

# **Groundwater Governance in the Zhengzhou region, China**

**Menggui JIN**

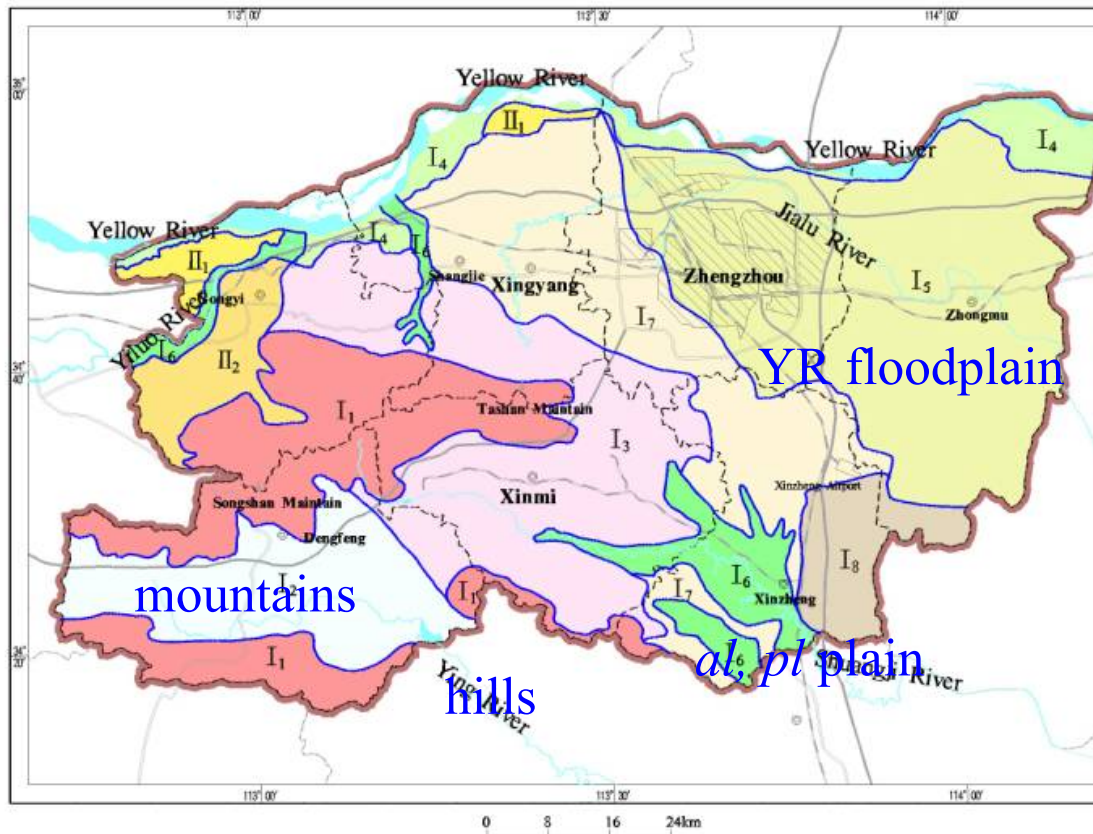
School of Environmental Studies  
**China University of Geosciences**

**Wuhan, Hubei 430074, China**

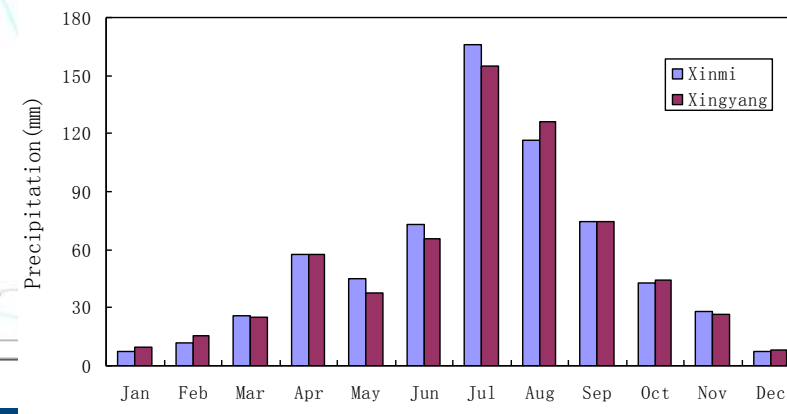
Email: [mgjin@cug.edu.cn](mailto:mgjin@cug.edu.cn)



