



Environmental Solutions for Smart City in China

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Outline

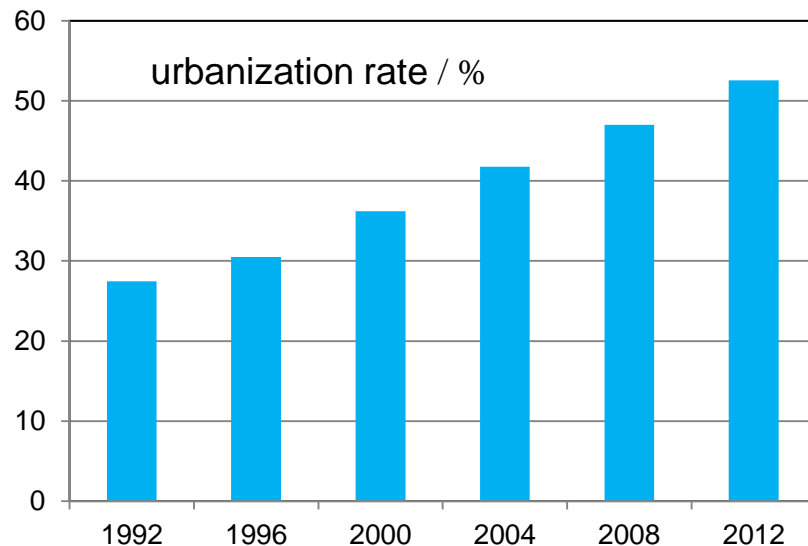
- 1. China's Urbanization**
- 2. Urban Environmental Issues Caused by China's Urbanization**
- 3. Urbanization Concept for Harmoniousness between Environment and Development**
- 4. Environmental Solutions for Smart City in China**

China's urbanization

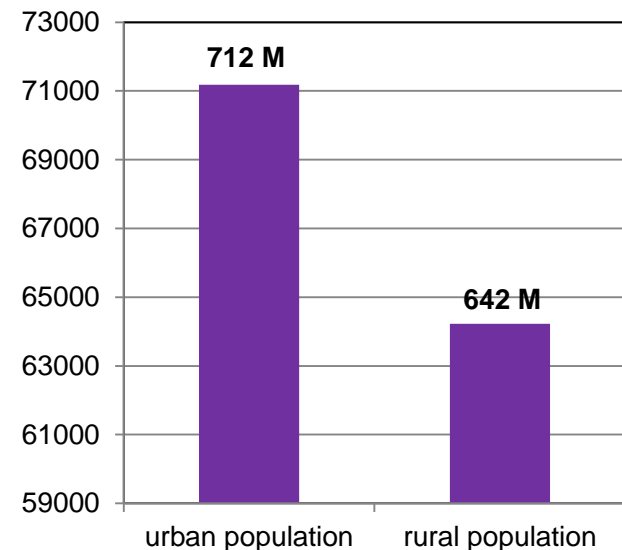
“Revolution of new technology and China's urbanizing process are expected to be the two big events that will affect humankind in the 21st century”, predicted by Joseph E. Stiglitz, former World Bank Vice President and also Nobel winner in economy, in 1999 when he came to China to participate in a symposium on urbanization

China's urbanization

- China's urbanization rate reached 52.57% in 2012, with an **annual 1.2 percent** increase from 26.41% as for 1990
- Urban population increased 15 million annually
- By the end of 2011, China has 657 cities. There were 30 cities with urban population more than 8 million, of which 13 cities more than 10 million



China's urbanization rate



China's urban and rural population distribution in 2012

China's urbanization

China's urbanization will aim at building World-Class City Group

✓ Three national city

groups: Beijing-

Tianjin-Hebei

Metropolitan Region,

Yangtze River Delta

Region, Pearl River

Delta Region

✓ Seven city groups

growing up with a

certain scale



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Urban Environmental Issues Caused by China's Urbanization

- **Urban Water Environment**

- **Eutrophication of water body**
- **Waste discarding**
- **Industrial wastewater discharging**



Chaohu Lake, Hefei



Offshore sea, Qingdao



River outside the forbidden city

Urban Environmental Issues Caused by China's Urbanization

• Urban Atmospheric Environment

- Vehicle source
- Industrial source

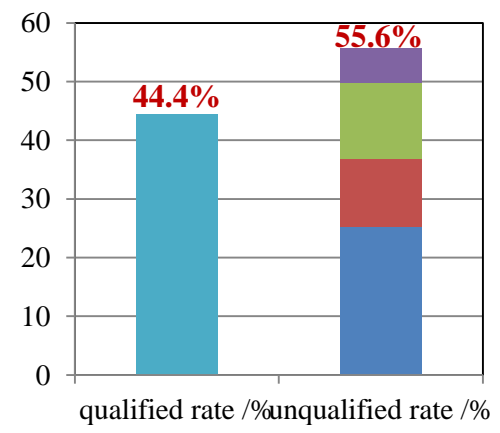


Haze, Beijing

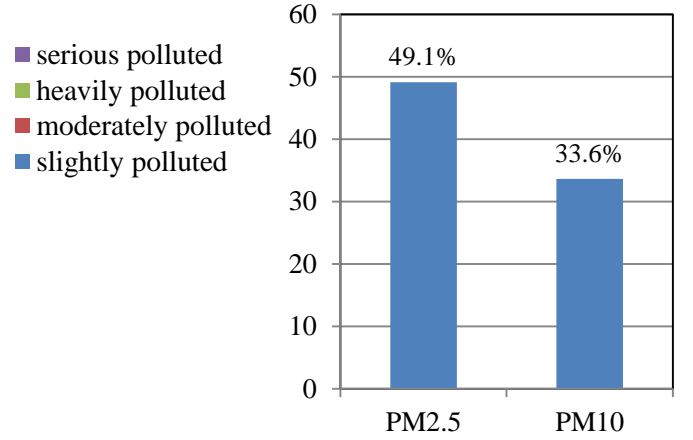


Tiananmen Square, Jan. 29, 2013

Late January in 2013, **more than 143 square kilometers** in middle-east China were covered by heavy haze, mainly Beijing, Tianjin, Hebei, Henan, Shandong, Jiangsu, Anhui, Hubei, Hunan, etc.



