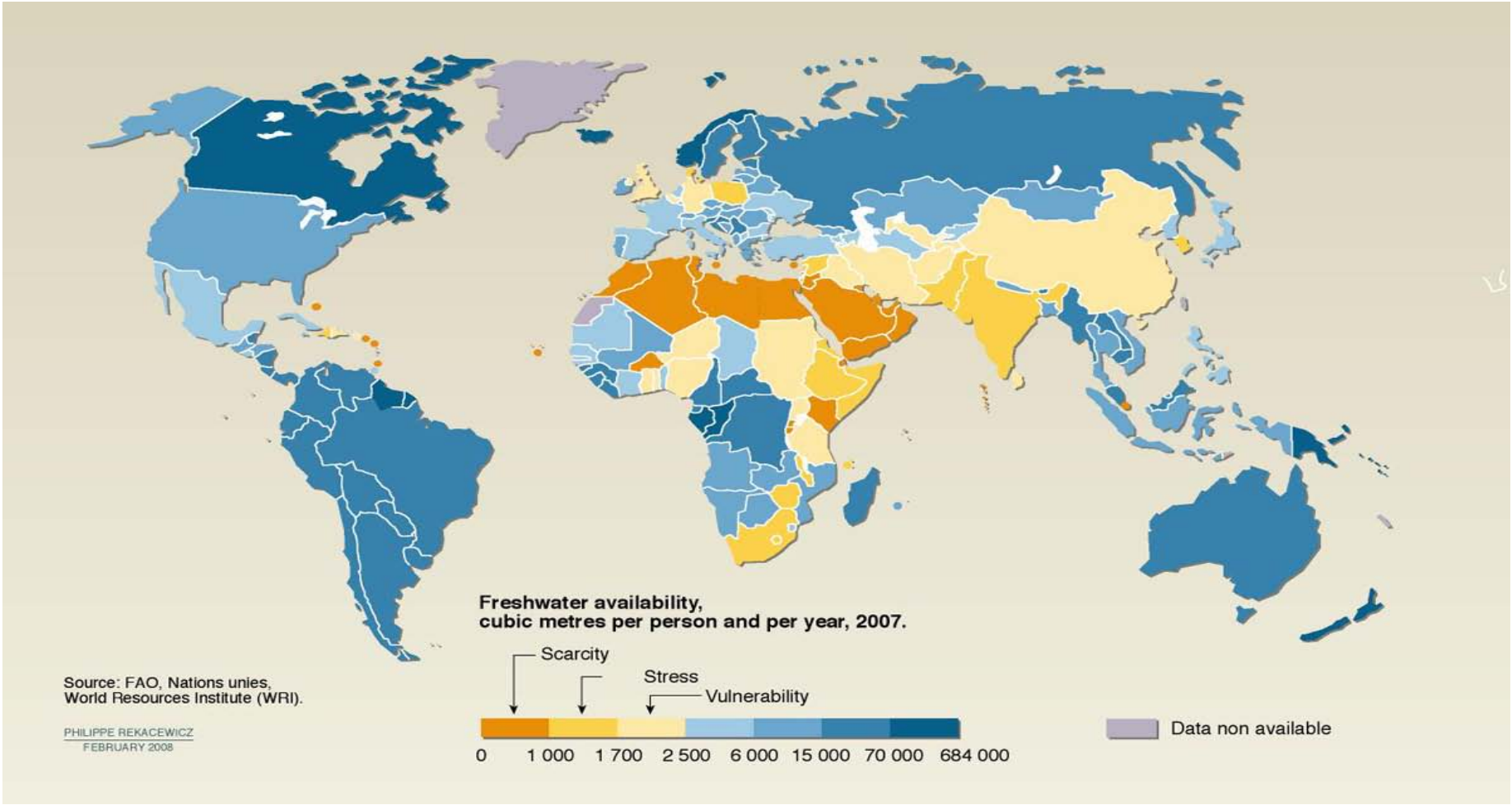
Outcomes and Impacts by the Sustainable Water Resources Program (2001-2010) in Korea

Sung Kim
Sustainable Water Resources Research Center
Korea Institute of Construction Technology

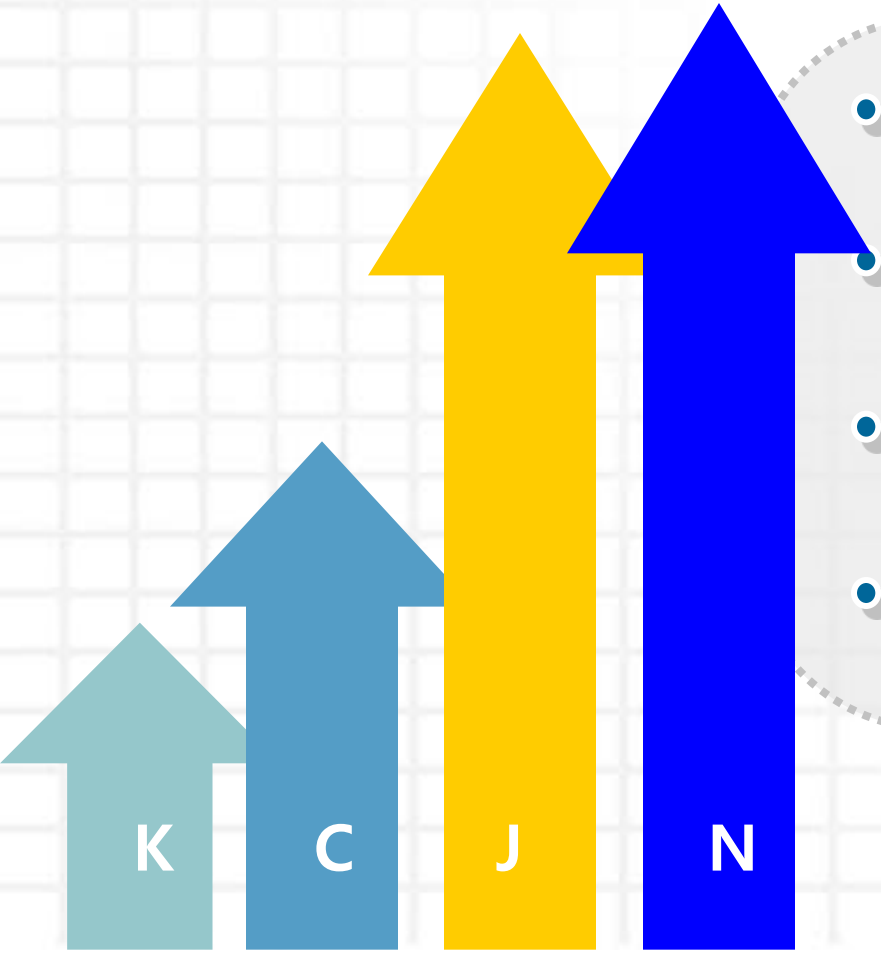
Korea is classified as “water stress country.”

Renewable Water Resources: 1,471 m^3/p



※ Source: http://www.unep.org/dewa/vitalwater/article69.html

The lowest among NE Asian countries

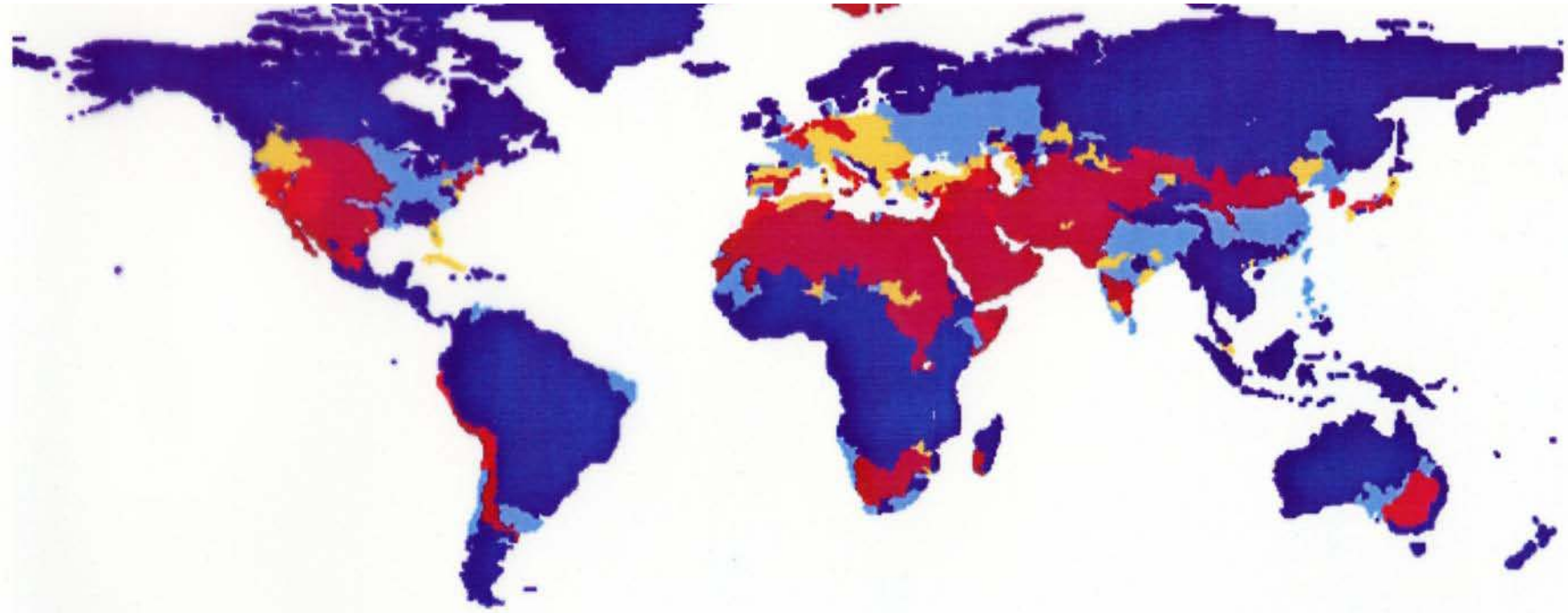


- K: Korea (1471 m^3/p)
- C: China (2186 m^3/p)
- J: Japan (3372 m^3/p)
- N: N. Korea (3415 m^3/p)

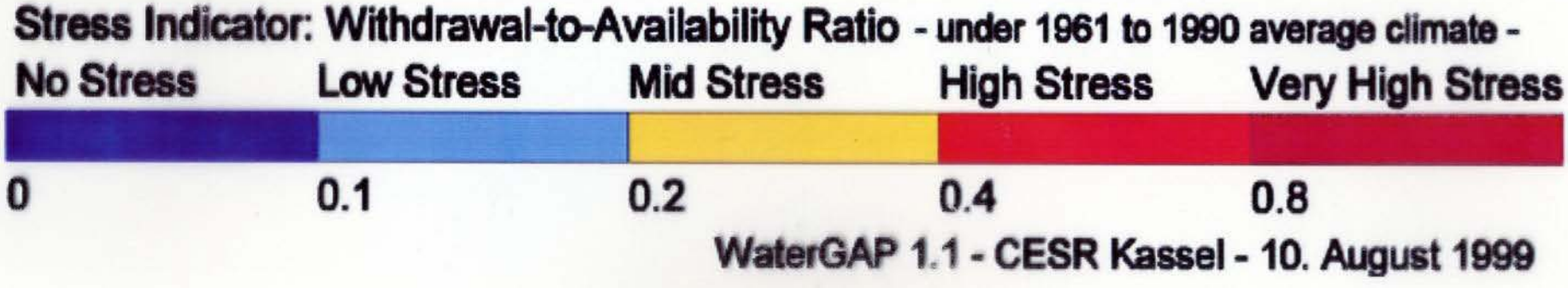
Source: WRI (2003)

Water Withdrawal Ratio is very high.