# Background of Zhengzhou



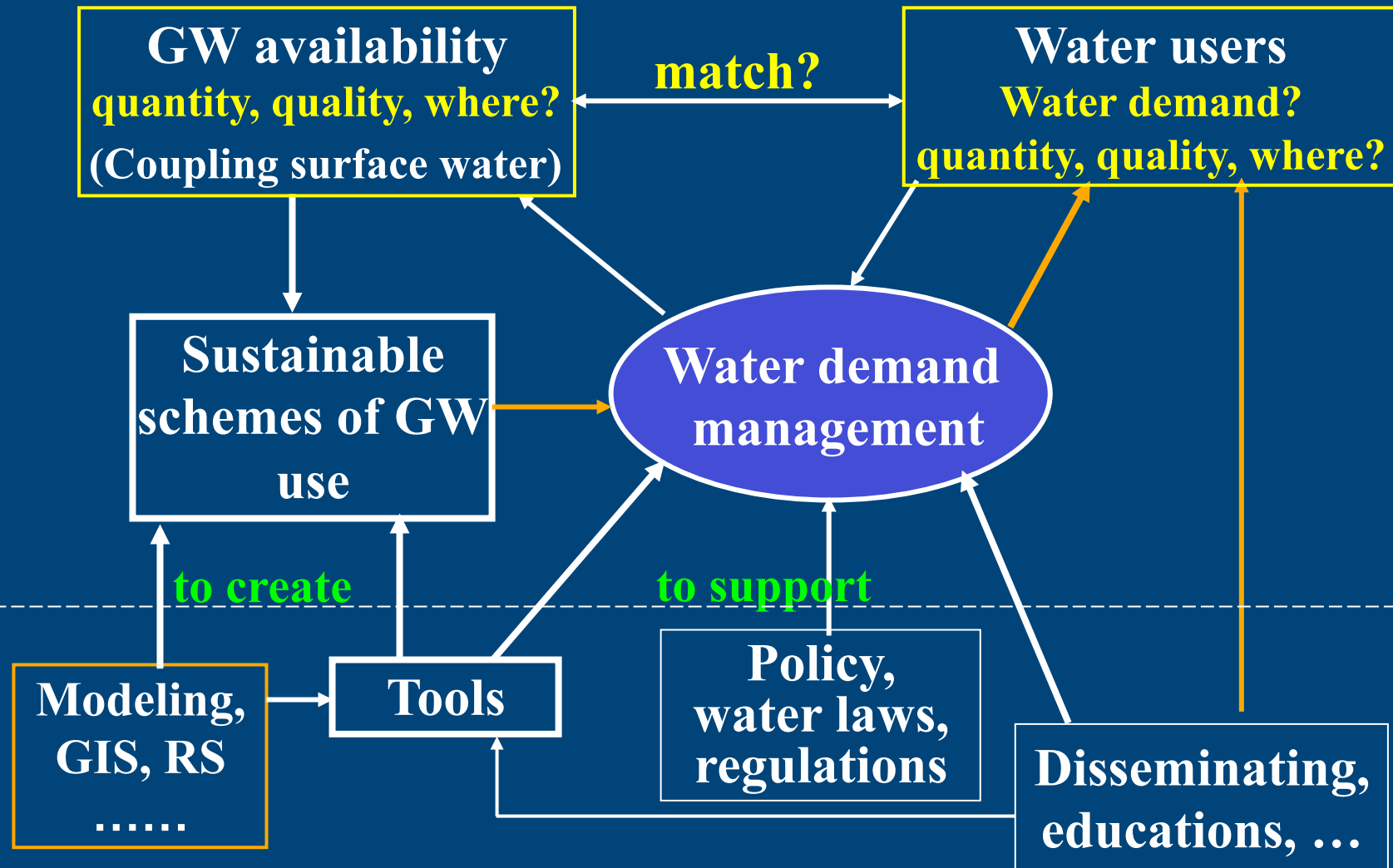
I<sub>6</sub> Valley Plain



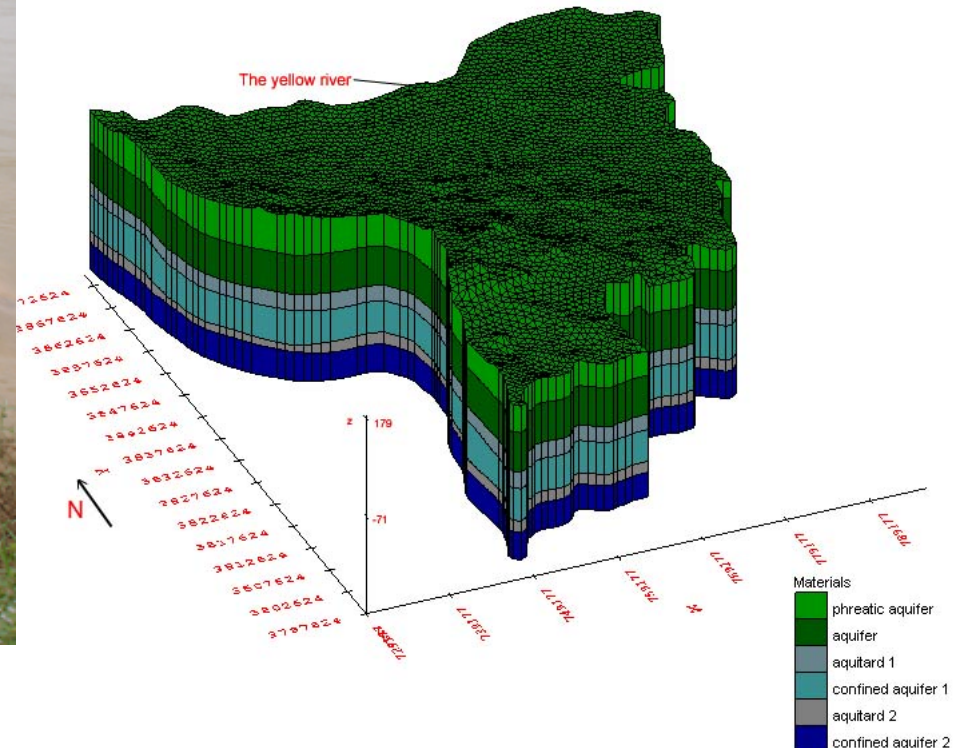
**Zhengzhou Municipal Region has an area of 7,446 km<sup>2</sup>.  
 Population 9.10M (2011); GDP 491.27 billion RMB(2011).  
 Mean annual precipitation 633 mm (575-700 mm).**



■ Key issues for GWG (Jin,2007 )



■ Field investigation, sampling, interview with water users and government officers, database creating, and numerical modeling, ...