Urban air quality of 74 cities in the first quarter of 2013



Average **unqualified rate** of principal air pollutants of 74 cities in the first quarter of 2013

Urban Environmental Issues Caused by China's Urbanization

- **Urban Ecosystem**
 - **Deterioration of the ecosystem**
 - **Decrease in biodiversity**



Sensitive species disappeared



Deterioration of natural habitats



Decrease of urban wetland



Destroy of urban forest

Urban Environmental Issues Caused by China's Urbanization

- **Urban Contaminate Sites**

- **Factory relocation**

- **Land reuse**



Urban Environmental Issues Caused by China's Urbanization

• Urban Solid Waste

- Disposal difficulty of municipal solid waste
- Industrial solid waste stockpiling in huge quantity
- Illegal discarding of hazardous waste



Garbage siege



Protest of MSW incineration



Illegal discarding of chromium slag



Stockpiling of red mud

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Urbanization Concept for Harmoniousness between Environment and Development

Green Low-carbon Ecological

- Humanistic Beijing, S&T Beijing, **green** Beijing had been the developing strategies for Beijing after Olympic Games
- National Development and Reform Commission launched pilot construction project of **low-carbon** cities (totally 36 cities) since 2008
- **Eco-city** becomes a new target for most cities after ecological civilization proposed in 2012



Urbanization Concept for Harmoniousness between Environment and Development

Better City, Better Life

- Space conflict, cultural friction, resource shortage and environmental pollution were inevitable results from high-density urban living
- As the inconsistency between environment and development become more and more serious, sustainable development concept emerged
- “**Better City, Better Life**” is the theme of Shanghai World Expo, in order to enhance the urban solutions to achieve harmoniousness between human and nature, human and human, spirit and material, etc



城市,让生活更美好
Better City, Better Life



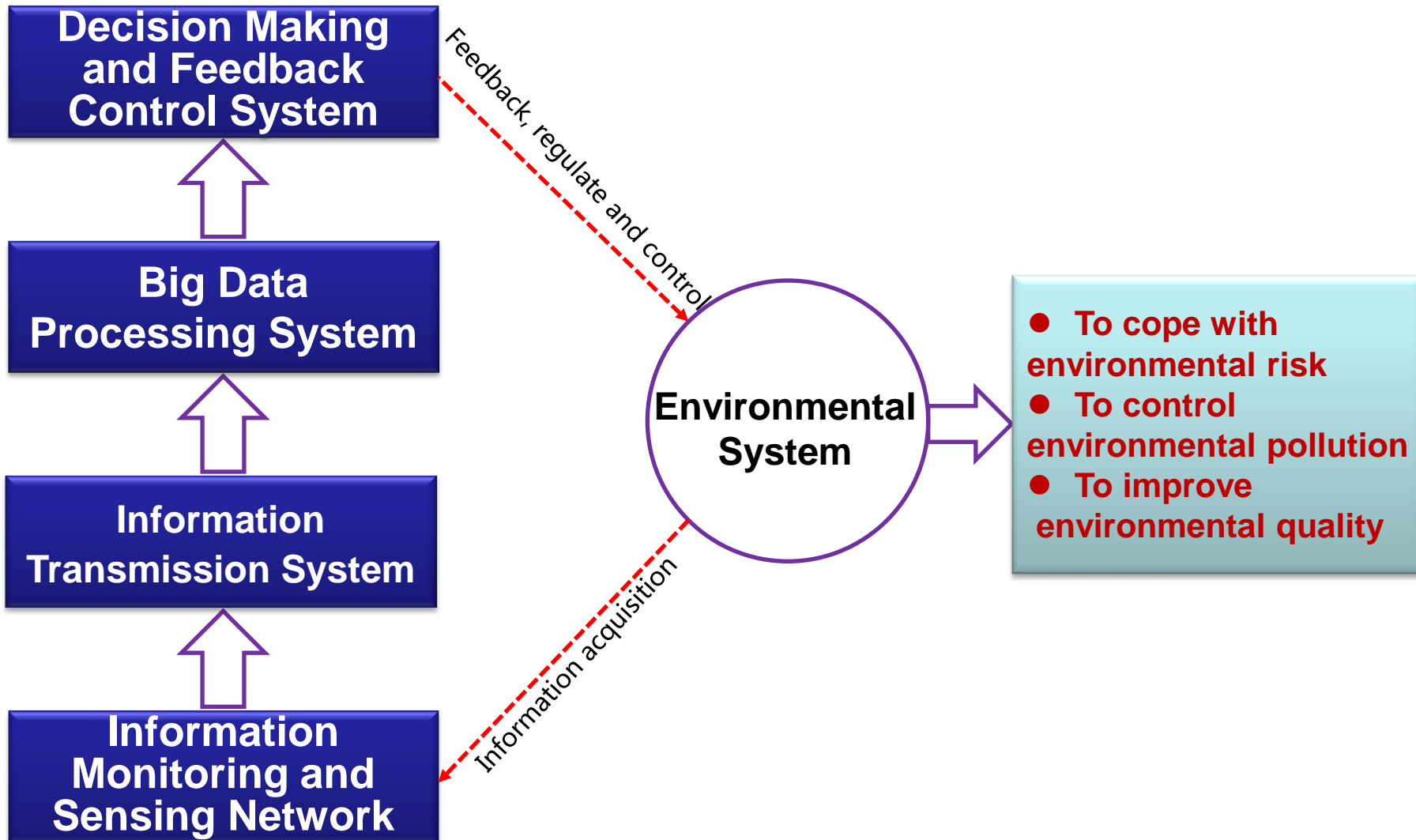
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National developing strategy