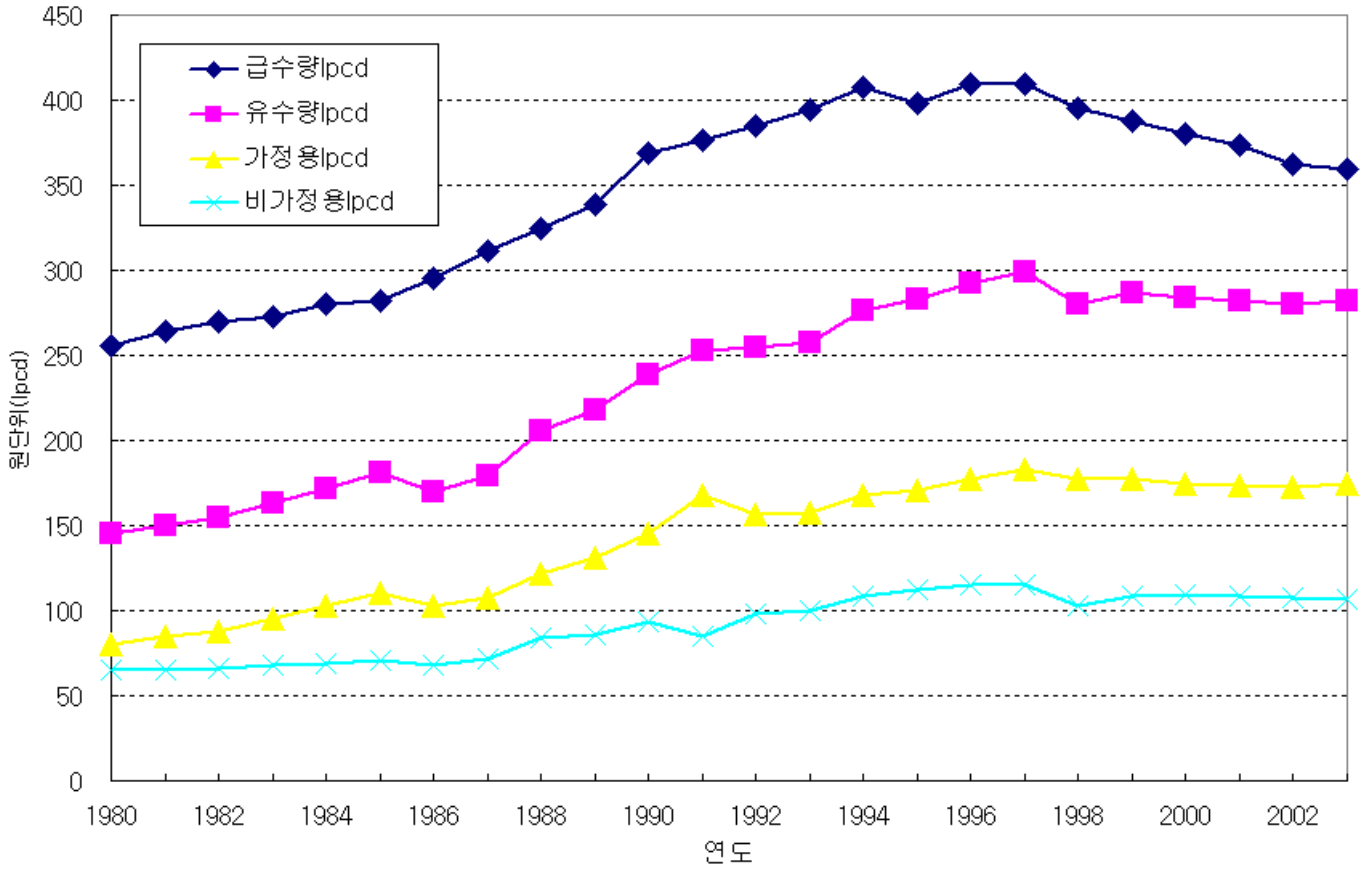
(Korea: 35.6% ➔ Highest among NE Asian Countries)



Thus, difficult to manage water resources.



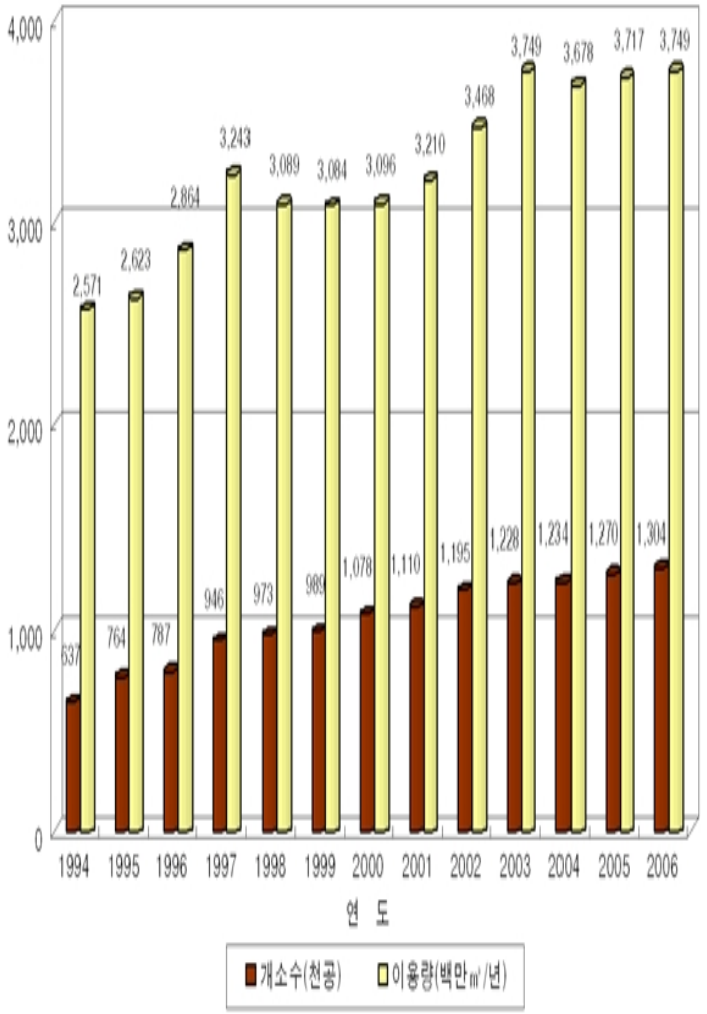
Water demands have been stabilized since 1998.



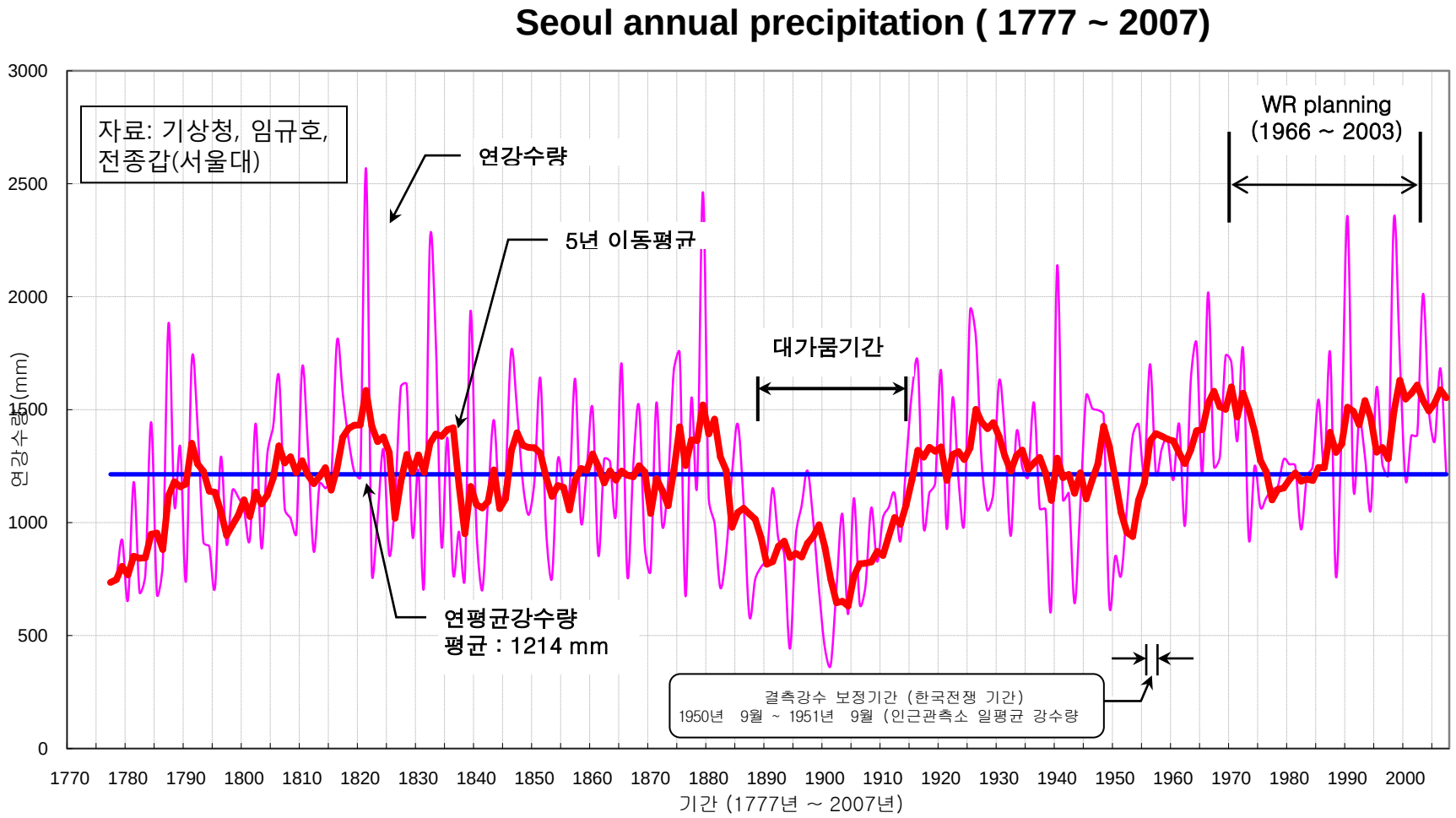
Actual water supply has been decreased because of lower leakage. However, instream flow demand increases rapidly.

GW use increases (www.gims.go.kr)

- 10% of total water use (3.7 bil. m^3/yr)
- Intensive use (37mm/yr)
- 50% of observation wells show water level decreasing while 33% increasing
- After 20yrs, GW level would be decreased by 58cm and 4.3 bil. m^3 of GW storage would be lost.

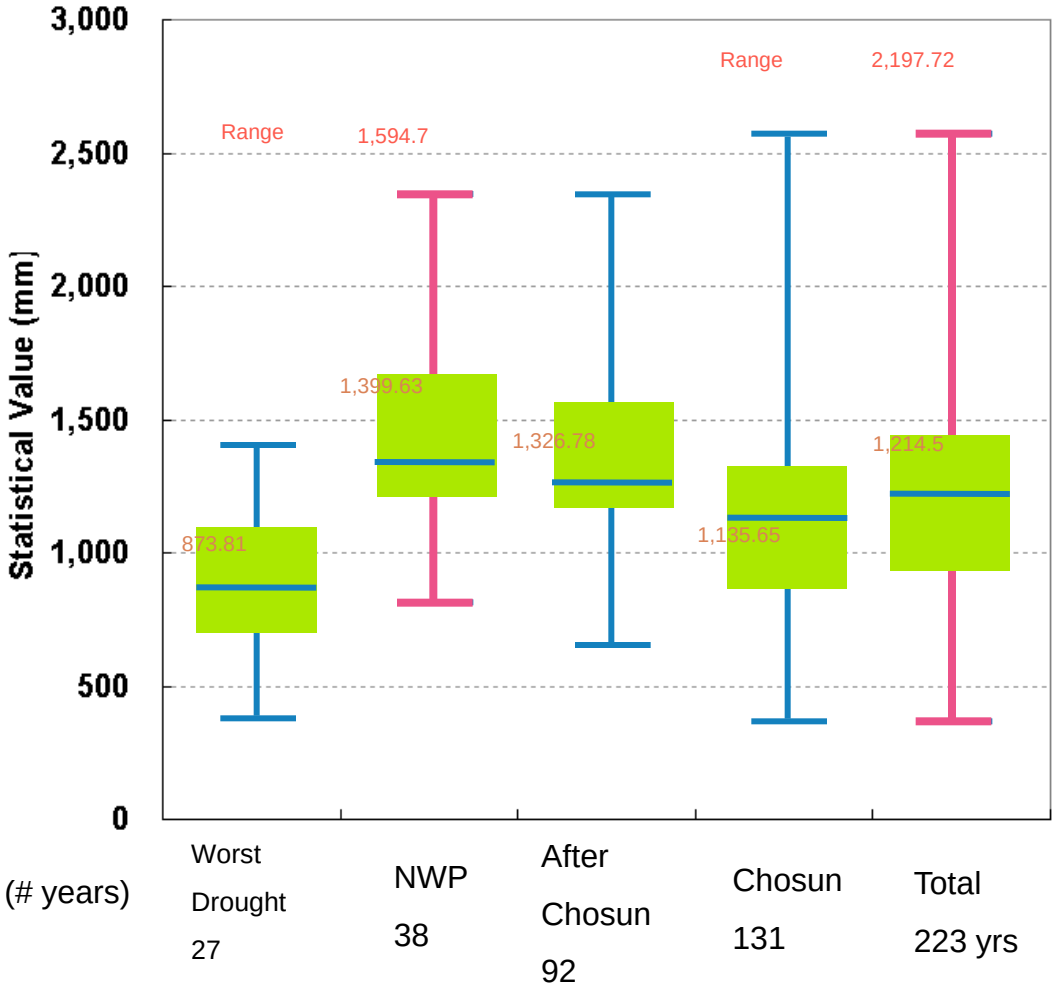


Climate of Korea shows extremely variable over past 230 yr period.