中国地质大学水资源研究所  
Institute of Water Resources, CUG

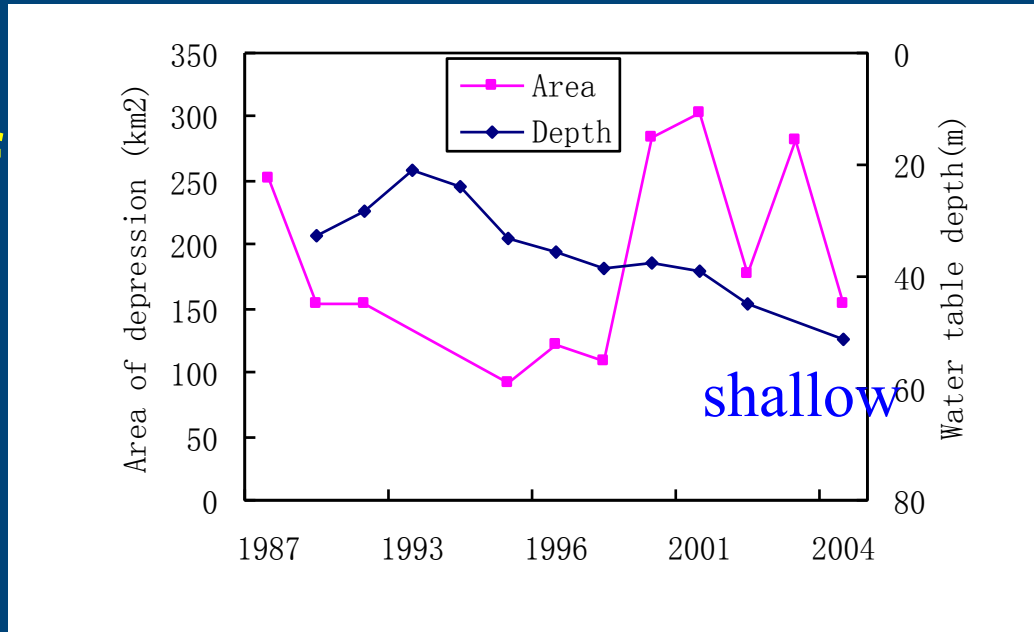
## Water situation of Zhengzhou

- Total water resources is  $1.40 \times 10^9 \text{m}^3/\text{yr}$ . Per capita water is less than  $190 \text{m}^3$
- Total water use was 1.6245 billion  $\text{m}^3$  (2011), in which 0.99 billion  $\text{m}^3$  from GW
- 43 K ha cultivated lands may be threatened by drought every year because of no water for irrigation in the west mountainous area.

