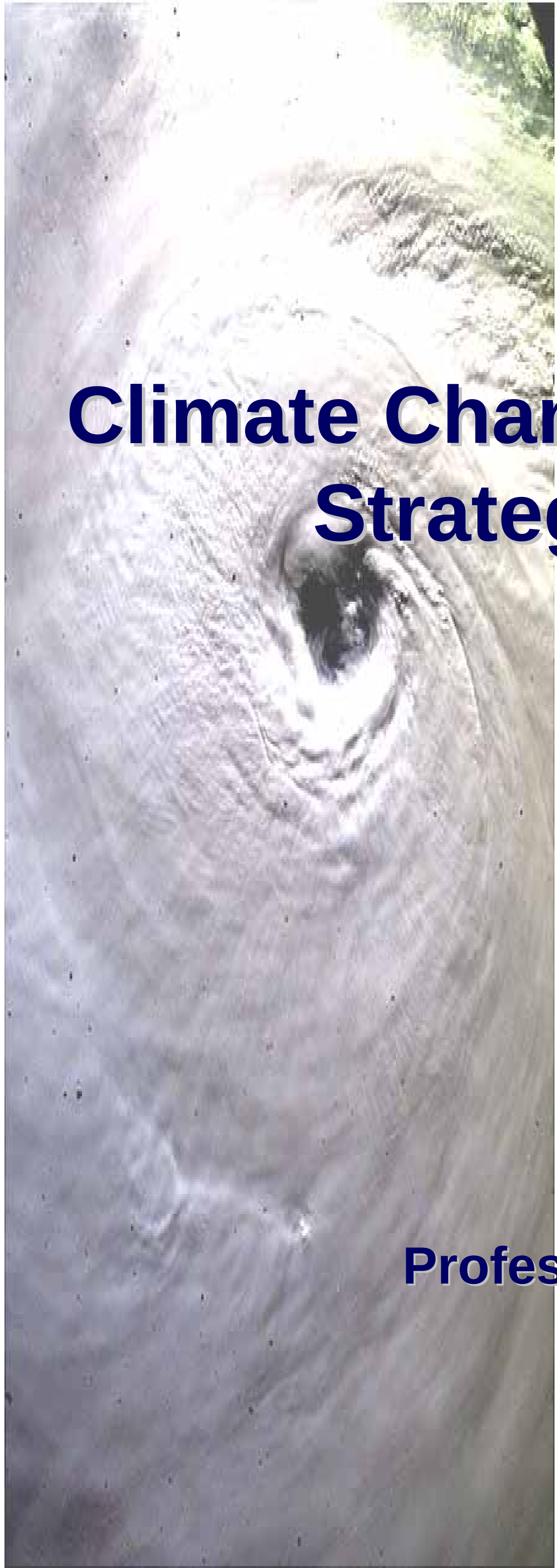

Climate Change Impact Assessments & Adaptation Strategies on Korean Water Resources

