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Water Resources and Environment Monitoring by Remote Sensing in Guanting Reservoir of China

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CONTENT

Introduction -Background

- **Guanting reservoir is an important water source for urban living and economy of capital Beijing.**
- **There's a great shortage of water resources and serious water pollution in Guanting catchment.**
- **Rapid acquisition of information on water resources, water quality and environmental factors, and assessment of water source safety for Guanting reservoir are significant to ensure sustainable development of capital economy.**

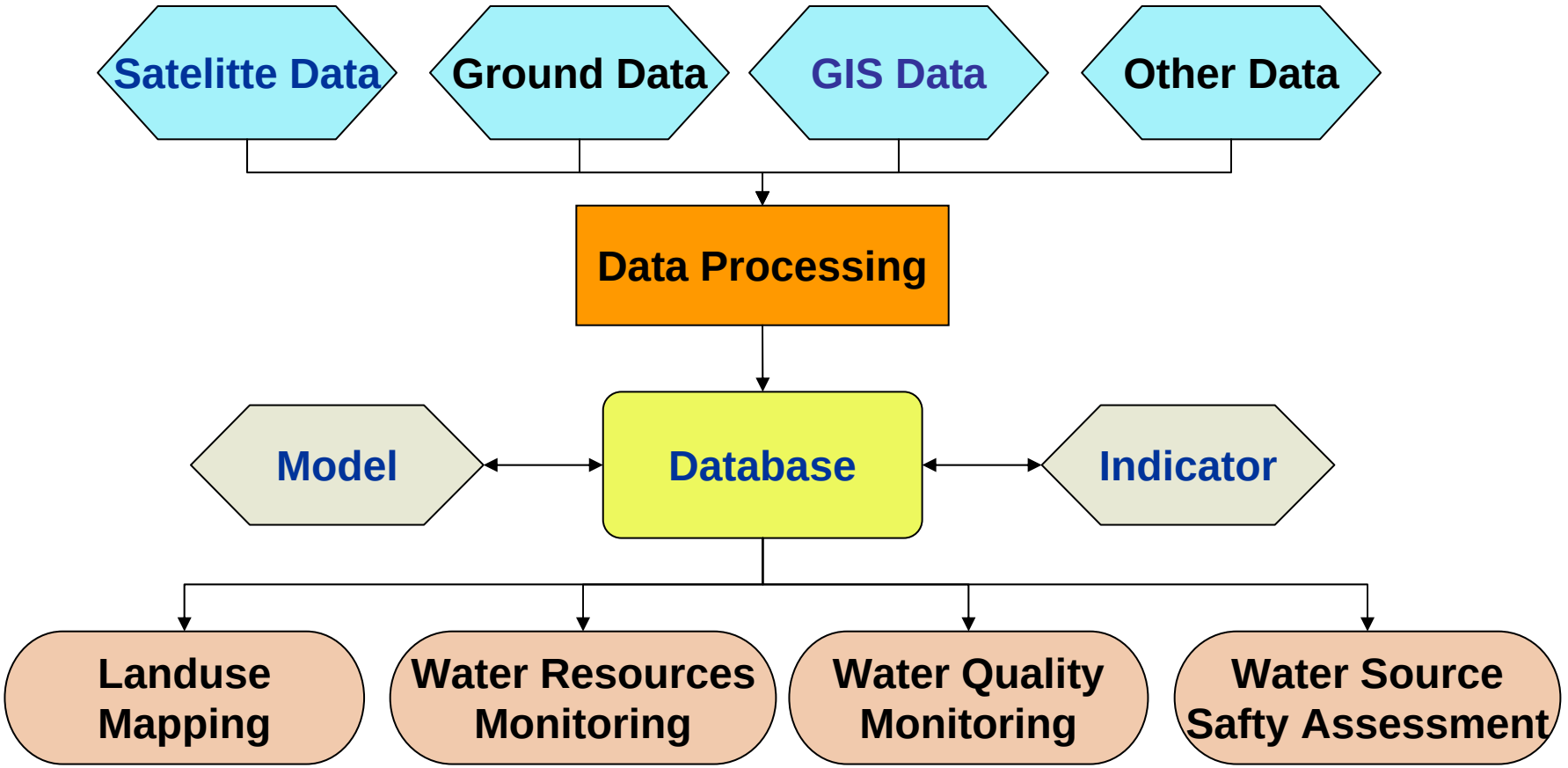
Introduction - Objectives

- To monitor land use, water body and water quality using multi-source satellite data.
- To analyze variation trends for land cover, water resources and water quality.
- To estimate eutrophication in Guanting reservoir.
- To assess water source safety and propose suggestions for ensuring water source safety.

Data used

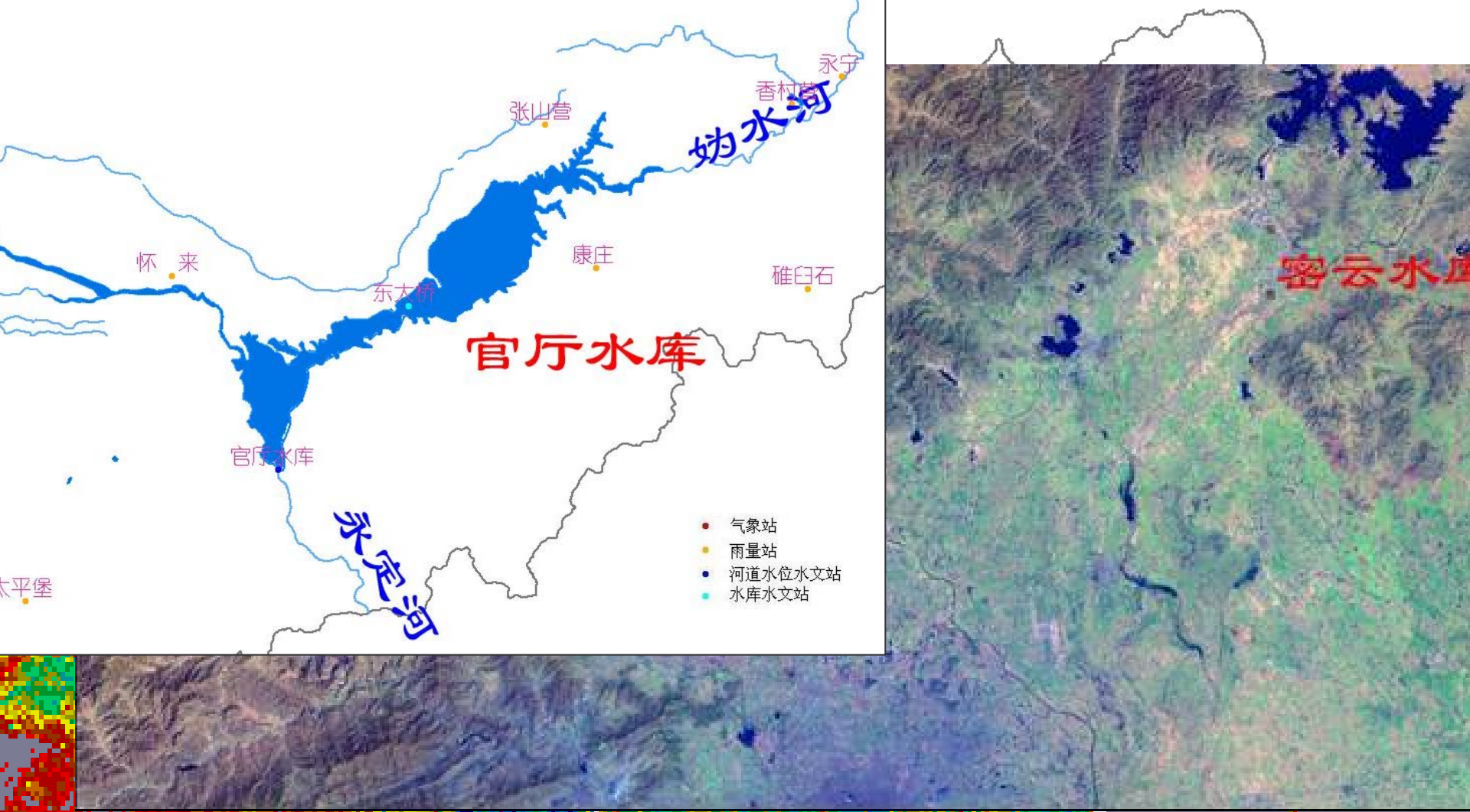
- EO data
  - PROBA CHRIS
  - TM/ETM
  - CBERS
  - Beijing-1
  - MODIS
  - ASAR
  - MERIS
- In situ data
  - Spectra measurement data
  - Water quality analysis data
  - Hydrological data
  - Meteorological data