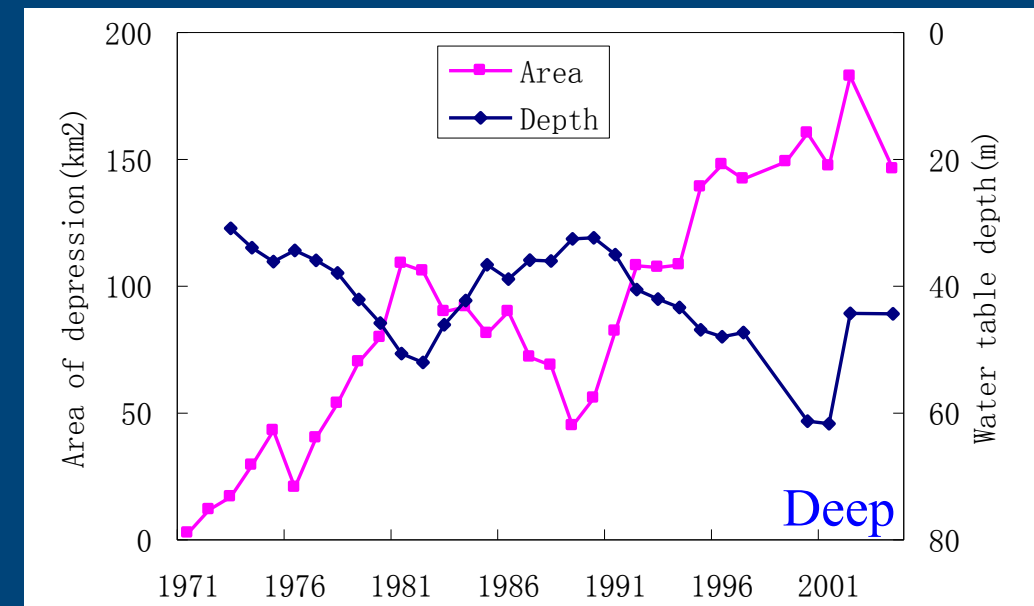


# Declining of water level and increase of depression cones

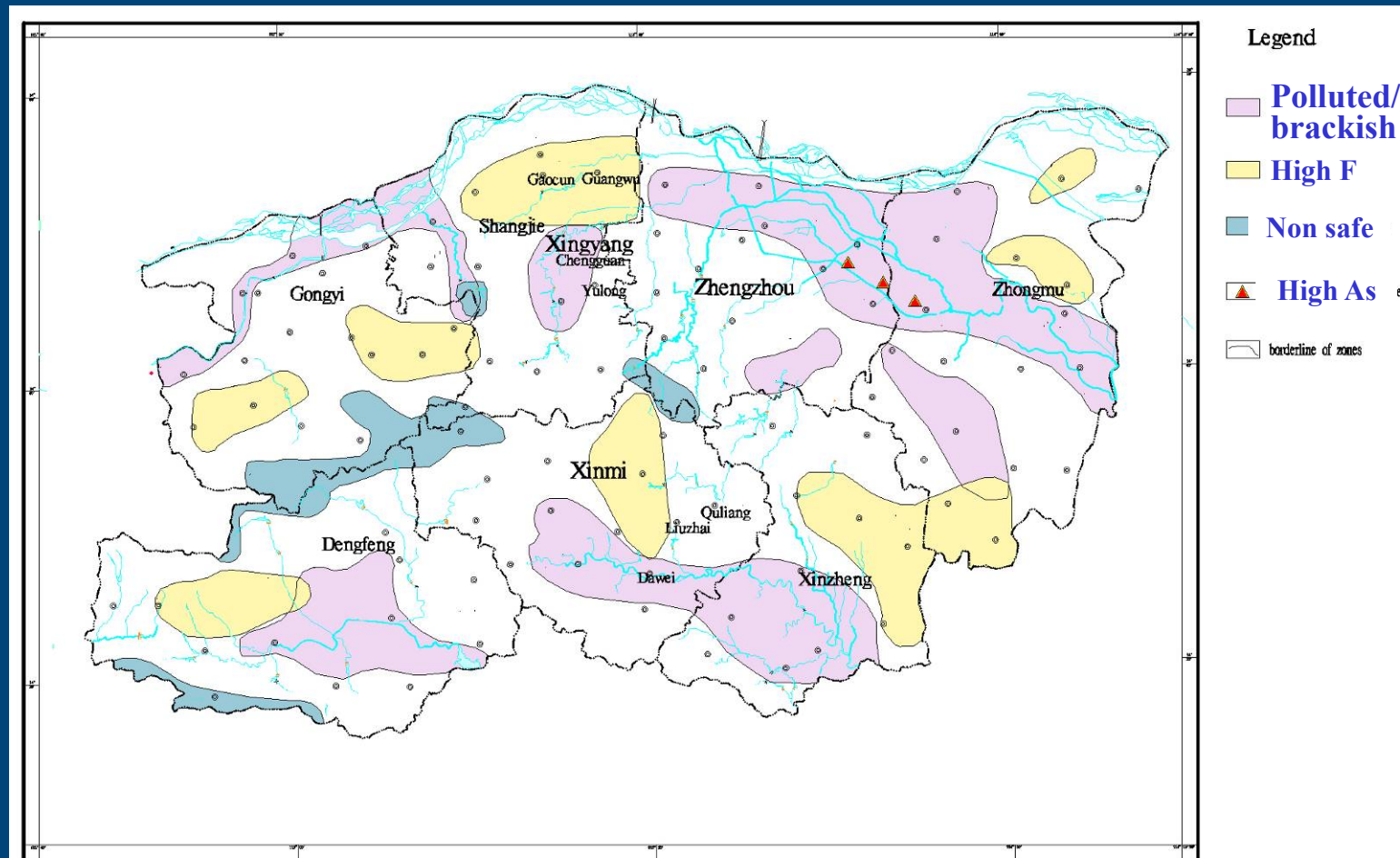
- Area of depression cone & deepest water table for shallow aquifers (Guomian 3)
- declined 30m (50m)



- Area of depression cone & deepest water level for deep aquifers (Guomian 3)
- declined 30m (60)



# Distribution of lower quality of GW



- Shallow GW in many areas of Zhengzhou has been polluted or lower quality.



# Safe drinking water for rural people

- ❑ 1.5 M people can not drink safety water(2006).
  - 621 K drinking polluted water;
  - 361 K drinking brackish water;
  - 233 K drinking high fluorine water;
  - and 4.35 K drinking high arsenic water.
- Government launched a project to solve the drink water problems by drilling deep well and rainwater harvest years ago.





