

Discussion on sustainable Groundwater Management in China (中国における持続可能な地下水管理 に関する考察)

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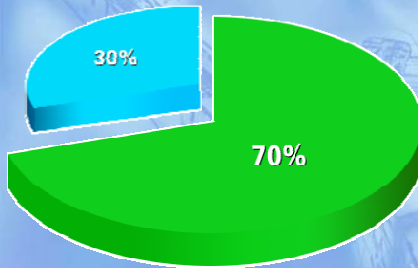
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1. Background on country's water resources (中国における水資源に関する背景情報)

(1) Precipitation in China (中国における降水量)

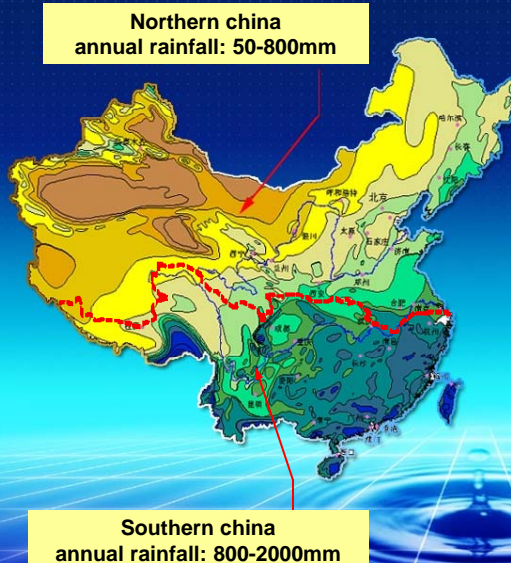
The amount of annual rainfall in avg.: 650mm
(平均年間降水量)



Unevenly **temporally** distributed:
(**時間的に**不均等な降水)

- Flood season(4 months): 70%
(洪水期(4ヶ月))
- Dry season(8 months): 30%
(乾期(8カ月))

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Unevenly **spatially** distributed:
(**空間的に**不均等な降水)

Northern China (中国北部)

- Rainfall (降水量): 19%
- Population (人口): 47%
- **Farm land (農地): 64%**
- GDP: 45%

Southern China (中国南部)

- Rainfall (降水量): 81%
- Population (人口): 53%
- **Farm land (農地): 36%**
- GDP: 55%

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(2) Water resources in China (中国における水資源)

- ★ The total amount of water resources :
28,412 b.m³, the 6th in the world
- ★ Amount of water resources per capita:
2185 m³, <1/3 of the world average

Of these, groundwater is about **104 billion m³**,
4% of the total amount

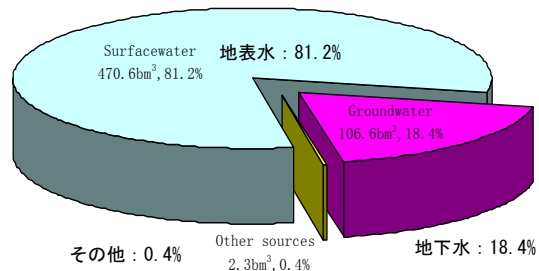
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-----Water Resources Assessment for China

Structure changes of water consumption in China (中国における水消費の構造変化)

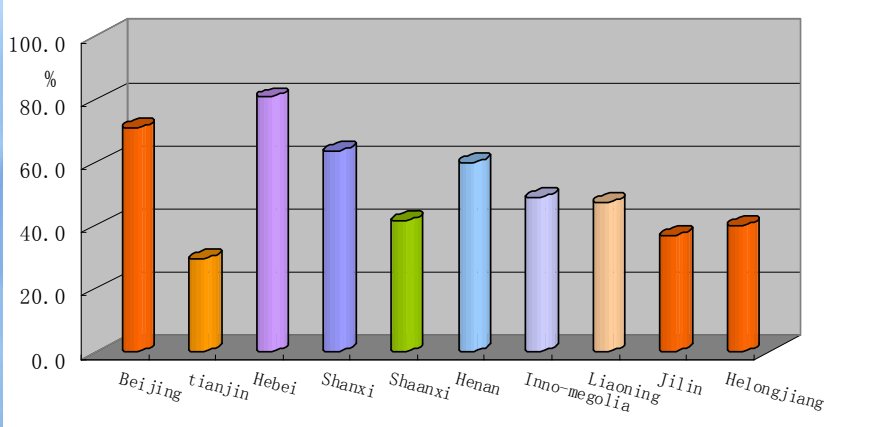
Category		In 1950's	In 1980's	At present	In 2030
Agriculture (農業)		97%	88%	70%	52%
Industry (工業)		2%	10%	20%	
Domestic (家庭)		1%	2%	10%	
total	surface water	> 92%	86%	81.6%	
	groundwater	< 8%	14%	18.4%	