- Data Sources: KMA, JG Jeon, and GH Lim

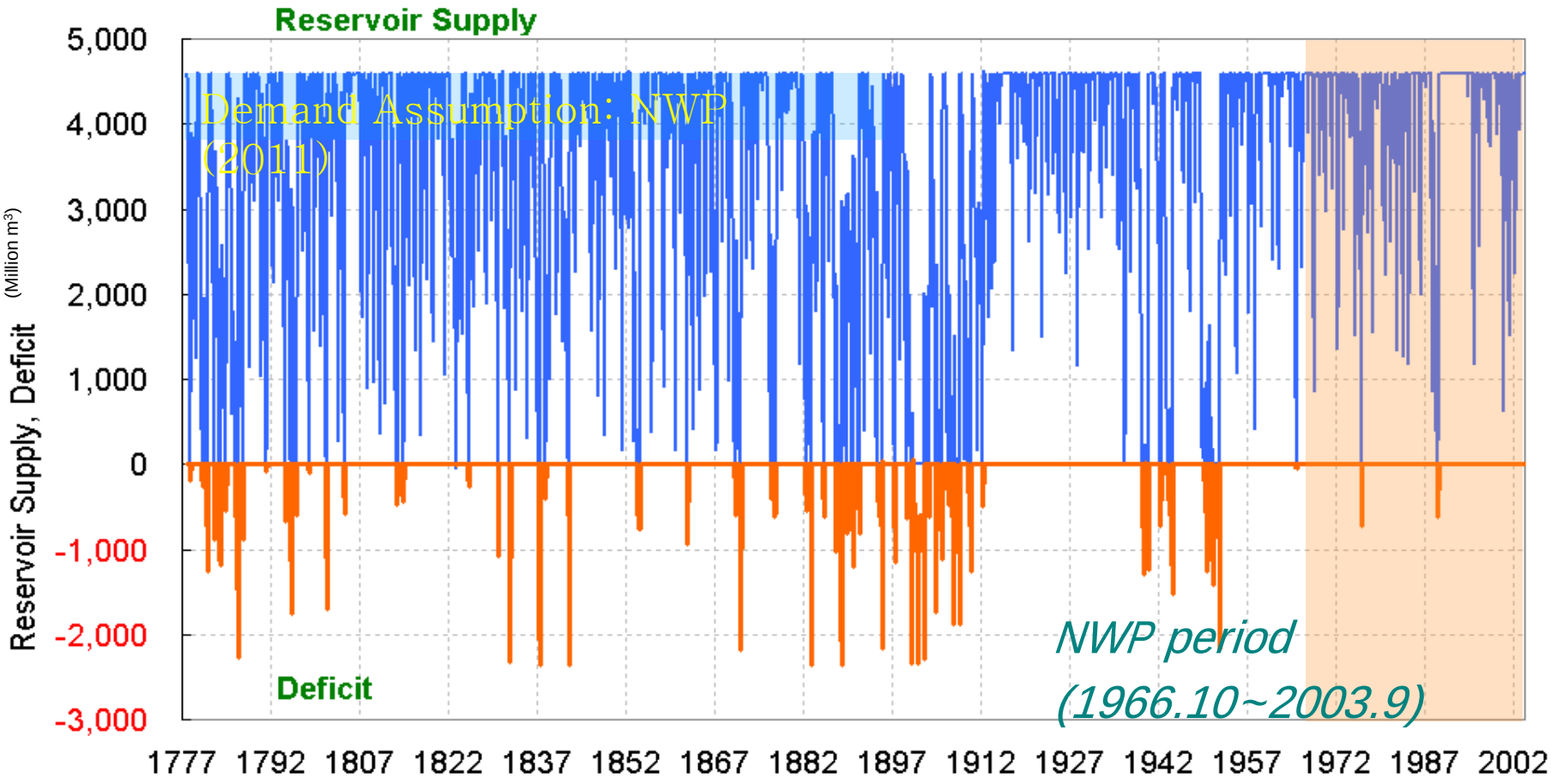
Statistics of Annual PRCP at Seoul by different periods



- Mean 1214.5 mm
  STD 382.62 mm
- Worst Drought: 72%
  NWP: 115%

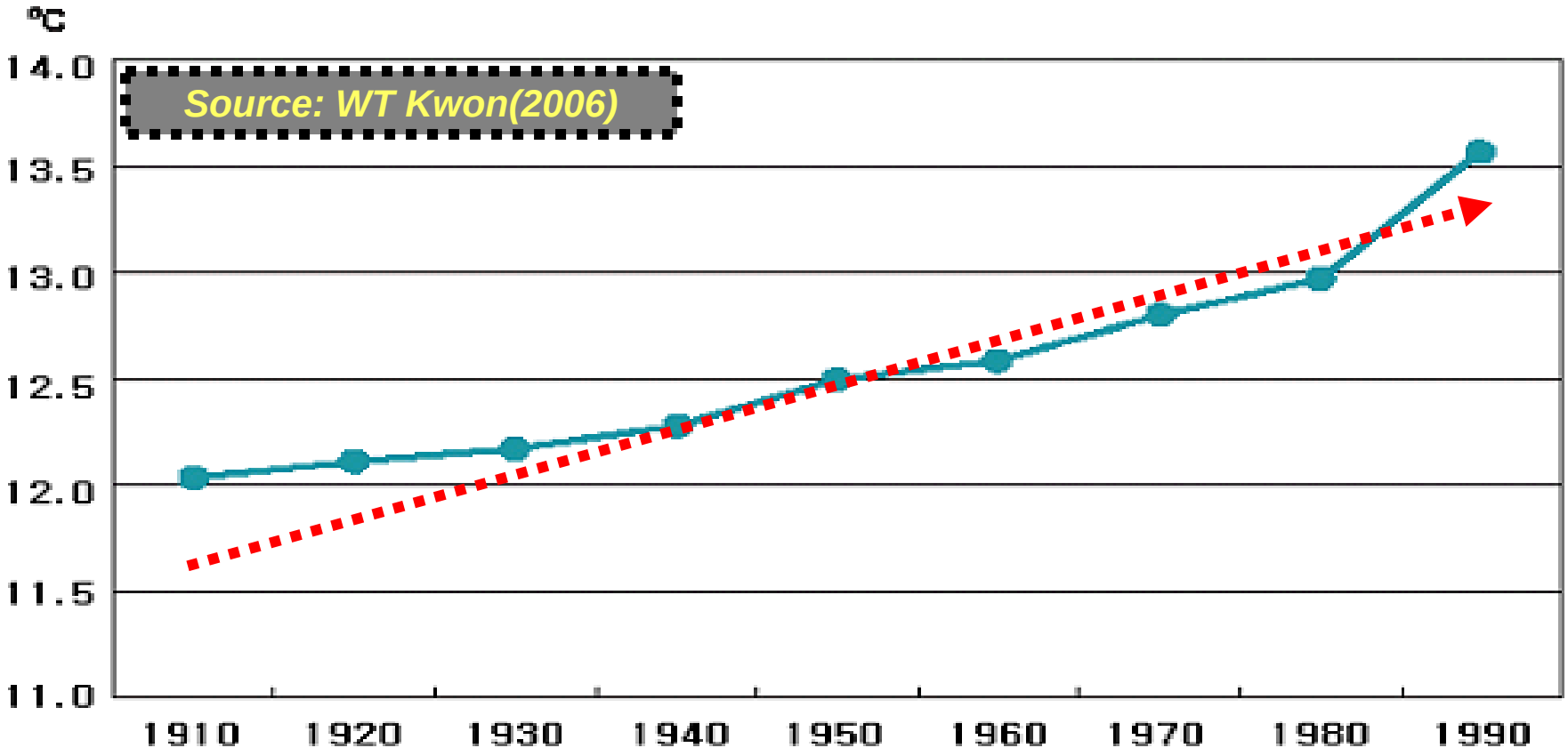
Significant difference exists depending on the chosen period.

Water Demand-Supply Analysis



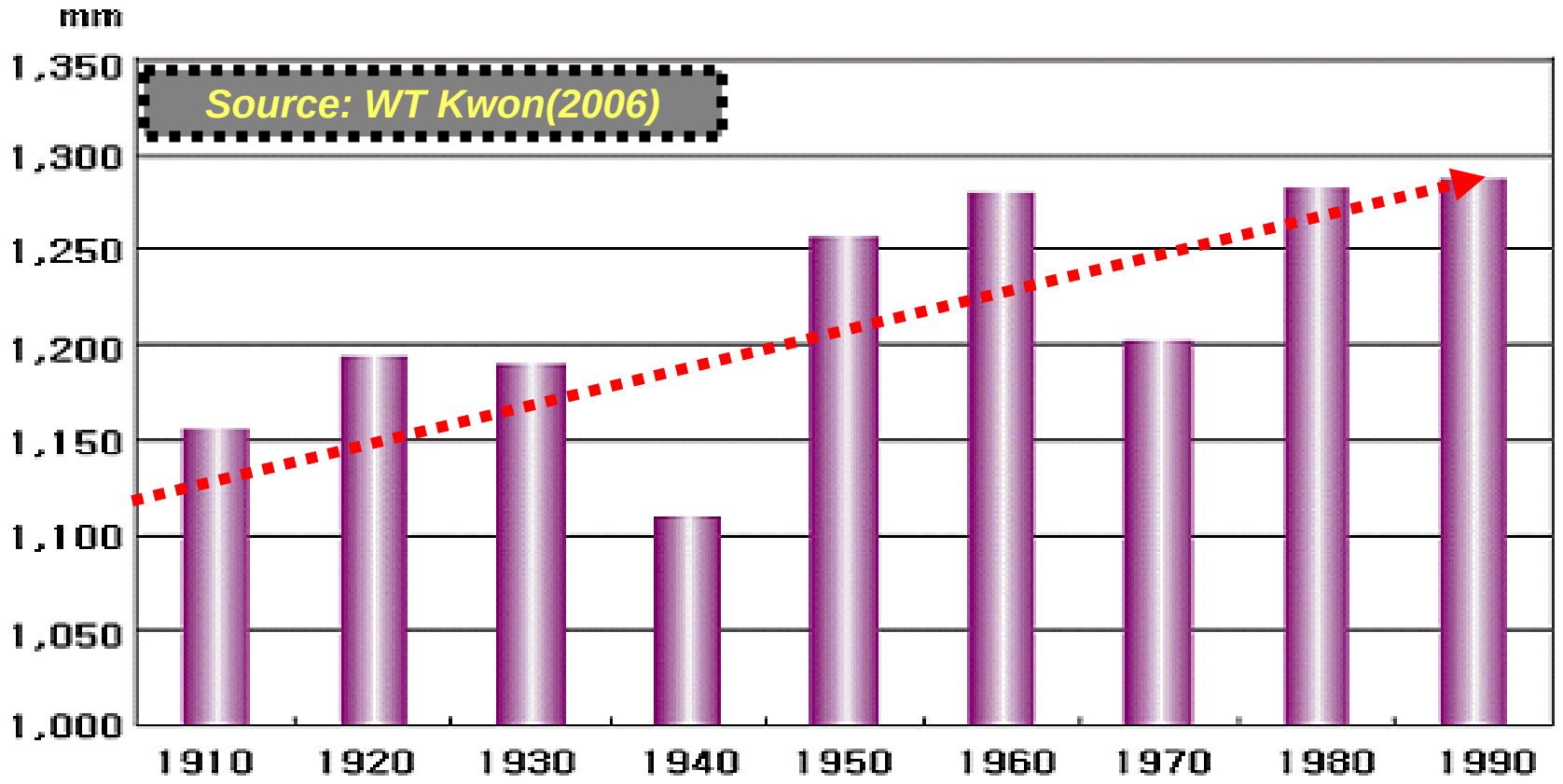
Reliability of water resources planning is depending on the chosen period.

10-yr AVG Air Temperature rises rapidly.



- For past 100 yrs, 1.5 degree (Global: 0.67)
- Trend has been intensified since 1990's.

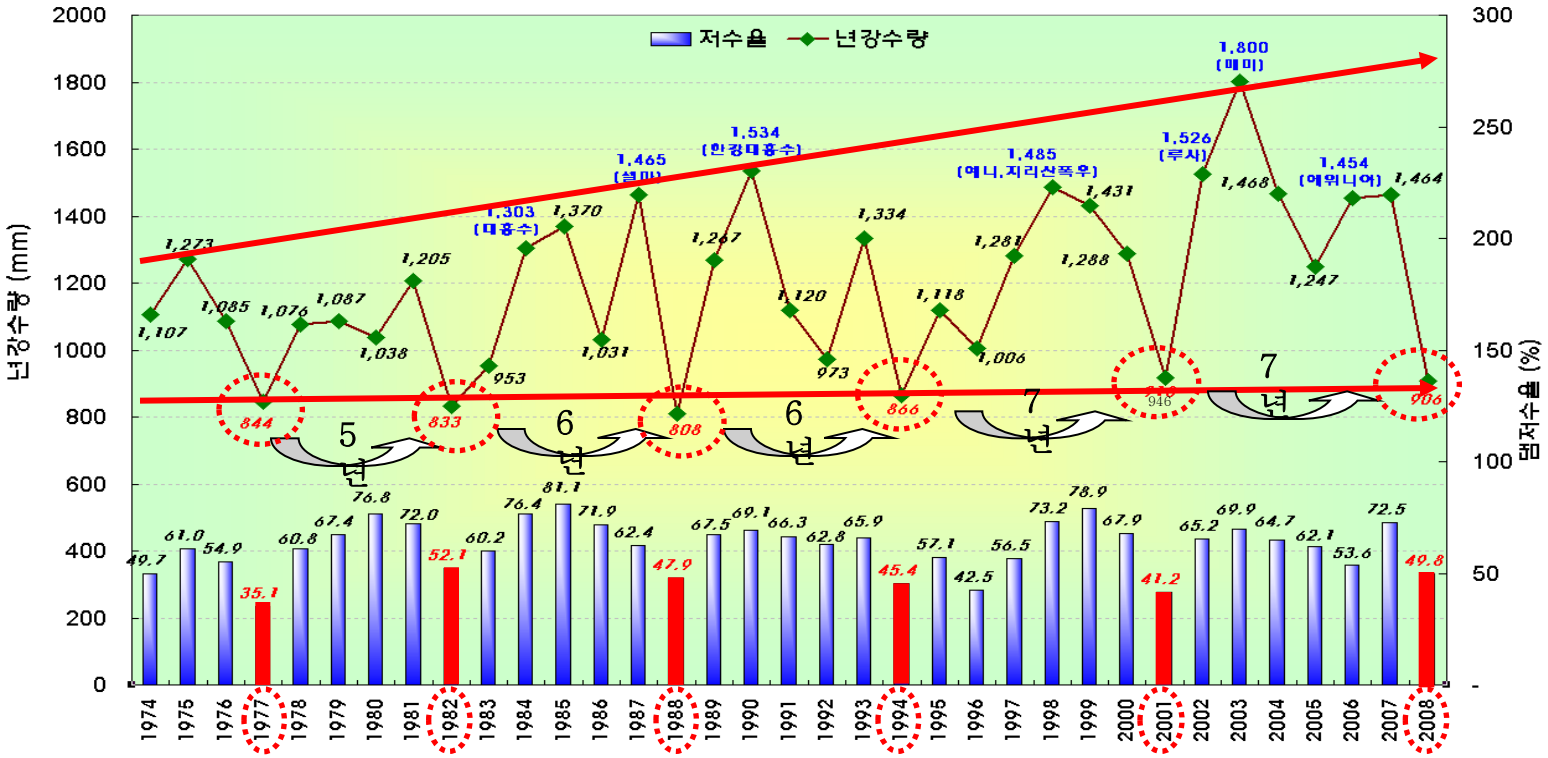
10-yr AVG Ann. PRCP rises



- Ann. PRCP(7% up), Rainy days (14% down)

  ➔ Days of more than 50mm (22-25% up)

Drought occurs every 5-7 yr period since 1970's.