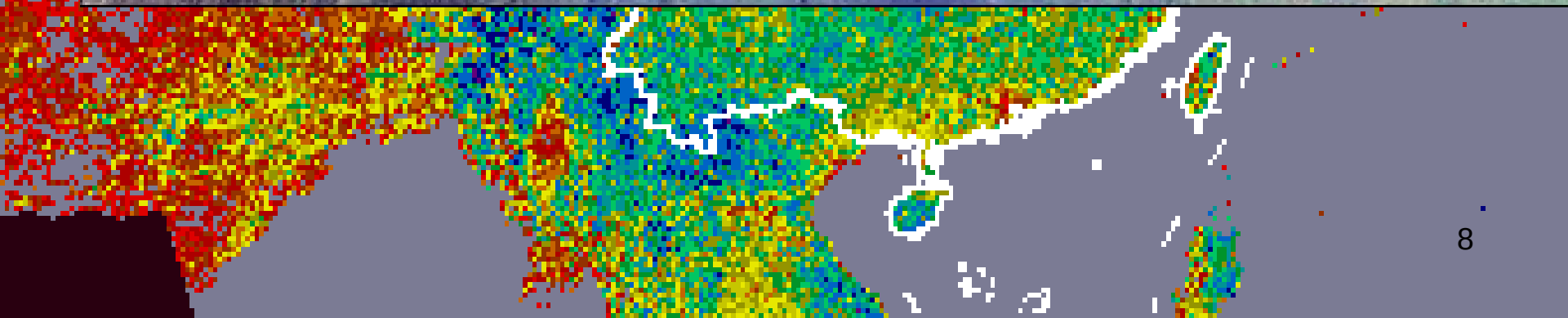
Methodology



Scientific results

1. Land use mapping
2. Water resources monitoring
3. Water quality monitoring
4. water source safety assessment


永宁
香村营
张山营
妫水河
怀 来
康庄
碓臼石
东大桥
官厅水库
官厅水库
永定河
太平堡
气象站
雨量站
河道水位水文站
水库水文站
密云水库



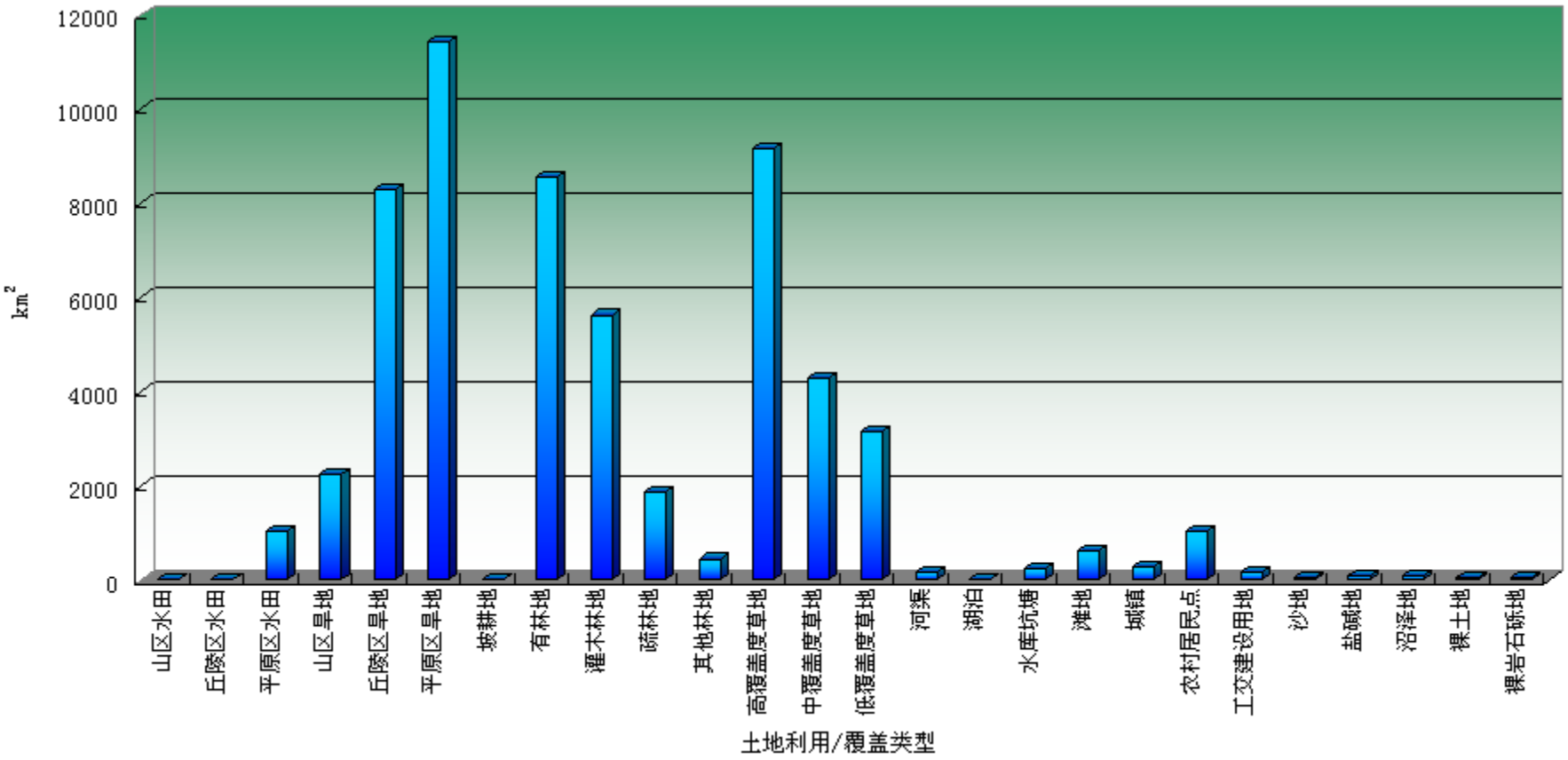
Land Cover/Land Use Mapping

流域生态环境变化遥感监测指标选取

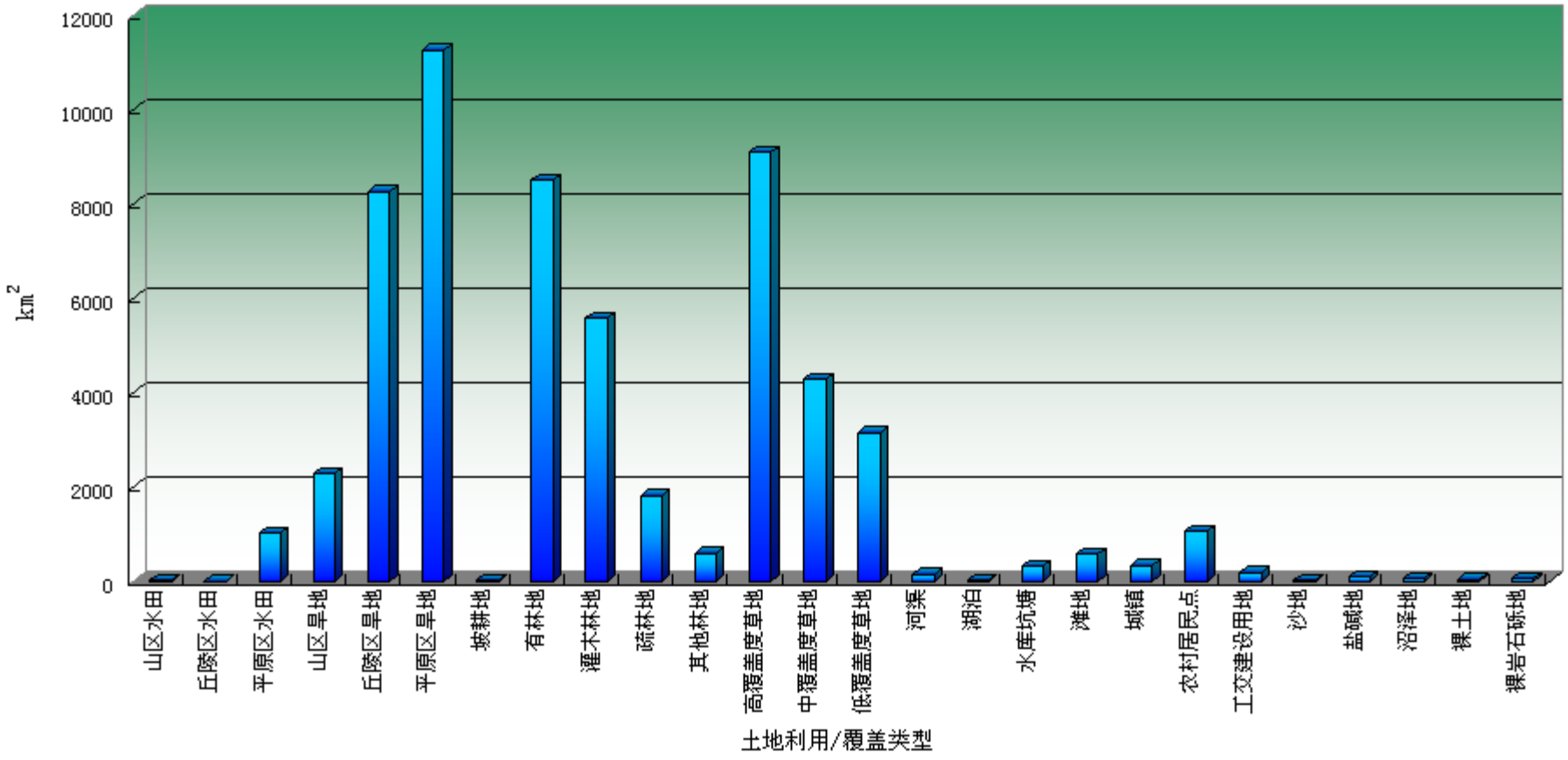
Monitoring Indicator for Eco-environment Variaton															
Land use / land cover variation index				Vegetation Index						Vegetation cover rate			Landscape pattern index			
单一土地利用动态度	综合土地利用动态度	土地利用程度综合指数	土地利用程度变化指数	比值植被指数	归一化植被指数	增强型植被指数	差值植被指数	缨帽变换中的绿度植被指数	垂直植被指数	经验模型法	植被指数法	像元分解模型法	斑块分维数	破碎度指数	香农多样性指数	香农均匀度指数

土地利用/覆盖监测分析

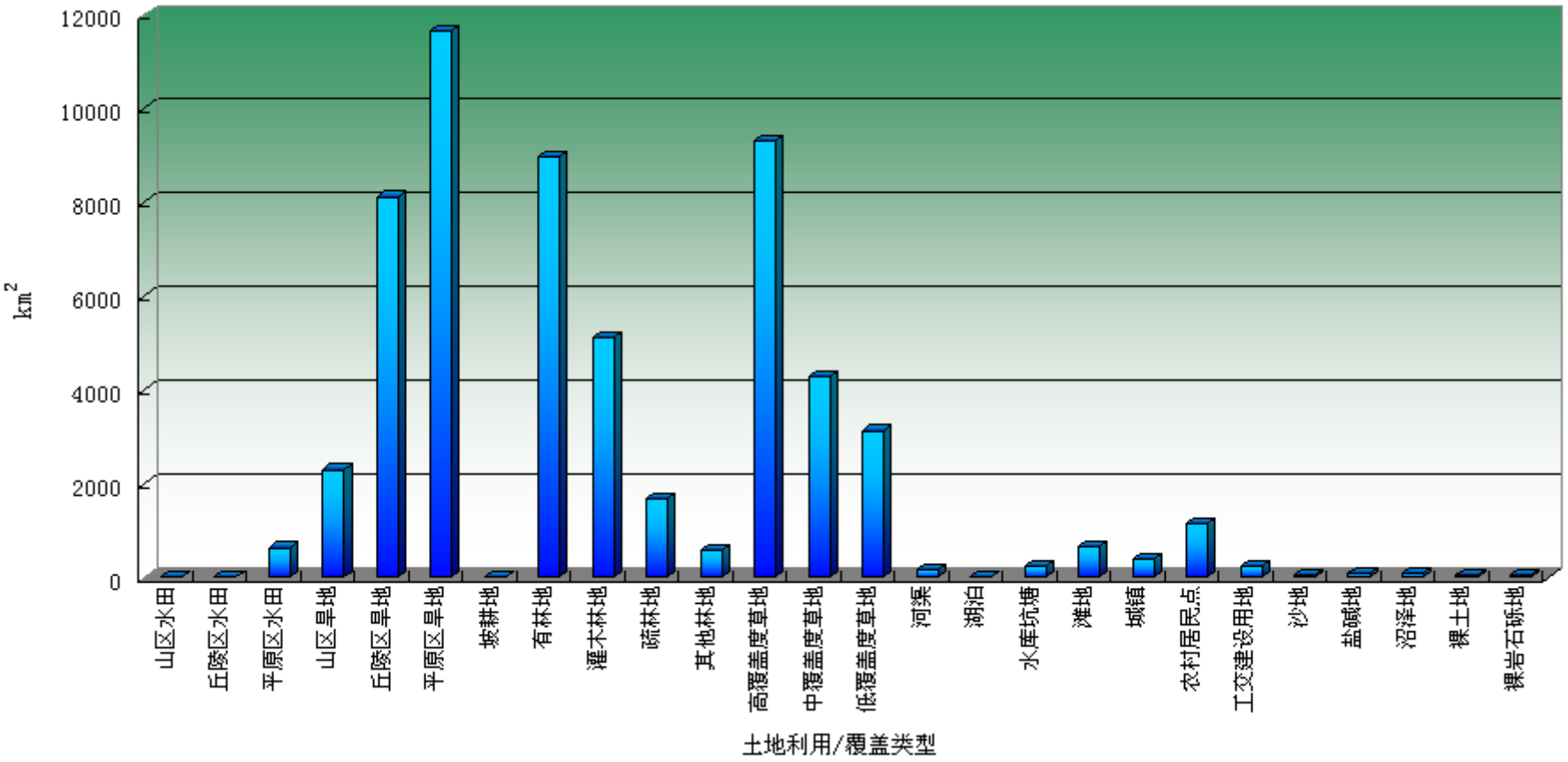
Land use mapping of Guanting catchment in 1980



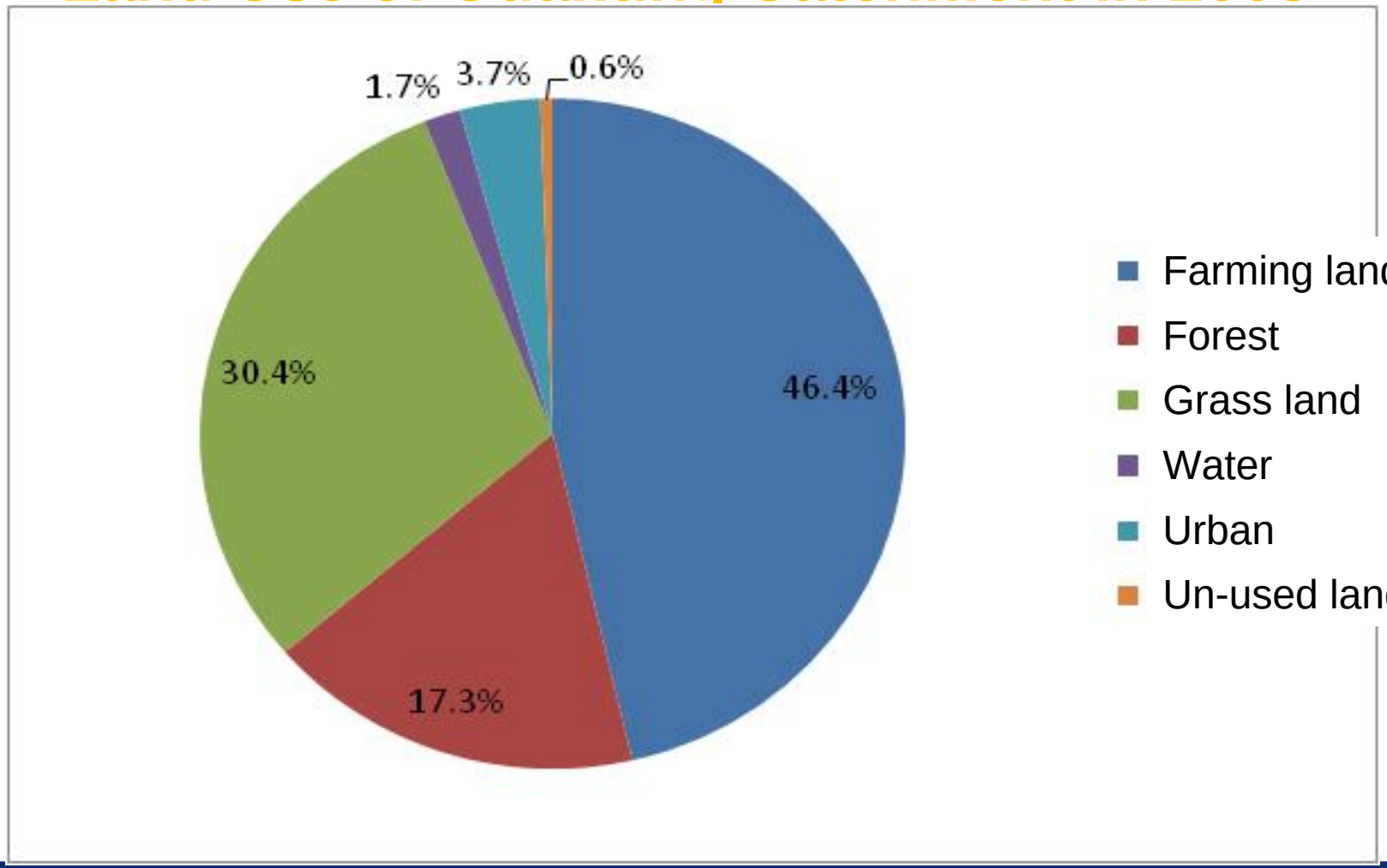
Land use mapping of Guanting catchment in 2000