Water consumption in China in 2006: 579.5 b.m³



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Percentage of groundwater supply over the total water supply in part of northern Provinces
 (北部地域における総水供給量に占める地下水供給の割合)

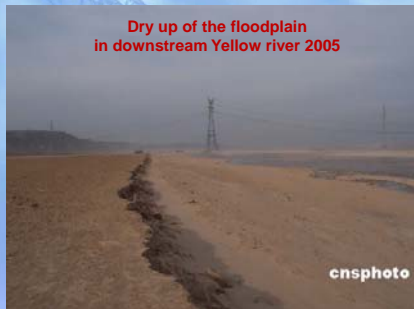


more than 400 cities out of 660 in China use groundwater
 (中国の660の都市のうち400以上の都市が地下水を利用している)

深层地下水位立体透视图

Problems due to heavy local GW exploitation:
 (地域の過剰の地下水くみ上げに起因する諸問題)

- ◆ continuous regional decreasing of groundwater level
- ◆ increased potential of dry up of river channel
- ◆ ground surface settlement
- ◆ pollution to groundwater
- ◆ Seawater intrusion , etc



2. Sustainable GW management in China

(中国における持続可能な地下水管理)

(1) GW management & protection legislation

(地下水管理及び保護に関する法制度)



2002, Water Law amended

- unified water resources administration
- **intensified groundwater monitoring for Sustainable water management**

2003, Regulations on reinforcing groundwater management for groundwater depression areas

2006, Byelaw on management of water licensing system and water fee charge system

(2) Highlighted groundwater Plannings

(特筆すべき地下水計画)

- ✓ National groundwater development & utilization planning (国家地下水開発・利用計画) (1998)
- ✓ Comprehensive national water resources planning (総合的国家水資源計画) (2002)
- ✓ National groundwater utilization and protection planning (国家地下水利用・保護計画) (2003)

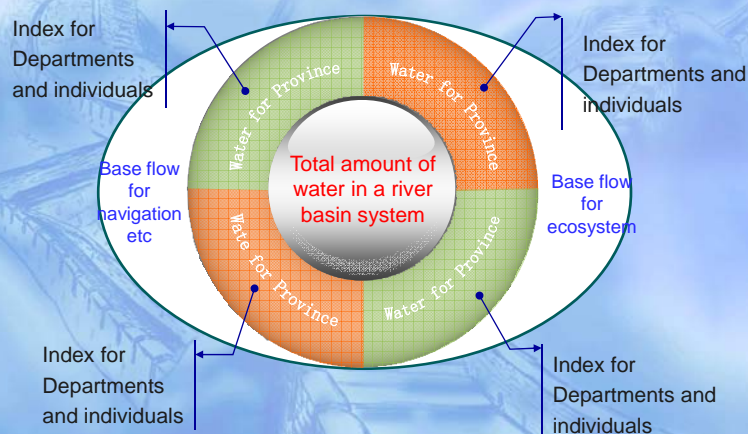
(3) Strict management on groundwater exploitation (地下水揚水に関する厳格な管理)

✓ Water licensing system and water resources appraisal (水ライセンス制度及び水資源評価)

- All users who access to groundwater resources need to apply for water license
- Planning of scaled projects must accommodate both local water resources limitation and flood defense requirement. For those areas with limited water, construction water consumption projects is restricted

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✓ Quantity control and quota management (水量の規制及び割り当て管理)



Q: at what extend, implementation of quantity control & quota management on water resources can be fulfilled?

