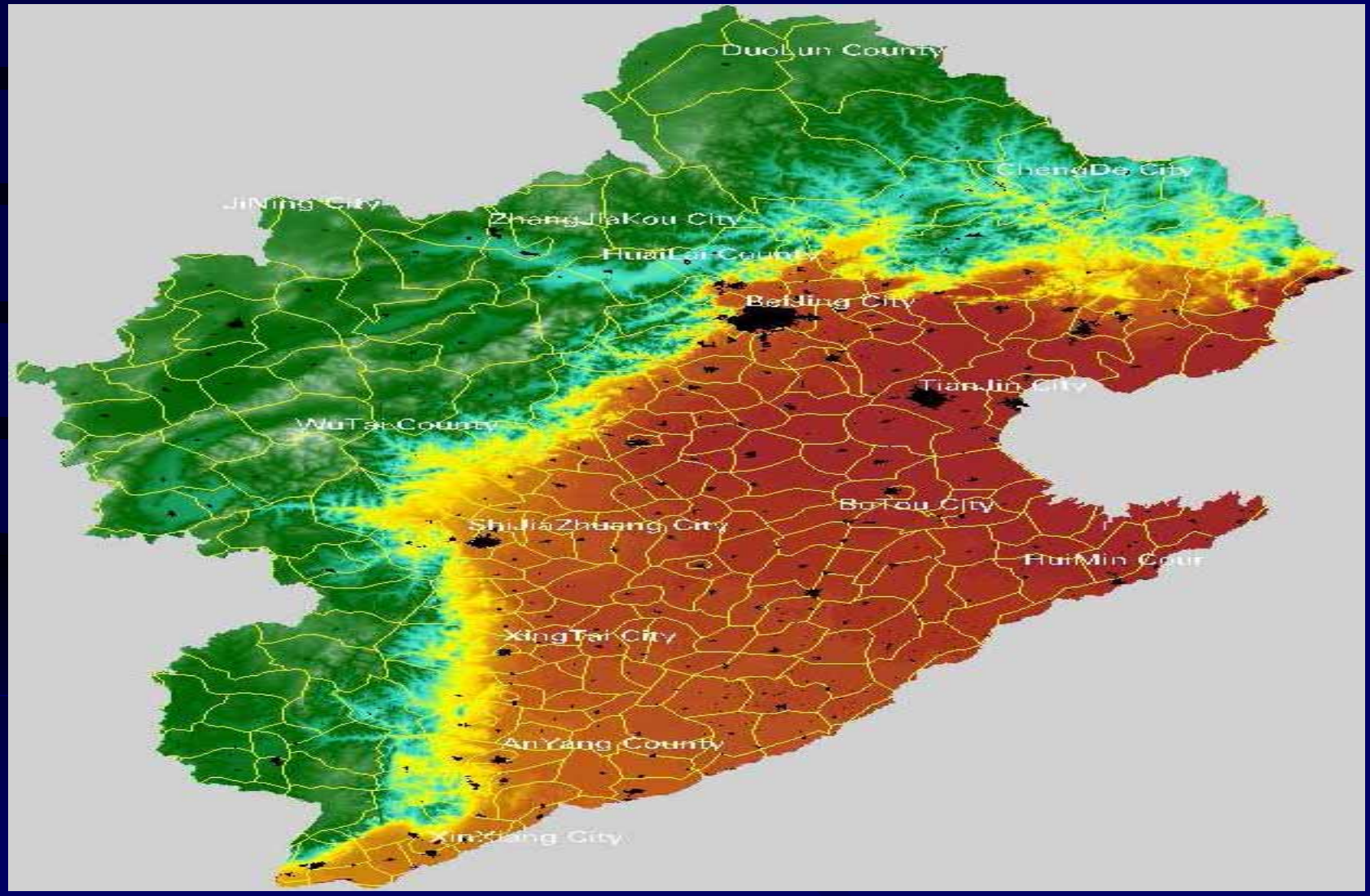
INTEGRATED RIVER BASIN MANAGEMENT IN HAI BASIN OF CHINA

BY LIPING JIANG
WORLD BANK OFFICE BEIJING
PRESENTED IN THE FIFTH WORLD WATER FORUM
MARCH 16-22, 2009

HAI BASIN IN CHINA



Water Shortage in Hai Basin

- Availability of water is only 285 m^3 per head;
- Groundwater abstraction pumped at 26 billion m^3/yr, exceeds recharge by 7.2 billion m^3/yr, water table drawdown by about 0.5-2.0 m/yr.
- Surface water is overused by 2.4 billion m^3/yr;
- This overexploitation, totaling 9.6 billion m^3/yr, has resulted in serious ecological and environmental degradation;
- The agricultural water use accounts for about 70% of the total water use, therefore irrigated agricultural water savings is very important.

