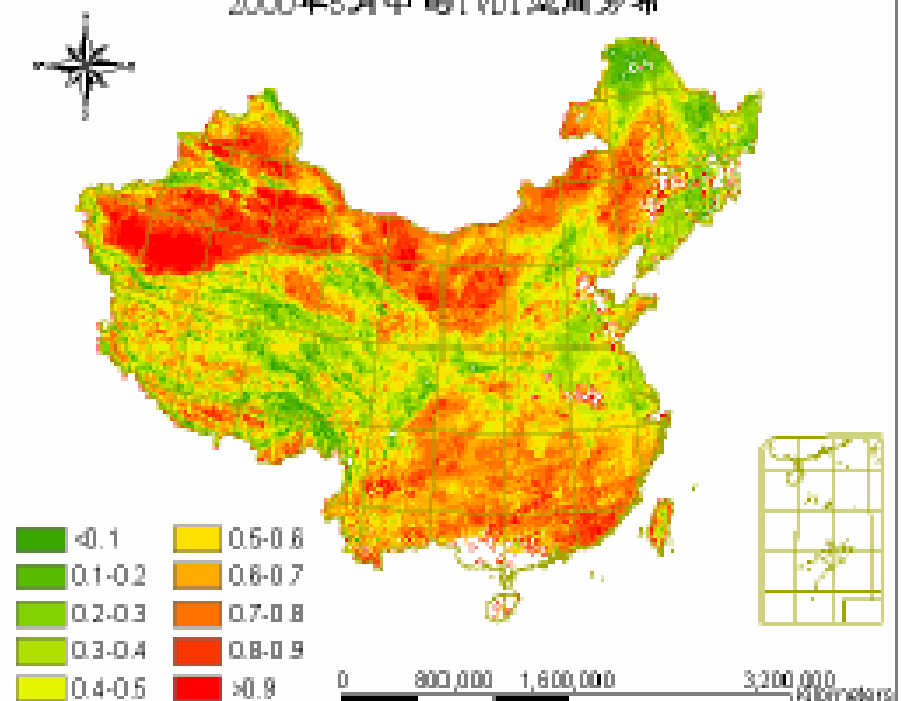
Drought Monitoring with MODIS

(Based on MOD11A2 LST & MOD13 VI)

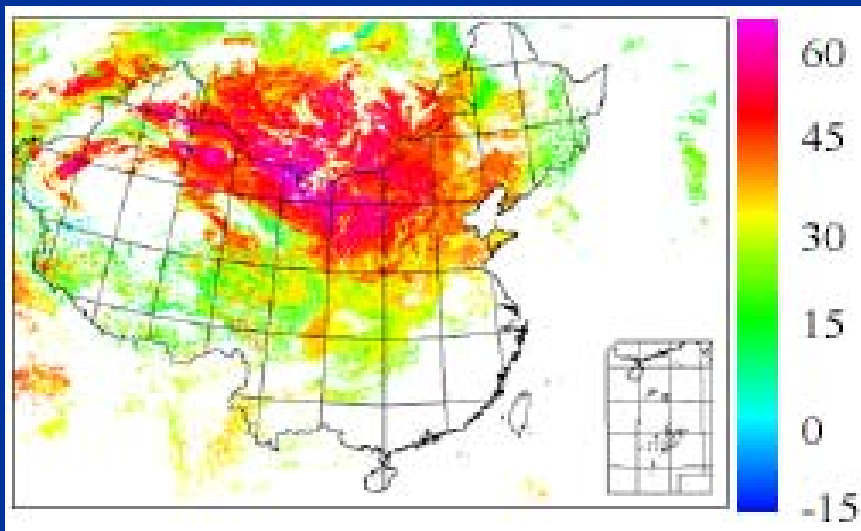
2000年4月上旬TVDI空间分布



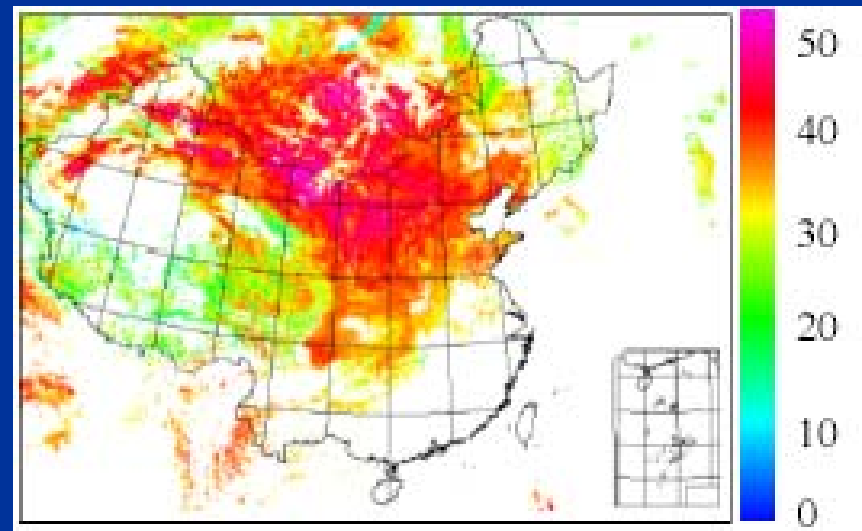
2000年5月中旬TVDI空间分布



Comparison between Land Surface Temperature and Air Temperature Derived from MODIS



The land surface temperature for the
150th day in 2002 for China



The air temperature for the 150th day in 2002
for China estimated from NDVI-Ts space

CWSI (Crop Water Stress Index)

$$R_n = H + \lambda ET + G$$

$$H = C_v (T_c - T_a) / r_a$$

$$\lambda ET = C_v VPD / [\gamma (r_a + r_c)]$$

$$r_{cp} = r_{sp} / LAI$$

$$r_{cx} = r_{sx} / LAI$$



$$(T_c - T_a) = [r_a R_n / C_v] [\gamma (1 + r_c / r_a) / \{\Delta + \gamma (1 + r_c / r_a)\}] - [VPD / \{\Delta + \gamma (1 + r_c / r_a)\}]$$



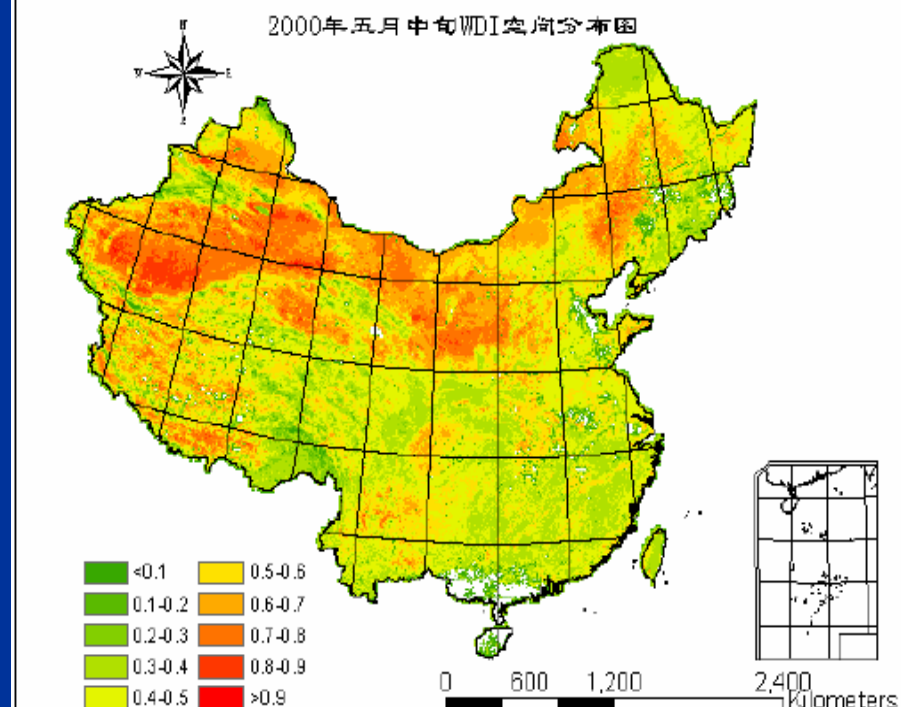
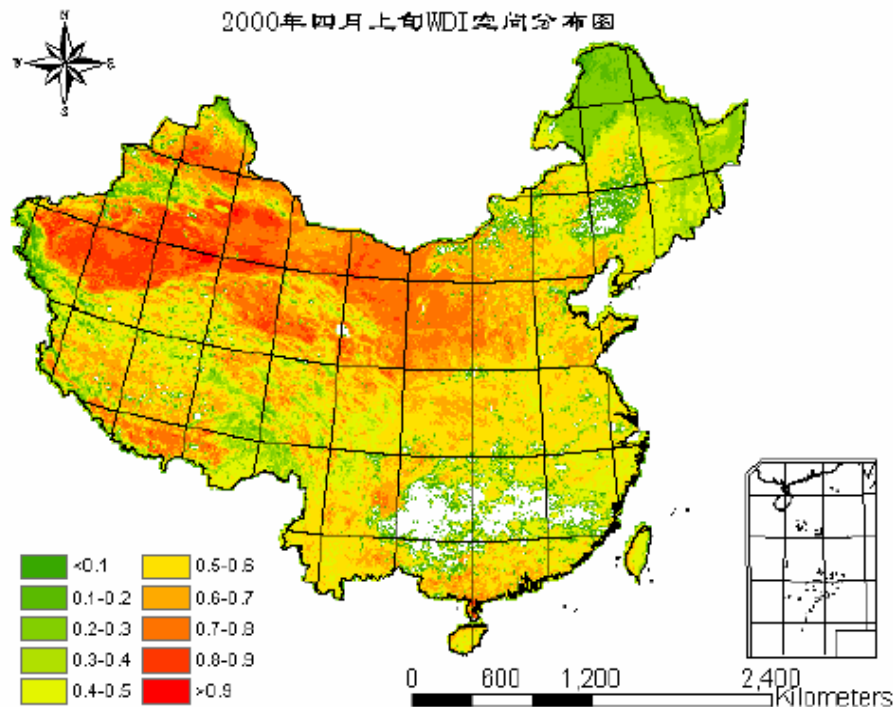
$$(T_c - T_a)_{\min} = [r_a R_n / C_v] [\gamma (1 + r_{cp} / r_a) / \{\Delta + \gamma (1 + r_{cp} / r_a)\}] - [VPD / \{\Delta + \gamma (1 + r_{cp} / r_a)\}]$$