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(4) groundwater protection actions

(地下水保護の取組)

China launched “national groundwater protection action” in early 2003
 (中国では2003年はじめに国家地下水保全アクションをスタートさせた)

Example of the Action: Recovery of the dried famous Springs in JiNan city

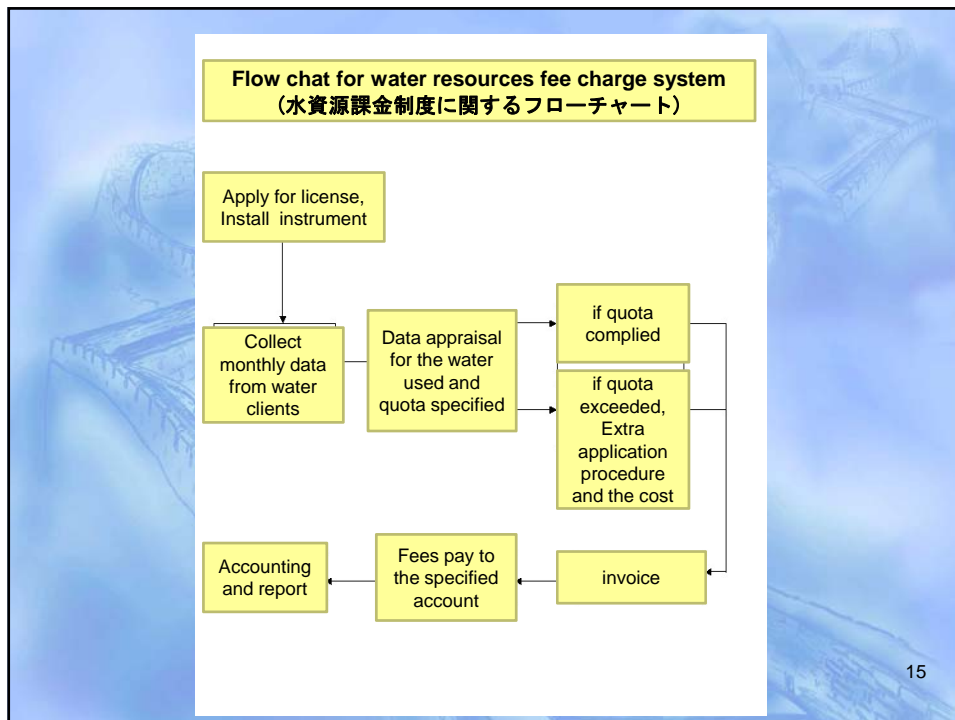
Measures conducted:

- ◆ groundwater recharge during rainy season
- ◆ new surface water supply project constructions
- ◆ closing-up wells in urban
- ◆ constructing small water conservation works



(5) Economic instruments stimulates rational water utilization (合理的な水利用を促す経済手法)

- ◆ Water fee charging since 1980
 (1980年から水課金制度を開始)
- ◆ Water Law (2002) reinforced its legitimacy
 (2002年の水法で正当性を強化)
- ◆ Specifications on the implementation of water fee charge system (2008) stipulated different standards at different regions based on local economic development levels and conditions of available water resources
 (水課金制度の実施に関する細則(2008)では地方の経済発展レベル及び利用可能な水資源の状況に基づいた地域ごとの基準を規定)



◆ **Case study: Water fee charge system in Shandong Province**
(ケーススタディ：山東省における水課金制度)

Criterion for fees charged (課金の基準):

- ◆ Higher price for private users than public purpose
- ◆ Higher price for groundwater than surface water
- ◆ Twice the price for GW depression areas of other regions
- ◆ Higher price for high quality water than poor quality ones
- ◆ Higher price for more developed regions than developing areas

In Weihai city of Shandong Province (山東省威海市) :

- **licensed groundwater at normal areas charges 0.8Yuan/m³**
- **licensed groundwater at depression areas charges 1.6Yuan/m³**

As a result, an expected decreasing of regional groundwater withdrawal, and the recovery of groundwater levels and local environment becomes visible