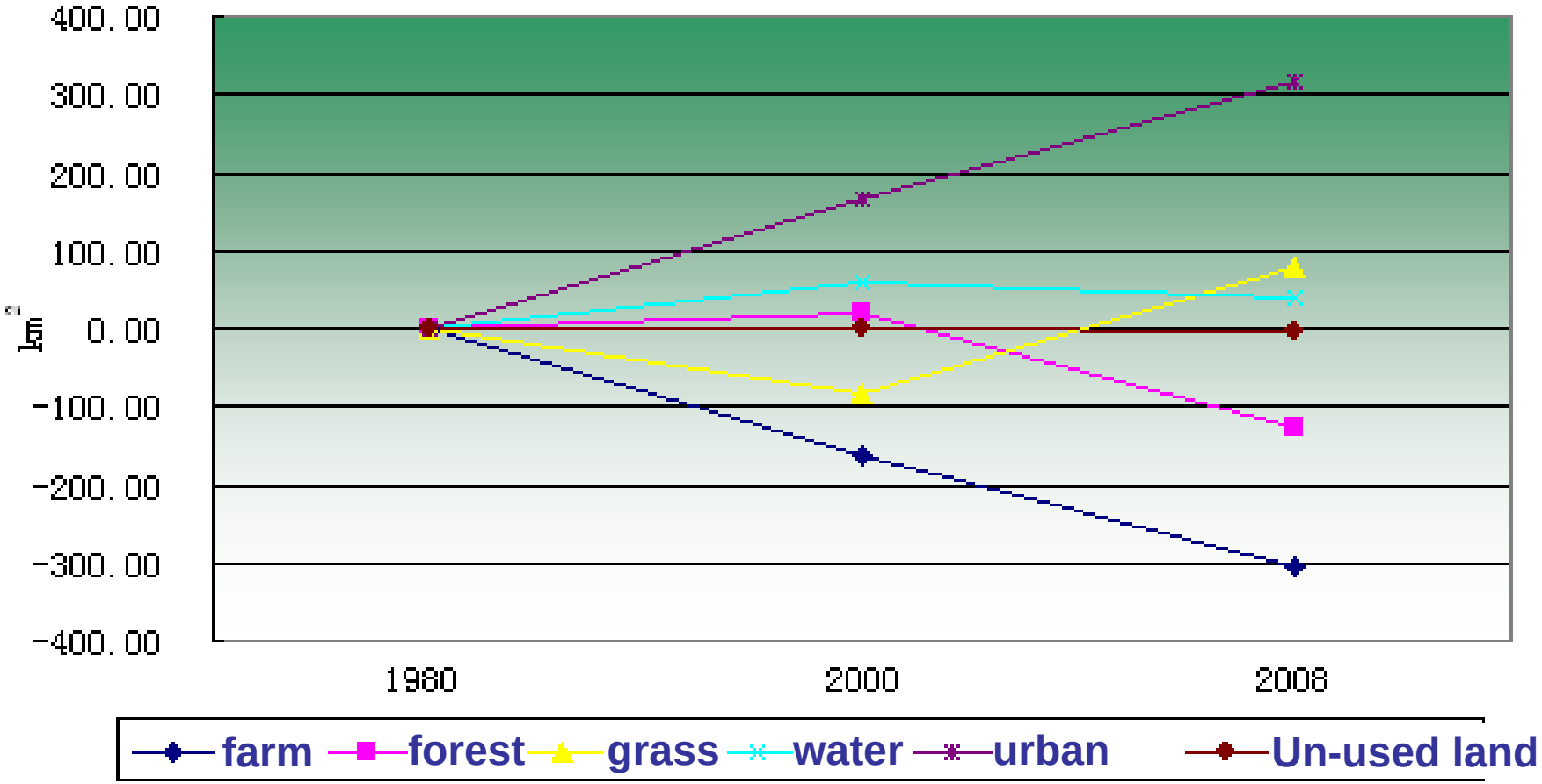
Land use mapping of Guanting catchment in 2008