# Institutions related to GW in Zhengzhou

- **Water Resources Bureau of Zhengzhou:**
  - **Water Resources Management Office - urban GW**
  - **Irrigation, Drainage and Rural Water Supply - rural GW**
  - **County-level of Water Resources Bureau**
- **Environmental Protection Bureau of Zhengzhou**
- **Henan Institute of Environmental Geology Monitoring**
- **Zhengzhou Water Supply Corporation**
- **Municipal Bureau of Zhengzhou**
- **Yellow River Conservancy Commission**



# Institutional problems of GWG

- MWR has been officially authorized to manage both groundwater and surface water since 1998, but the problems still remain:
- Separate management of GW quantity and quality
- Separate management of urban area and rural area
- Overlapped management of some functions
- **Lack of good communication among different departments**



# Laws and Regulations

- **The six laws related to GW:**
  - water law of PR China
  - environmental protection law of PR China
  - law of PR China on the prevention and control of water pollution
  - flood control law of PR China
  - law of PR China on water and soil conservation
  - administration of water abstract licensing and collection of water resources charges
- 14+ regulations or policy documents since 1994
- **But there are no detail item on GW governance except the regulation on water abstract licensing and water saving irrigation.**



# Water abstract licensing-rural

- By the regulation, most of water abstract needs getting license
- **Many irrigation wells** have not got the water abstract license.
- The regulation (version 2006) emphasized that users who **fight a drought** of agriculture **need not** applying license.



# Water abstract licensing-urban

- has been carried out strictly in urban areas. New tube wells have been forbidden in some over-exploited areas.
- IC card system are used to control well pumping for more than 10, 000 tube wells.



# IC card irrigation system

- IC card system to control well pumping for irrigation in Xinzheng, Zhongmu...



# Reasons for low efficient water management

- ❑ Water use rights not-well-defined (esp. GW),
- ❑ Low water prices, or electricity-cost-only of GW abstraction
- ❑ Poor consciousness on water-saving practices
- Insufficient investigation and understanding on GW in the area
- Weak public awareness of GW knowledge
- Poor communication/big gaps between researchers, users and managers on water resources (esp. GW)



# Suggestions to GW Governance in Zhengzhou

- Efficient use of allocated water from Yellow River and SNWTP
- Changing cropping patterns and industry structures,
- Adapting water saving technologies,
- New wells should be issued based on sustainable schemes of GW use
- Reforming water pricing or subsidy
- Enhance public awareness of groundwater





# Summaries

- **GW pollution and over-exploitation need to be efficiently controlled urgently. These need further research on both technical and non-technical aspects. It needs efficient approaches for GW governance.**
- **GW governance institutions need to be coordinated**
- **Sustainable GW development and governance is a complex systems engineering.**
- **Our proposed schemes/ planning of GW development should be user friendly, easy to be understood on the basis of well investigation and well consideration of user' s demand.**



# Summaries

- **To achieve sustainable use of GW needs efforts from all of the world (scientists, decision makers and all individual water users). The most important things are:**

**To enhance public awareness and knowledge of GW; and to create a work desk for better communication among water managements, planners, decision-makers, scientists, water users and others to exchange ideas and knowledge and**

**reduce the gaps between different parties.**



# Acknowledgements

- IWMI and CPWF (PN 42)
- Yellow River Conservancy Commission (YRCC)
- Water Resources Bureau of Zhengzhou
- Second Team of Hydrogeology and Engineering Geology, Henan Province
- Henan Institute of Geo-environment Monitoring
- Henan Geological Survey



# Thank you very much

## 地下水是水文循环中重要的部分

水文循环是发生三大气水、地表水和地表岩石空隙的地下水之间的水循环。地表水、包气带水及潜水带中浅层水通过蒸发和植物蒸腾而变为水蒸气进入大气圈。水汽随风飘移，在适宜条件下形成降水。落到陆地的降水，部分汇集于江河湖淀形成地表水，部分渗入地下，渗入地下的水，部分留在了包气带中，其中的土壤水为植物提供了生长所需的水分，其余部分渗入潜水带岩石空隙中，成为地下水。地表水与地下水可通过蒸发或排泄口入大气圈，有的通过地表径流或地下径流返回海洋。

地下水是水循环的一个关键环节。地下水可通过下渗方式补给河流、湖泊和沼泽，或者通过下渗方式直接注入海洋；在土壤中的水分又可以蒸发或经植物根系吸收再散发的方式进入大气。