2008. 4. 15

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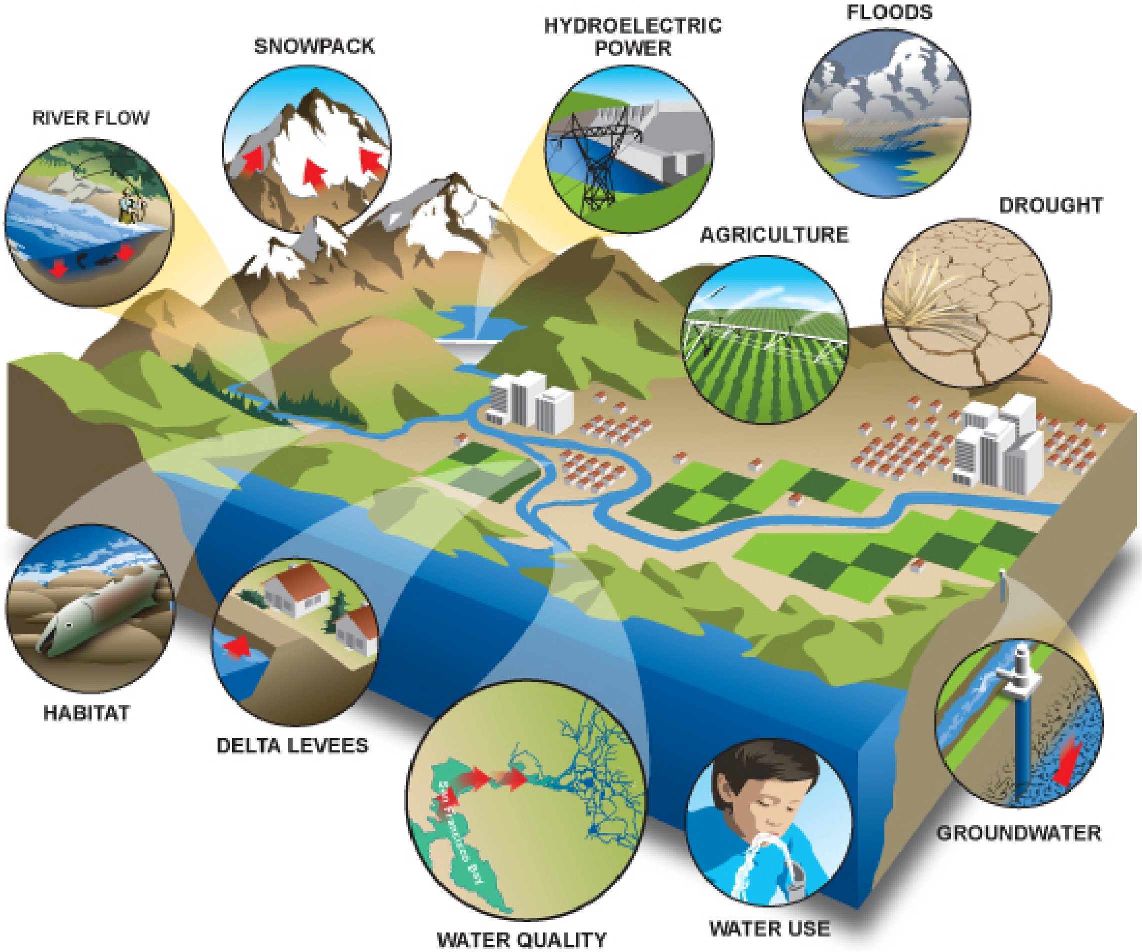
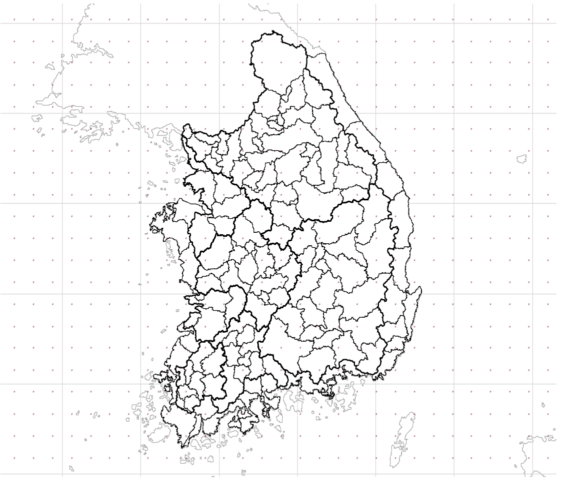
The Impacts of Climate Change on Water Resources



www.climatechange.water.ca.gov/

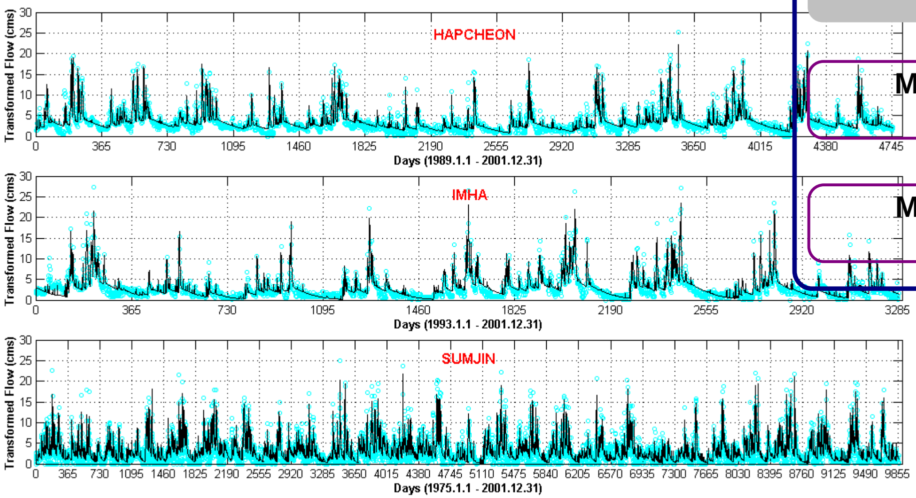
Possible Evidence for Climate Change (CC) on Water Resources