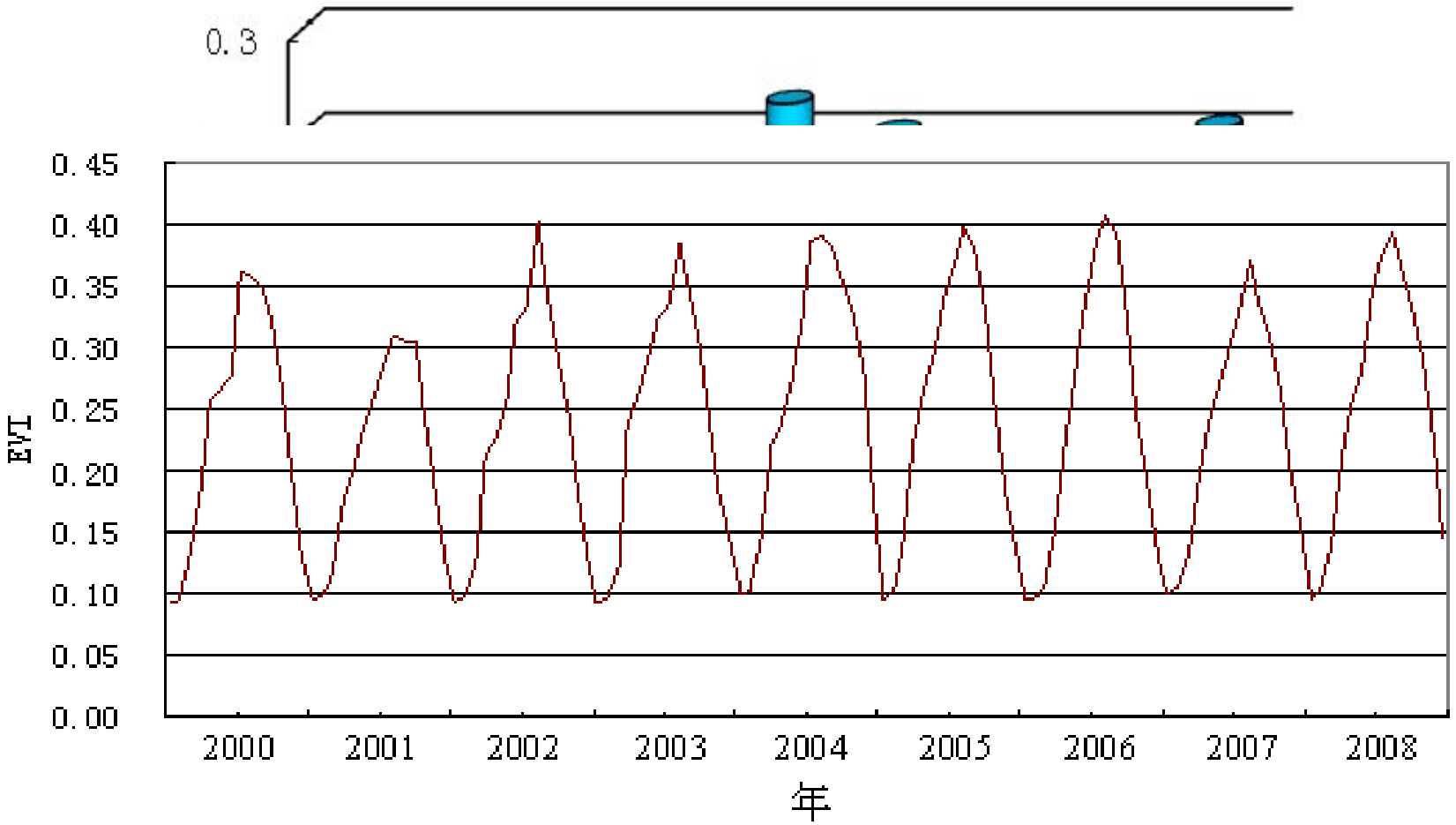
Land Use of Guanting Catchment in 2008



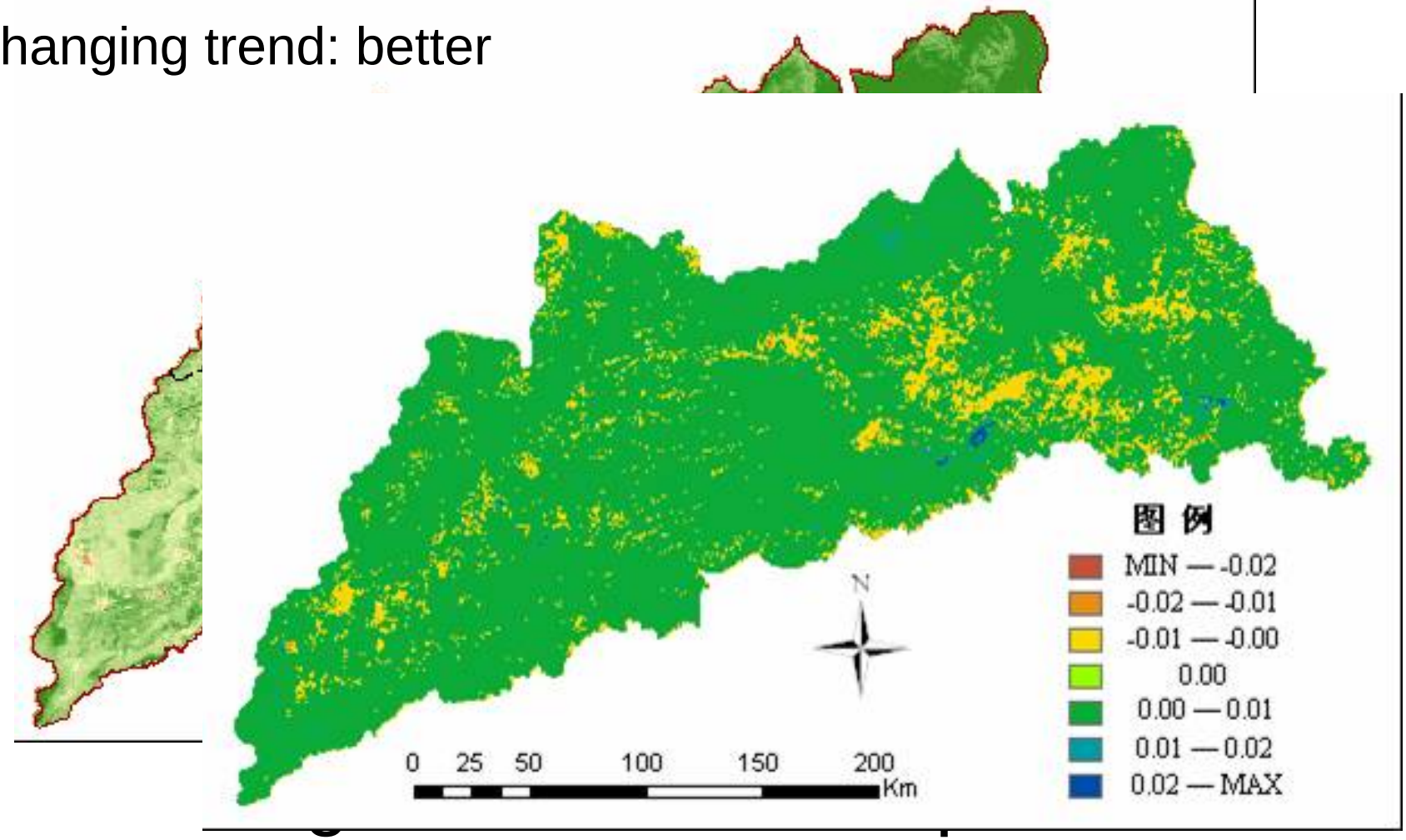
Land use change from 1980 till 2008



Vegetation index variation from 2000 to 2008

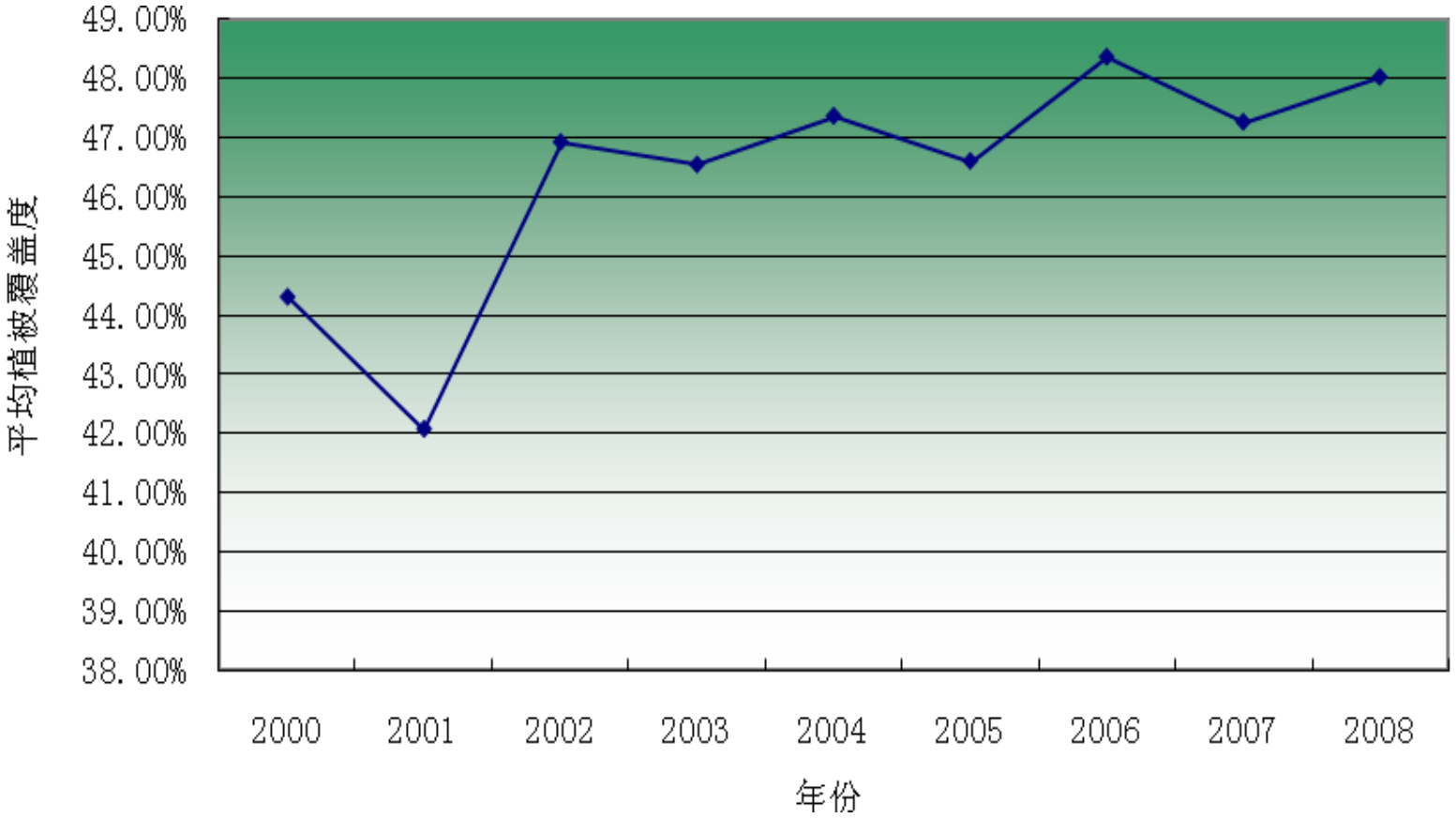


Changing trend: better



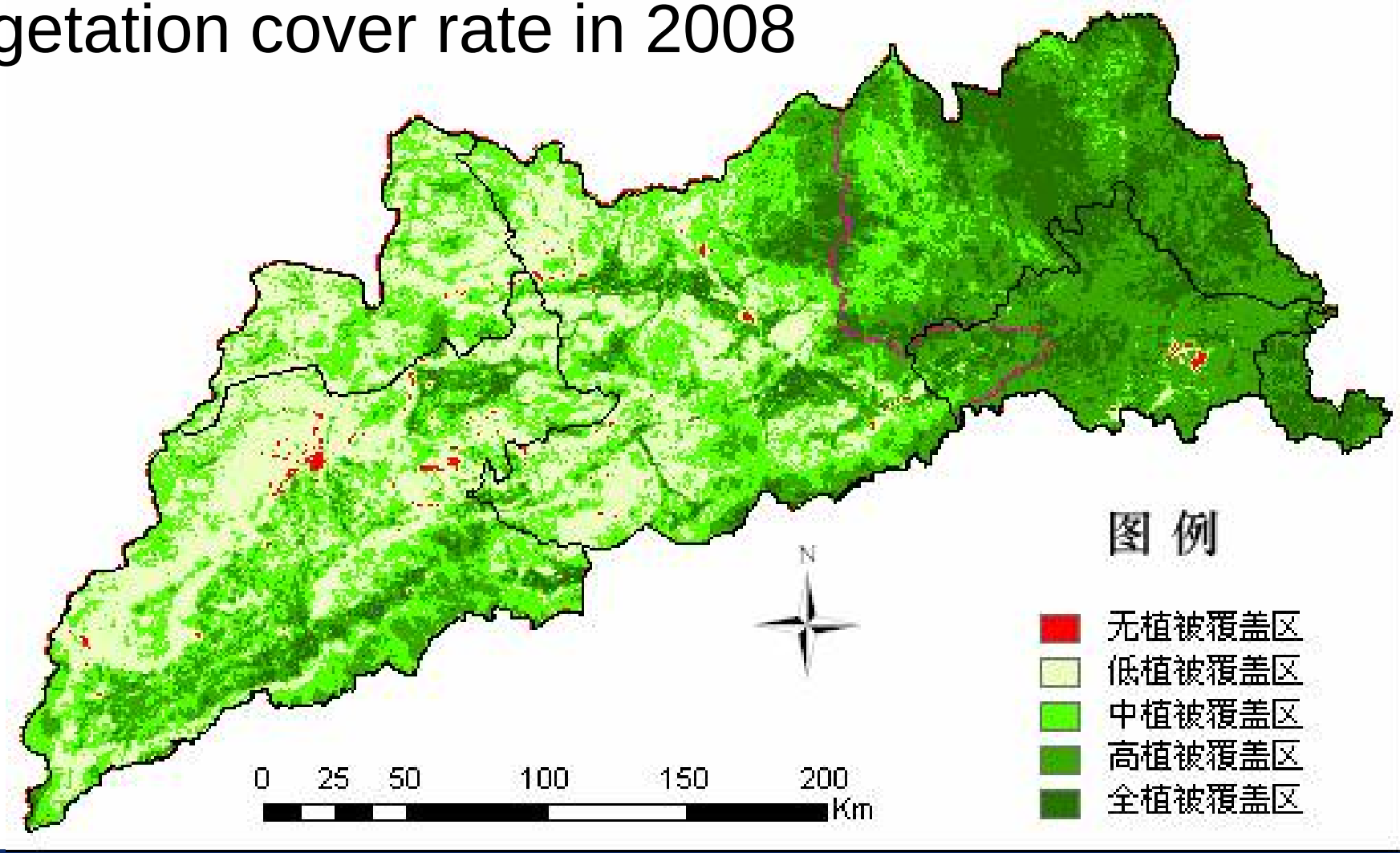
Vegetation index variation map

Vegetation cover rate in 2000~2008



2000~2008年官厅流域平均植被覆盖度变化曲线

Vegetation cover rate in 2008



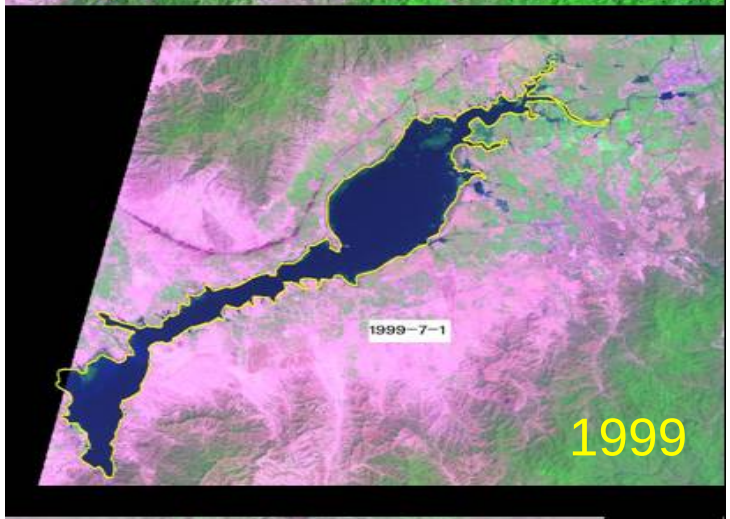