## 地下水的补给

地下水的补给来源有大气降水、地表水、凝结水，来自其它含水层或含水系统的补给等。与人类活动有关的地下水补给有灌溉回水、水壅渗漏水，以及专门性的人工回灌。

## 地下水的排泄

地下水通过泉、向河排泄及蒸发、蒸腾等方式向外界排泄。此外，还有一个含水层（含水系统）向另一含水层（含水系统）的排泄。

水井孔状排泄地下水、咸田排泄、抗堆等排泄地下水，均属地下水的人工排泄。

## 人类活动对地下水的不良影响

人类活动对地下水既可以产生有利于人类的影响，也可以产生不利于人类的影响。人类对地下水产生不良影响通过三个方面发生：过量开采地下水，过量补充地下水，污染物进入地下水。

## 地下水的污染源

污染物主要来自生活污水与垃圾、工业污水与废渣以及农用肥料与农药。随着人口急剧增长与工农业的发展，产生的污染物数量十分巨大。

## 地下水污染后治理的发展

地下水的污染与地表水污染不同。污染物进入地下水含水层及在其中运移的速度都很慢，若不进行专门治理，存在性及持久；地下水污染已达到相当严重的程度。地表水循环流动迅速，只要持续污染源，水质能在短期内改善净化。地下水由于补给交替缓慢，不仅很难净化，一旦进入地下水的污染物，将在含水层中长期滞留。随着地下水流动，污染物还将不断扩散。因此，要使已经污染的含水层自然净化，需要很长的时间（几十、几百甚至几千年）；如果采取打井拦截污染物的方法清除污染，则要付出相当大的代价。

为了避免地下水遭受污染，首先要控制污染源，力求污染物彻底处理后再行排放。其次，要根治毒性以及地下水流动系统分析污染条件，尽量将可能发生污染的工矿企业安置在不易污染地下水的部位。

## 地下水的过量开采

过量开采地下水，会造成地下水位下降，引起一系列严重的环境退化现象，如土壤盐渍化、地裂缝、地面沉降、海水入侵等。



干旱地区因地下水强烈蒸发导致第二类盐渍土（砂白灰土）



2002年12月10日排桑塔纳新嘉坡空气污染严重的供水管道（《中国环境报》，上海科学出版社，2005）



地面沉降太原晋源区农村房屋倒塌（马峻拍）



经济纳兹地恩河沿岸萨地恩地下水下降而退化（徐恒力拍）

## 地下水?

养成节水的好习惯，杜绝浪费；  
化学物品和生活污水；  
E:  
活动，了解地下水的知识。

## 三

18日第47届联合国大会上通过了一项决  
22日定为“世界水日”。旨在使全世界  
《资源短缺这一日益严重的问题，要求  
的国情，开展相应的活动，以提高公  
保护意识。

呼唤地球儿女，要珍惜每一滴水。曾  
《人类继续破坏和浪费水资源，那么人  
水将是自己的眼泪。”这并不是耸人  
听闻的事实！

88号  
E:地学院

83461  
E:cug.edu.cn



水是人類赖以生存的不可缺少的宝贵资源。地球上可  
被人类利用的淡水水，98%是来自地下水。

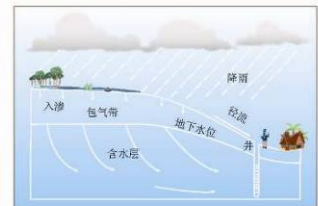
地下水即是赋存于地面以下岩石空隙中的水，由于其  
水质良好，分布广泛，变化稳定以及便于利用，是理想的  
供水水源。

在我国半干旱与干旱的华北、西北地区，地下水往往  
是主要的，有时甚至是唯一的生活以及工农业生产供水  
水源。

2006年全国总用水量5795亿方，地下水用量为1065.5  
亿方。其中浅层地下水占80.5%，深层承压水占19%，微咸  
水占0.5%；南方地下水用量占全国地下水用水量的13%，  
北方地下水用量占87%。

地表层十余公里范围内，都或多或少存在着空隙，  
特别是深部一、两公里以内，空隙分布较为普遍，这就  
为地下水赋存提供了必要的空间条件，形象的说“地表层  
层就好像是包含着水的海绵”。

赋存在地下岩石空隙中的水，含水岩土分为两个带：  
上部是包气带，即非饱和带，在这里除水以外，还有气  
体；下部为饱和带，即饱和带。饱和带岩石中的空隙充  
满水，狭义的地下水是指饱和带中的水。



中国地质大学水资源研究所  
Institute of Water Resources, CUG