Evidence from the historical observation data

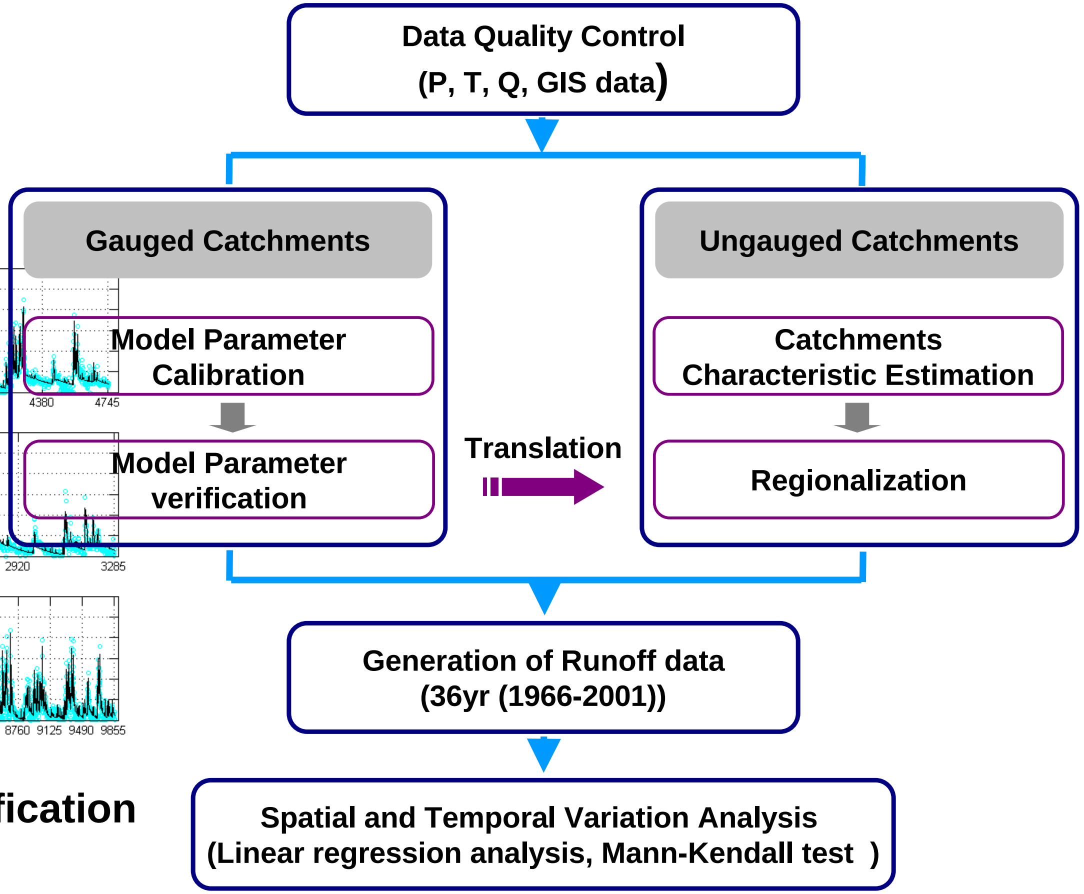


*** Analysis Overview**

- Analyze the spatial and temporal variations of the data
- Use obs. data for P and model-driven data for Q
- Use 325 station data for P and 135 subdivisions for Q
- Use linear regression and Mann-Kendall test