Water Resources Montoring

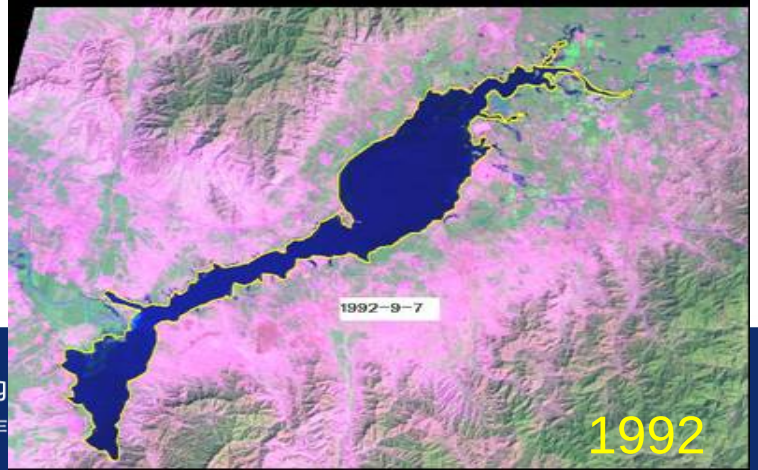
1978-2000

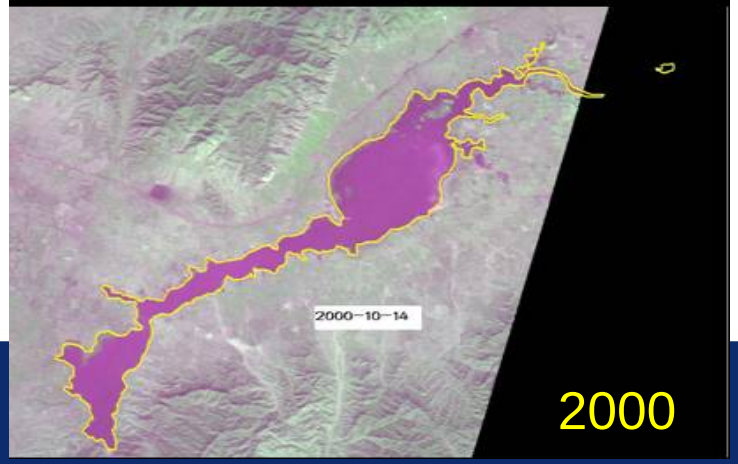

1978-9-20
1978


1995-7-5
1995

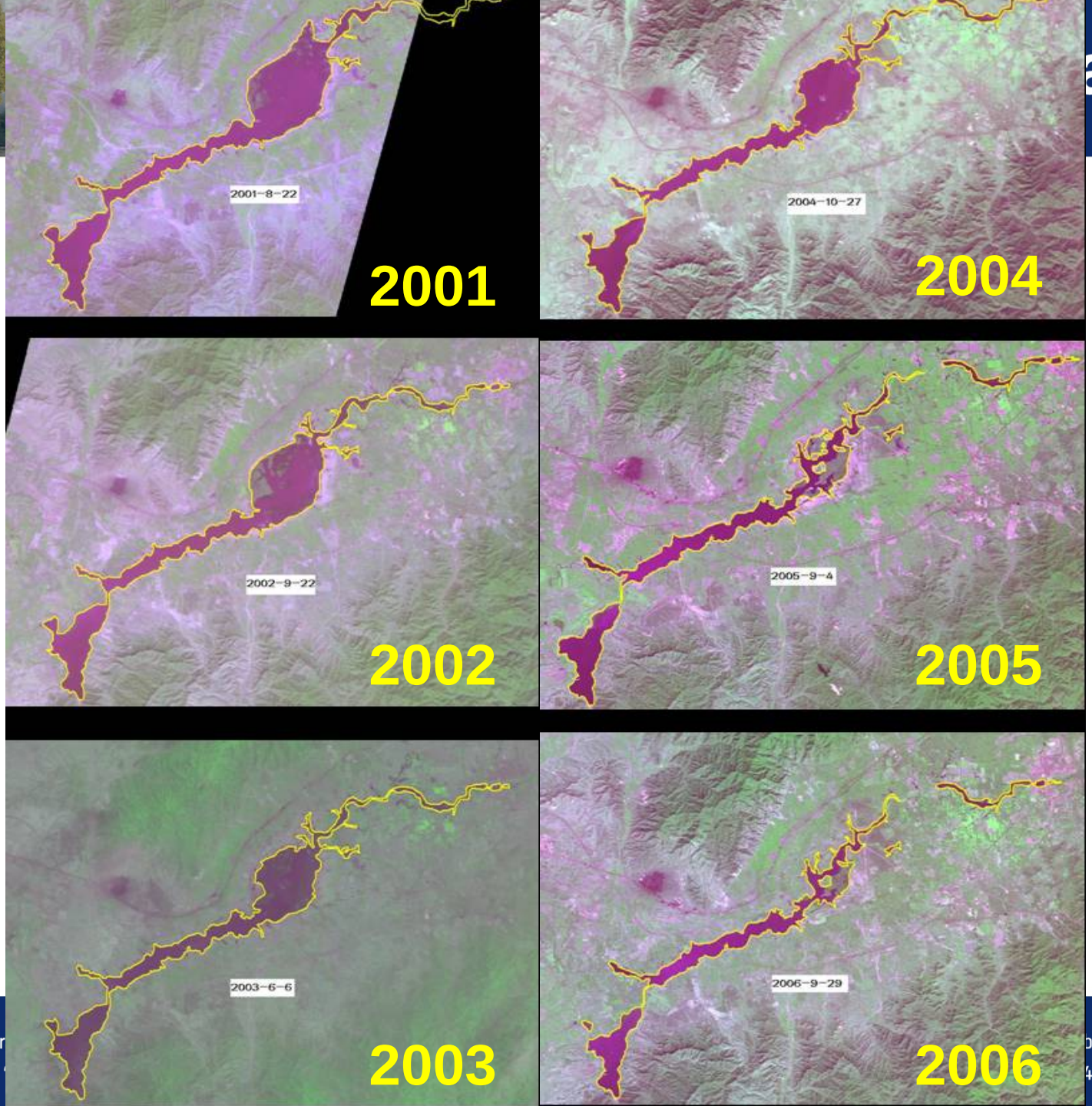

1986-4-16
1986

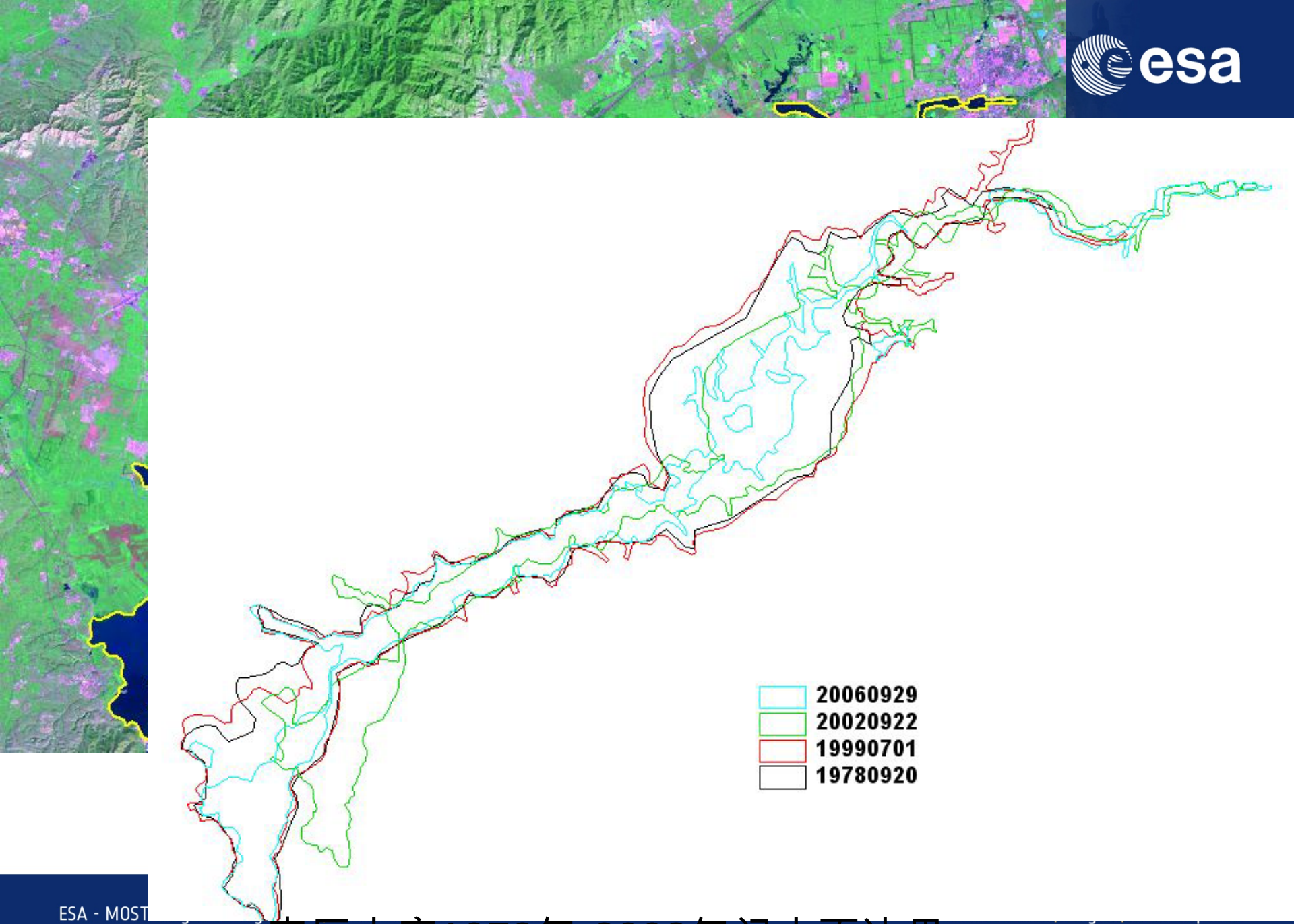

1999-7-1
1999


1992-9-7
1992


2000-10-14
2000

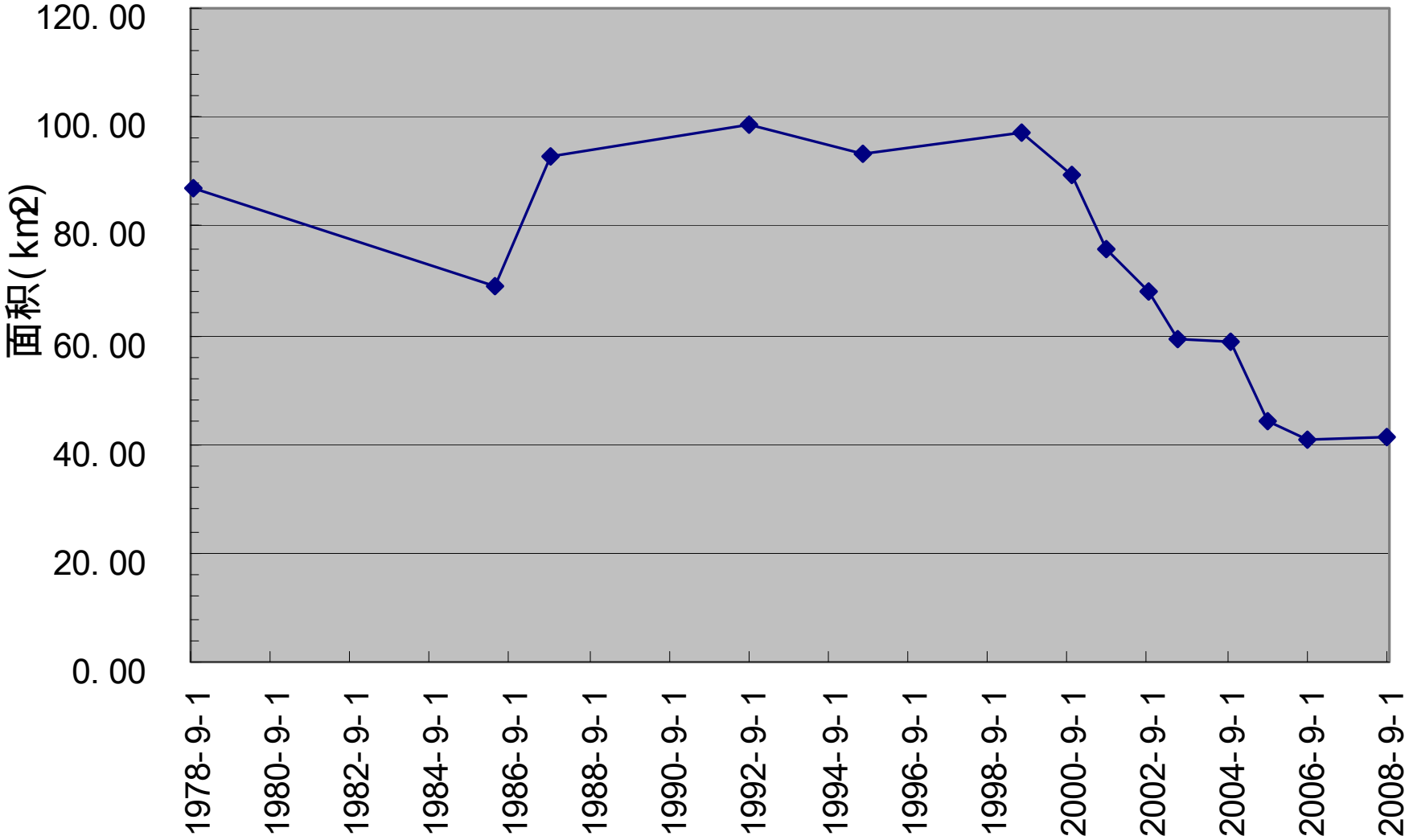
2001-2006

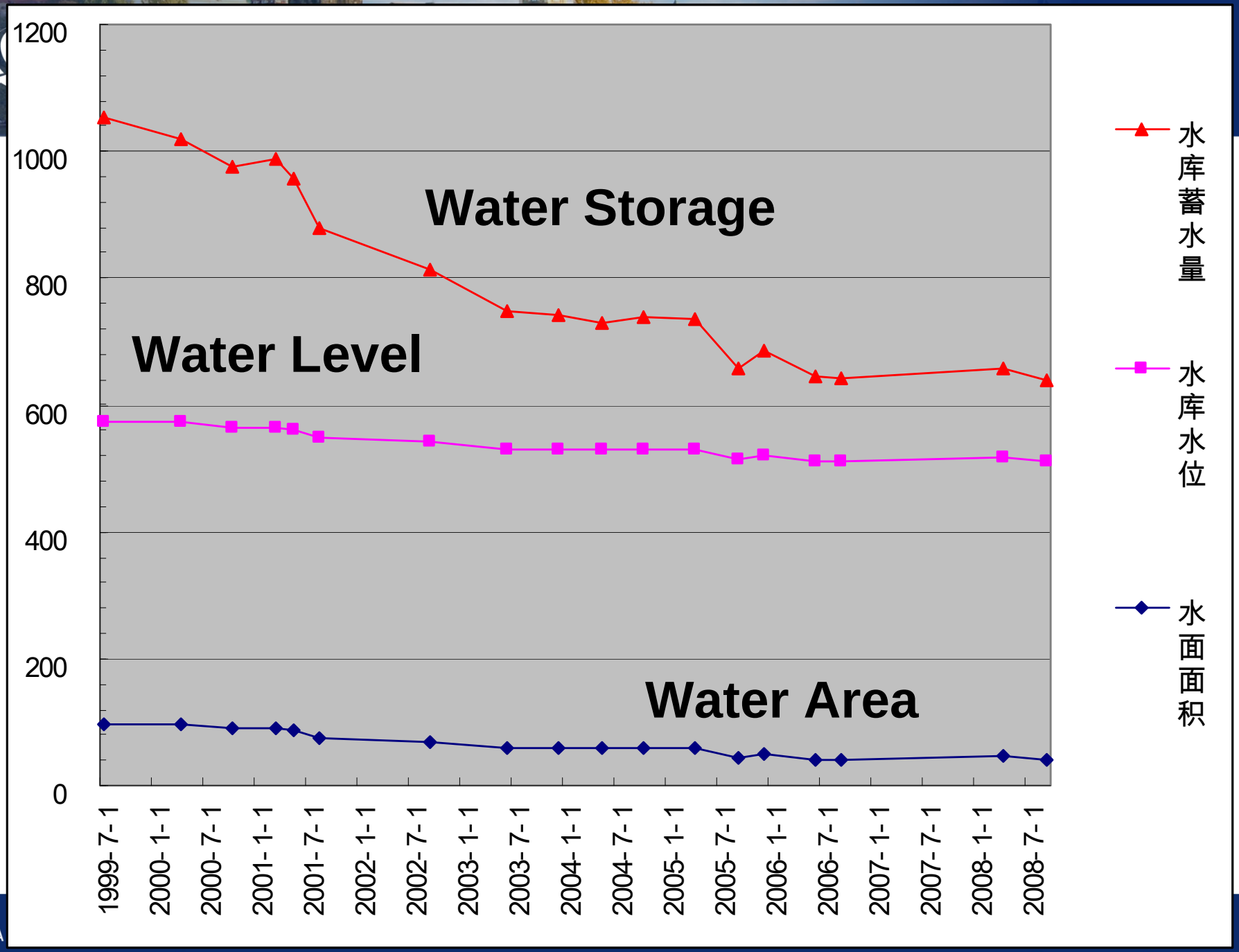

2001-8-22
2001
2004-10-27
2004
2002-9-22
2002
2005-9-4
2005
2003-6-6
2003
2006-9-29
2006