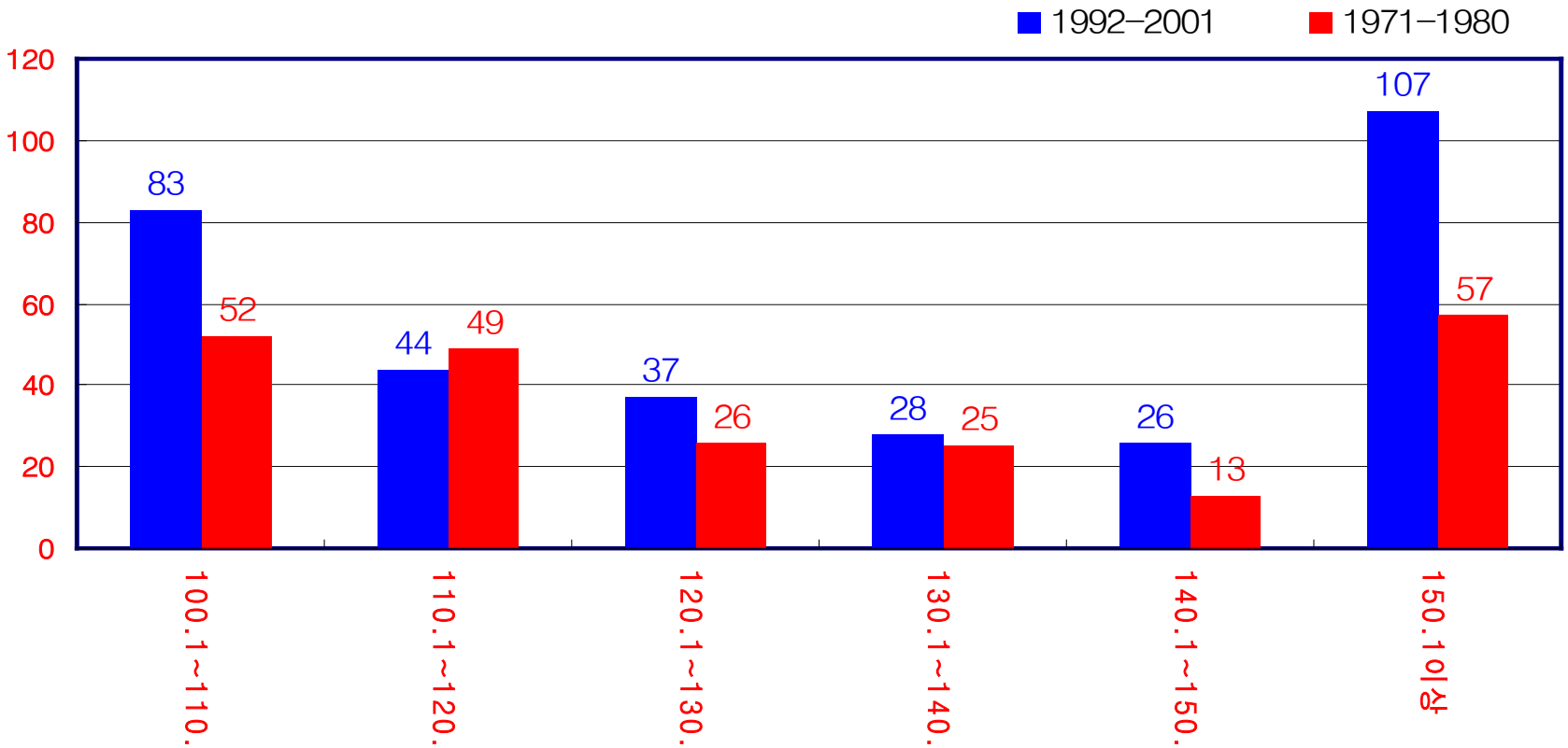


※ Deviation of annual rainfall expands gradually.

Source: Hwang (2009)

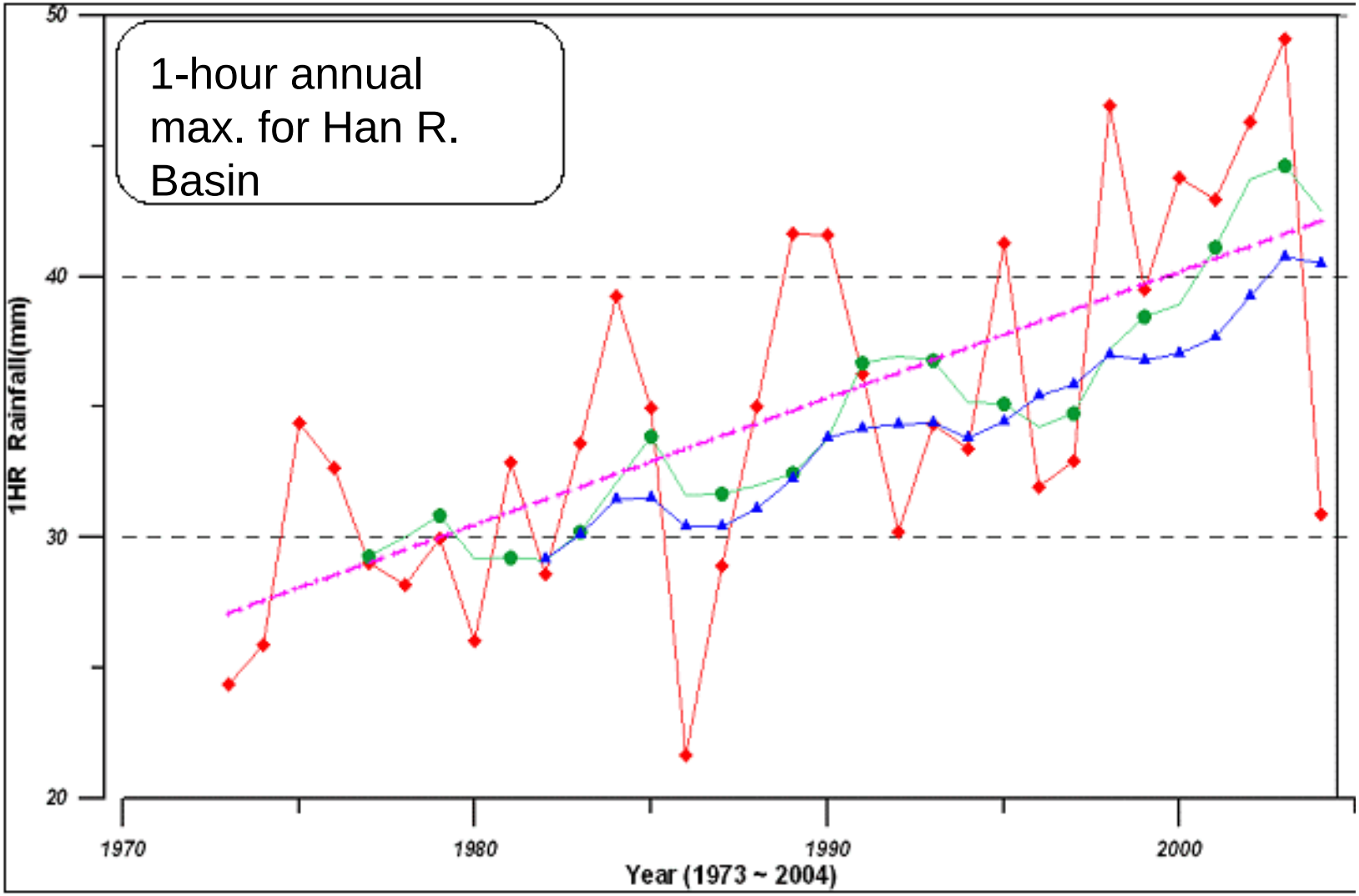
Heavy storms occur more since 1990.

Source: KMA

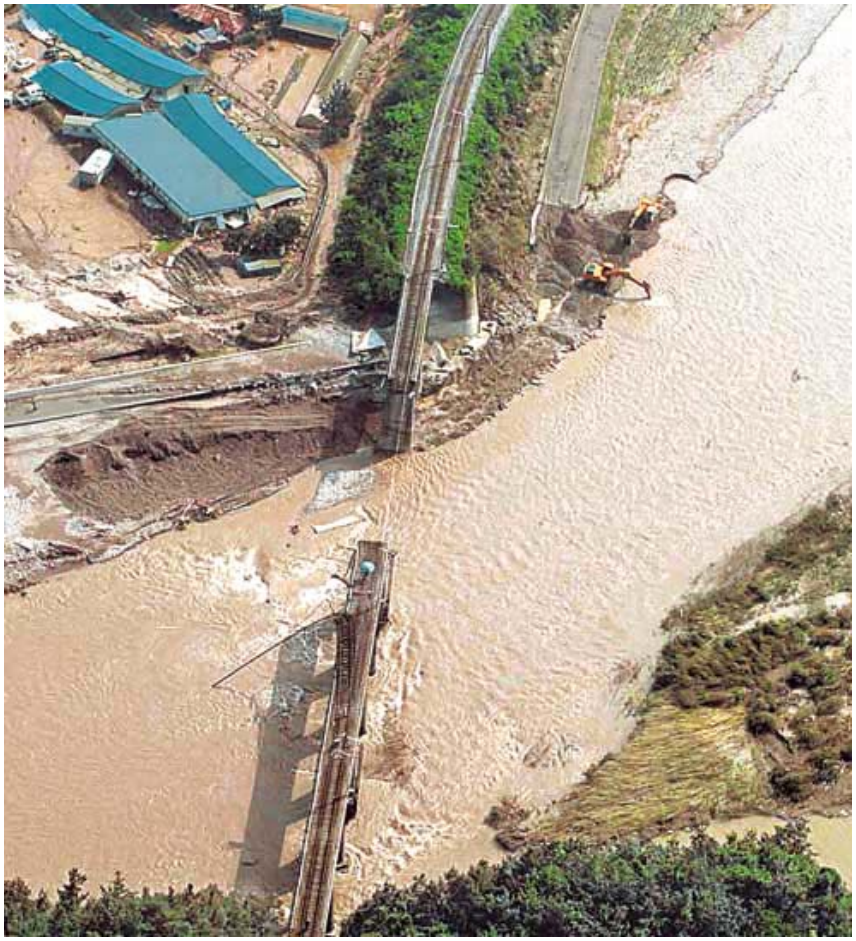


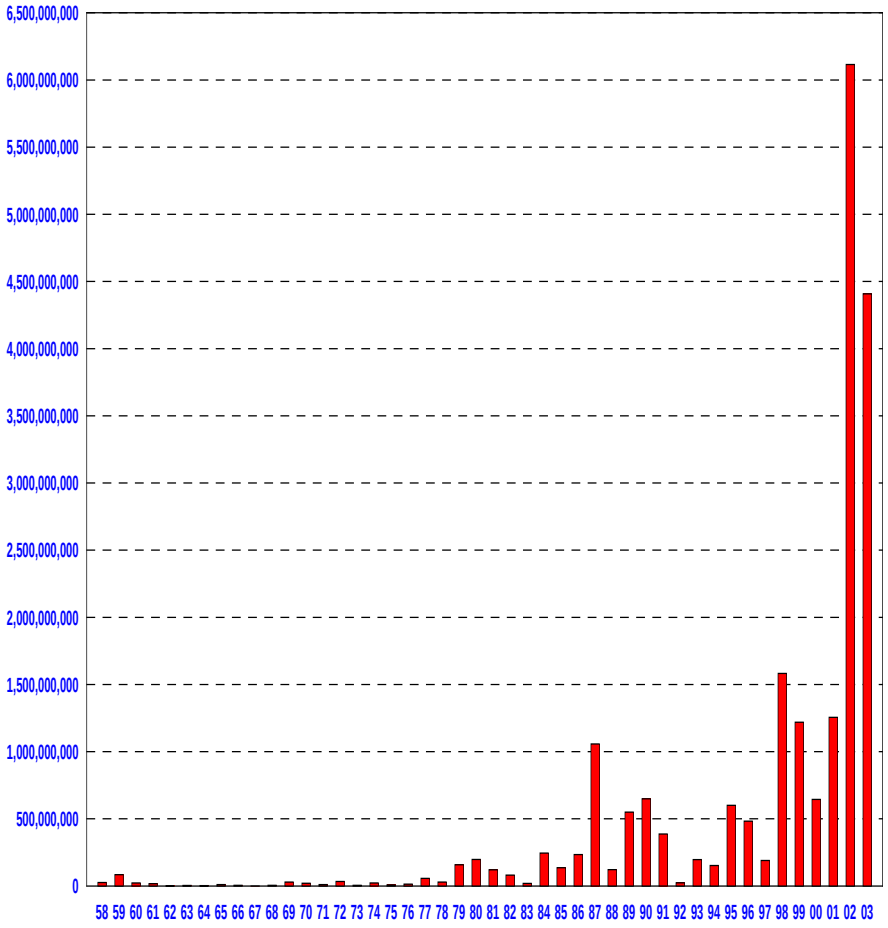
For more than 150 mm/day, occurs twice since 1990's.