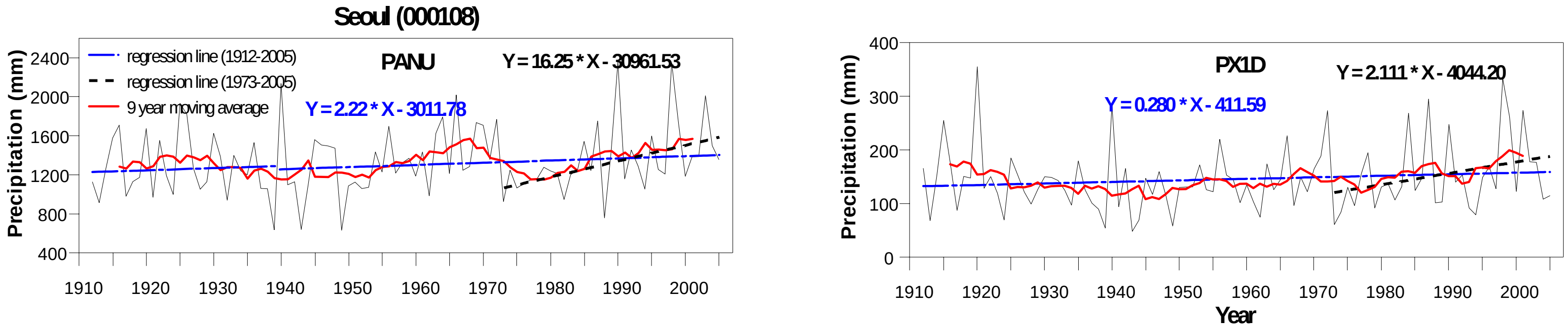


Hydrologic Model Calibration and Verification

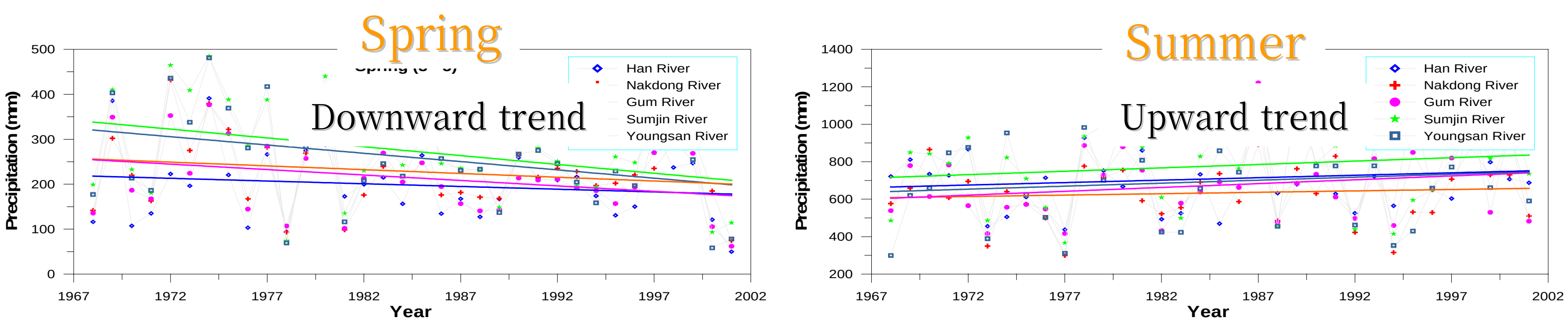


Evidence from the historical observation data

* Major Outcomes



Trends of annual precipitation and daily maximum precipitation

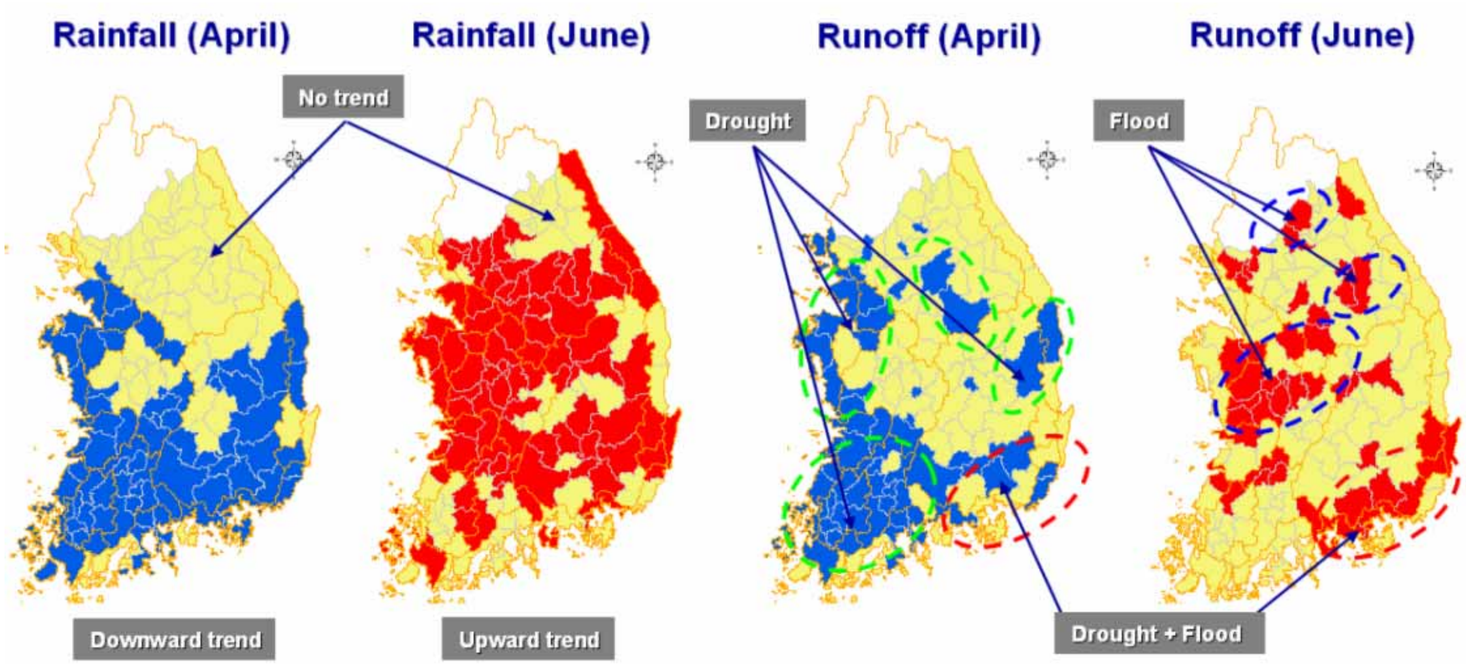


Trends of seasonal precipitation(1968-2001)- decreasing in spring, increasing in summer

Evidence from the historical observation data

*** Major Outcomes**

- Spatial trend according to Mann-Kendall test for P & Q in April and June
  - Decrease of P & Q in April is related to severe droughts in spring season
  - Increase of soil moisture corresponding to the increase of P in June will lead to higher chance for summer flood