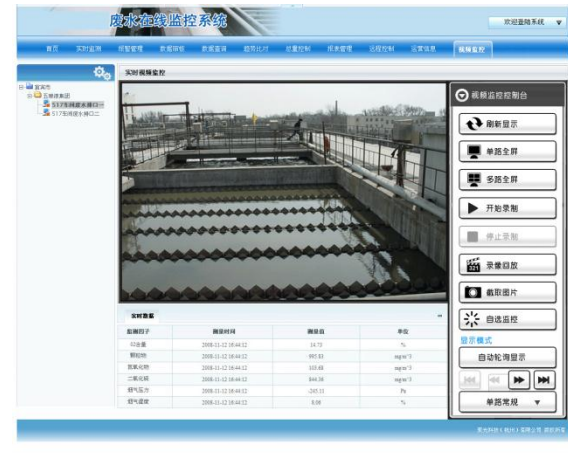
- ❑ To solve the key environmental issues caused by China's urbanization
- ❑ Focused on **intelligent perception, intelligent processing, and intelligent application** of environmental information to establish a smart environmental management system for cities
- ❑ Aiming at making the urban environment be sustainable and harmonious with economy and society development through the change of environment protection mode
 - ✓ From pollution source control to environment quality improvement
 - ✓ From targeted pollutant quantity control to environment capacity control
 - ✓ From passive emergency management to positive risk management

Architecture of Smart Environmental Management System



Information Monitoring and Sensing Network

- **Automatic monitoring system of the key pollution sources**
 - 356 monitoring and control centers in province and city levels had been built in China
 - Automatic and online monitoring had been enforced on more than 15000 enterprises by the Internet of Things (IOT)



code



RFID



satellite



sensor



camera

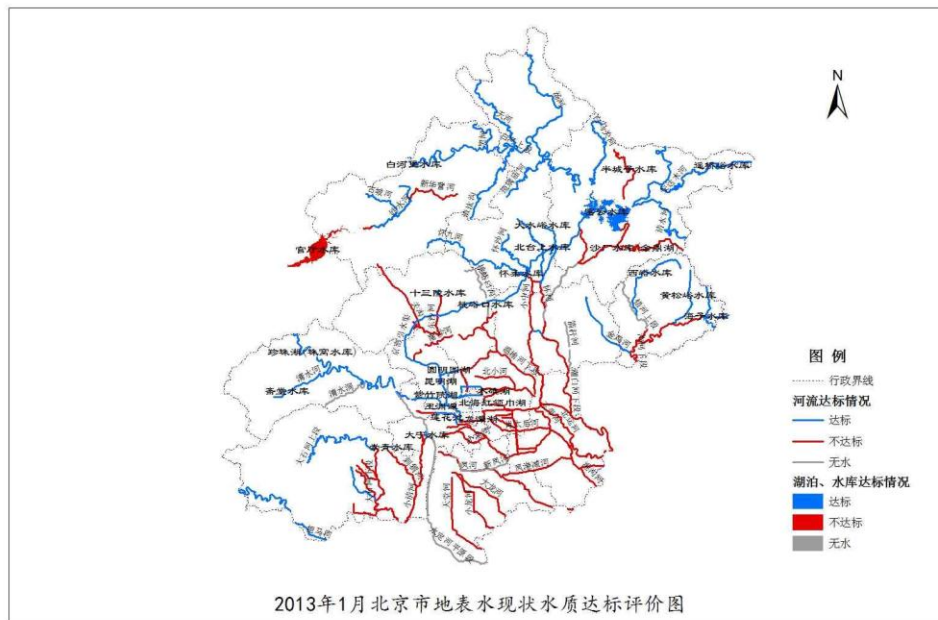
Information Monitoring and Sensing Network

- **Automatic monitoring system of urban atmospheric quality**
 - Automatic monitoring network with 1500 monitoring stations for atmospheric quality will be built in cities at prefecture level or above in China by 2015
 - As well, 96 regional air quality monitoring stations will be built



Information Monitoring and Sensing Network

- **Automatic monitoring system of urban water environment quality**
 - Water environmental quality risk assessment and early warning platforms had been built in Beijing, Chongqing, Shenyang and other cities by the foundation of the national water project during the 11th five-year plan
 - Automatic monitoring system with 88 water quality monitoring stations had been built to monitor and sense 81 drinking water sources in real time in Zhejiang Province



Surface water quality of Beijing, Jan. 2013

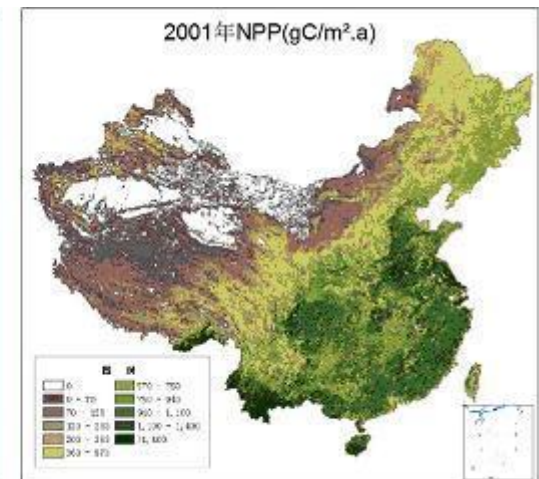
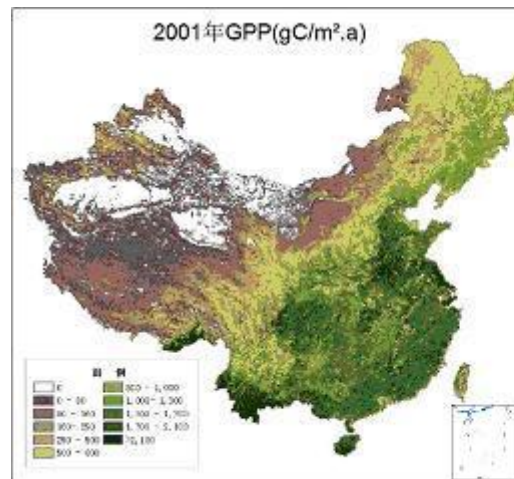


Information Monitoring and Sensing Network

- **Automatic monitoring system of urban ecosystem**
 - The first provincial ecological environment monitoring center had been founded in Jiangsu Province in September 2011
 - A national ecological monitoring network will carry out biodiversity monitoring in wetlands, ground and soil environment in the ecological vulnerable areas and important ecological preservation areas during the 12th five-year plan