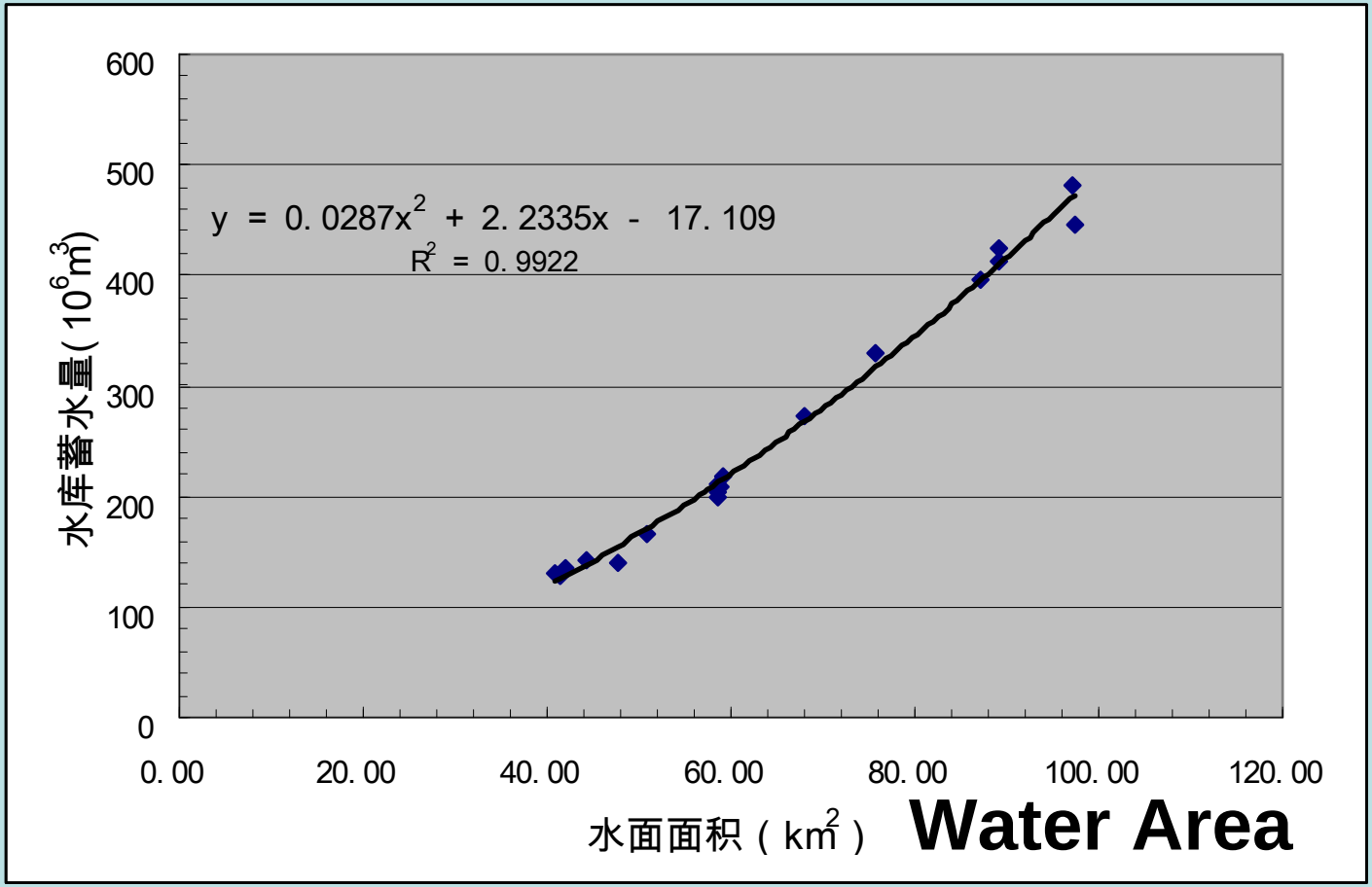
官厅水库1978年-2008年间水面边界

Variration of water area in Guanting Reservoir

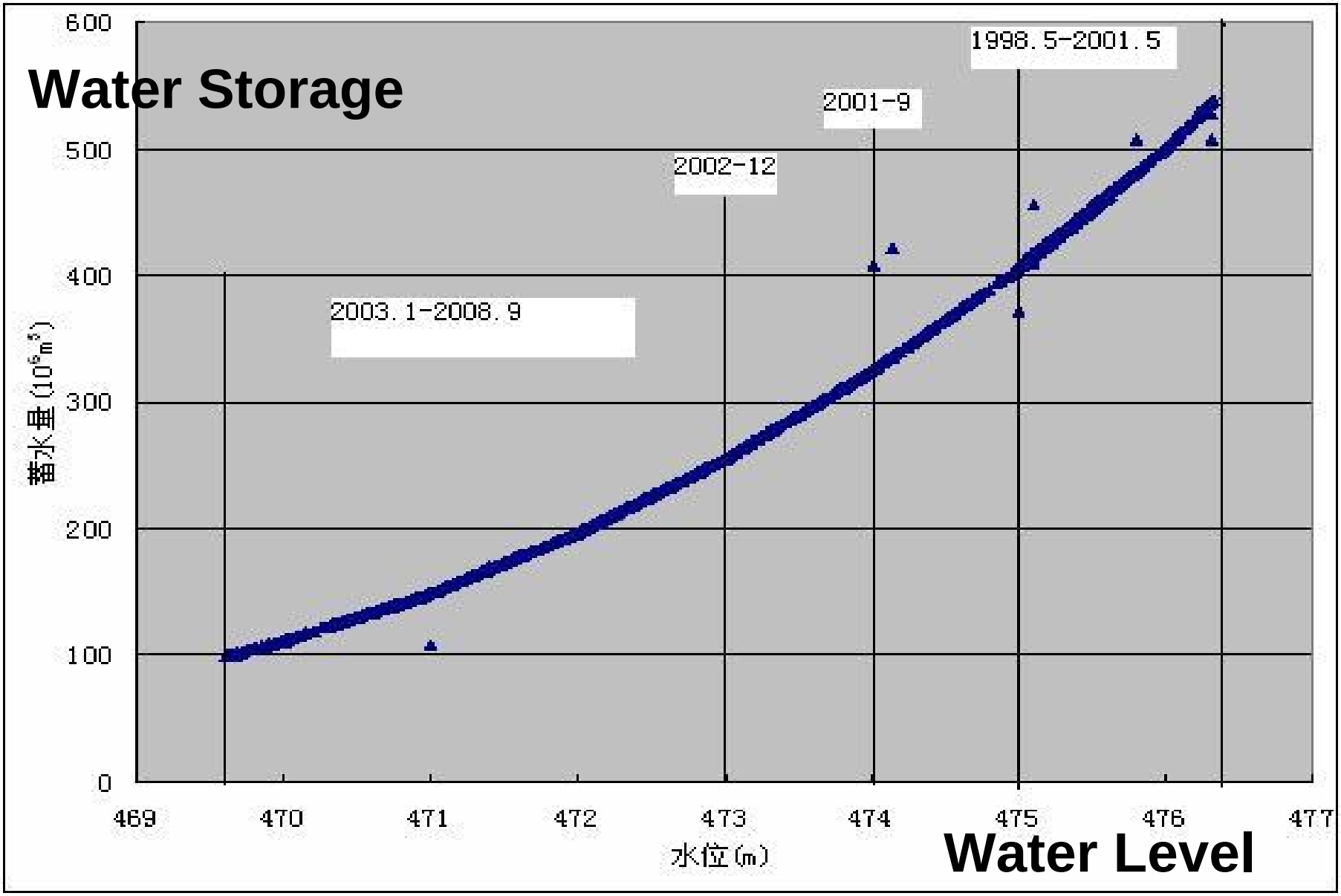



1200
1000
800
600
400
200
0
Water Storage
Water Level
Water Area
1999-7-1
2000-1-1
2000-7-1
2001-1-1
2001-7-1
2002-1-1
2002-7-1
2003-1-1
2003-7-1
2004-1-1
2004-7-1
2005-1-1
2005-7-1
2006-1-1
2006-7-1
2007-1-1
2007-7-1
2008-1-1
2008-7-1
水库蓄水量
水库水位
水面面积

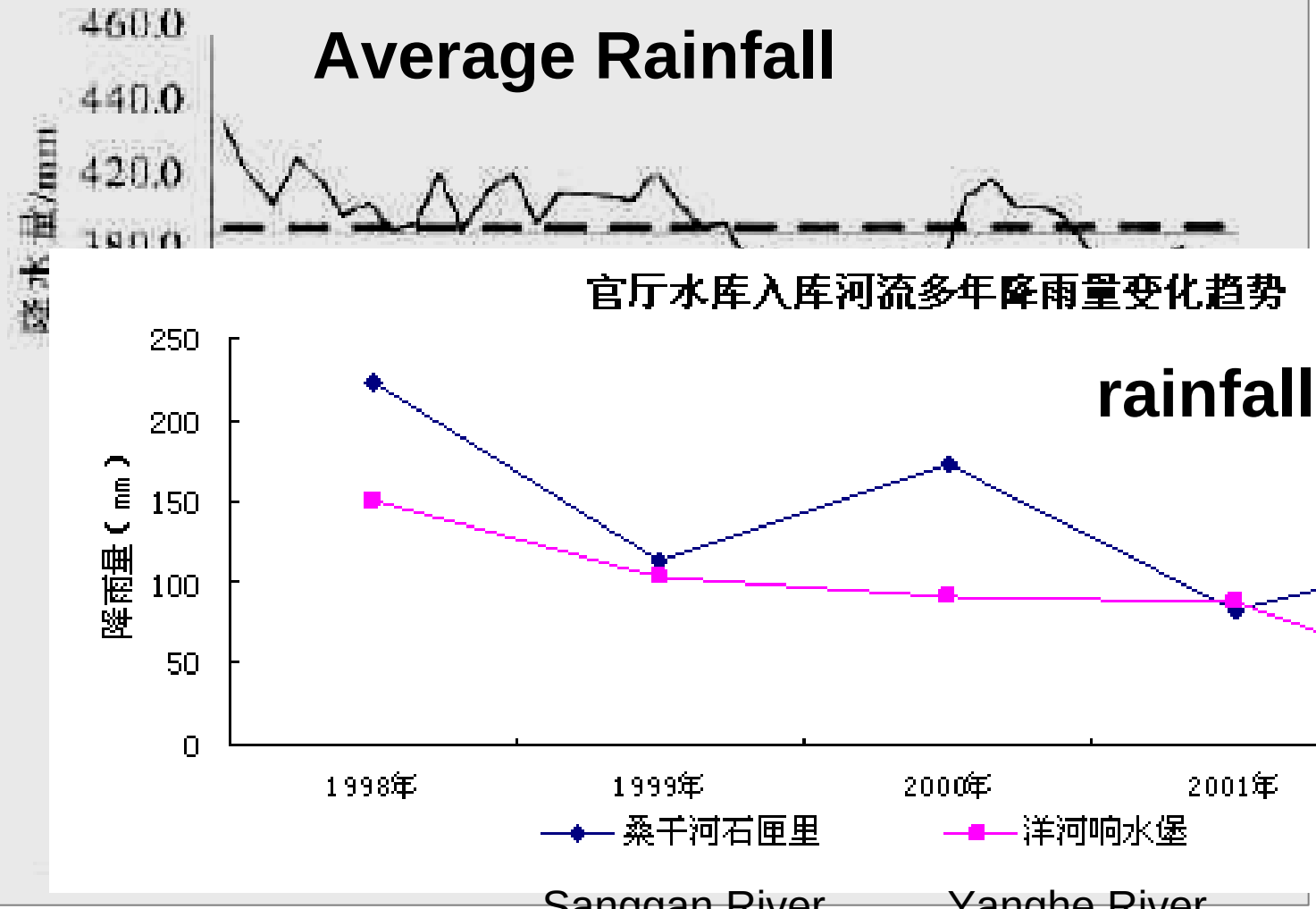
Water Storage



遥感反演水面面积与水位、蓄水量关系


Water Storage
1998.5-2001.5
2001-9
2002-12
2003.1-2008.9
蓄水量($10^6 m^3$)
600
500
400
300
200
100
0
469
470
471
472
473
474
475
476
477
水位(m)
Water Level