What is the main challenge in Hai River Basin for Integrated River Basin Management?

The main challenge is to take a pragmatic but principled IWRM approach to deal with a set of cross-cutting legal, regulatory, operational, social, economic and environmental issues, and local governments and water users' incentives, rather than independent management of water by different water-using sectors.

Five innovations have been taken in Hai River Basin to carry out integrated river basin management, which are fully consistent with "the Dublin Principles" for Modern Water Resources Management:

- River basin is taken as the unit of analysis;
- Remote sensing based evapotranspiration (ET) management;
- New concept of water rights;
- Economic value and incentives driven;
- Participation by all stakeholders.

River Basin - The Unit of Analysis

Target Water Consumption (TWC or Target ET) is derived at the river basin level so that much greater attention could be really paid to the sustainable use of water resources and eco-environment improvements.

If we let:

P: Precipitation;
I: Inflow to the Basin;
IADWC: Industrial, Agricultural and Domestic Water Consumption;
EWC: Ecological and Environmental Water Consumption or ET;
O: Outflow out of the Basin and to the Sea;
CS: Change of Surface and Groundwater Storage;
TWC: Target Water Consumption or target ET;
ARQ: Annual Reduction Quota of Groundwater Overdraft

Then we have:

$$P + I - IADWC - EWC - O = CS$$

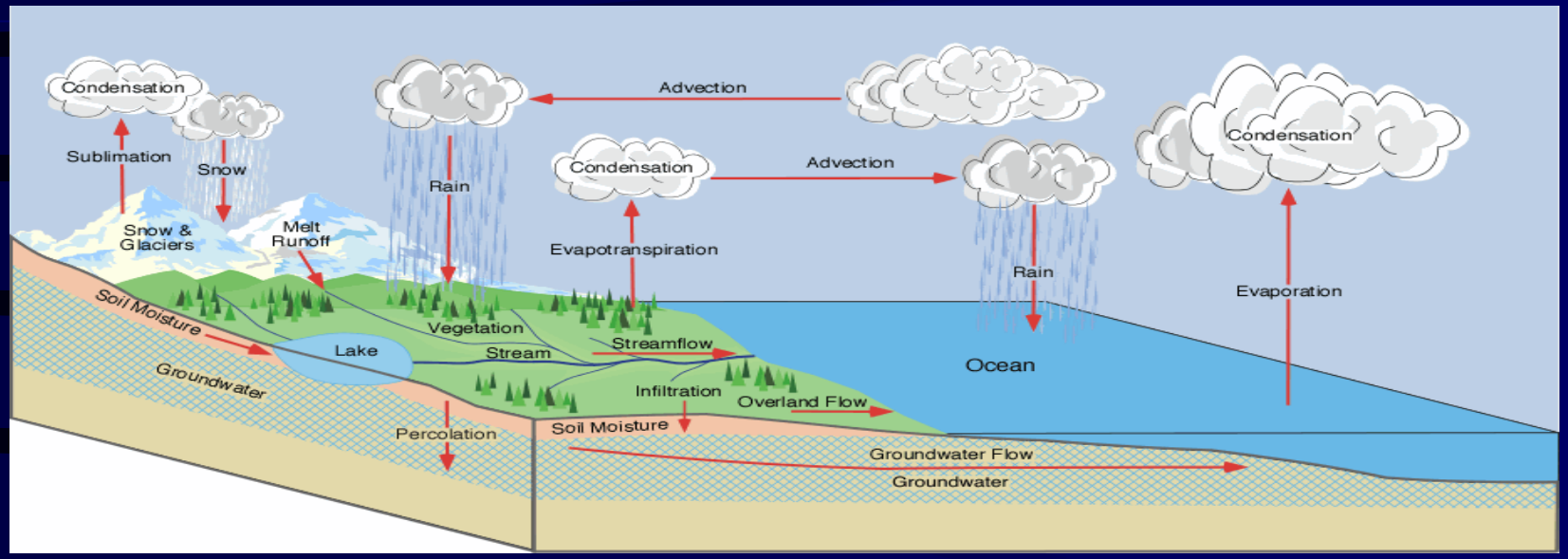
Let: $IADWC = TWC + ARQ$

$$TWC = P + I - ARQ - EWC - O - CS$$

River Basin - The Unit of Analysis

- The target water consumption or target ET at the river basin level is then allocated to the administrative areas within the basin;
- Only reduction in water consumption is regarded as water saved in quantity;
- The quantity of water saved is first used to mitigate groundwater overdraft (to meet the annual reduction quota) and then provided to new water users; and
- Increase of farmers' income is ensured through various ways at the same time as water is saved.

Remote Sensing Based ET Management



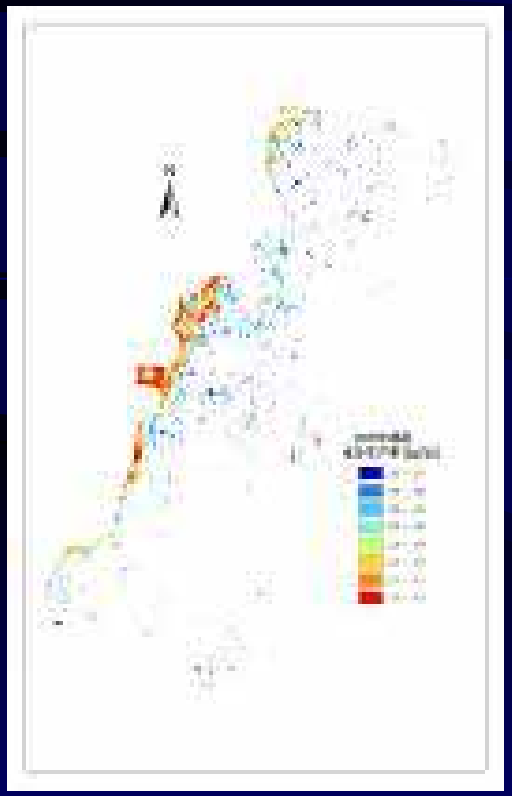
China has been using Remote Sensing Technology to measure and monitor actual water consumption or evapotranspiration (ET) in quantity from irrigated agriculture and ecological environment, which makes it possible to know TWC;

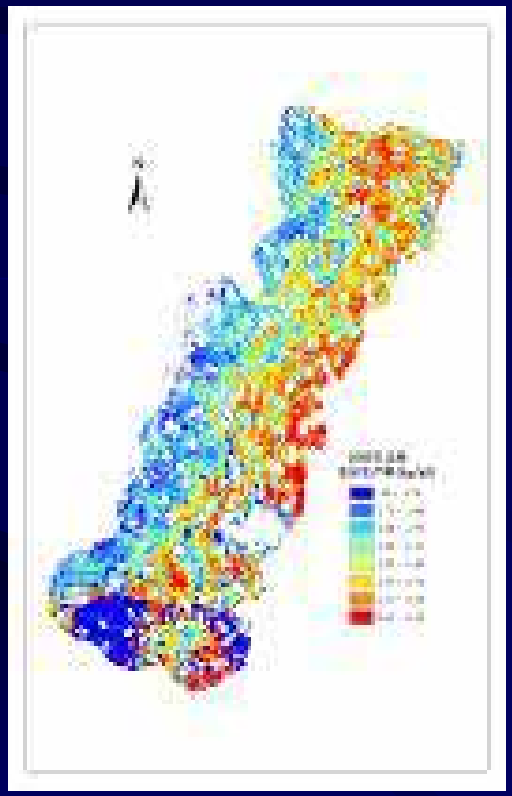
It measures the actual ET within a pixel (30x30 meter or 1x1 km) with an accuracy up to the level for precipitation so that the measured ET could be directly used to derive the TWC at the river basin or regional level;