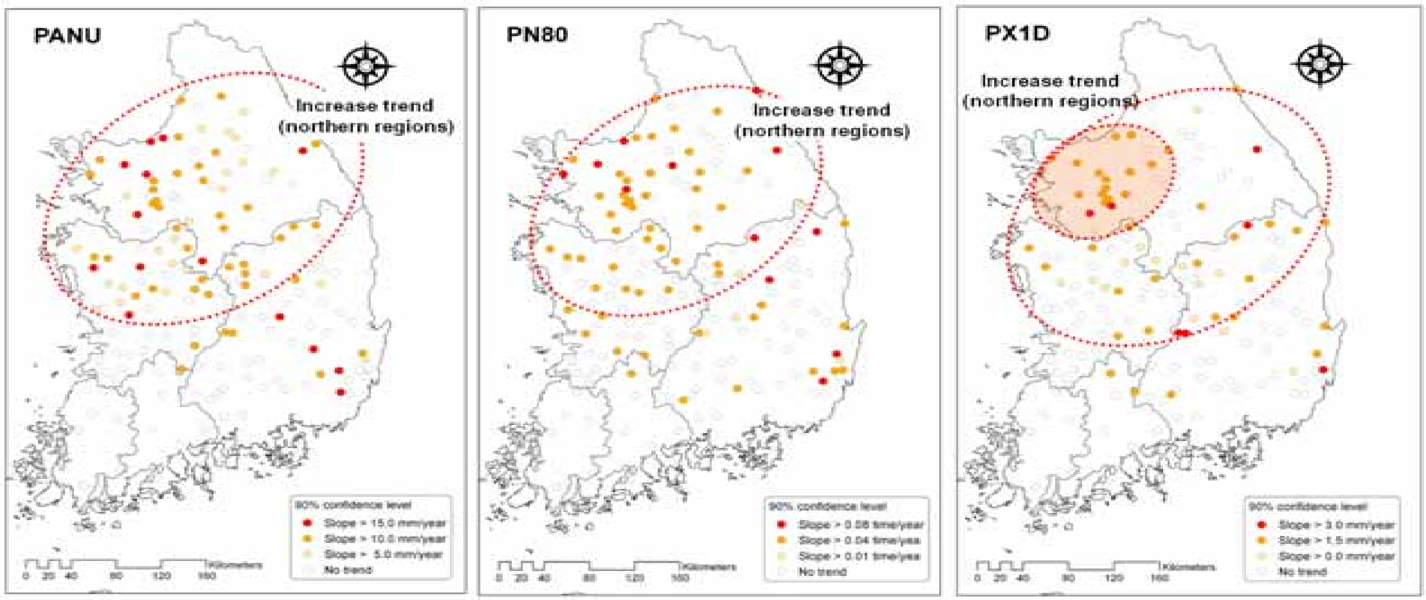
Vulnerability assessment-increasing possibilities for the damage occurrence from flood and drought

Evidence from the historical observation data

*** Major Outcomes**

- Analysis for the extremes

  - The current 33-year (1973-2006) trends of rainfall intensity and frequency are much larger than those of past 94 years
  - Those for northern part are larger than southern part