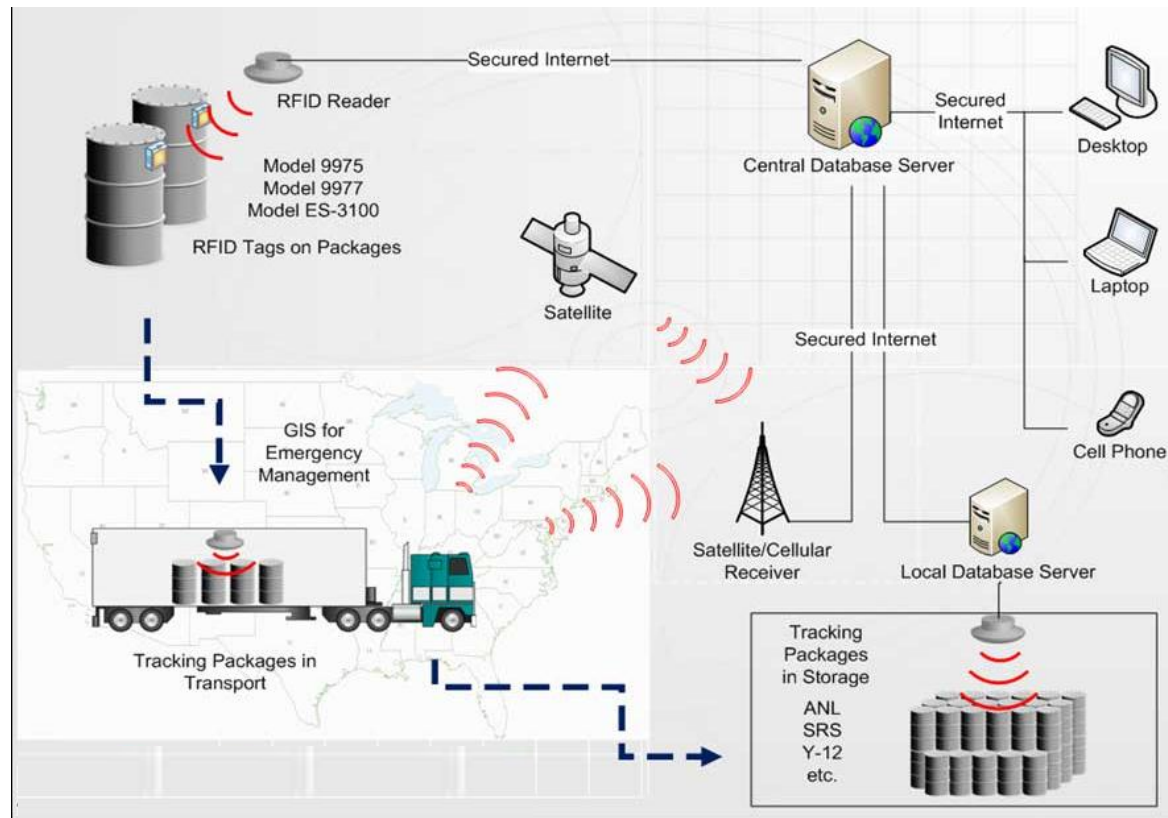
**Ecosystem
monitoring system**



RS monitoring of carbon cycle of terrestrial ecosystem

Information Monitoring and Sensing Network

- **Monitoring of solid waste**
 - IOT was widely used in the monitoring and tracking of hazardous waste and medical waste



Information Monitoring and Sensing Network

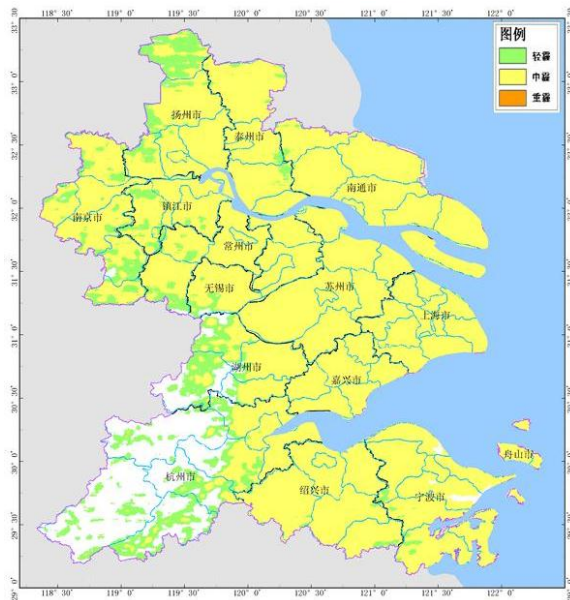
- **Monitoring of urban contaminated sites**
 - Establish prior control list of urban key contaminated sites
 - Establish long-term monitoring system of soil quality for key cities



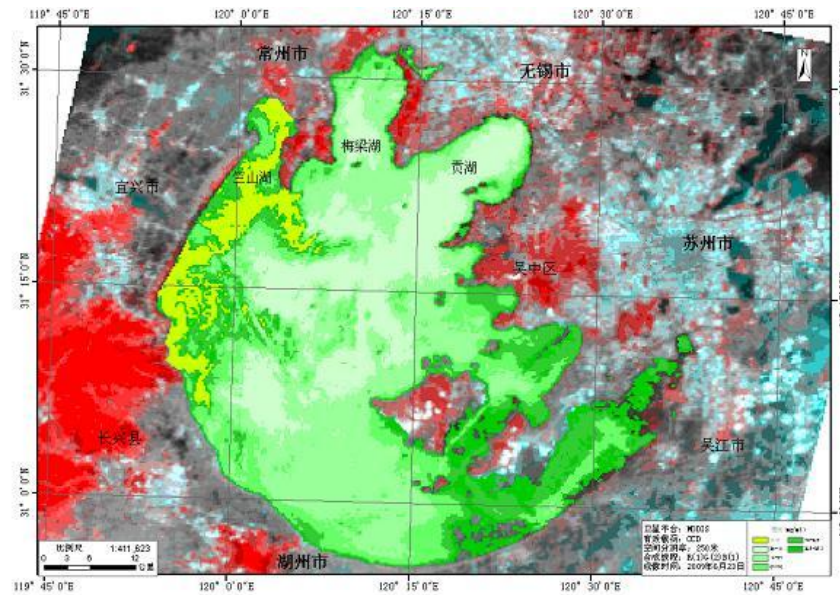
Monitoring of dry deposition

Information Monitoring and Sensing Network

- Application of hyperspectral remote sensing technology in environmental remote sensing