A short-duration rainfall intensity increases very rapidly since 1970's

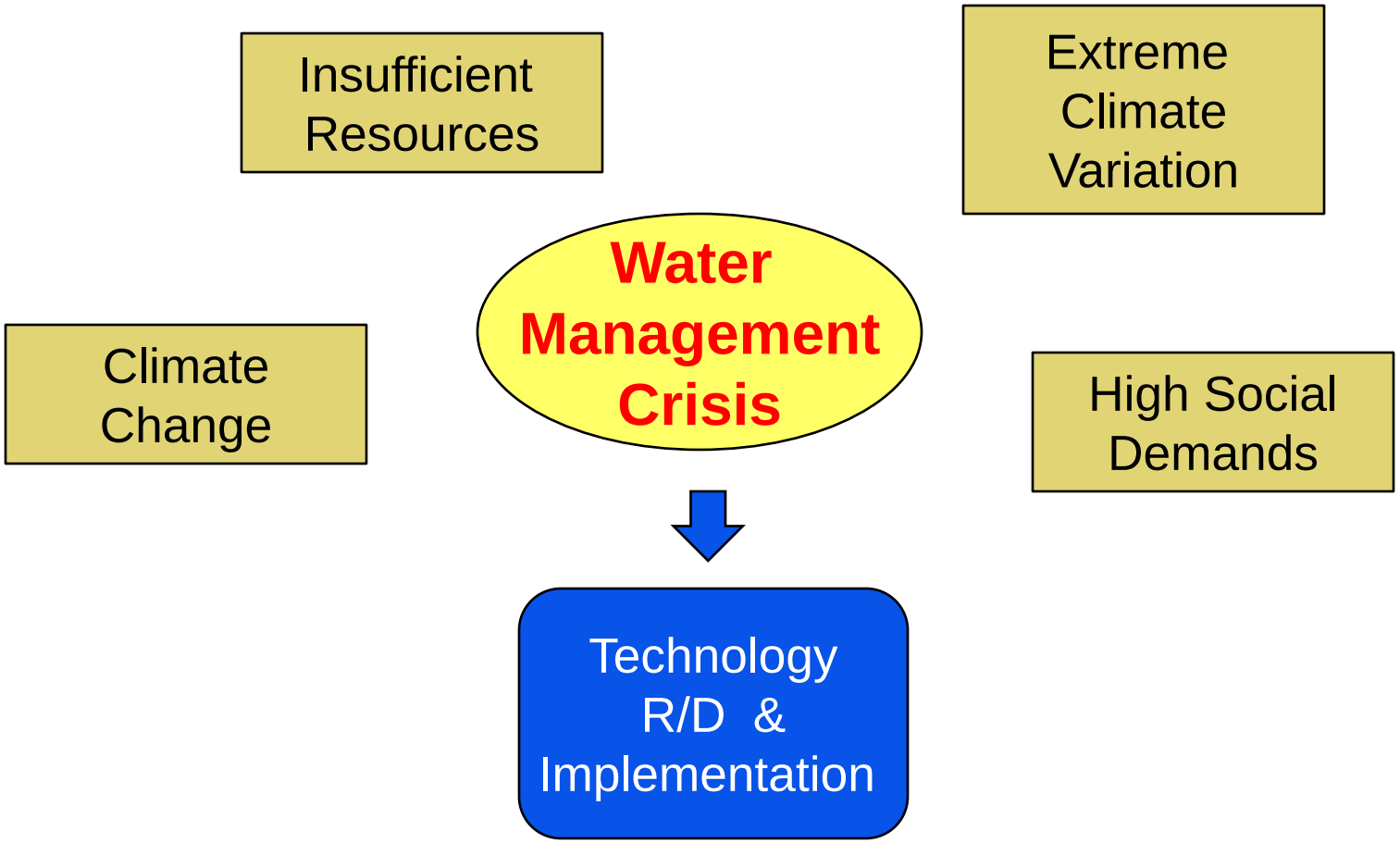


Flood damage rises very rapidly.



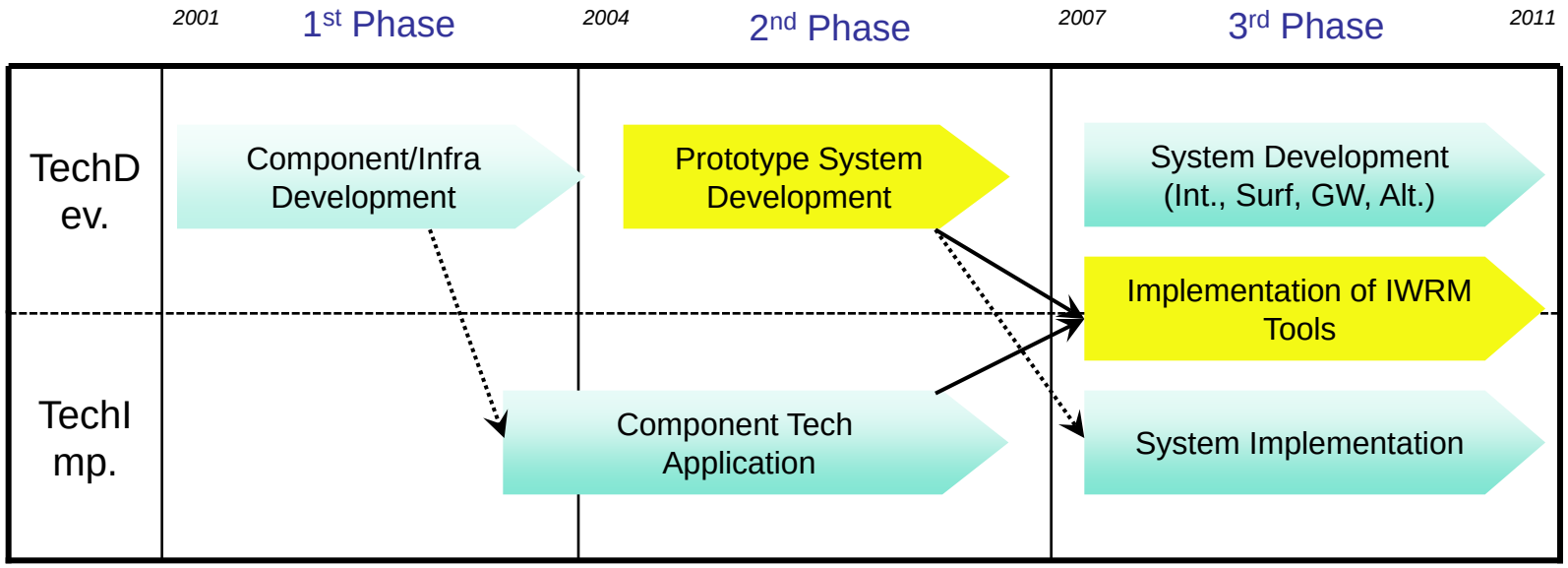


Korea needs to overcome water management crisis.

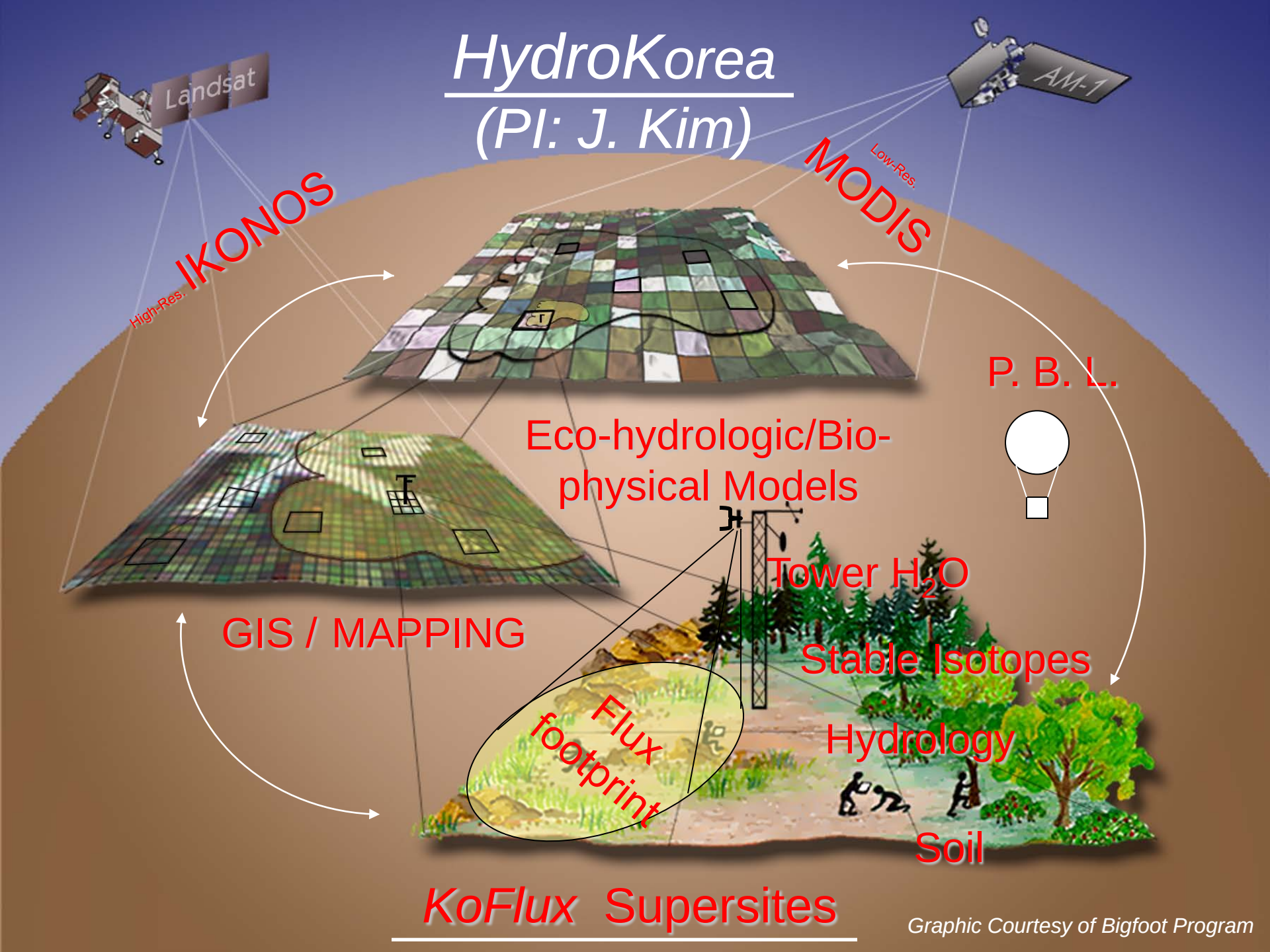


Sustainable WR R&D Program

Period	2001. 8. 1 – 2011. 3. 31
Budget	147.5 B Won (Gov. 73%, Industries 27%)
Ministries	MOST 70%, MOCT 30%
Participants	77 orgs (Univ. 28, Res. 11, Industry 13), 800 people