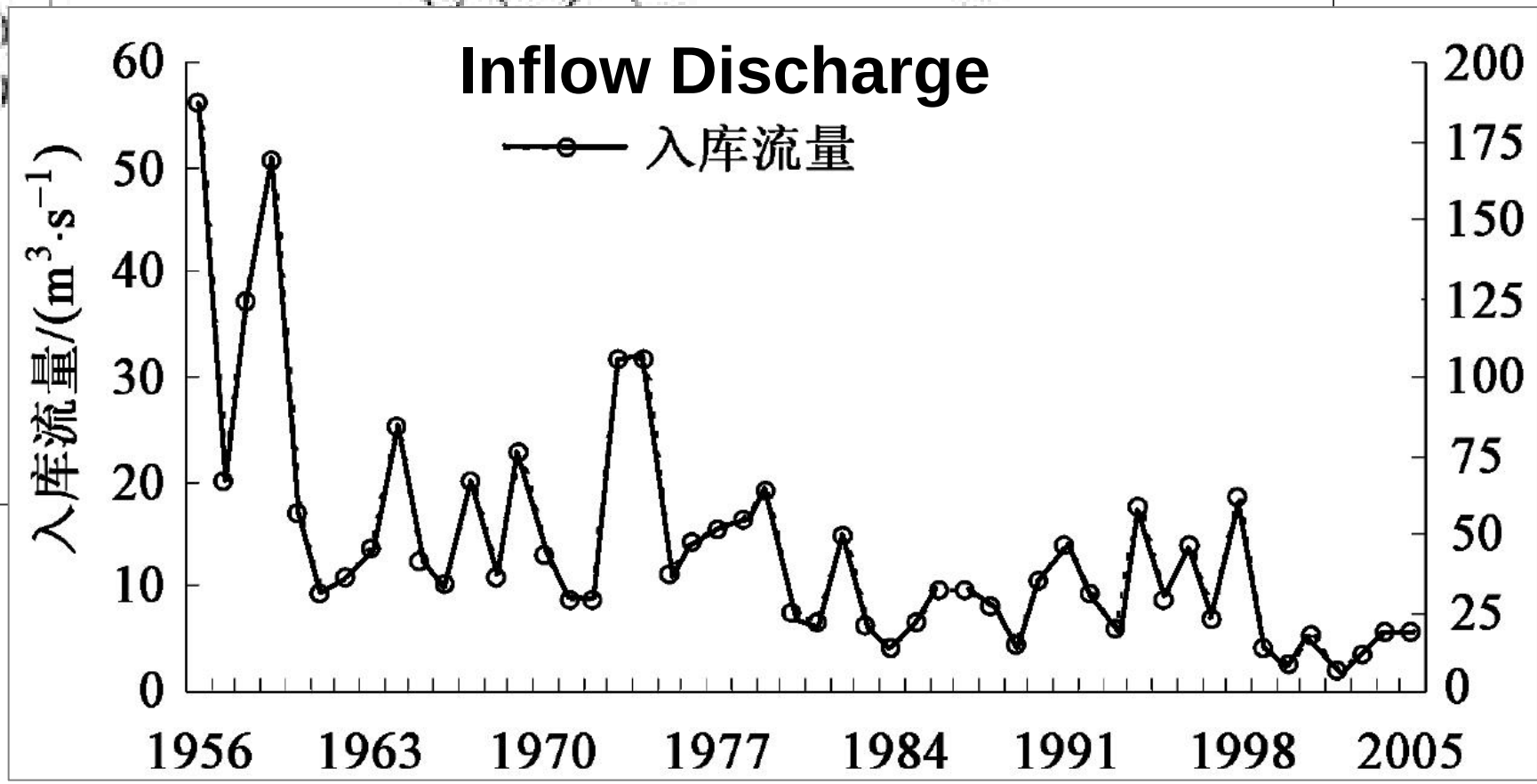
Average Rainfall



Sanggan River Yanghe River

Inflow Volume

Inflow Discharge

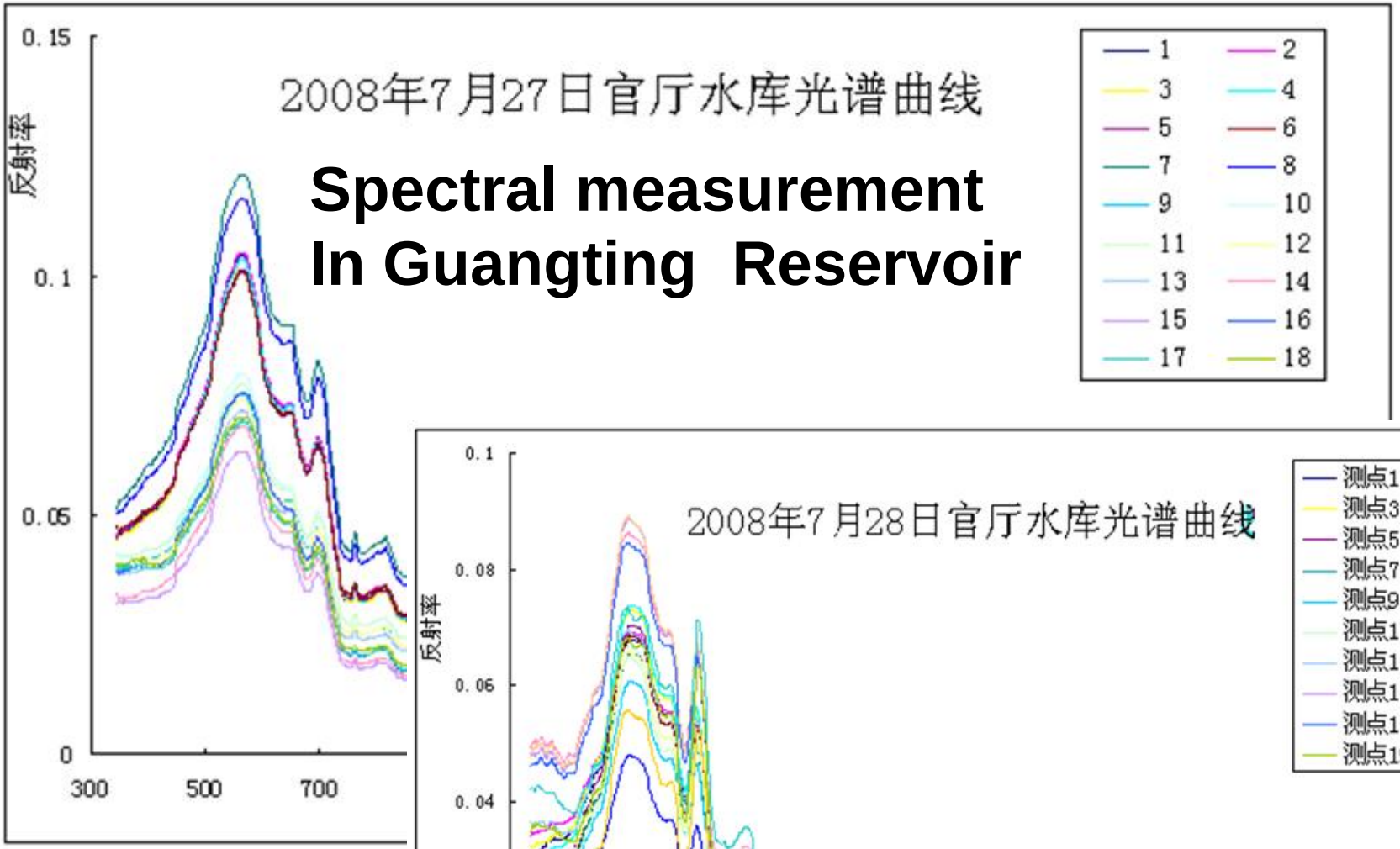


Water Quality Monitoring

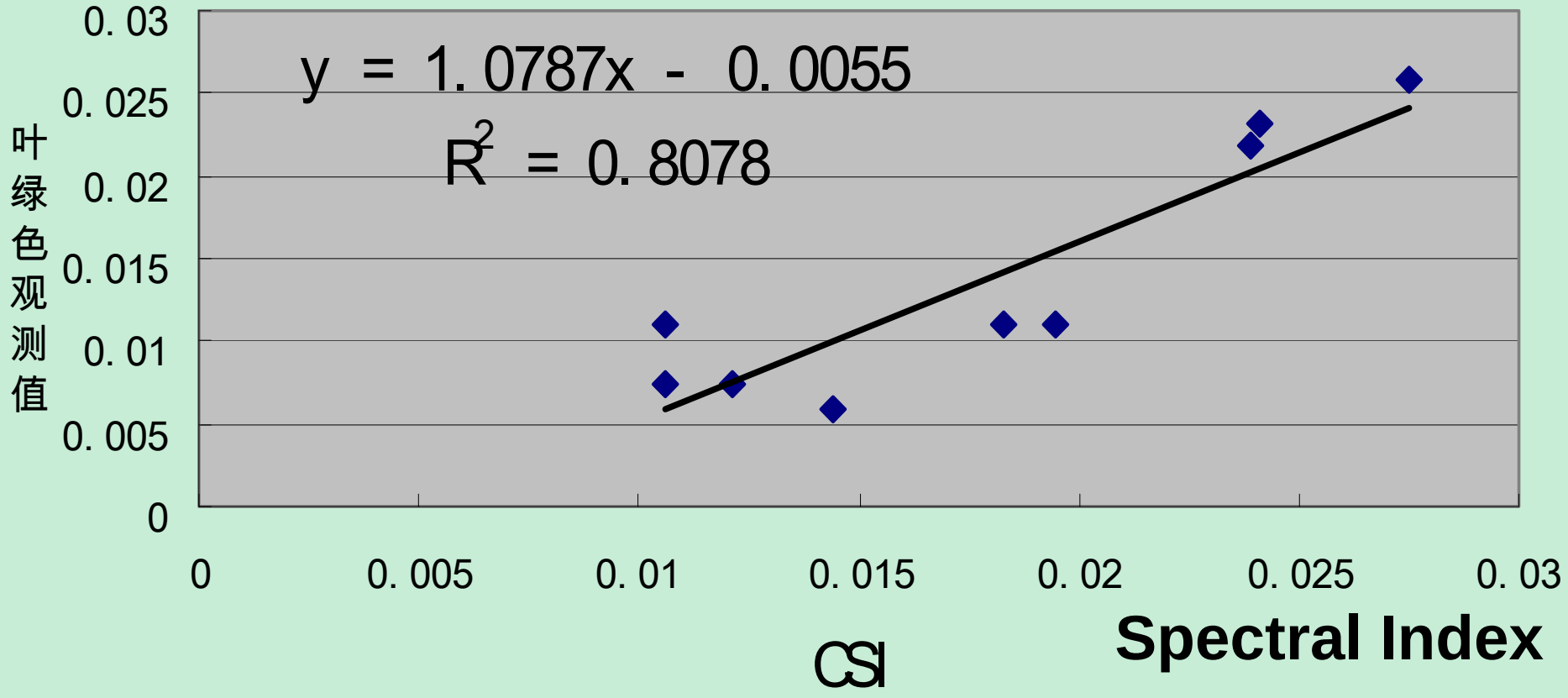

2008 9 28

2008 9 28

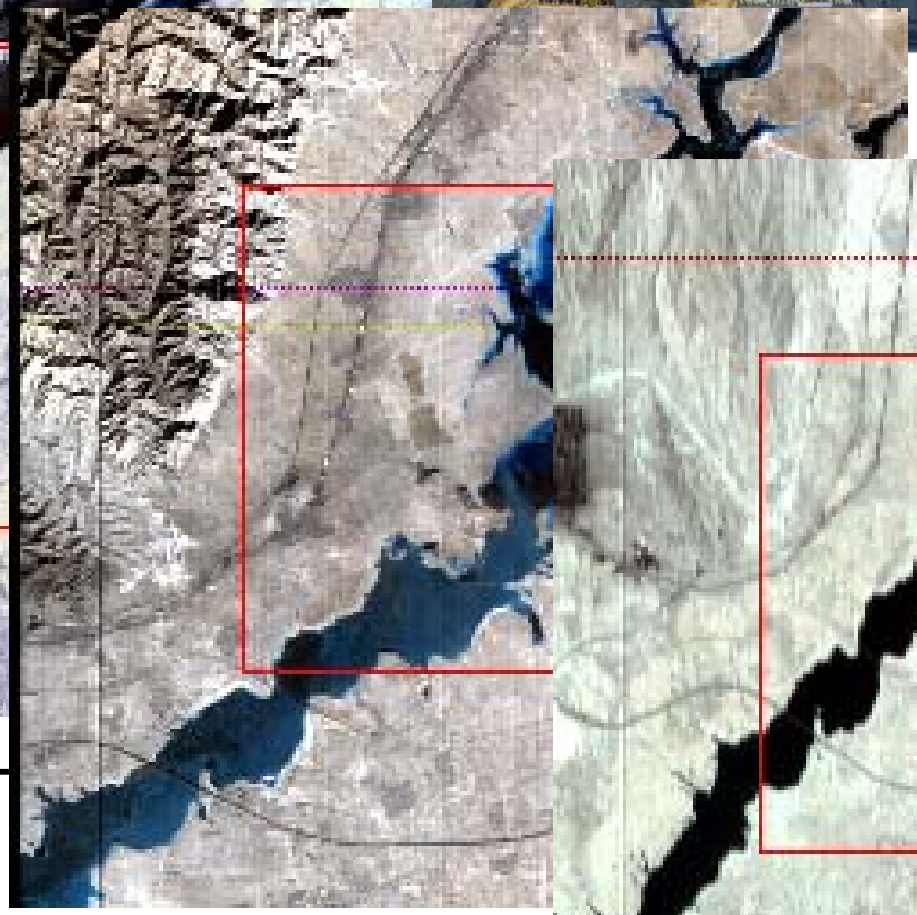
Spectral measurement In Guangting Reservoir