Haze distribution
in RS image



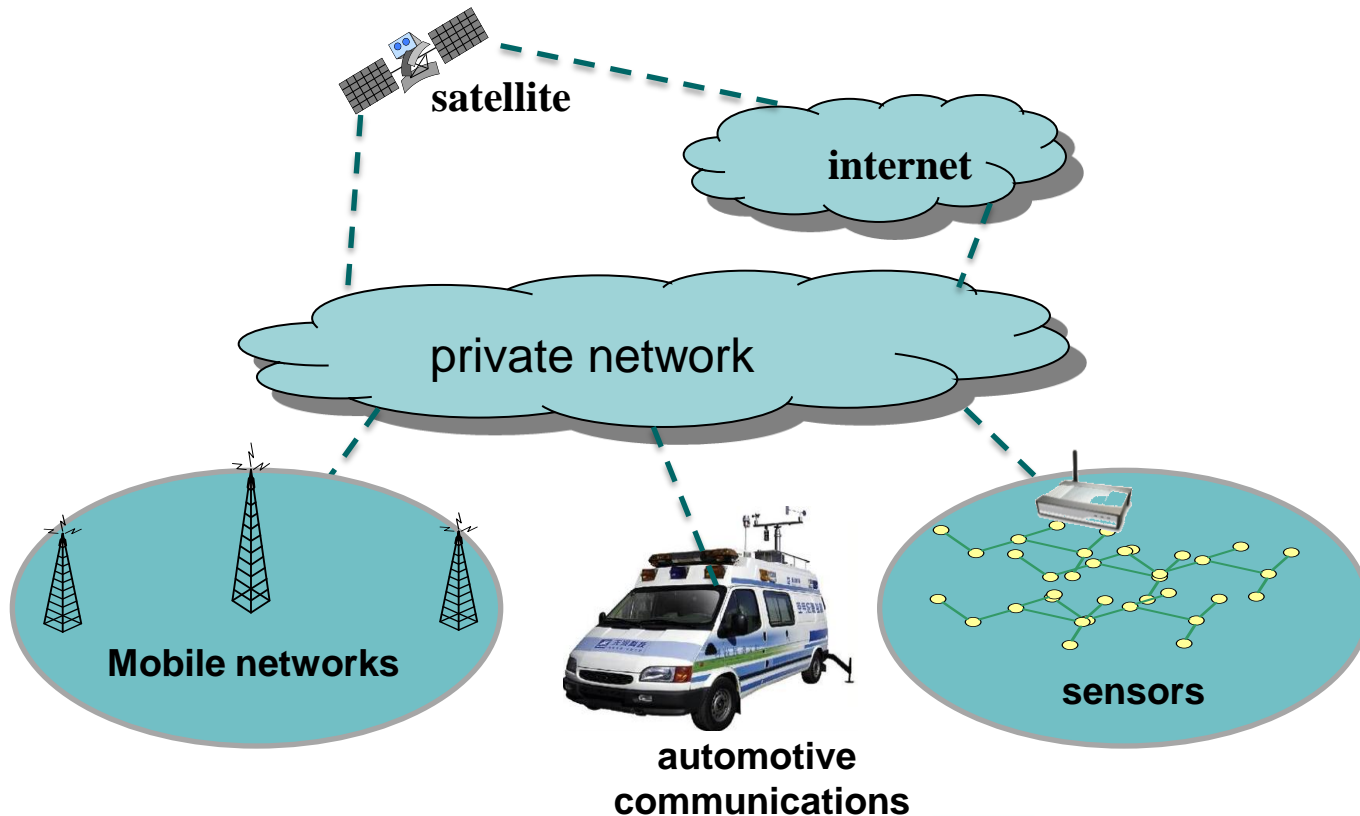
Chlorophyll a concentration
distribution in RS image



The first high-resolution
remote sensing satellite
was launched in April 2013

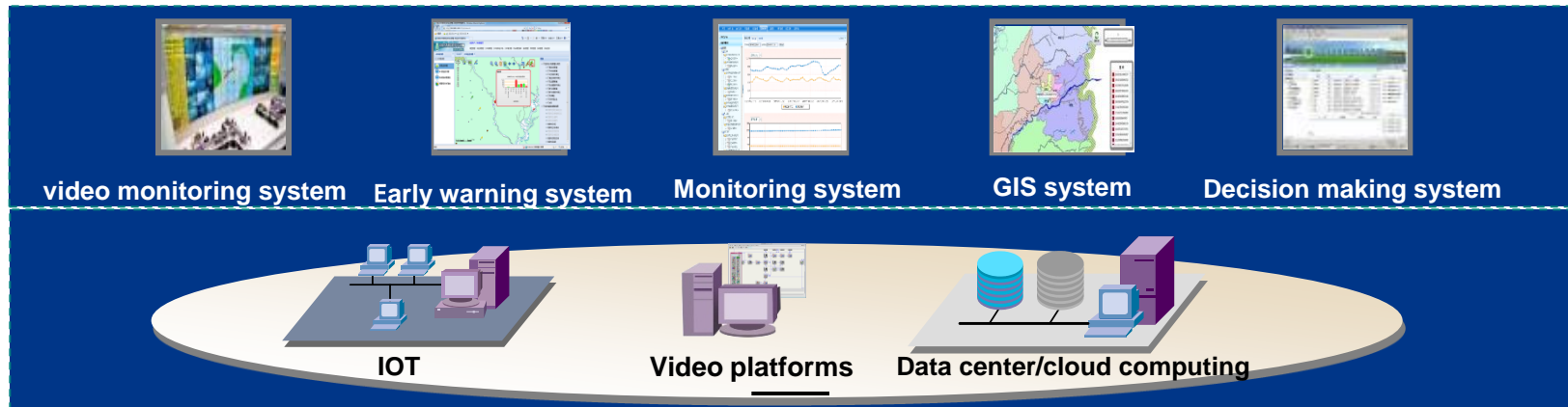
Information Transmission System

- **Urban environmental information transmission system for full coverage and all time can be built by wireless transmission networks(GSM, Remote sensing, GPS, Internet, etc)**