$$(T_c - T_a)_{\max} = [r_a R_n / C_v] [\gamma (1 + r_{cx} / r_a) / \{\Delta + \gamma (1 + r_{cx} / r_a)\}] - [VPD / \{\Delta + \gamma (1 + r_{cx} / r_a)\}]$$



$$CWSI = [(T_c - T_a)_m - (T_c - T_a)_{\min}] / [(T_c - T_a)_{\max} - (T_c - T_a)_{\min}]$$

$$WDI = 1 - ET / ET_p = [(T_s - T_a)_{\max} - (T_s - T_a)_r] / [(T_s - T_a)_{\max} - (T_s - T_a)_{\min}]$$



WDI (Water Deficit Index) in April & May, 2000 From MODIS

Desertification

The Earth Observation Technology Application for Resources Management and Sustainable Development was especially emphasized by the international organization of United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP).

Seven Asia countries in arid and semi-arid areas were invited in the project to communicate the experiences in water and land management by RS and GIS and to promote the cooperation in the Developing Countries.

Desertification

Research Area

China

Mongolia

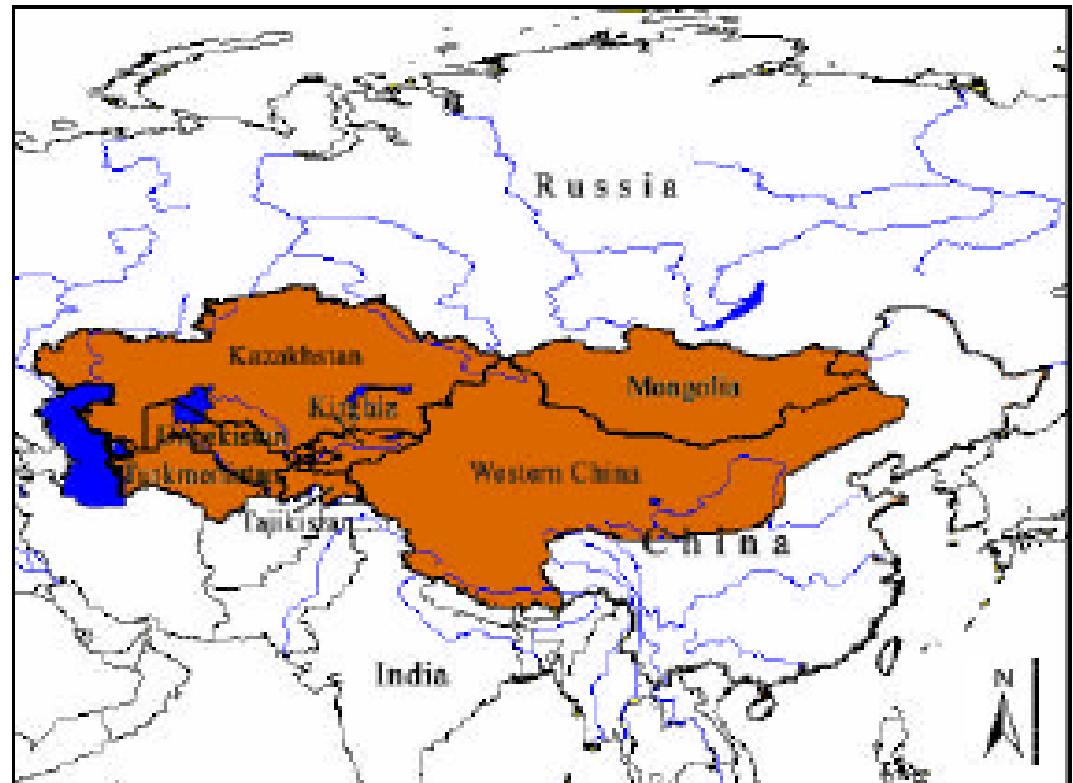
Kazakhstan

Uzbekistan

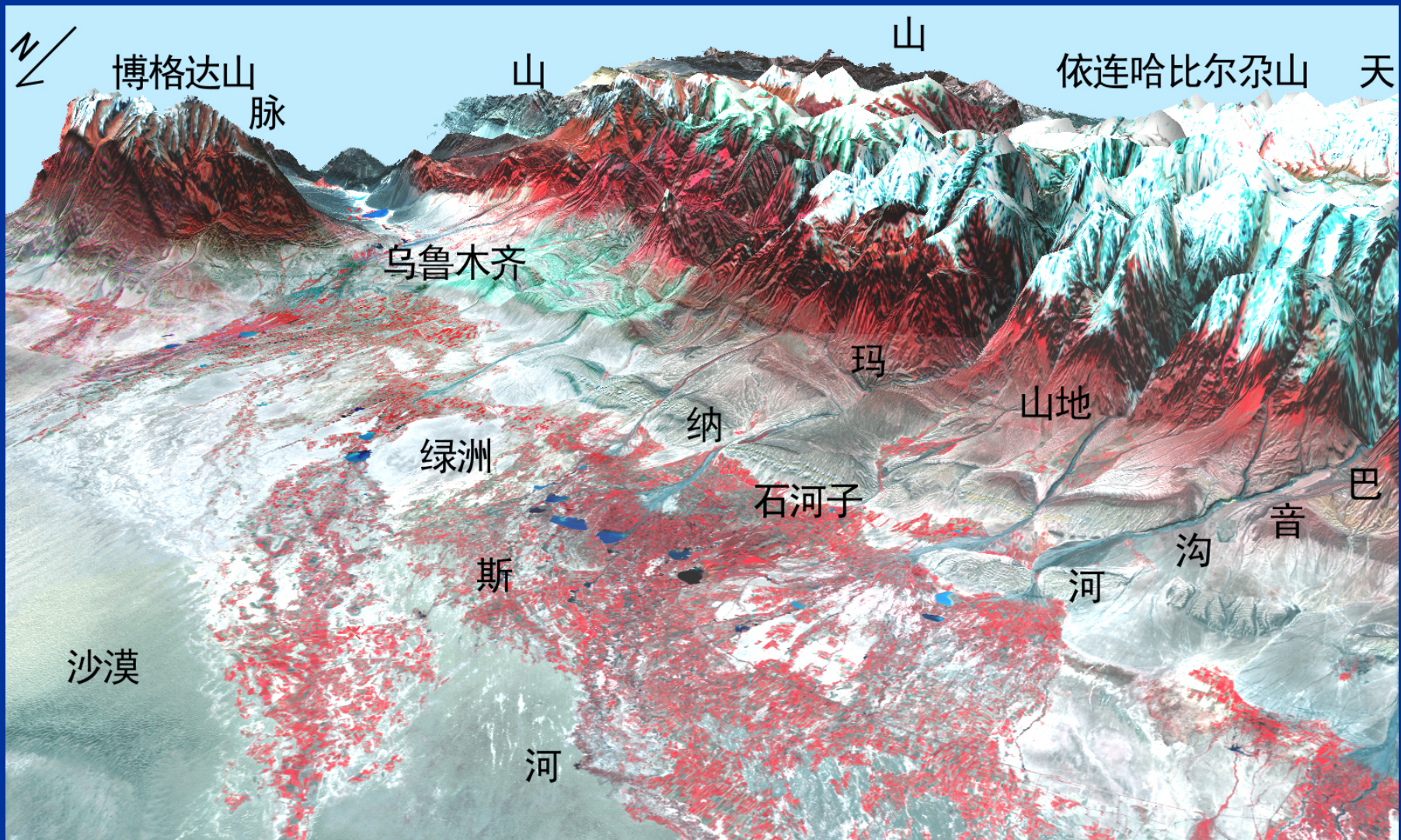
Turkmenistan

Kyrgyzstan

Tajikistan

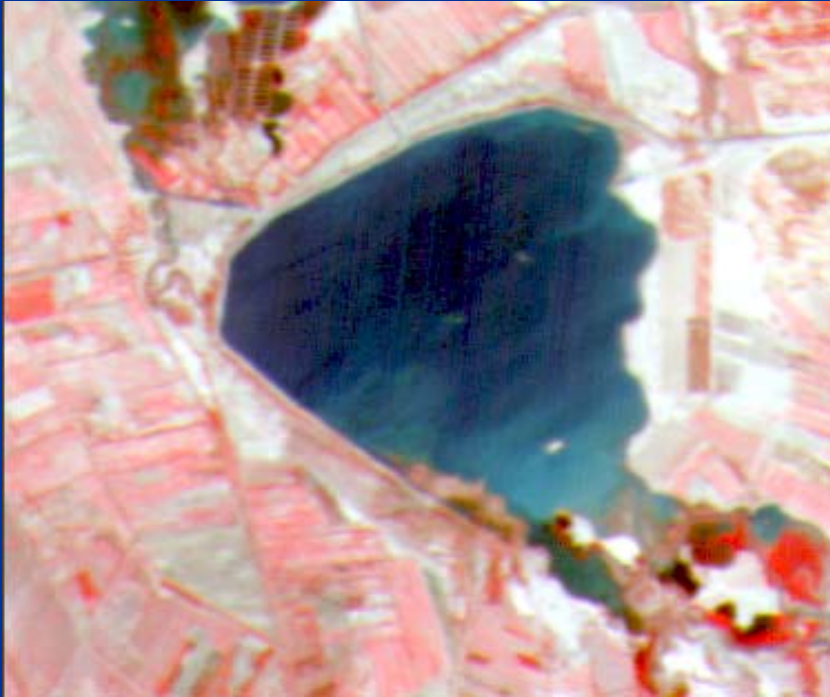




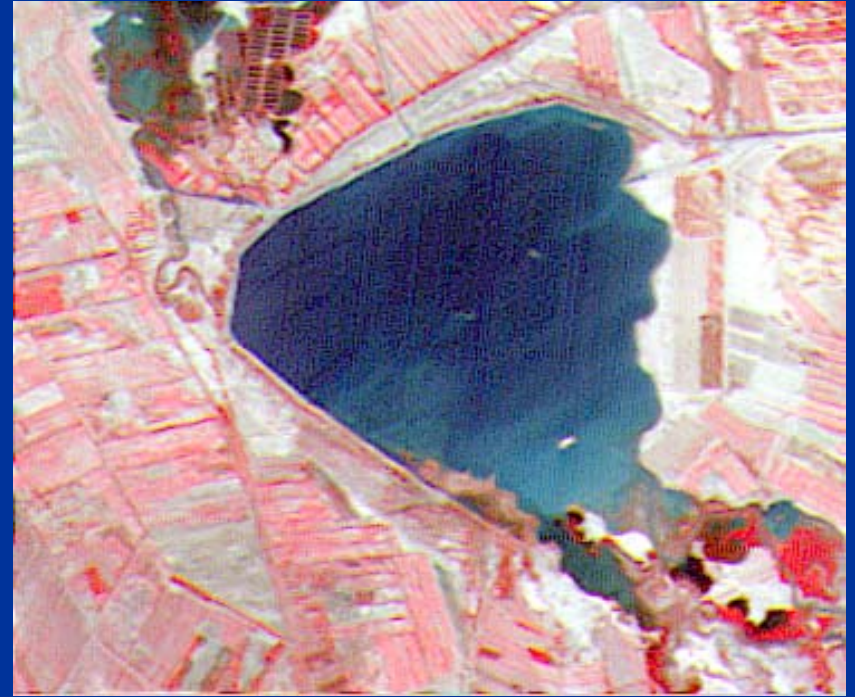


XINJIANG, Western China

Remote Sensing Data Preprocess——Restoration

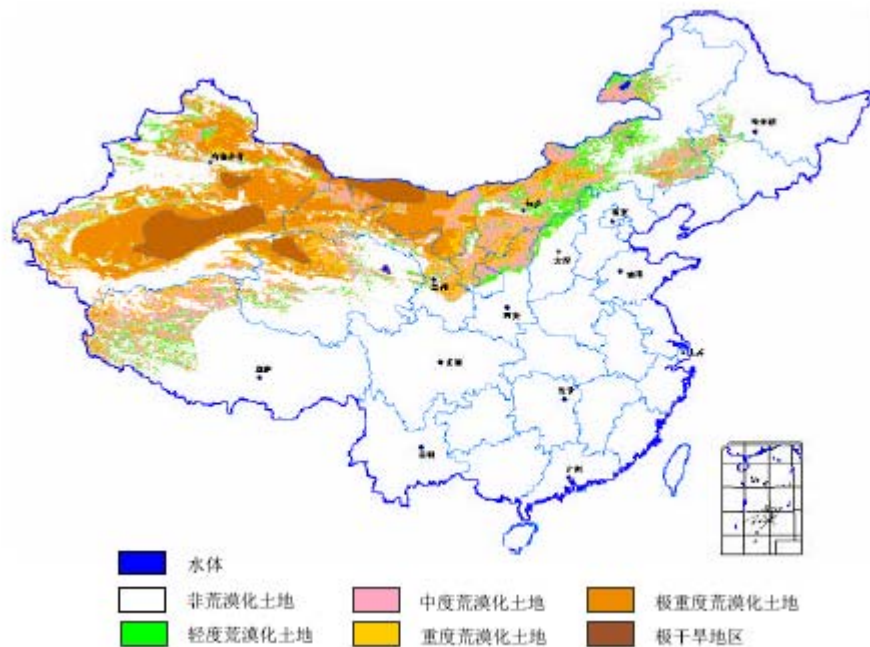


Before Restoration

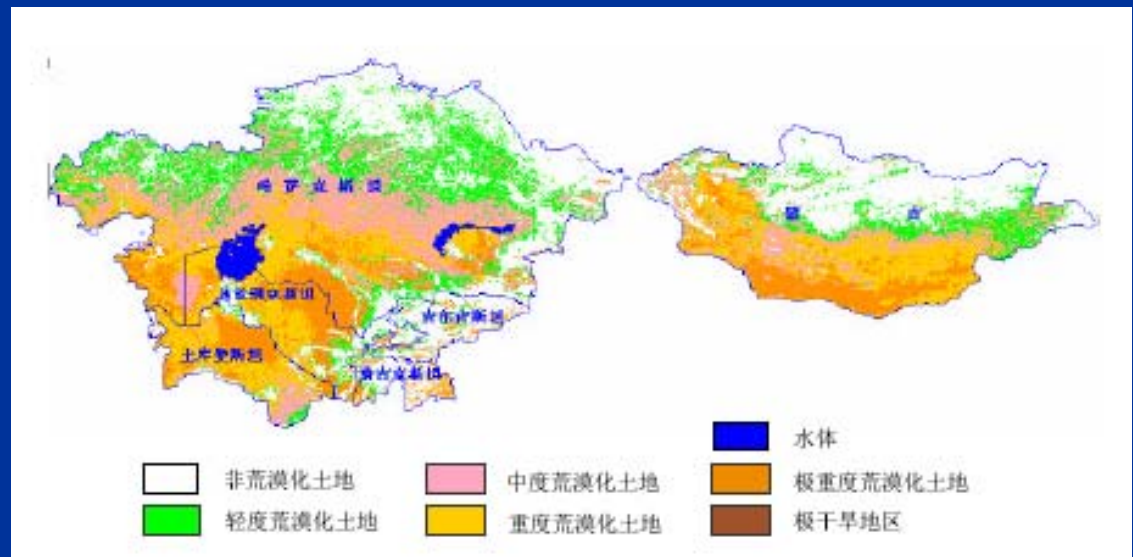


After Restoration

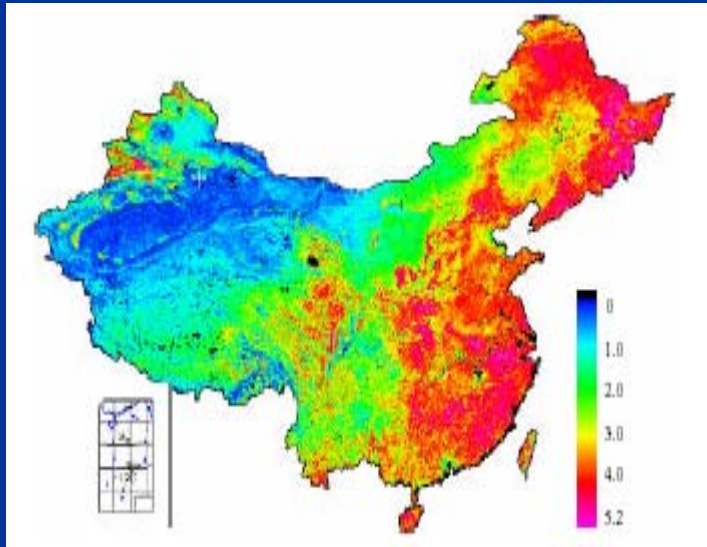
1995 Desertification in China



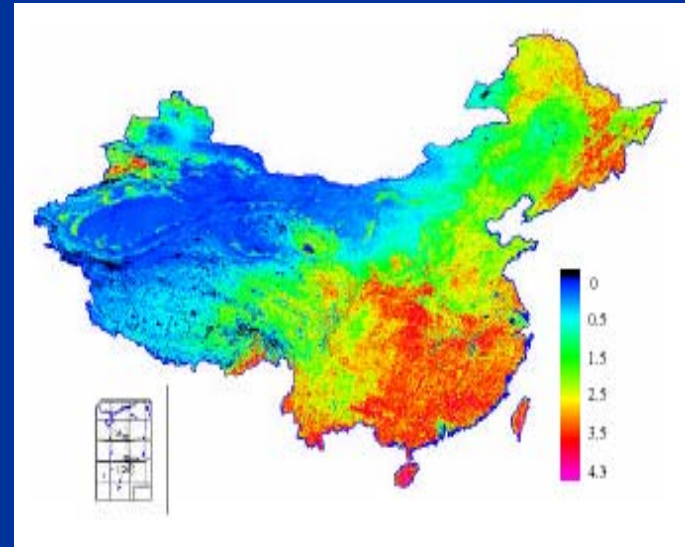
1995 Desertification in central Asia



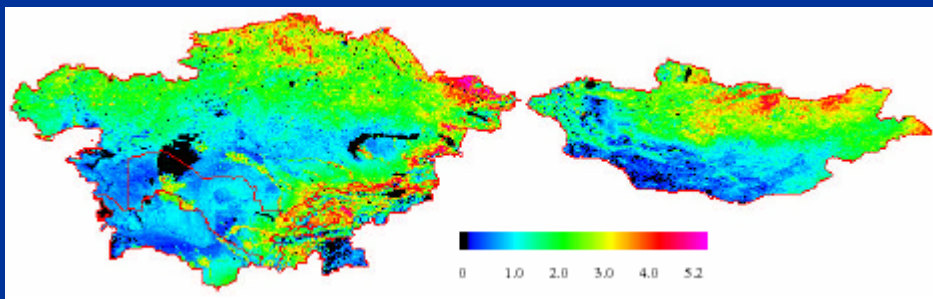
MSAVI (Modified Soil-Adjusted Vegetation Index)