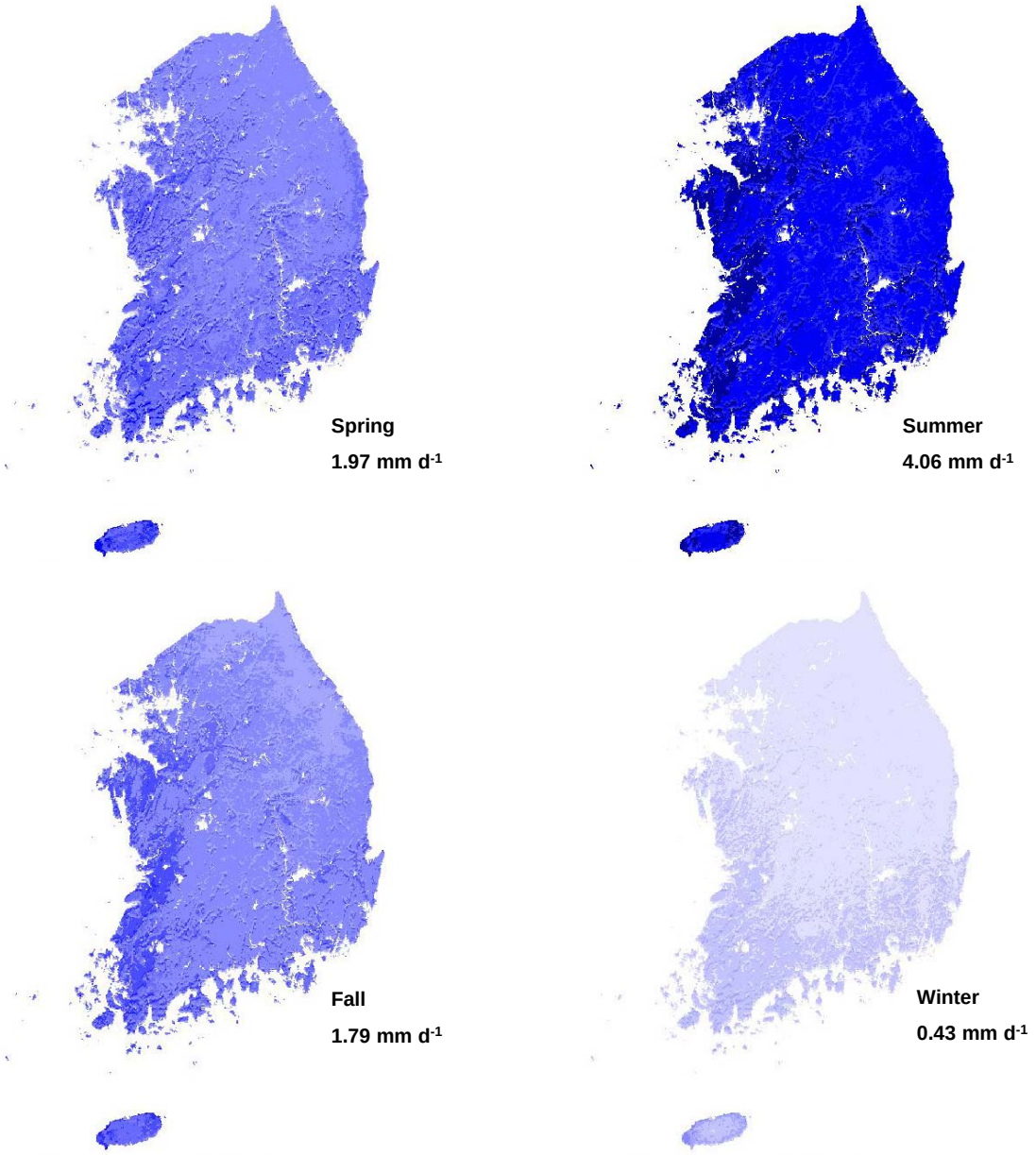


www.water21.re.kr

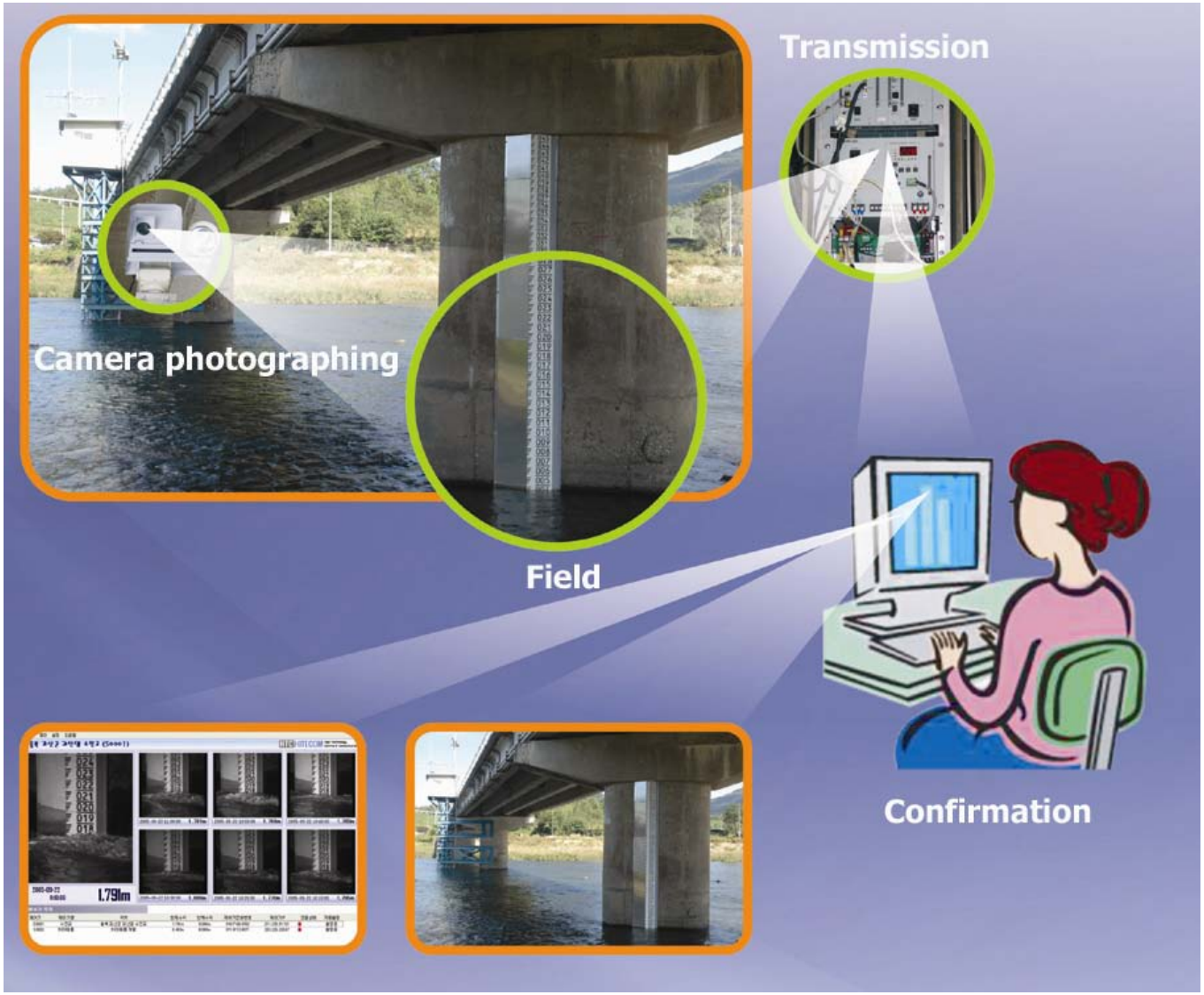


Graphic Courtesy of Bigfoot Program

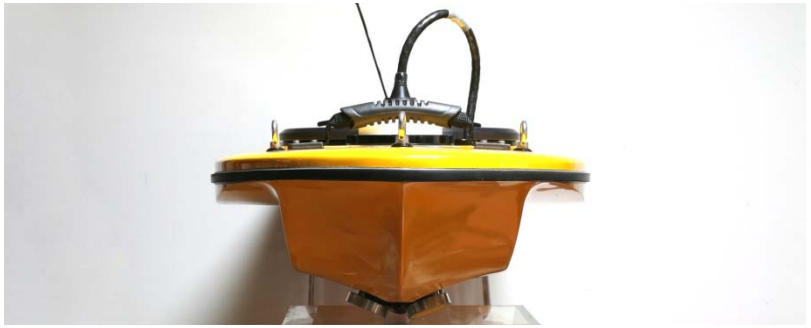
Partially Gap-filled Daily Averaged ET



Improving Water Measurement Technologies (PI: W. Kim)
Image Water Level Gauge



Monitoring Boat (R2V2)

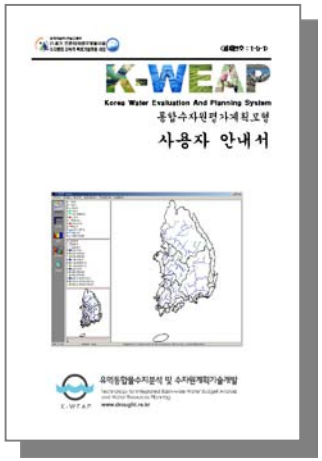


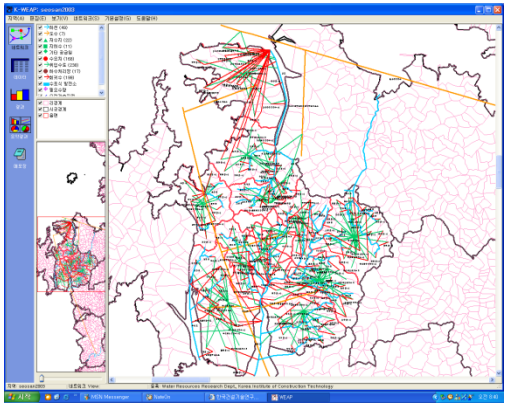
Certified and used by UK EA

- Maximum velocity : 2.3m/s

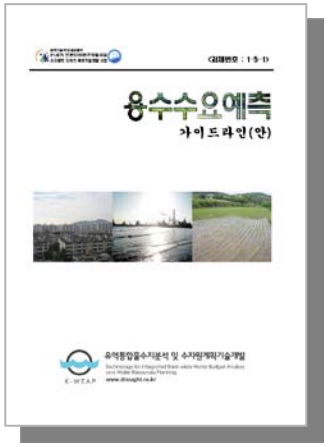
Development of Water Resources Planning System (PI: DR Lee)

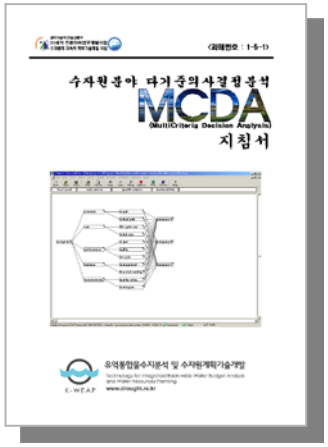
▶ K-WEAP





▶ 가이드라인



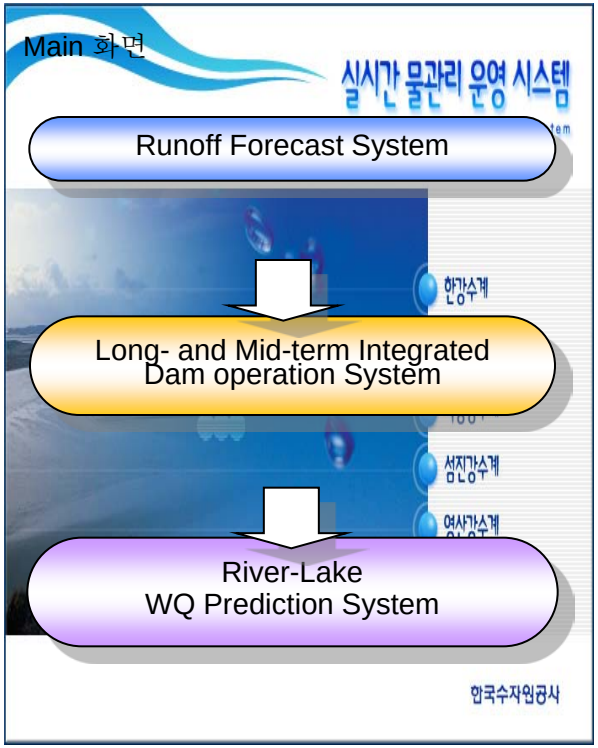


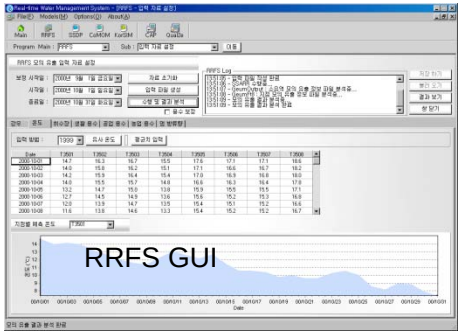
▶ K-WEAP 홍보

Development of River Basin Operation System (PI: IH Koh)

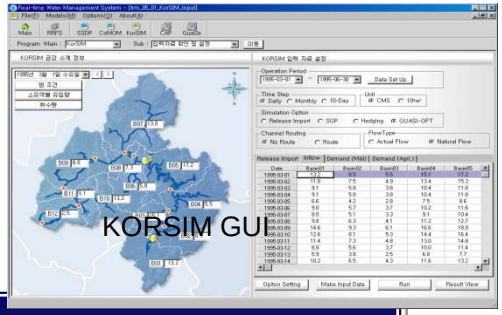
PRCP Forecast System

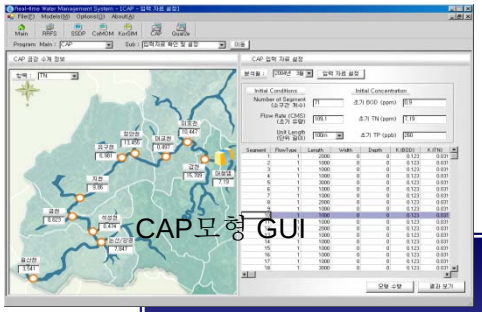
Reservoir Sediment Monitoring System





(GIS)





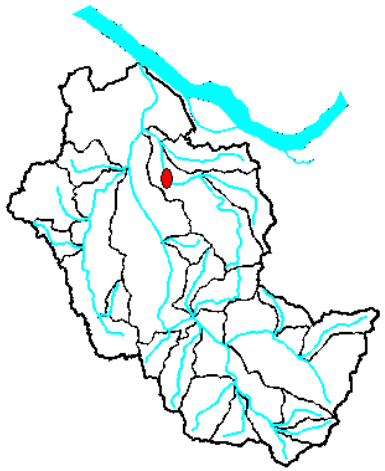
Web/GIS Based Real-time DSS Sytem

Development of integrated watershed management schemes

by K.S. Lee and E. Chung (J. of Hydro-Environment Research, 2008)