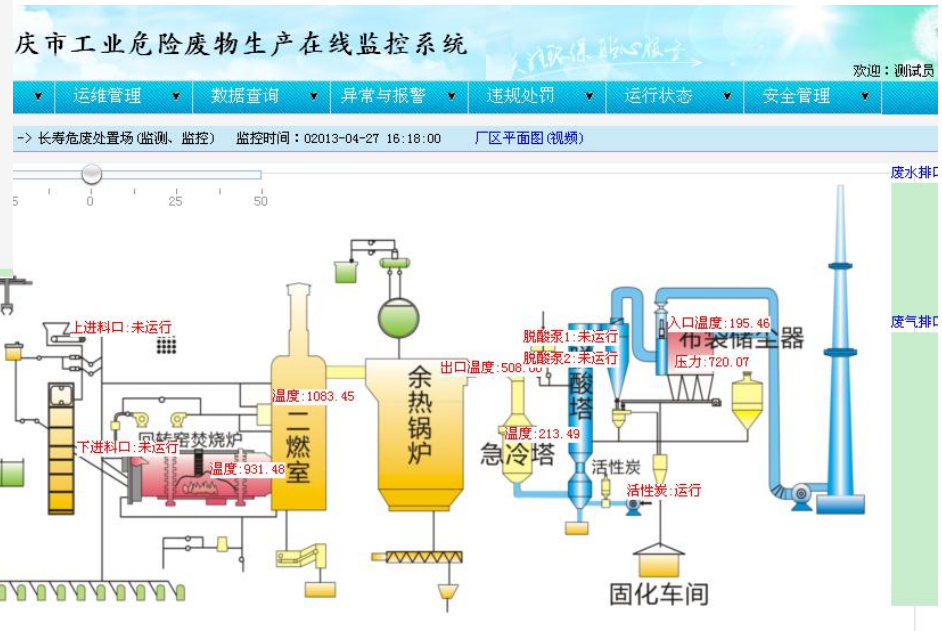
Big data Processing System

- **Big data of environmental information processing system by cloud computing technology**
 - **Big data of environmental information sharing system**
 - **Unban environmental information processing system and evaluation models**
 - **Big data of unban environmental information simulation platform**



Decision Making and Feedback Control System

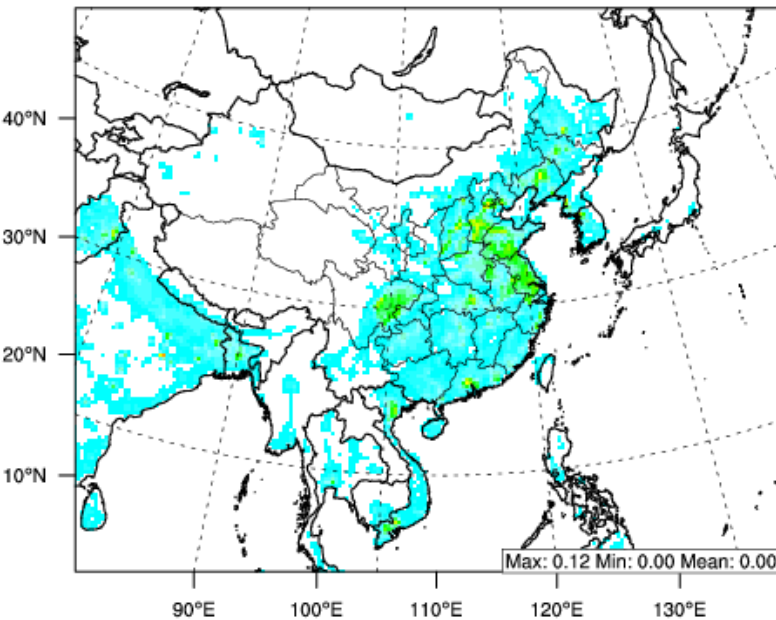
• Pollution source management



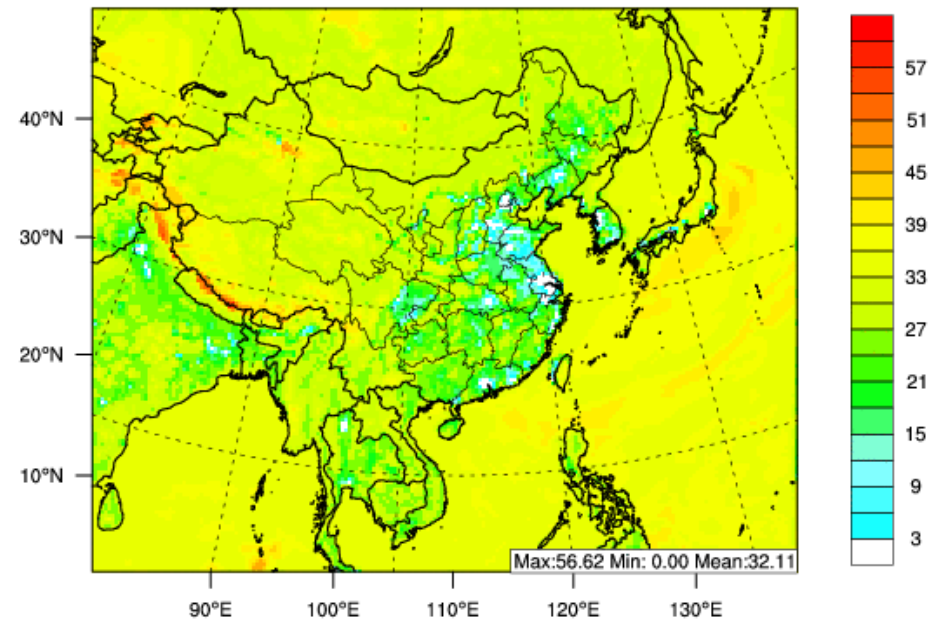
Decision Making and Feedback Control System