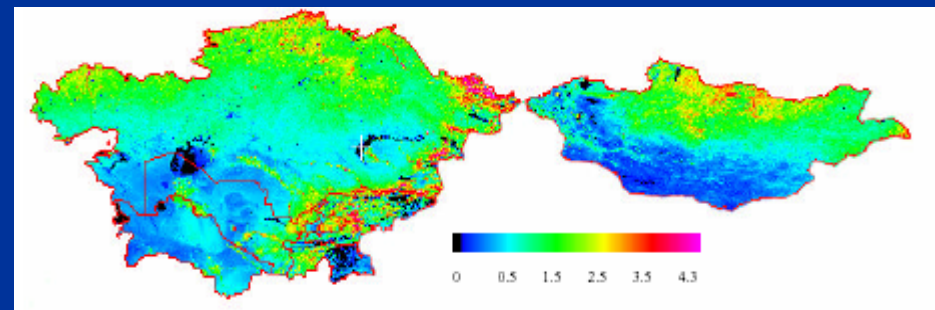
MSAVI of China in 1995



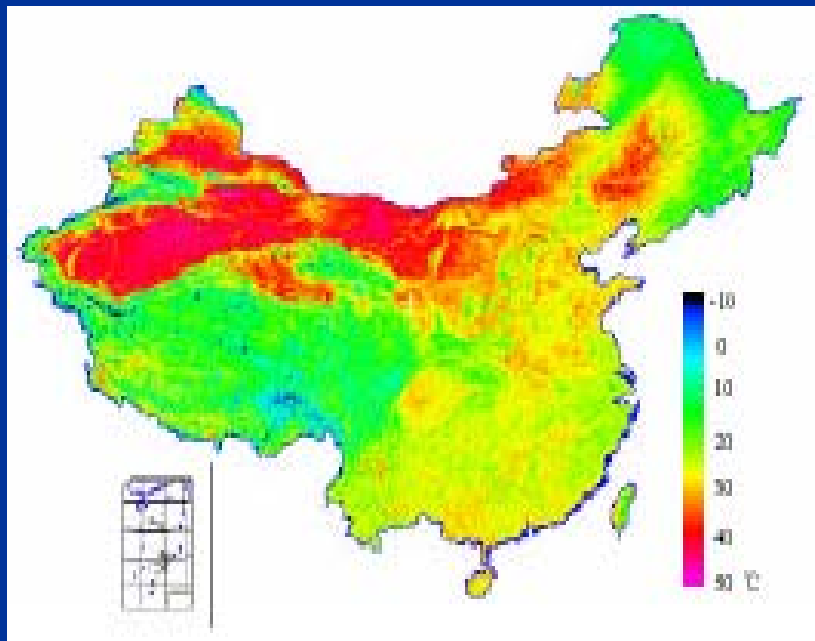
MSAVI of China in 2001



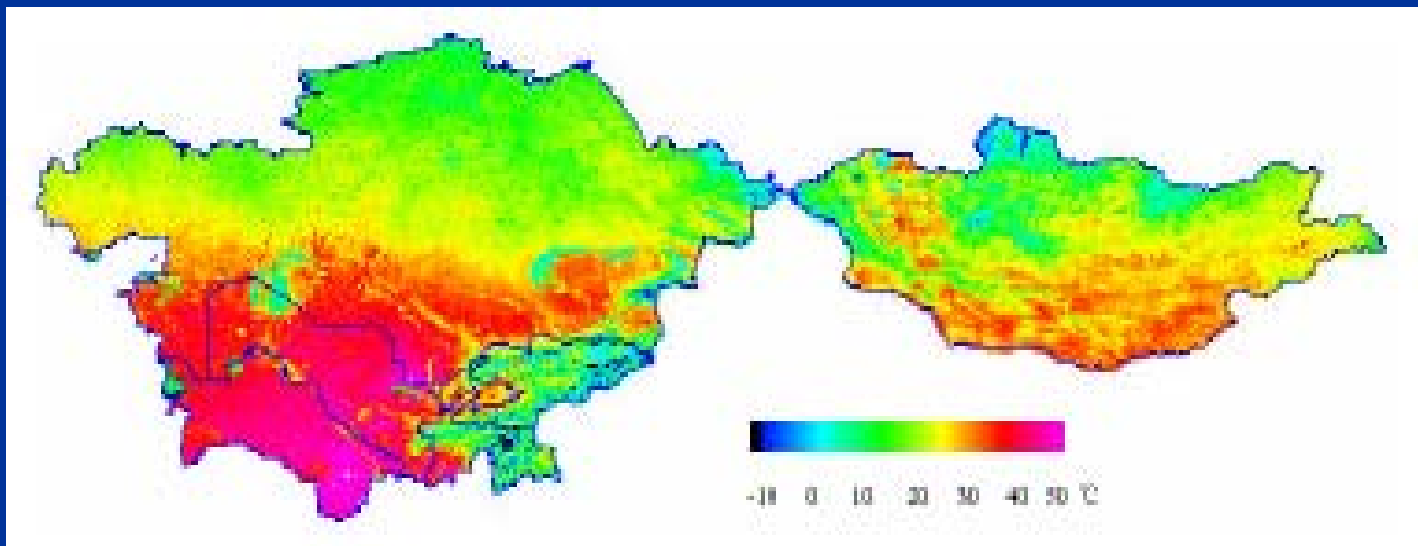
MSAVI of Central Asia in 1995



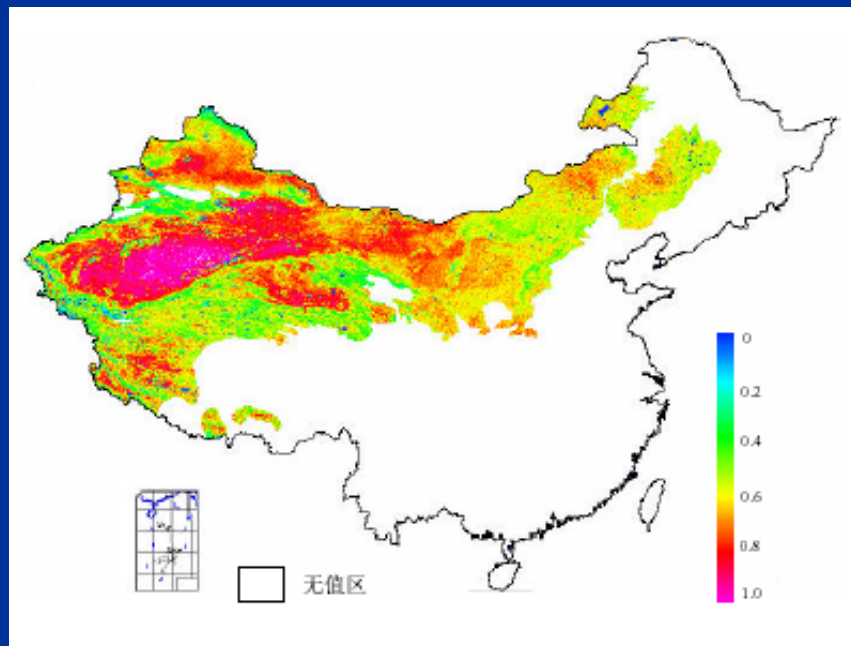
MSAVI of Central Asia in 2001



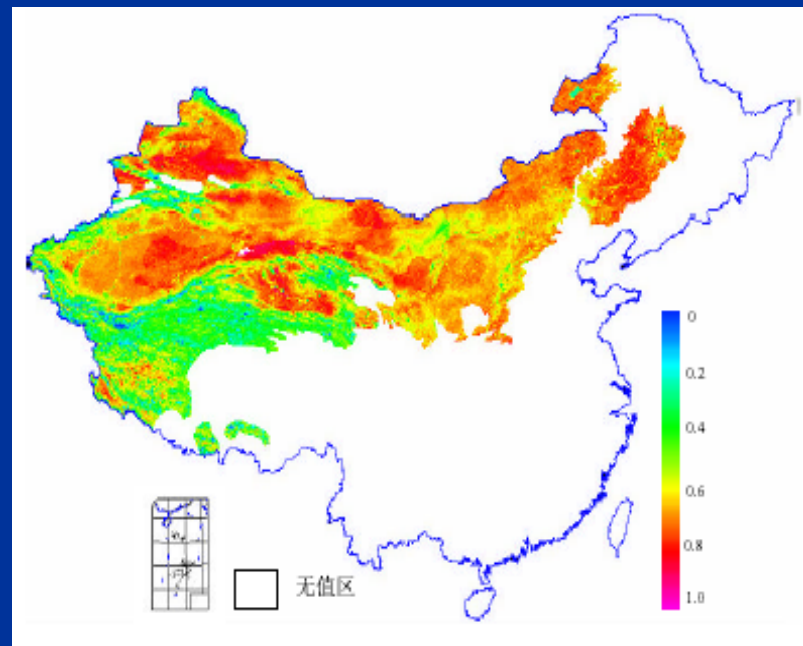
LST (Land Surface Temperature)
in 2001 Derived from MODIS



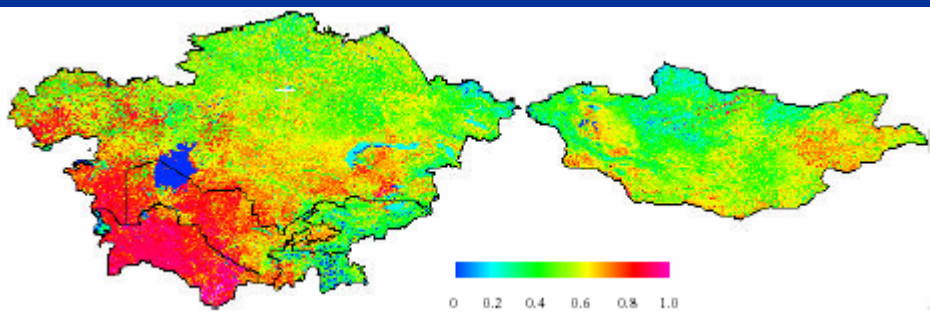
TVDI (Temperature-Vegetation Dryness Index)