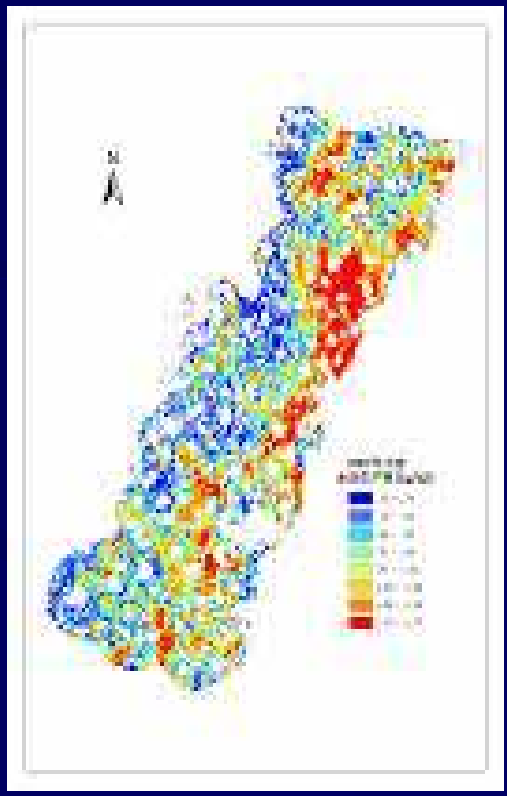
Remote Sensing based ET Management

It measured water productivity for cotton, maize and wheat in Guatao County of Hebei Province from 2003 to 2007.

Cotton **Maize** **Wheat**

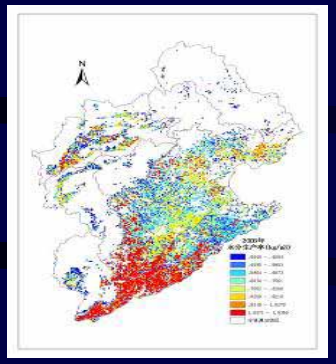
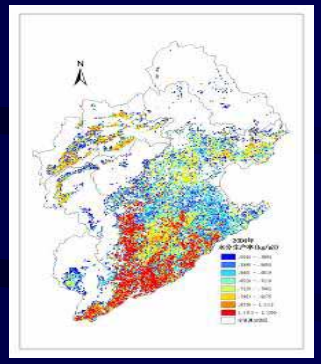
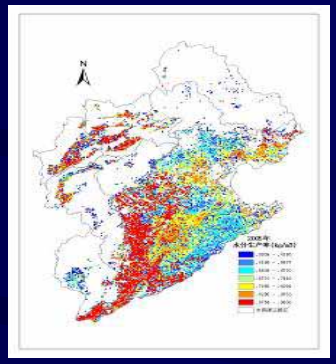
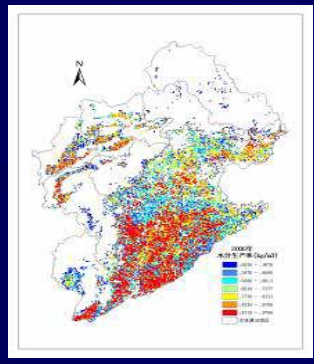
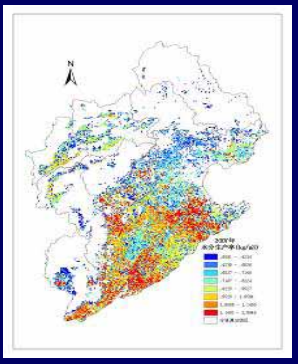