- **Forecasting and warning**

Forecast of PM_{2.5} (mg/m³) at 00h 27/04/2013



Forecast of O₃ (ppb) at 00h 27/04/2013

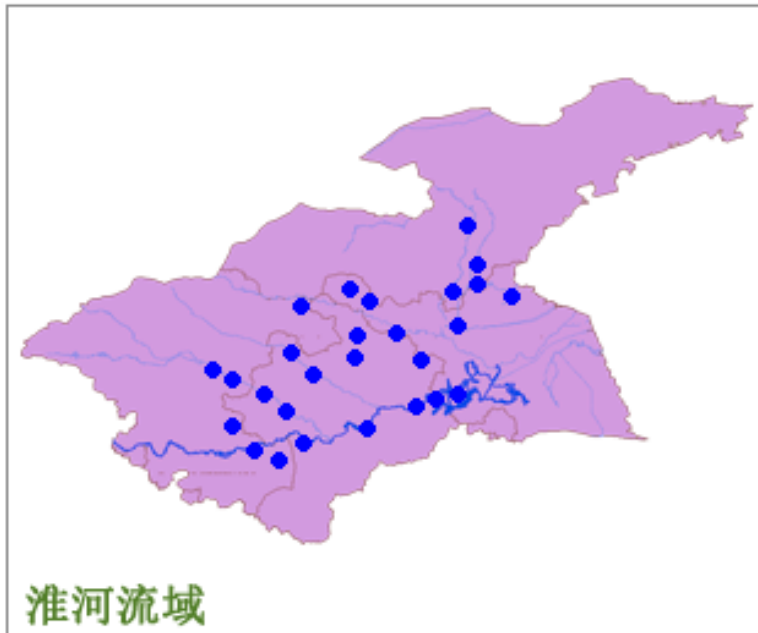


Numerical forecasting of air quality

Decision Making and Feedback Control System

- **Forecasting and warning**

Digital basins can forecast and warn the water environment by monitoring and simulating the pollutant release process of potential sources and water quality evolution process of lakes and rivers



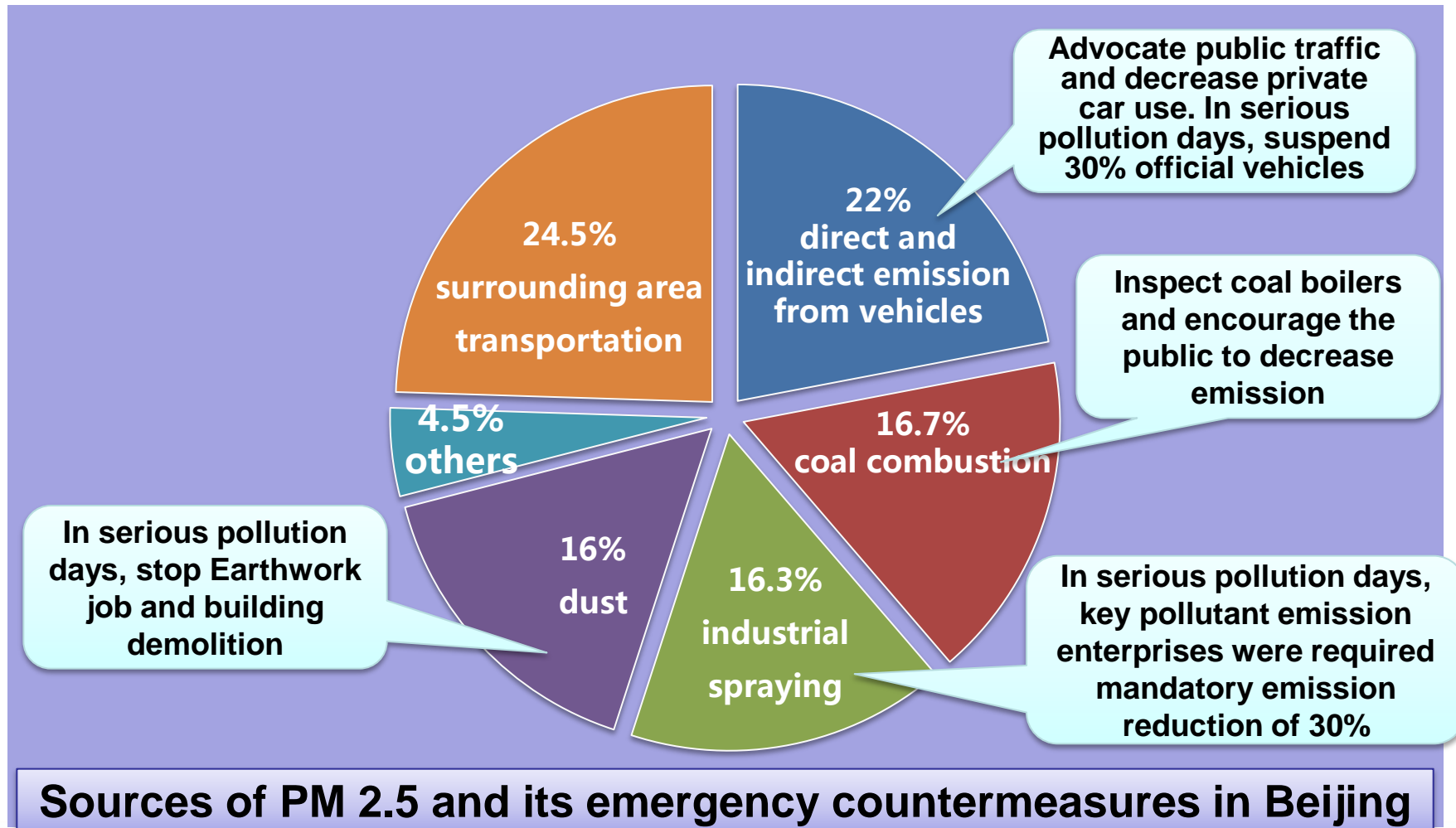
Automatic water quality monitoring system of Huaihe River Basin



Quantity and quality management for water diversion project from Yangtze River to Taihu Lake

Decision Making and Feedback Control System

- **Emergency Countermeasures**



Decision Making and Feedback Control System

- Information disclosure



“Beijing Air Quality”
Mobile Client Software



Self-service
terminal

Smart environment development in Jiangsu

An environmental monitoring and early warning platform covered 13 cities had been built to manage environmental information intelligently in Jiangsu province.