Step 1	Understanding watershed components and processes
Step 2	Identifying and ranking problems to be solved
Step 3	Knowing the management preference of interested publics
Step 4	Setting clear and specific goals
Step 5	Developing a list of management options
Step 6	Eliminating infeasible options
Step 7	Testing the effectiveness of remaining feasible options
Step 8	Evaluating the alternatives and developing the candidates
Step 9	Estimation of benefit and cost
Step 10	Choosing the best alternatives

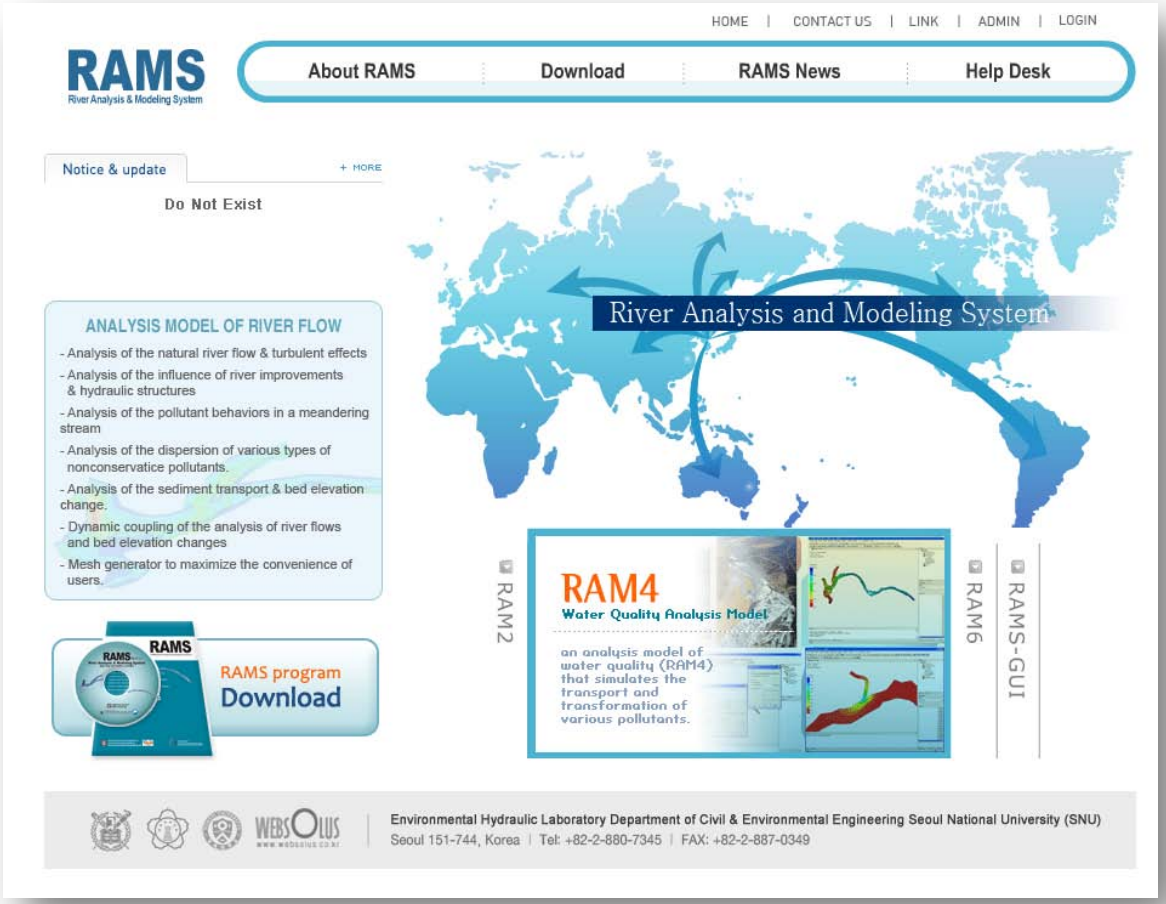
Solutions for Streamflow Depletion



- The streamflow is reduced and depleted during the dry period due to the groundwater and streamflow pumping and urbanization
- The study provides tool to analyze and solutions to fix.

Two-dimensional River Model (RAMS) (PI: IW Seo)

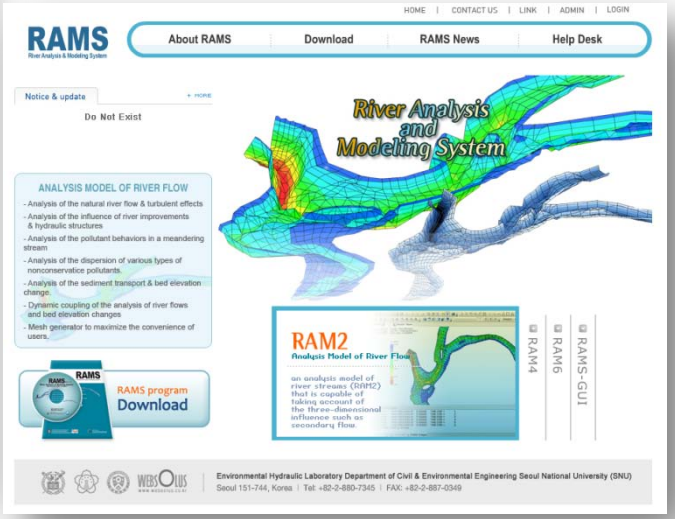
http://www.RAMS.or.kr



For more information,

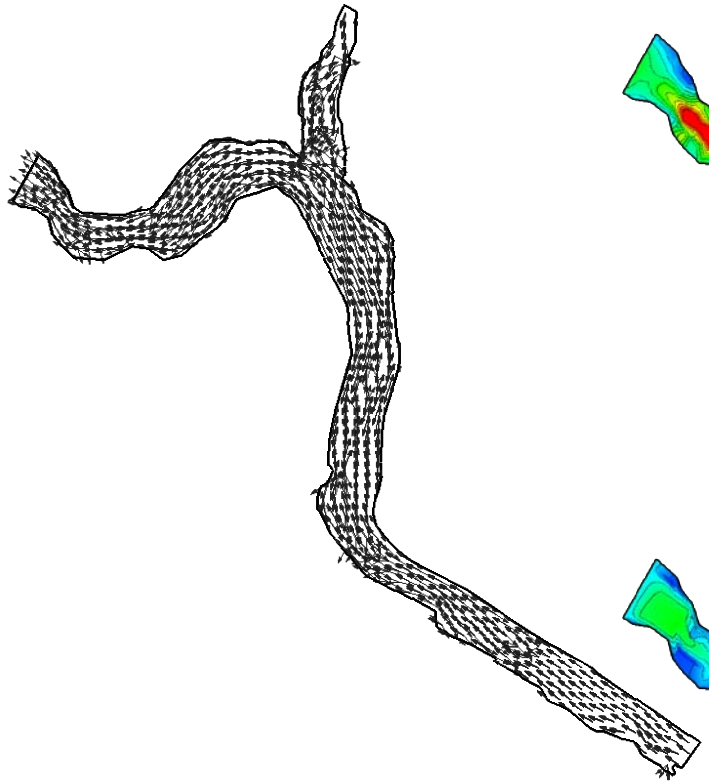
Contact :

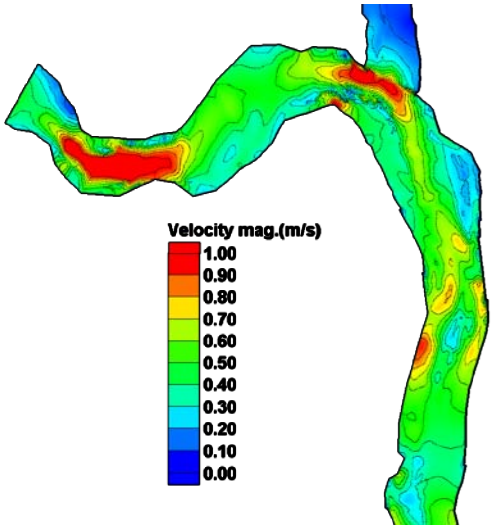
ramsmanage@gmail.com

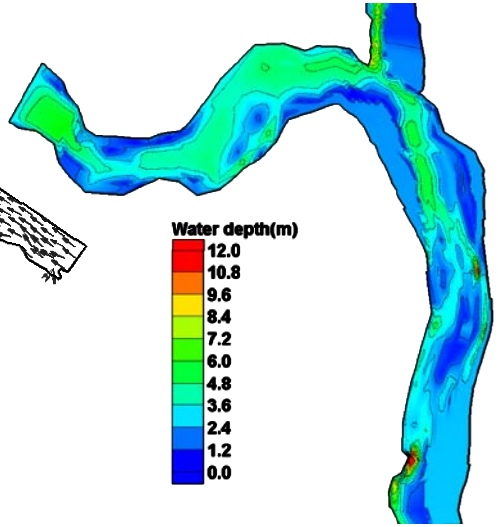


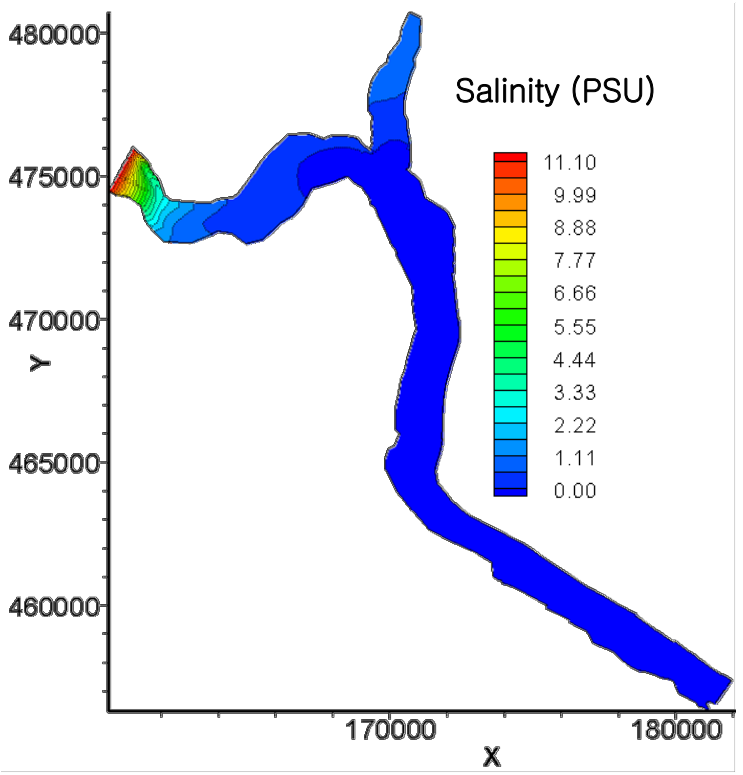
2D Salinity Analysis

***t*= 46.25 ~ 58.5 hr**

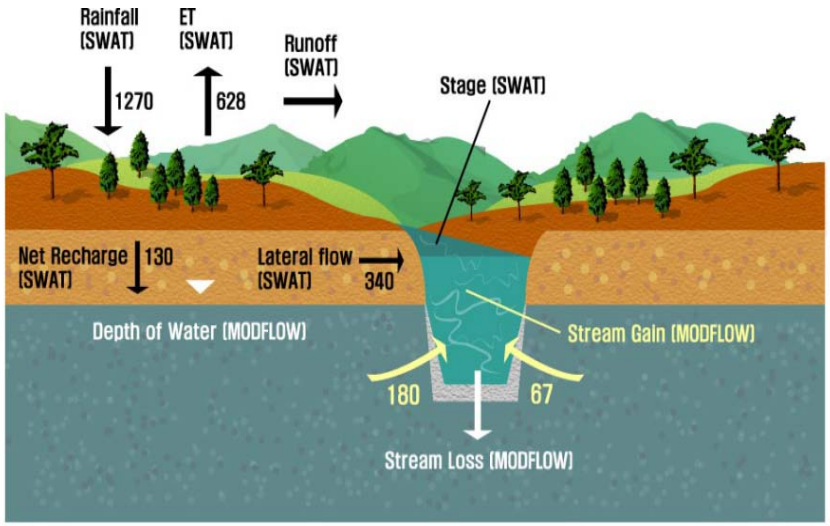


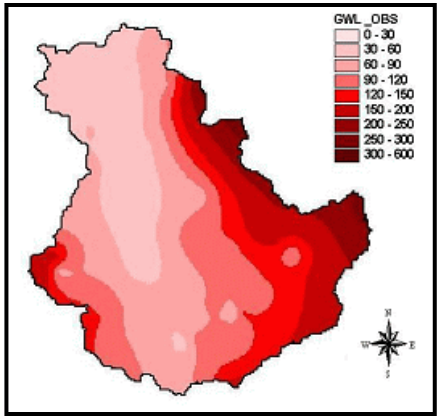


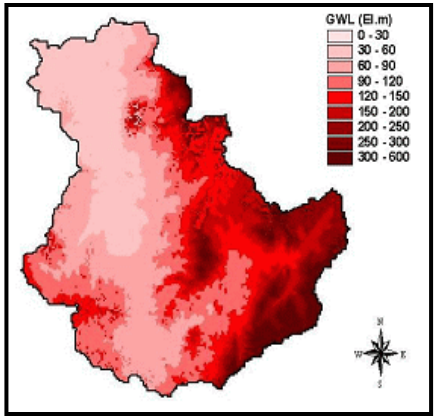




Surface Water-Groundwater Linking Model (PI: NW Kim)







A module for simulating paddy rice fields was added to SWAT, and linked to MODFLOW for simulating surface-ground water interaction with fully-coupled manner. GW module of SWAT was replace by MODFLOW.