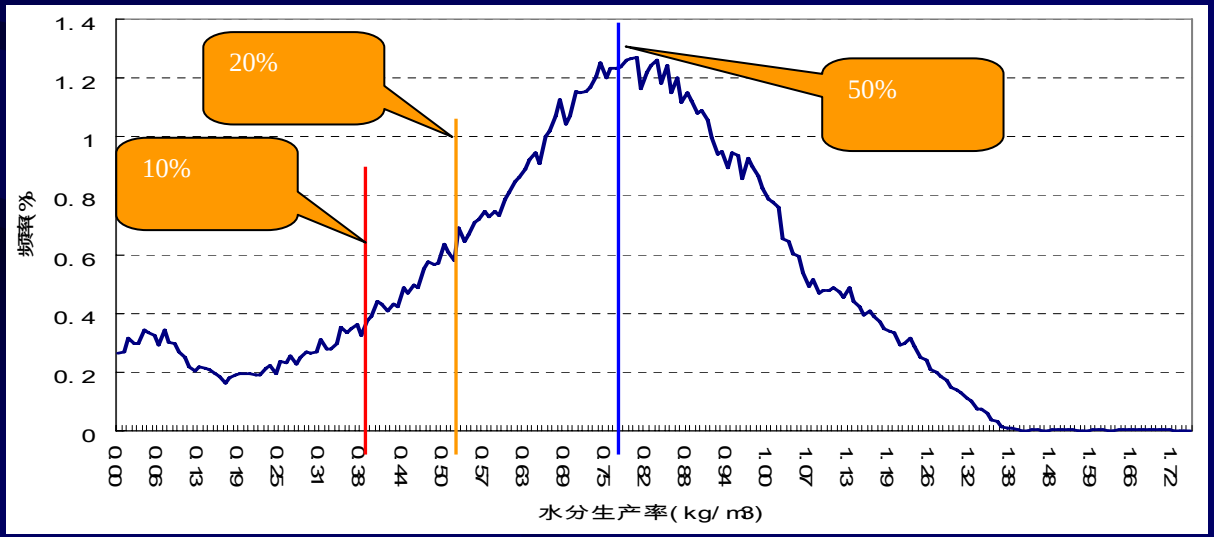
Remote Sensing based ET Management

It measured water productivity for average crops in irrgated agricultural area in Hai Basin from 2003 to 2007;

$$CWP_c = \frac{CY_c}{ET_{ac}}$$

2003: 0.761kg/m^3
2004: 0.737 kg/m^3
2005: 0.765 kg/m^3
2006: 0.757kg/m^3
2007: 0.797kg/m^3
Average: 0.763kg/m^3



Participation by All Stakeholders

The approach with the top-down, bottom-up, horizontal and vertical integration is adopted.

- Top-down integration: local governments and WUAs or farmers at lower levels should enforce the laws, policies, regulations, water allocations from the higher levels;
- Bottom-up integration: local governments and WUAs or farmers at lower levels needs to have strong ownership of the project and take actions for project implementation from the bottom;
- Horizontal integration: Cross-sectoral cooperation and coordination of actions between different line bureaus at each level of central, provincial and county; and
- Vertical integration: local governments and WUAs at lower levels should have a direct linkage and constant interaction with training and workshops sharing experiences and lessons with the other project activities at the higher levels.

Farmers' Incentives to do Irrigated Agricultural Water Savings

- Farmers' income must get increased while they are doing water savings (we should try all the ways to help increase their incomes);
- Farmers need to know the consequences of the groundwater overdraft and to have serious concerns (through CDD approach);
- Volumetric water charges must be conducted with transparent water charges;
- Water tariff should be gradually increased as farmers' income increases;
- Block tariff is to be imposed in a progressive manner when abstraction quantity exceeds the target water consumption or target ET;
- ET-based new water rights system should be established to ensure that the actual water consumption (ET) does not exceed the allowed target consumption (ET) as the irrigation efficiency increases.

Why increase of irrigation efficiency may lead to increase of water consumption, which makes groundwater overdraft even worse?

- This is because given the same amount of water withdrawal the water users with higher water-use efficiency would normally consume more water than the water users with lower water use efficiency;
- This is one of reasons why groundwater overexploitation has been getting more serious after over 15 years of irrigated agricultural water savings in the Hai Basin;
- This is also why we need to establish the new water rights system in China.

New Concept of Water Rights

Traditional Approach - only one element is indicated in the water use permit:

- **The amount that is allowed to be extracted.**

Innovative Approach - three elements are indicated in the water use permit:

- **The amount that is allowed to be consumed (allocated target water consumption or ET);**
- **The amount that is allowed to be extracted (converted from the allocated target water consumption or ET, which should be inspected and ratified once a year);**
- **The amount that must be returned to the local water system with water quality stipulated.**

Economic Value and Incentives Driven

- Water is a scarce resource and greater use is made of incentives and economic principles in improving allocation and enhancing quality;
- Initial water rights is determined prior to allocating to higher value uses to protect farmers' interest and to arouse farmers' incentives;
- Water productivity for irrigated agriculture is increased through integrated engineering, agronomic and management measures within the allocated target water consumption or ET, while increasing farmers' income by all means including cropping pattern adjustments.

THANKS !

YOUR QUESTIONS ARE WELCOME !