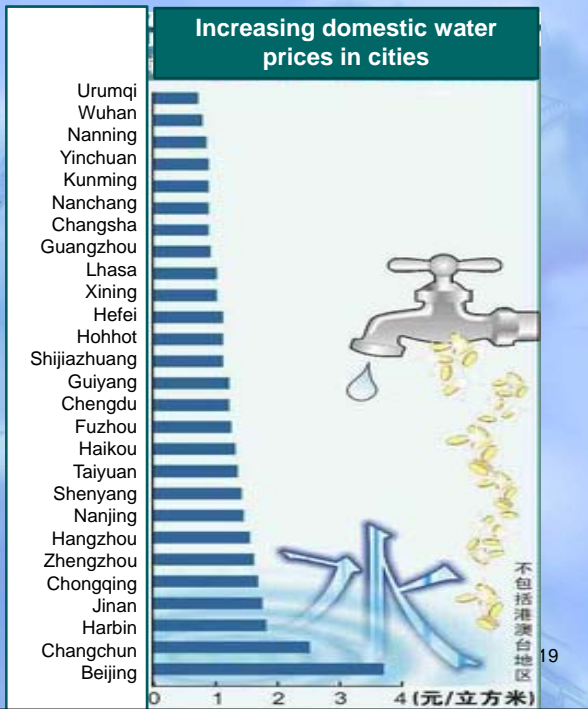
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Nonetheless, at present, water price in China is low in comparison with the market demand.

(それにも関わらず、現在市場における重要と比較すると中国における水の価格は安い)

There is an urgent need to increase water price, particularly for the amount of water exceeded the quota management. (割り当て量を超過する水量に対しては特に水の価格の引き上げが緊急に必要である。)



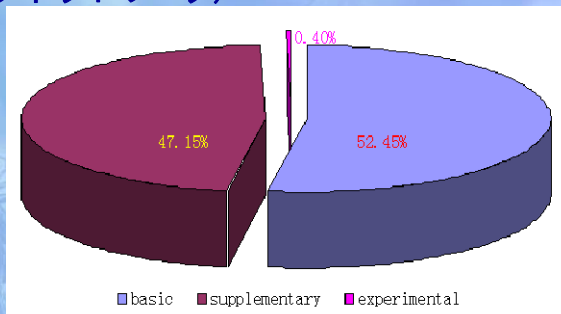
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(6) Technical support through groundwater monitoring and analysis

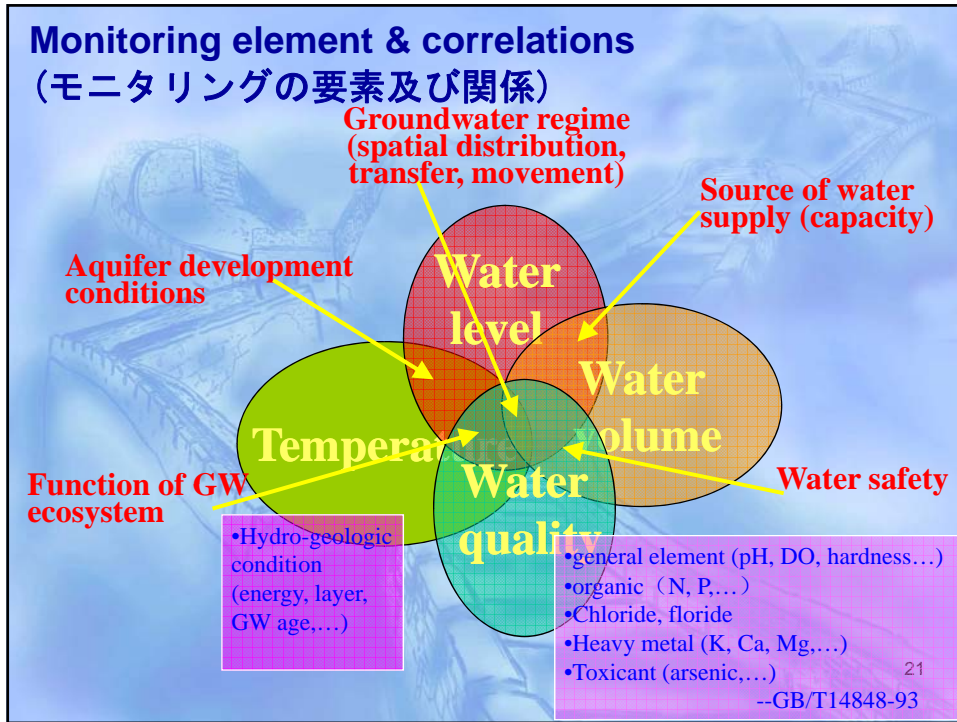
(地下水モニタリング及び解析を通じた技術サポート)

◆ The groundwater monitoring network (地下水モニタリングネットワーク)

Currently, a nationwide GW monitoring network has been set up, where 24,515 groundwater monitoring stations are distributed across the country.