Desktop cloud

■ 54 applications

Information processing

■ 8 monitoring systems

Data center

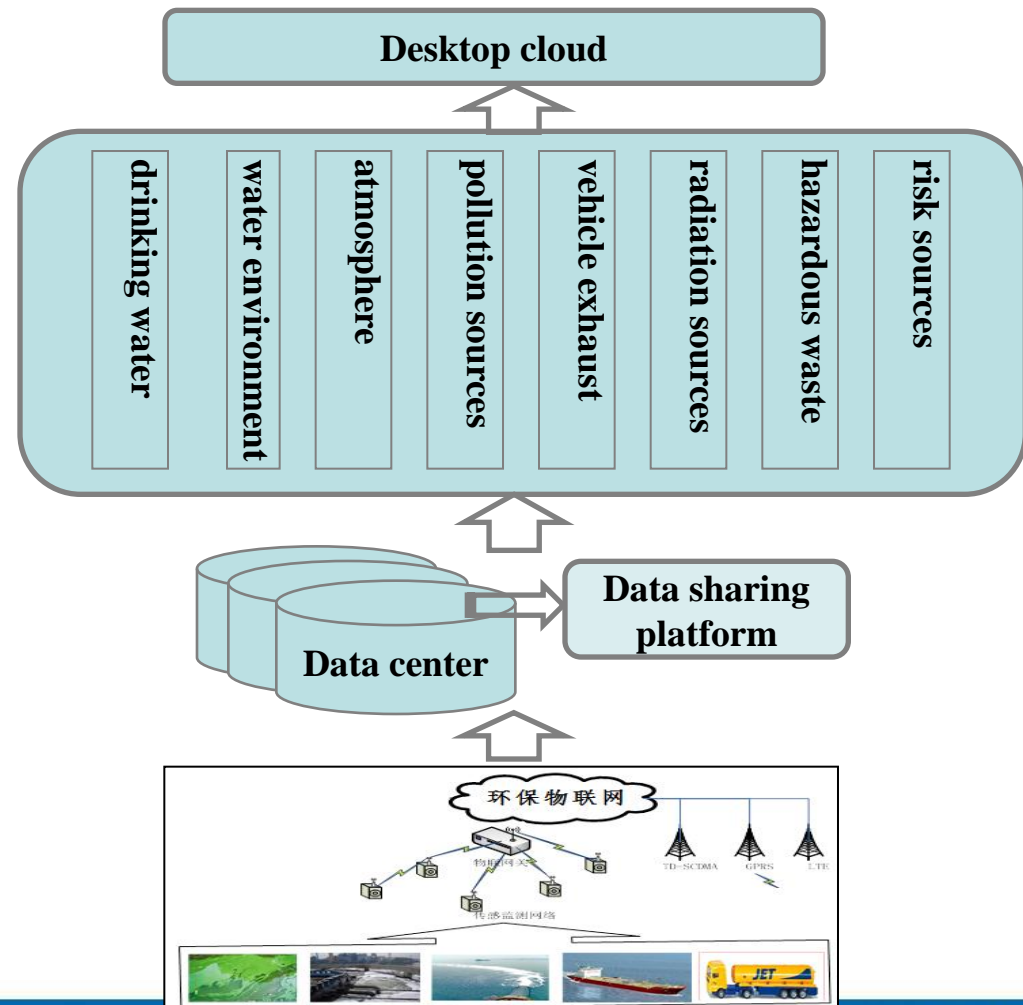
■ All environmental data in one map

Private networks

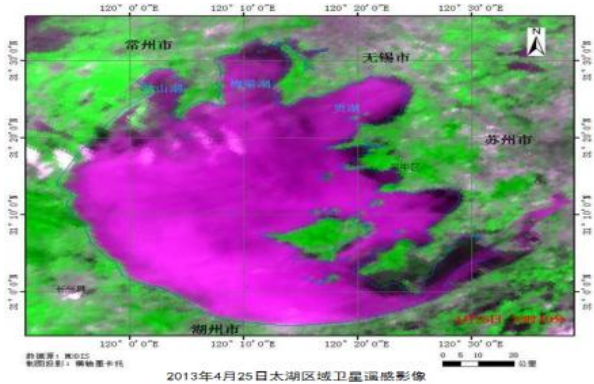
■ 127 private networks

Environmental IOT

■ Advanced IOT applications



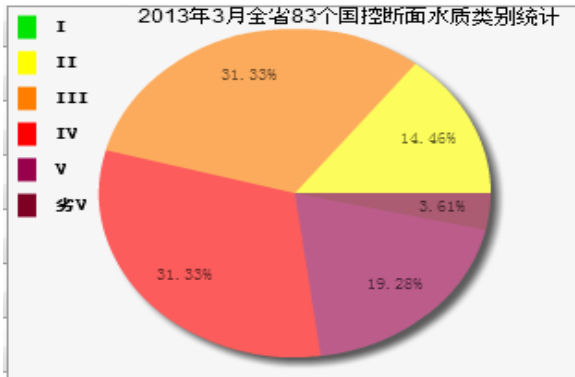
Smart environment development in Jiangsu



Daily published monitoring image of blue-green algae in Taihu Lake



Publishing platform of air quality monitoring in Jiangsu



Publishing platform of water quality monitoring of sections in Jiangsu

城市实时空气质量指数 (AQI)

2013年4月26日 11时

城市	AQI	级别	类别	首要污染物	*PM2.5小时均值
苏州	103	III	轻度污染	PM2.5	52.7
无锡	101	III	轻度污染	PM2.5	51.0
徐州	91	II	良	PM10	46.9
常州	101	III	轻度污染	PM2.5	48.2
南通	117	III	轻度污染	PM2.5	52.8
连云港	75	II	良	PM10	46.8

Real time publishing platform of urban air quality index

Summary

- **Urban environment improvement, prevention and protection must be a prominent and prior task due to a series of environmental issues caused by China's urbanization**
- **Based on high levels of city informationization, ubiquitous real-time **environment service system** will be built, including dynamic perception, integration, processing, decision-making and service of urban environmental information**
- **The intelligent environment strategy** was expected to achieve urban environment sustainable and harmonious with economy and society development, of which **information disclosure is an essential breakthrough**
- **Sharing and integration of big data** including environment, land, forestry, and water conservancy will further improve the environmental management level of smart cities

Thank You