SWAT-MODFLOW Model (NW Kim et al., J. of Hydrology, 2008)

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10. **Land-use effects on fluxes of suspended sediment, nitrogen and phosphorus from a river catchment of the Great Barrier Reef, Australia**
    Journal of Hydrology, Volume 356, Issue 1-feb, July 2008, Pages 131-146

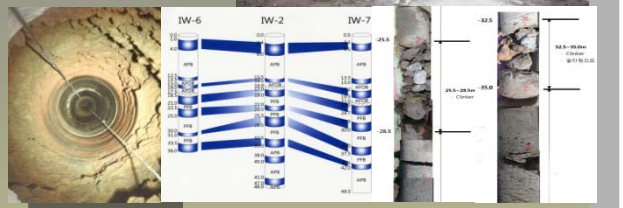
Second downloaded paper in 2008

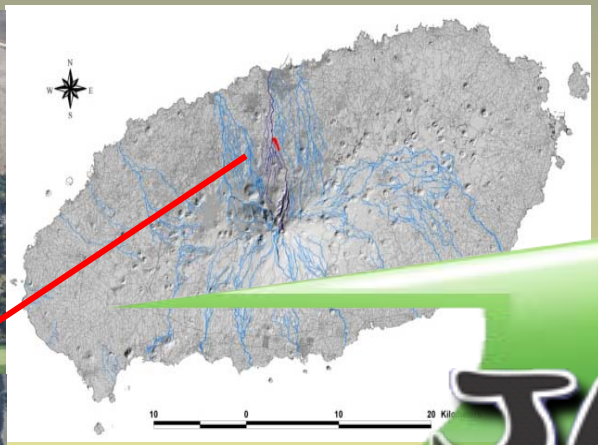
Jeju Artificial Recharge Technology (PI: YJ Kim)

- **Aquifer Storage Transfer Recovery (ASTR) method**

Visual HydroGeoSphre

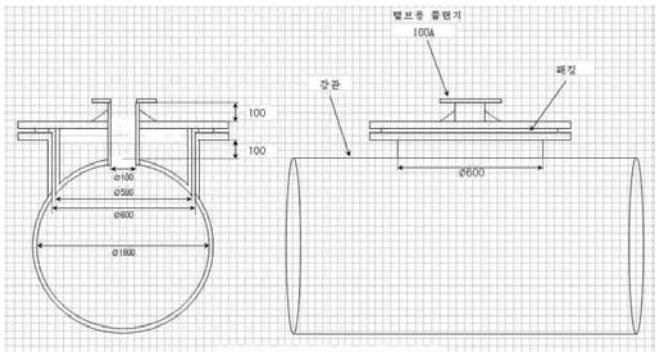
20 AR wells (15,000m³/each)

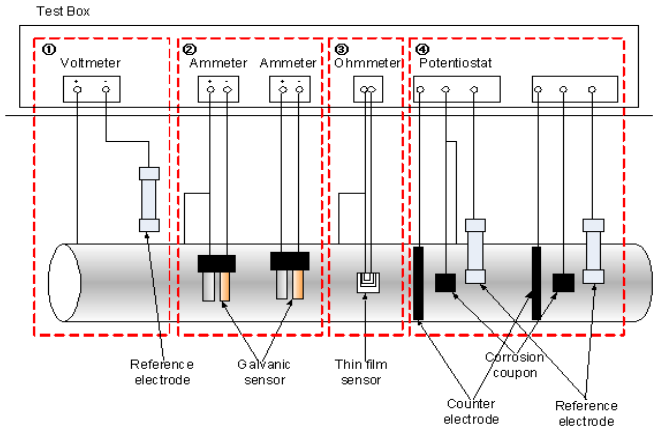




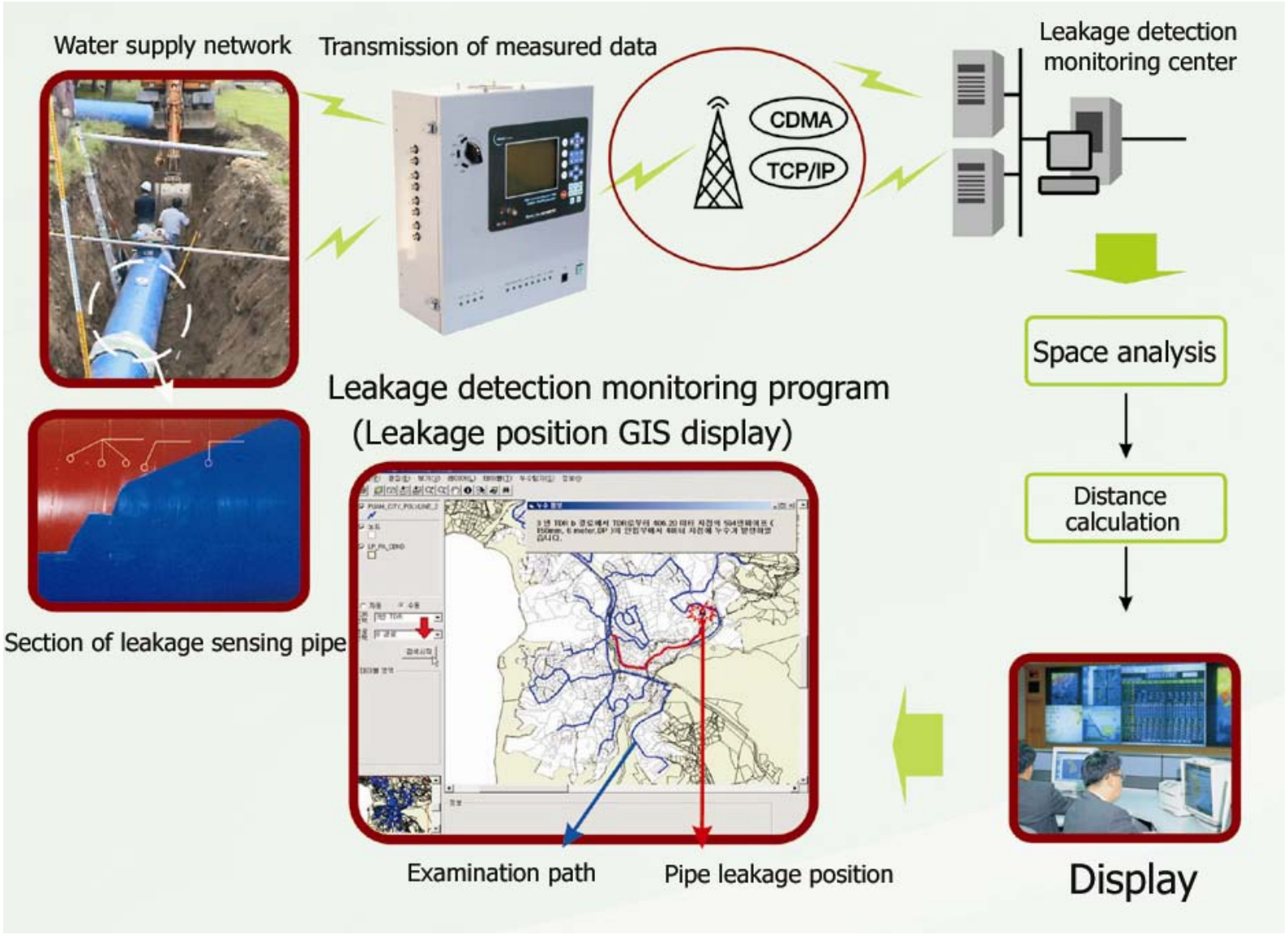
JART

Development of Leakage Control System (PI: Dr. Gu, Univ. of Seoul)

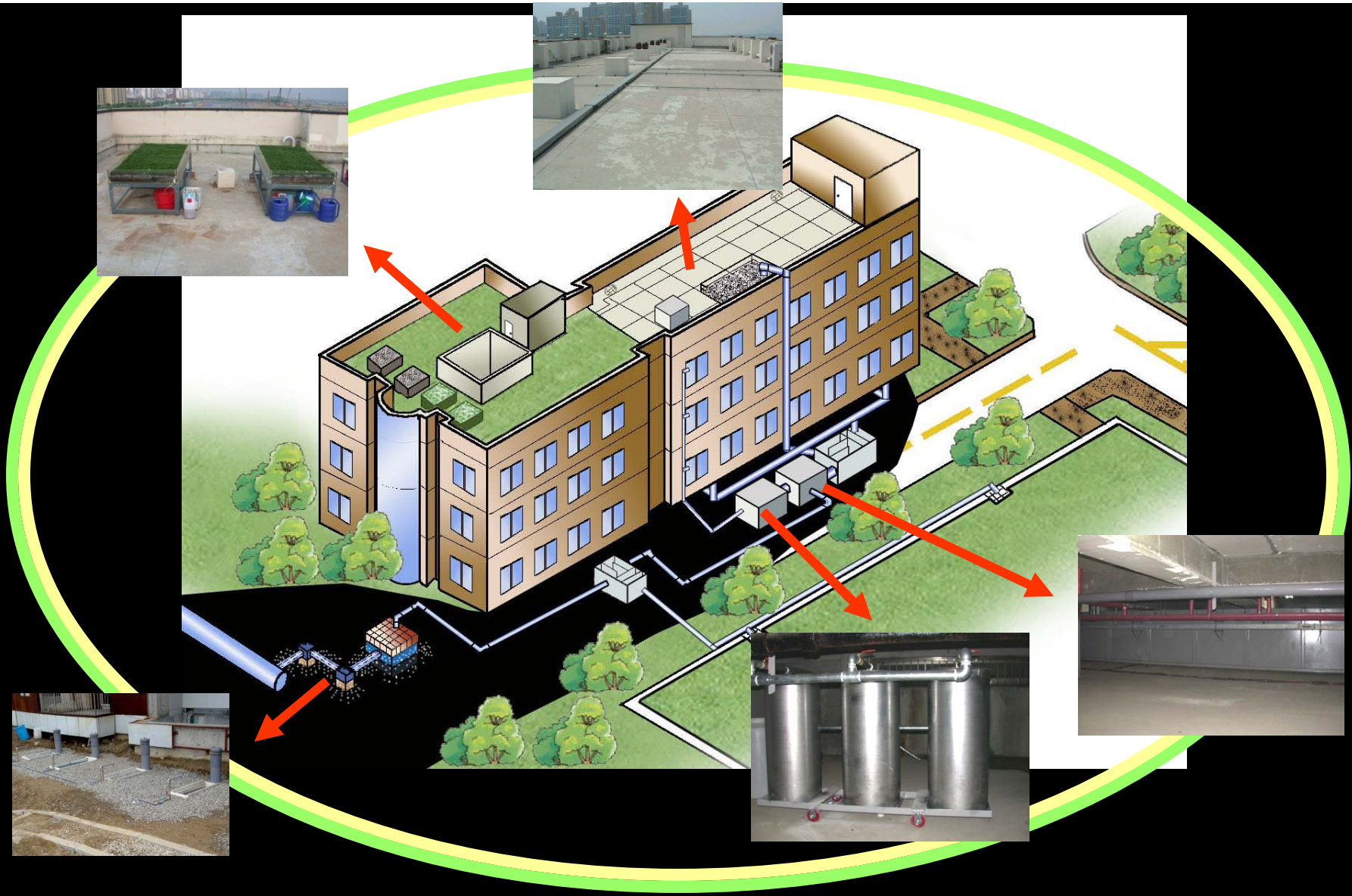




Development of Leakage Detection System



Rainwater Use Technology
(PI: Dr. Ree-Ho Kim, KICT)



Waste Water Reuse for Irrigation

(PI: SW Park)

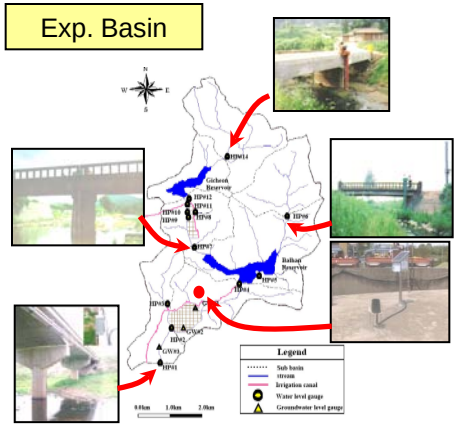
Environmental Assessment

Soil | Water Quality | Ecology | Health

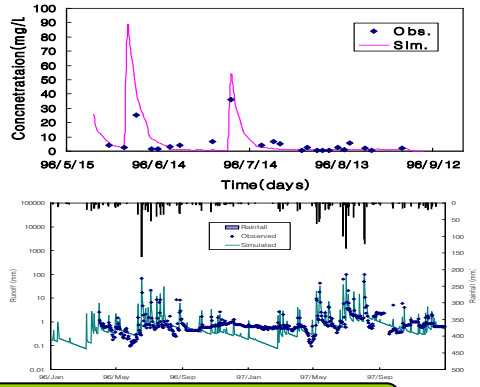
Risk Analysis

Safety Test

Exp. Basin



Quality



Monitoring/Modeling

Pilot Project
(Suwon, 2006)

Develop Field Level Tech ➔ Establish Tech. Center ➔ Improving Tech.

Concluding Remarks

1. Water management in Korea needs great challenges to overcome poor water resources, high demand of water service, and large variation and change of climate .

2. The Sustainable Water Resources Research Program has been conducted successfully since 2001 to overcome Korean water problems by sustainable manner.
- About 1000 papers, 50 technology transfers, 100 implementations

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