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◆ **Groundwater analysis and application**
 (地下水分析及応用)

To ease the problems caused by continuous large groundwater exploitation, it is necessary to enhance groundwater analysis and forecasting to provide scientific support for decision making and remedy measures.



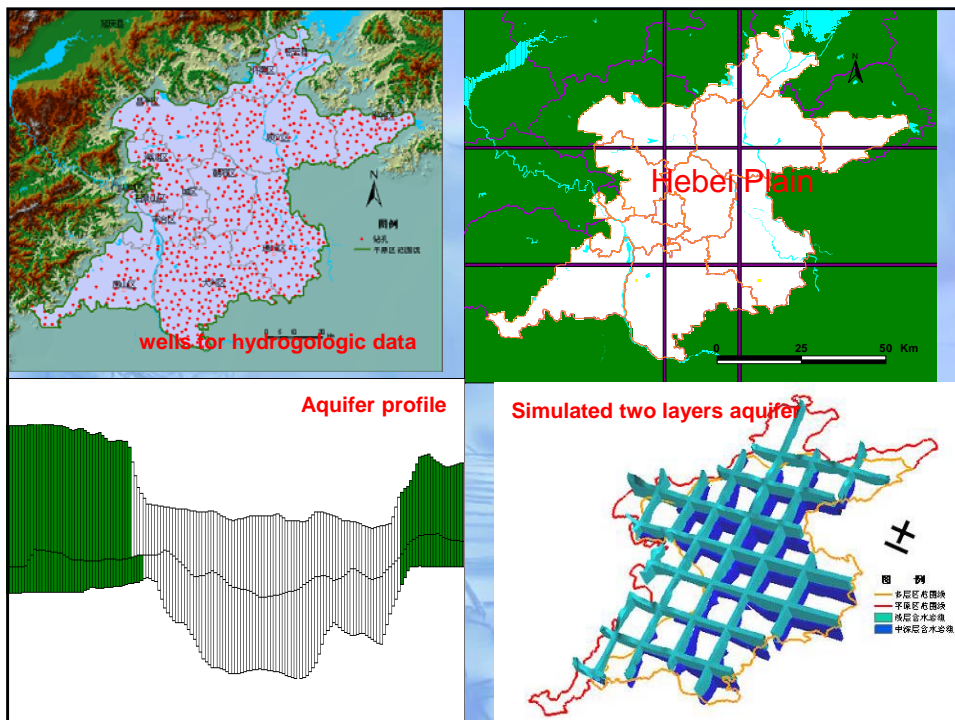
groundwater simulation laboratory

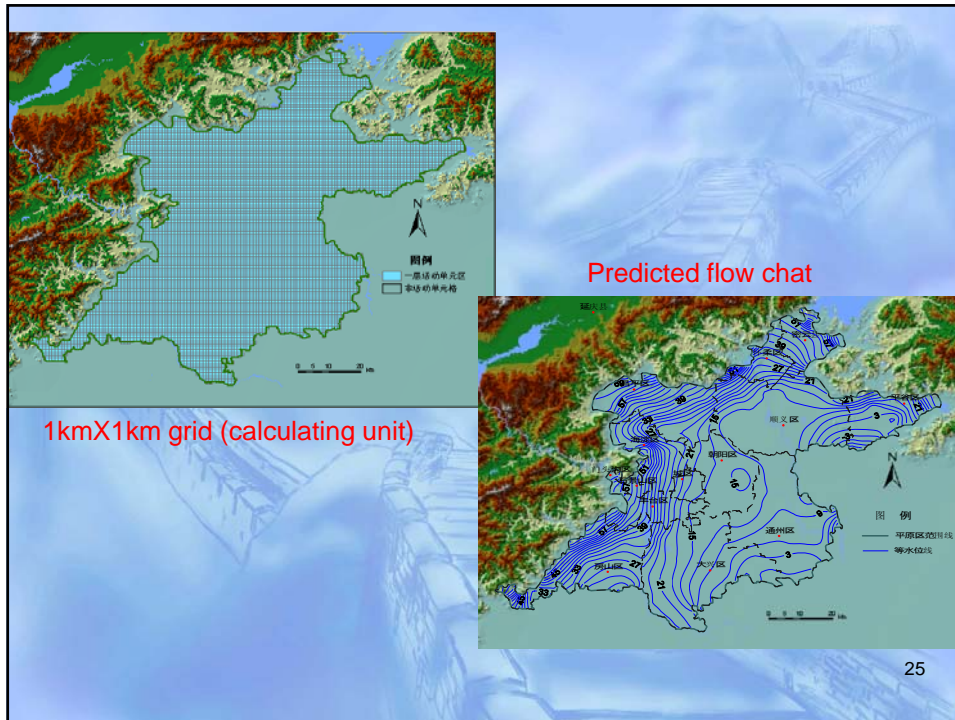


high speed PC with 124-parallel working unit



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◆ Pilot study: Managing climate change effect on groundwater through monitoring (パイロットスタディ: モニタリングを通じた地下水への気候変動の影響の管理)

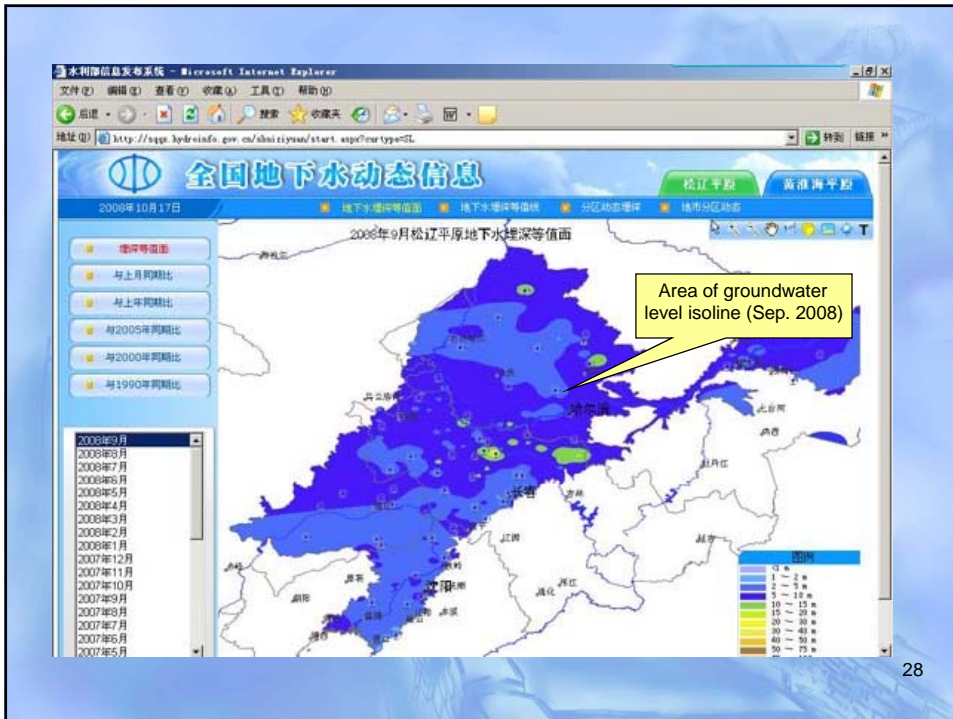
Climate change effort on GW irrigation supply (at Cangzhou)

Climate change effort on GW/ investigation (in Xianyang)

Climate change effort on water safety through quality sampling (in Cangzhou)

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◆ Information share and public awareness
(情報共有及び国民の意識)



北京市平原区地下水普查信息系统

北京市政地下水普查信息系统

Beijing Municipality groundwater investigation information system

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3. Future challenges (将来の挑戦)

- ✓ Continuous intensive groundwater extraction in a predictable period
- ✓ Continuous population growth
- ✓ Climate change impacts



Thanks for your attention!

Arigato gozaimasu
(ありがとうございます!)



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