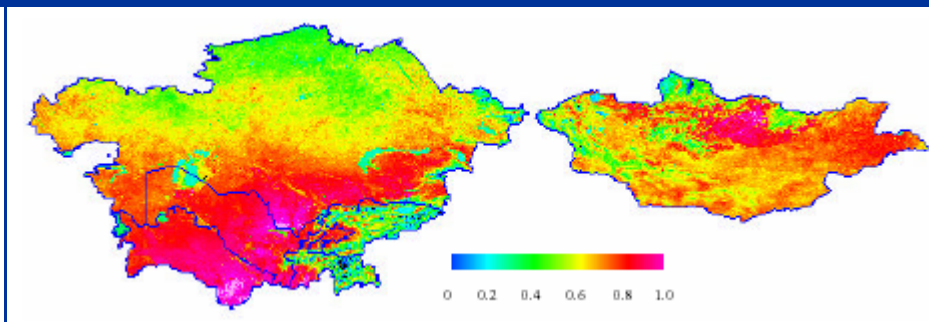
TVDI of China in 1995



TVDI of China in 2001

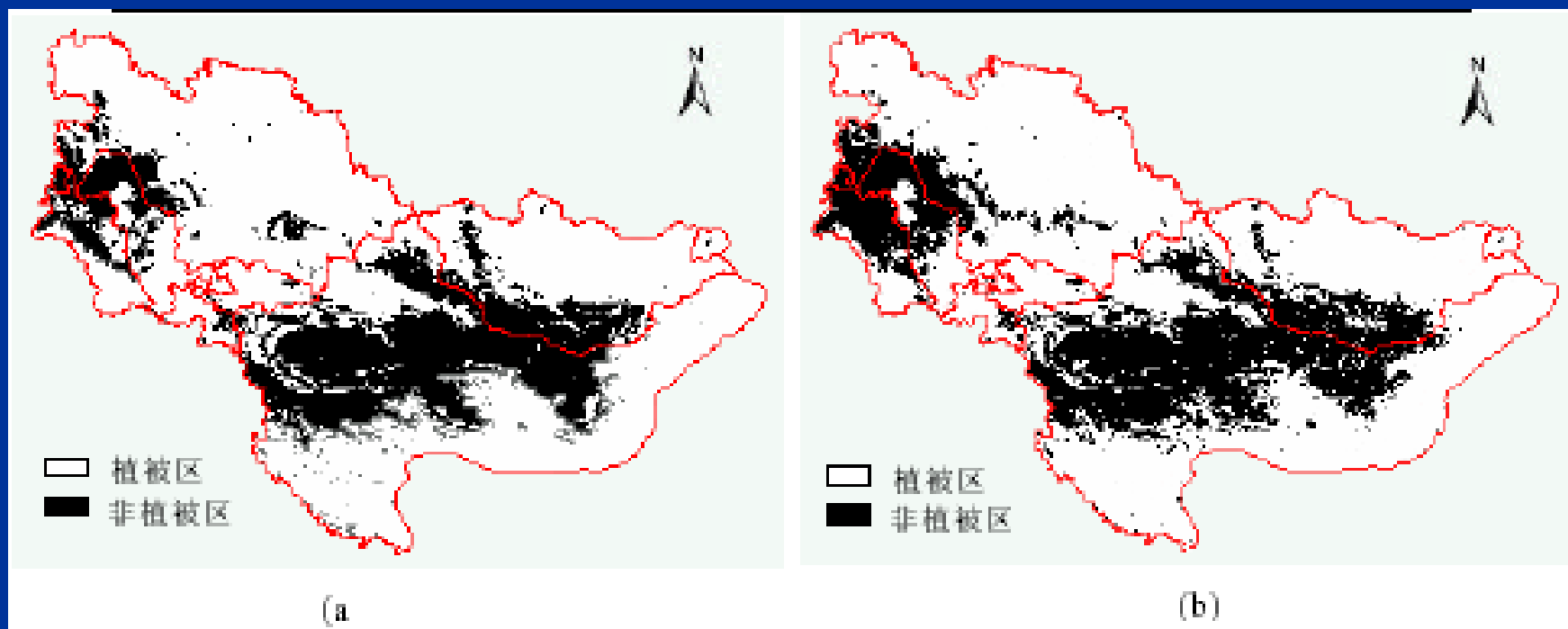


TVDI of Central Asia in 1995



TVDI of Central Asia in 2001

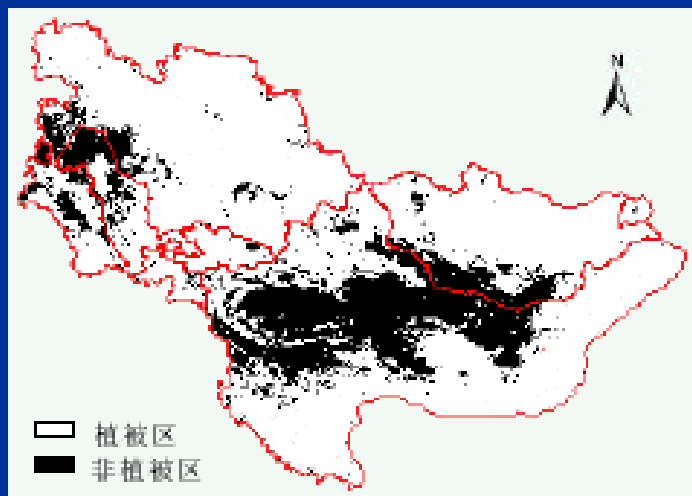
Desert Boundary in Different Years (1)



1982

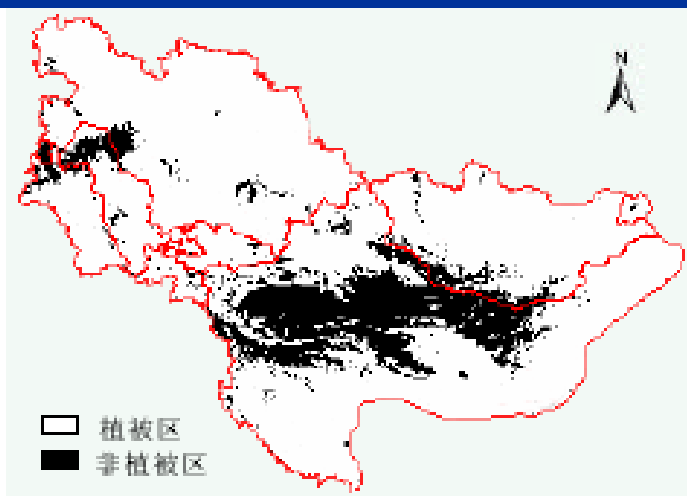
1986

Desert Boundary in Different Years (2)



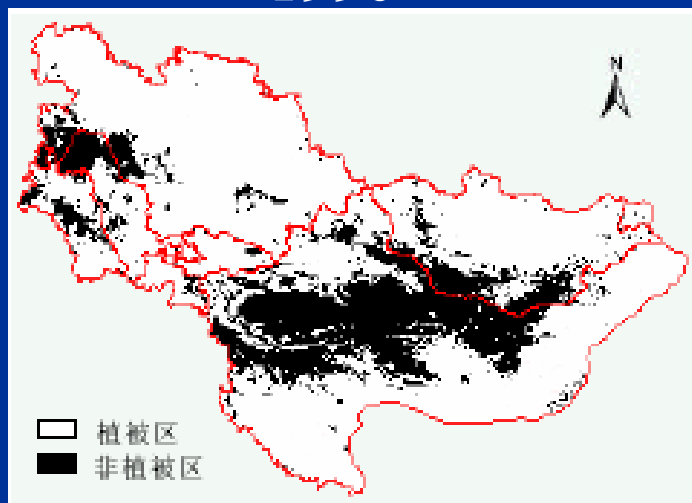
(c)

1990



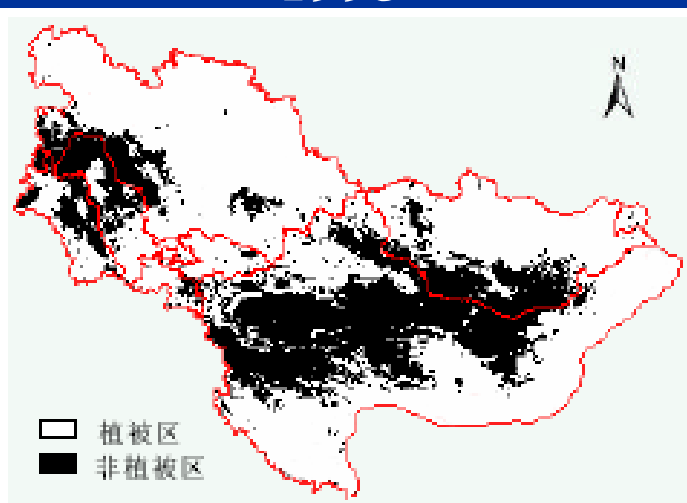
(d)