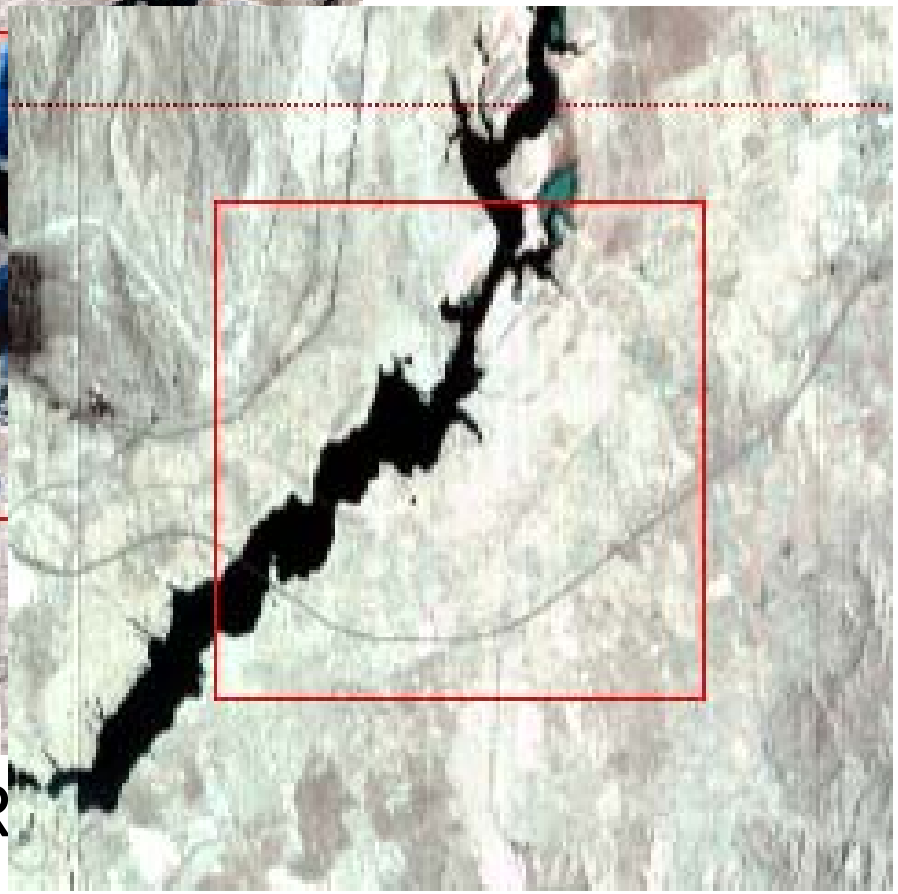
叶绿色测值与CSI 回归关系



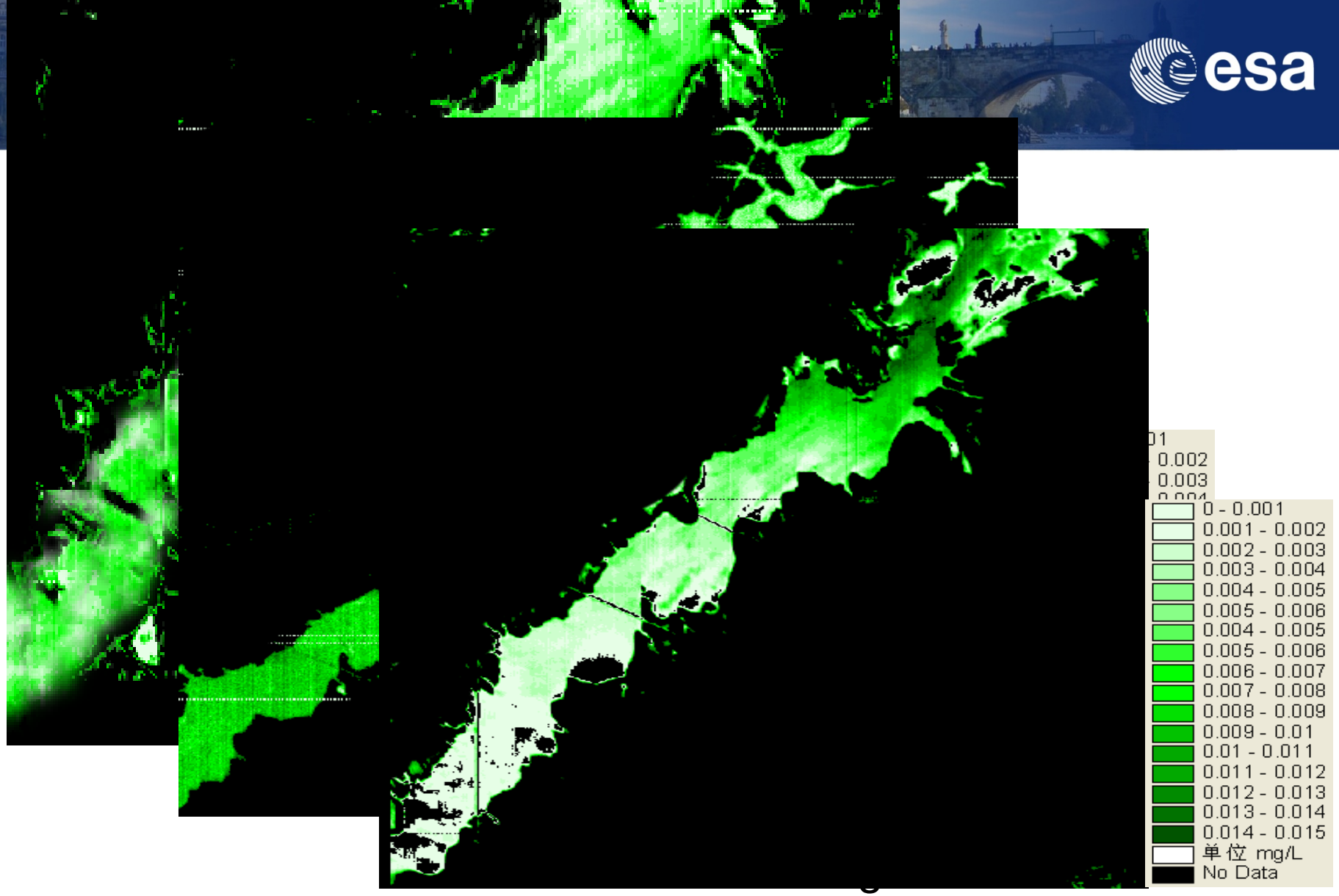
2005.7.3 CH



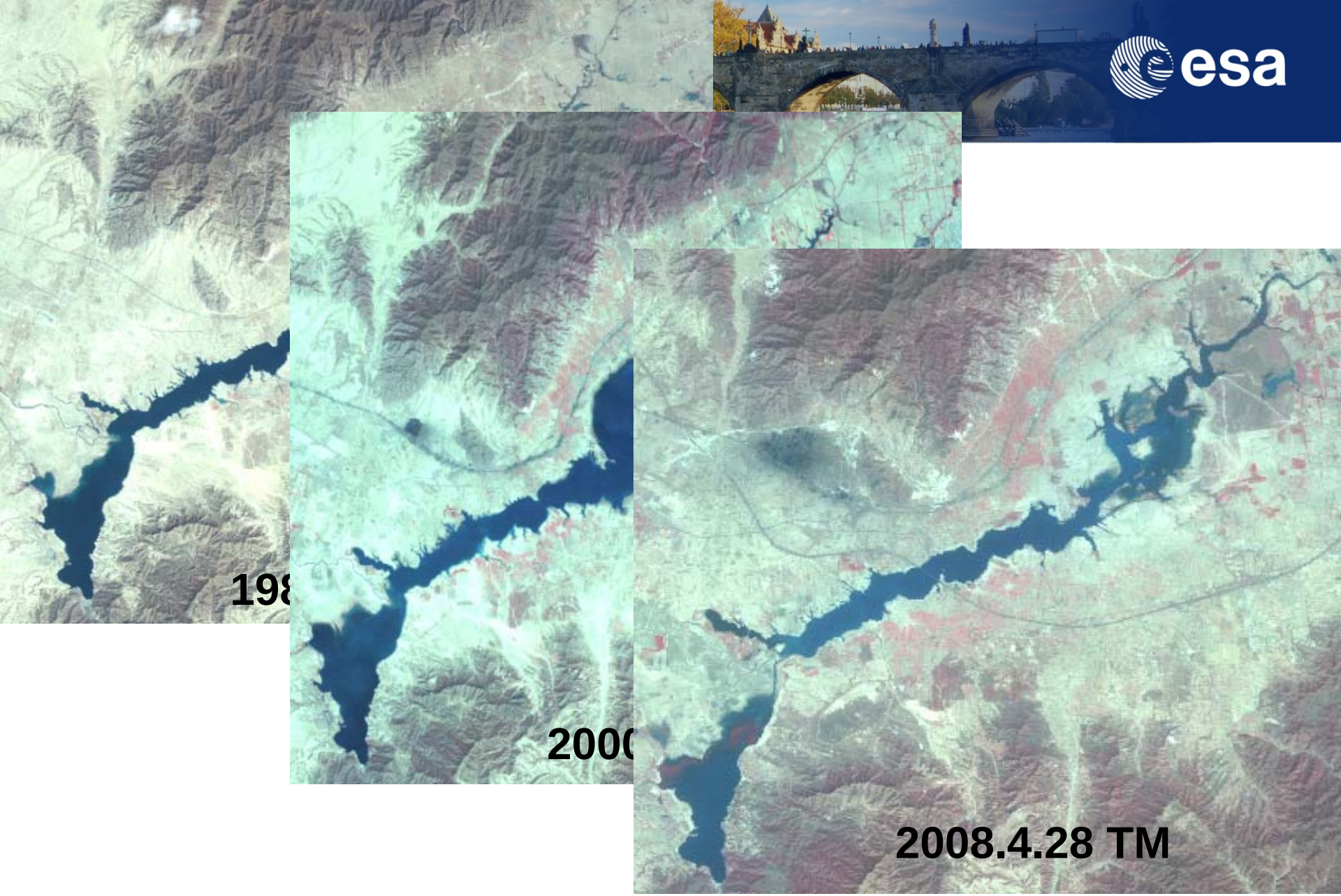
2006.10.6 CHR



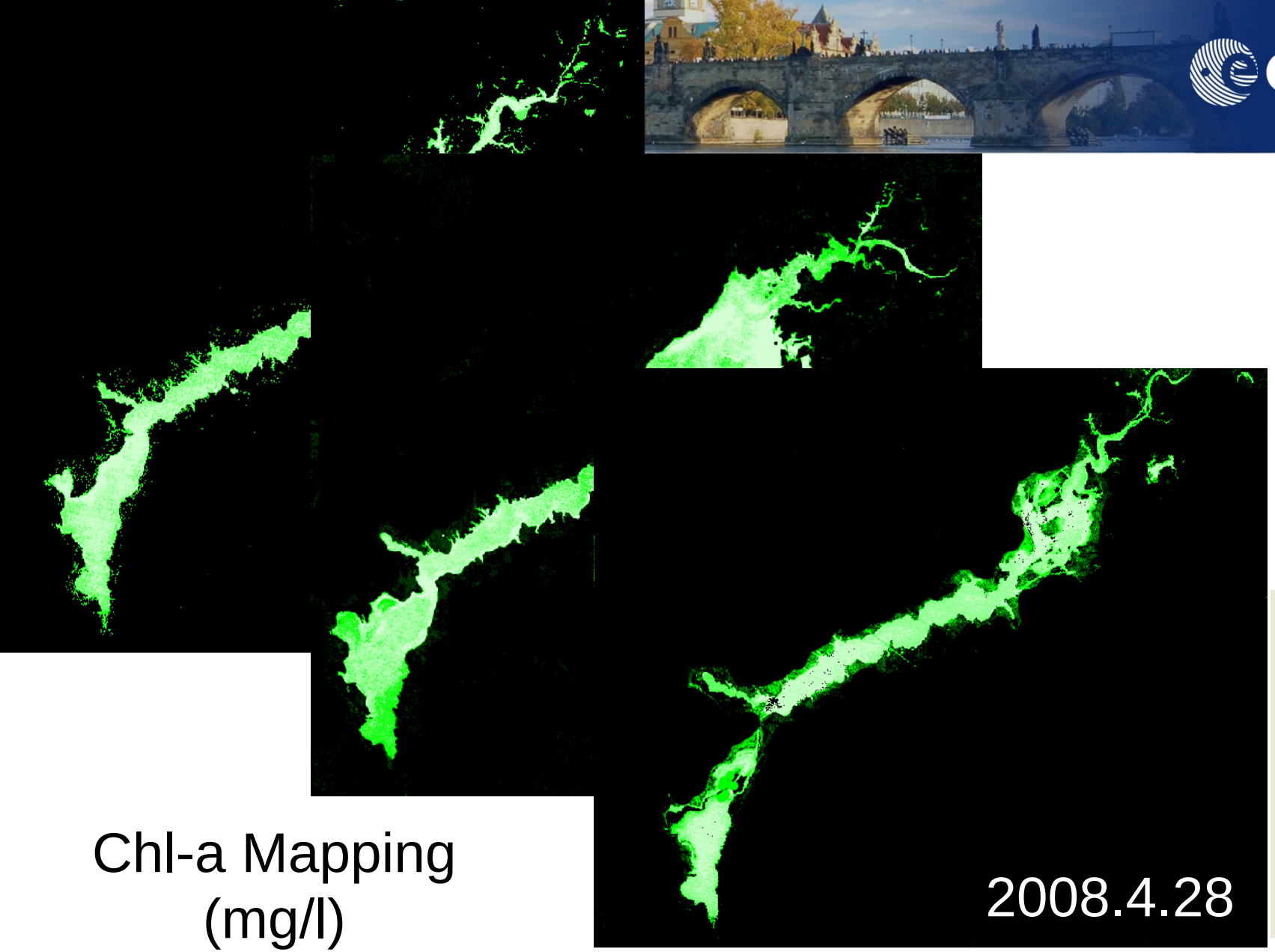
2007.9.20 CHRIS



2007.9.20 Chl-a mg/l


198
2000
2008.4.28 TM

Chl-a Mapping (mg/l)



Eutrophication Level

Time	1986	2000	2008
Chl-a (mg/l)	0.0032	0.0088	0.0123
Level	Mesotrophication	Mesotrophication	Eutrophication

Water source safety assessment for Guanting Reservoir

Indictor system for water source safety assessment

1. Water volume safety

Aim	Assessing index	Assessing standard				
		1	2	3	4	5
Water volume safety	Water supply capacity (%)	≥95	≥90	≥80	≥70	< 70

2. Water quality safety

Safety grade	Ⅰ (very high)	Ⅱ (high)	Ⅲ (medium)	Ⅳ (low)	Ⅴ (very low)
Assessing index	1	2	3	4	5
Assessing index for water quality safety	$0 \le I \le 1$	$1 < I \le 2$	$2 < I \le 3$	$3 < I \le 4$	$4 < I \le 5$
water quality condition	good	medium	generous	poor	Very poor

Assessment on Water source safety in Guanting Reservoir

Index	Water supply index	Water vulome safety index
Water vulome	**5**	**5**

	Stage	Pollutants assessing index	Eutrophication assessing index	I_{yf}	Water quality safety assessing index
Water quality	Whole year	4.4	3	3.6	3.6
	Flooding season	5.0	3	3.8	3.8
	Non-flooding season	4.1	3	3.4	3.4

Conclusion

Through 30 years analysis, we found：

- 1、the land use pattern is under changing, human activity strongly affects the catchment.
- 2、the diversity of landscape pattern decrease，and the pressure from industry and economy development increase. These cause that Vegetation cover area decrease and construction land increase.

结论

3. Water area and water storage decrease from 1978 to 2008。
4. The factors affecting inflow volume are natural ones (mainly railfall) and human activities (water consumption and conditions of runoff formation and concentration).

结 论

5. The concentration of chl-a is gradually increase in Guanting reservoir and is at the level of eutrophication
6. The water source is not safe in Guanting reservoir in terms of water volume and water quality.

Thanks