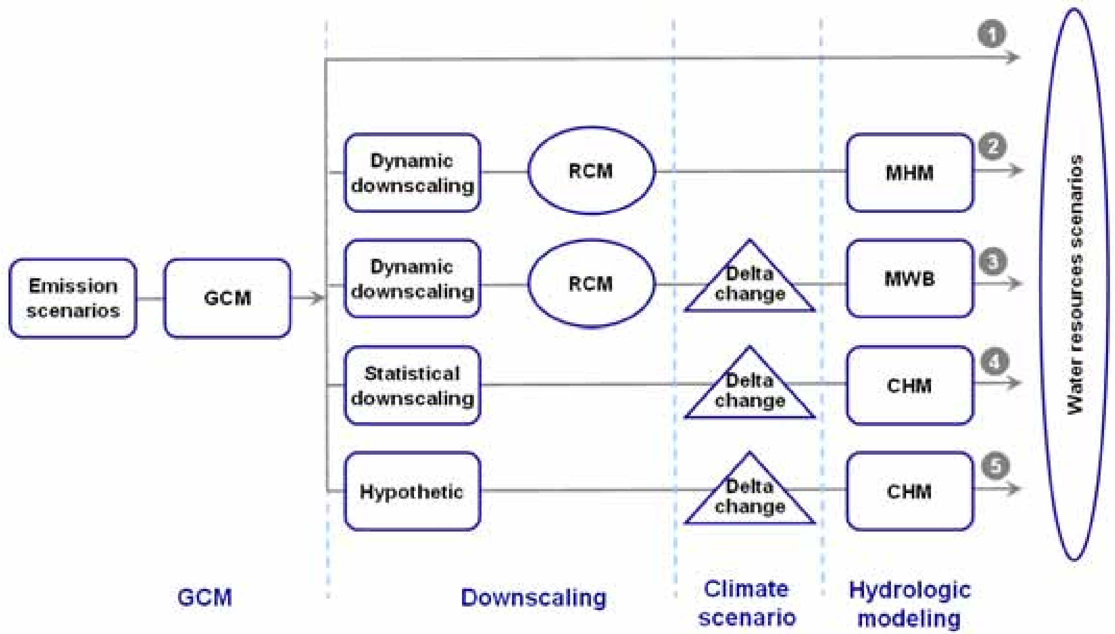


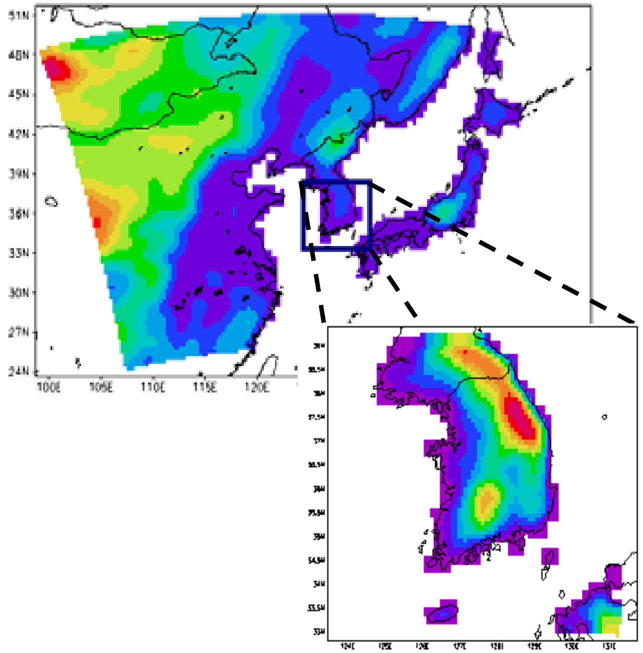
Trends of annual P, daily extremes greater than 80mm, daily max precipitation

Evidence from numerical simulation under climate change scenario

*** Analysis Overview**

- Emission scenarios: A2 (pessimistic scenario – CO_2, 820ppm at 2100)
- GCM (ECHO-G), RCM (MM5)
- Downscaling methods: Hybrid scheme (dynamic & statistical methods)
- Resolution: 27km
- Data periods: 1970-2100

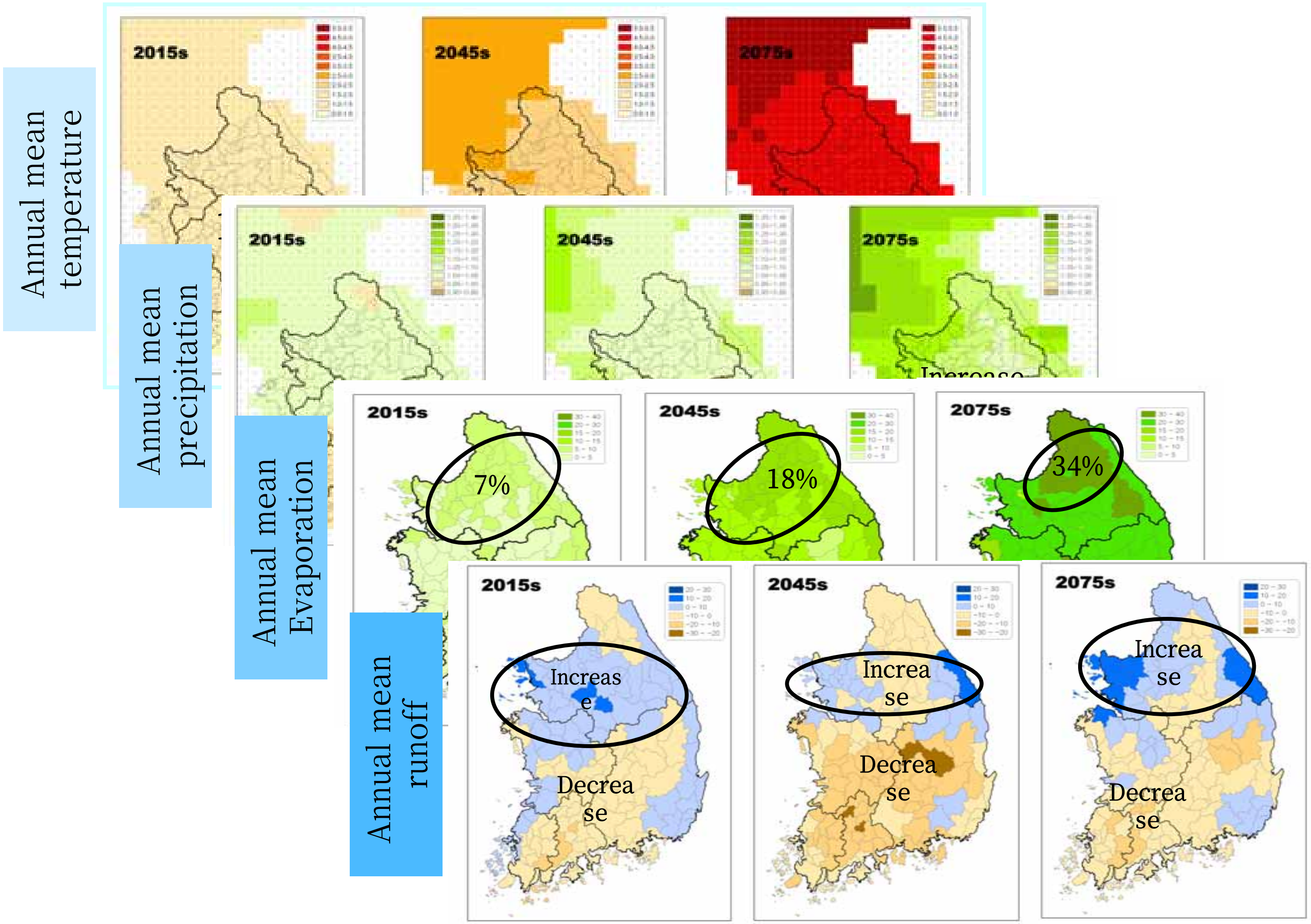




Procedures for climate change impact assessments on water rsources(Xu and Singh, 2004)