1993



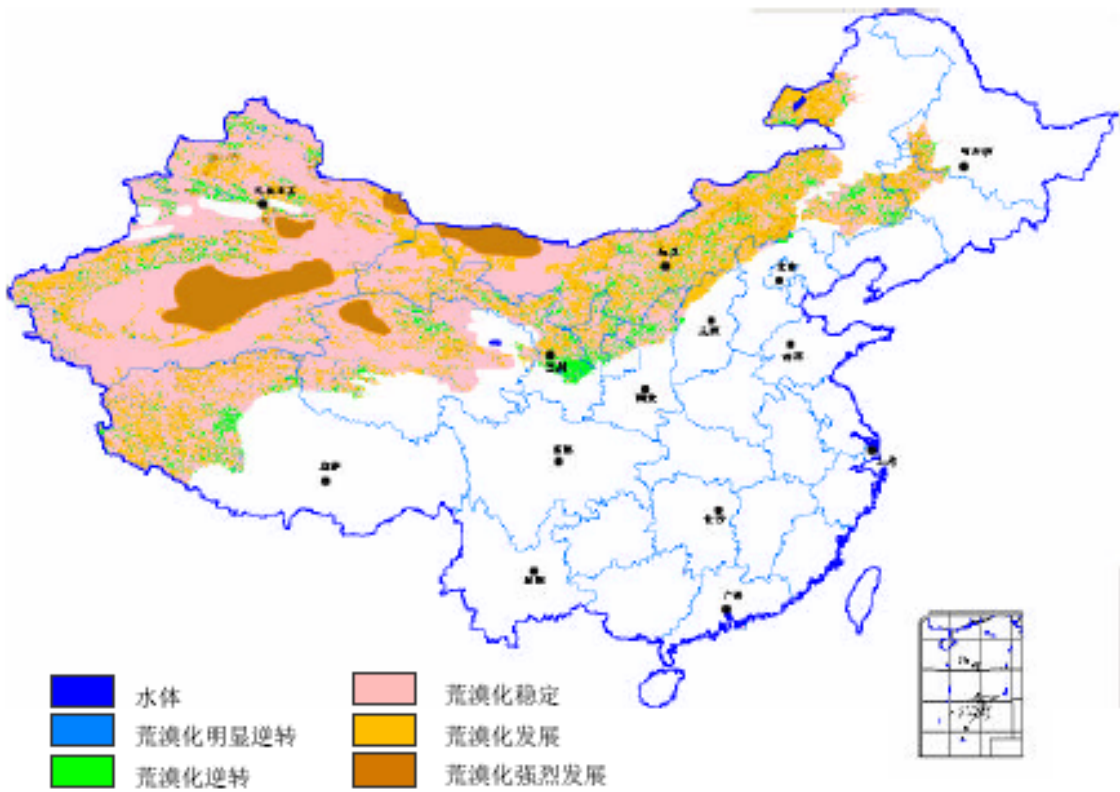
(e)

1997



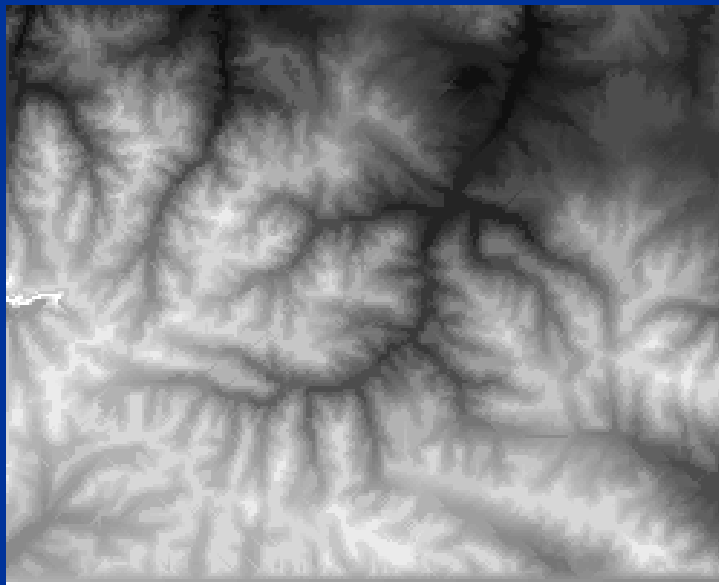
(f)

2000

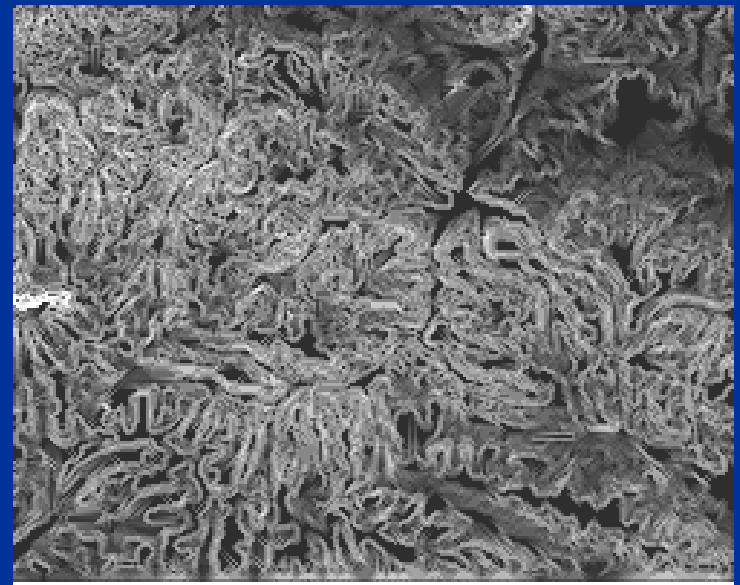


Land Desertification Spread

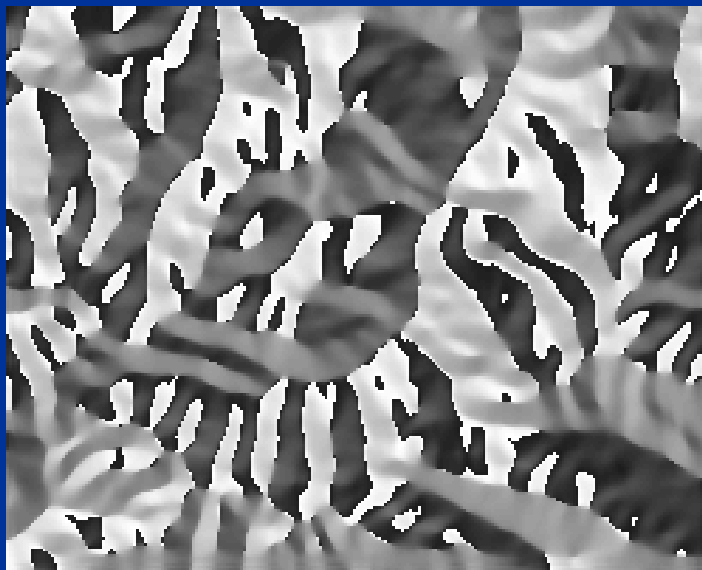




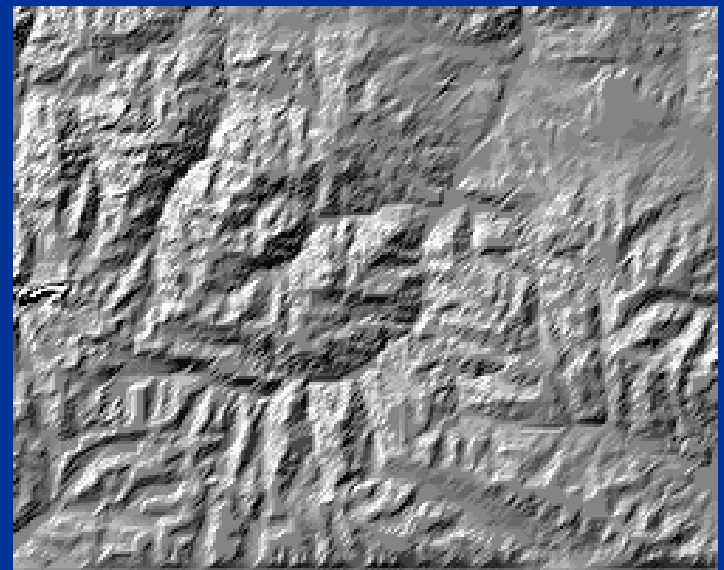
DEM of drainage basin



Slope Map

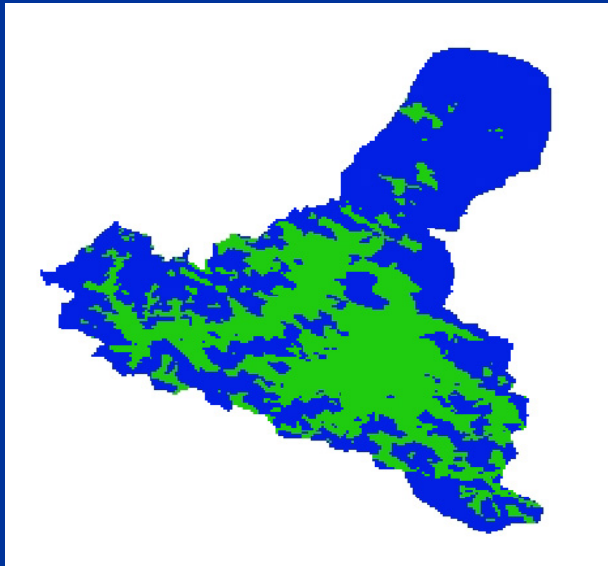


Slope Direction Map

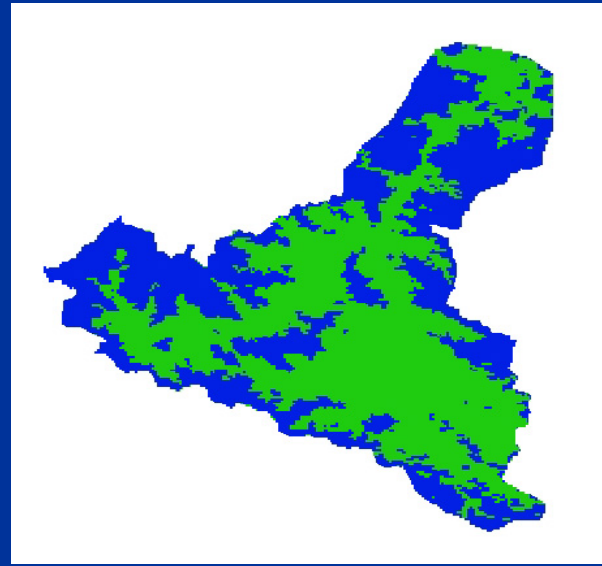


Radiation Distribution
in a Slope

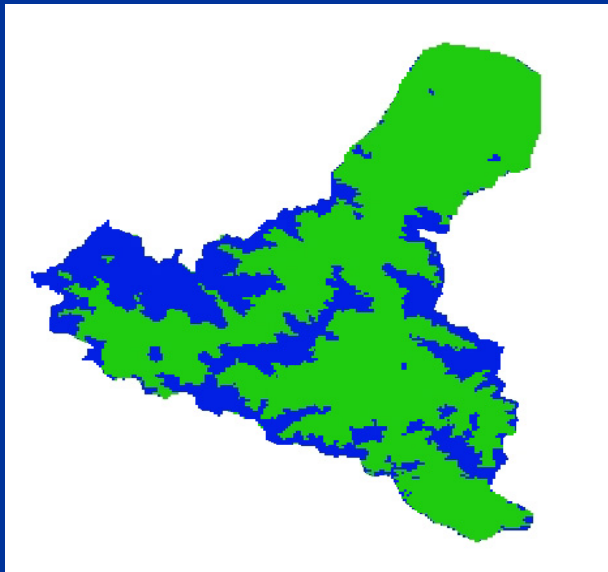
Winter in 2001



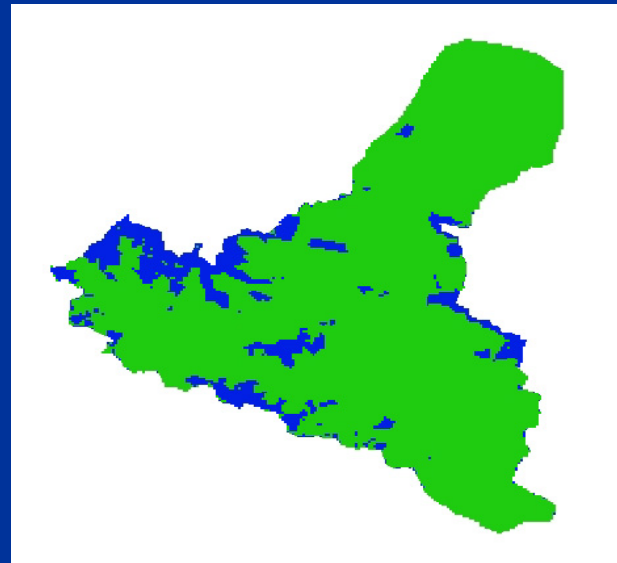
Spring in 2001



Summer in 2001



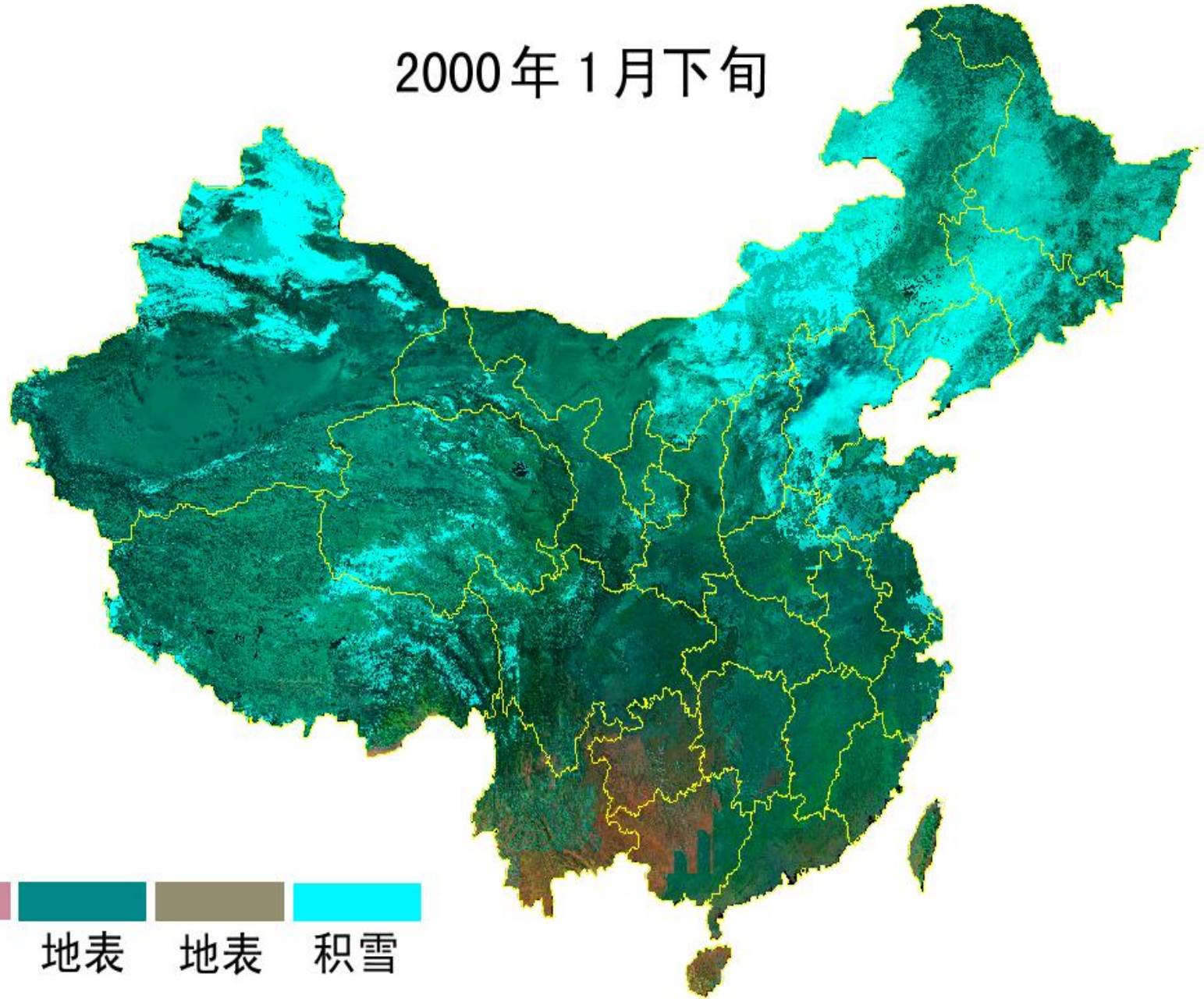
Autumn in 2001



Snow Cover in Manas River Basin (BLUE)

Snow Cover Monitoring with Meteorology Satellite

2000年1月下旬



地表 地表 地表 积雪

Conclusion (1)

- Infrastructure
- Standards
- Data Sharing
- Observations
- Hardware/Software

Conclusion (2)

Water Cycle Observation over a region is not possible without observations from space.

Countries located at arid and semi-arid areas are facing the same environment problems, so it was expected that spatial technique could be utilized in water resources and environment monitoring, land and water resources management and sustainable development planning, and further international cooperation of sharing and communion of spatial data techniques and research methods were also expected.

THANK YOU