Evidence from numerical simulation under climate change scenario

*** Major Outcomes**

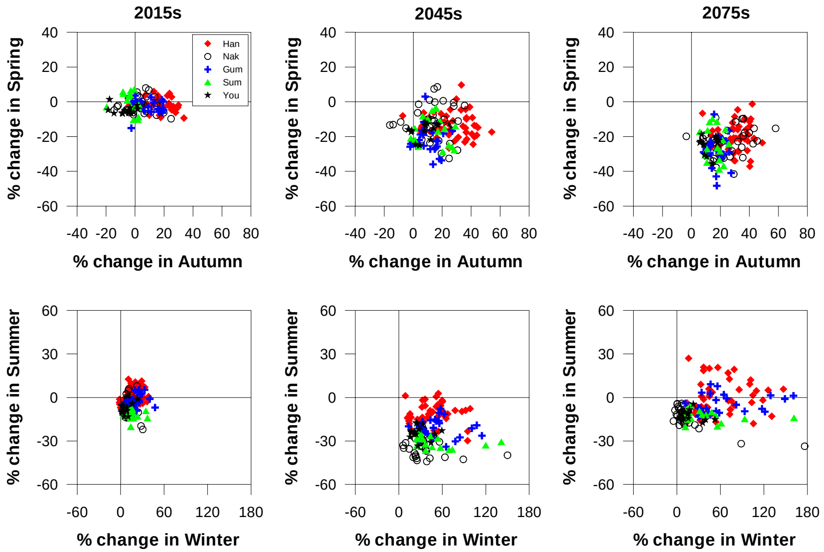


Annual variations of water cycle components under A2 climate change scenario

Evidence from numerical simulation under climate change scenario

*** Major Outcomes**

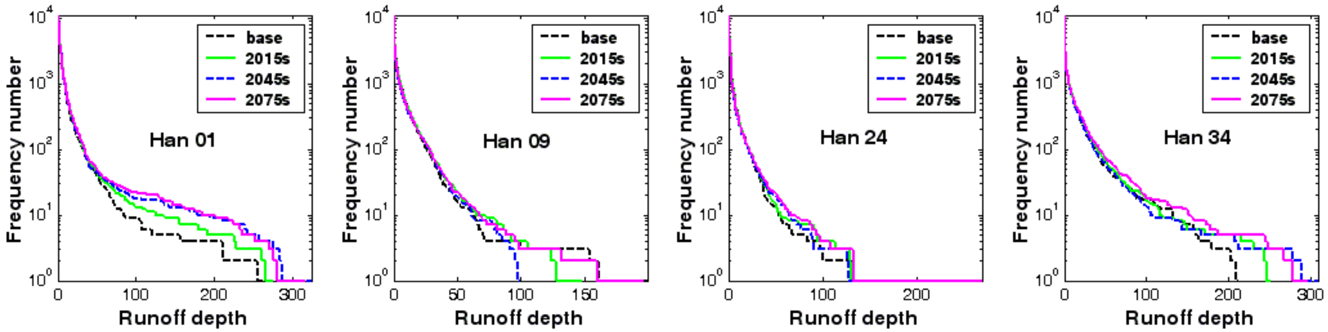
- Changes in seasonal runoff



Significant increasing trends of runoff in fall and winter, decreasing in spring and summer

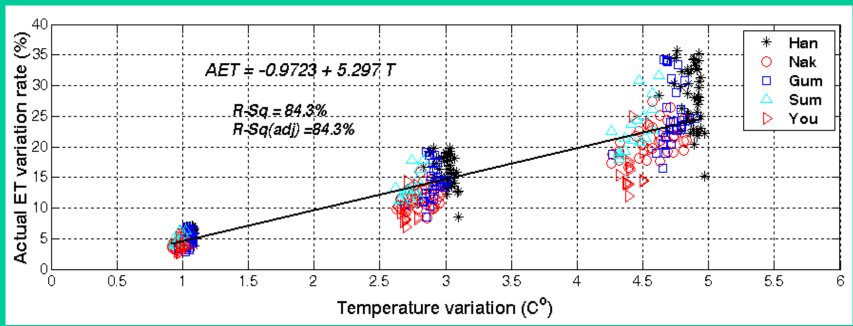
- Variations of extreme events

Extreme discharge increases in the future periods, especially for the runoff depth more than 100 mm



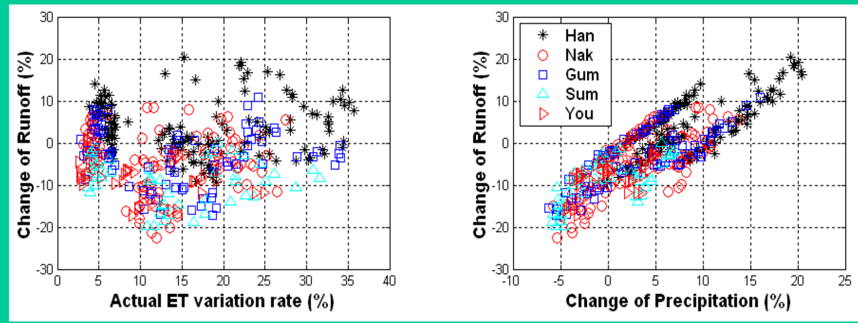
Expected Variation of Water Cycle Components under CC

Sensitivity analysis using multiple regression method



Basin	Regression Eq.	R-Sq	Adjust R-Sq
Han River	AET = -0.4850 + 5.751×T	88.0%	87.9%
Nakdong River	AET = -0.7901 + 4.676×T	93.6%	93.6%
Gum River	AET = -1.1280 + 5.477×T	86.2%	86.0%
Sumjin River	AET = -0.9435 + 5.393×T	90.6%	90.4%
Youngsan River	AET = -0.4766 + 3.887×T	84.3%	83.9%
Total	AET = -0.9723 + 5.297×T	84.3%	84.3%

Actual ET is highly correlated to temperature variation



Basin	Regression Eq.	R-Sq	Adjust R-Sq
Han River	R = -0.178 - 0.524×AET + 1.53×P	92.1%	92.0%
Nakdong River	R = -0.264 - 0.795×AET + 1.80×P	88.2%	87.9%
Gum River	R = -0.818 - 0.507×AET + 1.45×P	92.9%	92.7%
Sumjin River	R = -1.710 - 0.500×AET + 1.45×P	79.0%	78.2%
Youngsan River	R = -1.380 - 0.662×AET + 1.62×P	89.9%	89.4%
Total	R = -1.150 - 0.568×AET + 1.63×P	90.9%	90.9%

R as a function of P and AET for major river basins

Runoff variations: -18%~12% (Han, Gum river), -21%~15%(Nakdong), -18%~11%(Seumjin), -20%~13%(Youngsan) under the variations of 1℃ increase of temperature, ±10% of precipitation

The most sensitive basin under the variation of T and P**: Nakdong River basin**

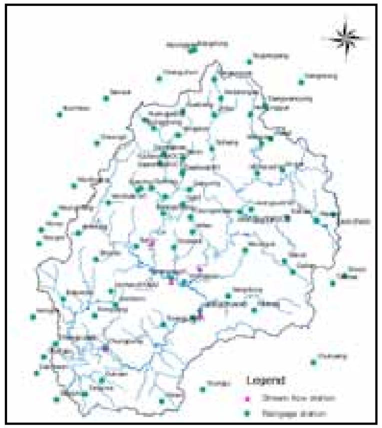
Ongoing/Planning Strategies and Countermeasures for Climate Change

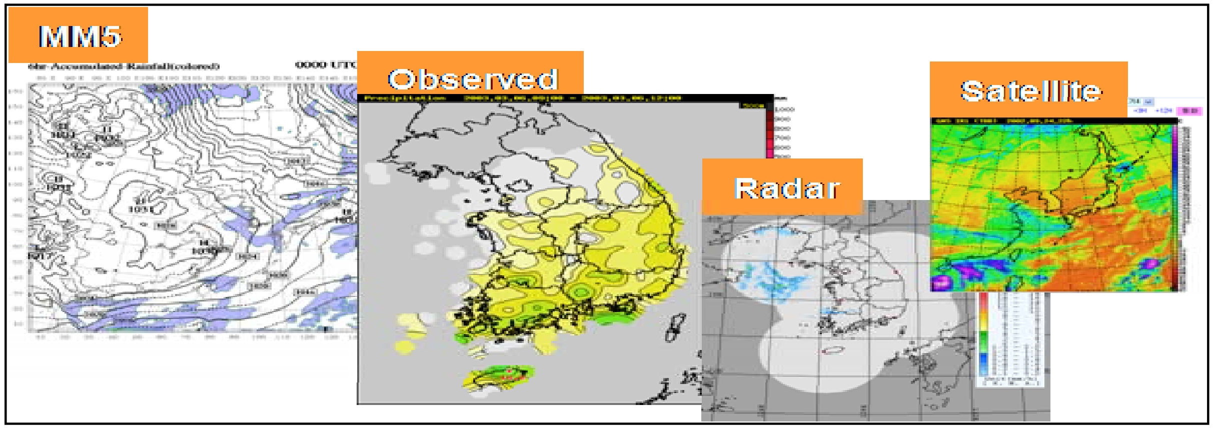
- **Scientific findings (national level) for the climate change evidence**

  - Performance of scientific researches (e.g., 21st century frontier project)
  - Based on the climate change impact assessment, various structural/nonstructural adaptation strategies are considered

- **Another implementation planning for climate change on water sectors**

  - Link with GEOSS/AWCI for the Korean demonstration project
  - Three targeted issues for demonstration project and capacity building program
    - > Use of satellite and numerical data for developing flood management techniques
    - > Use of short- and long-term weather forecast information for water resources application
    - > Climate change impact and vulnerability assessment on water resources





Concluding Remarks

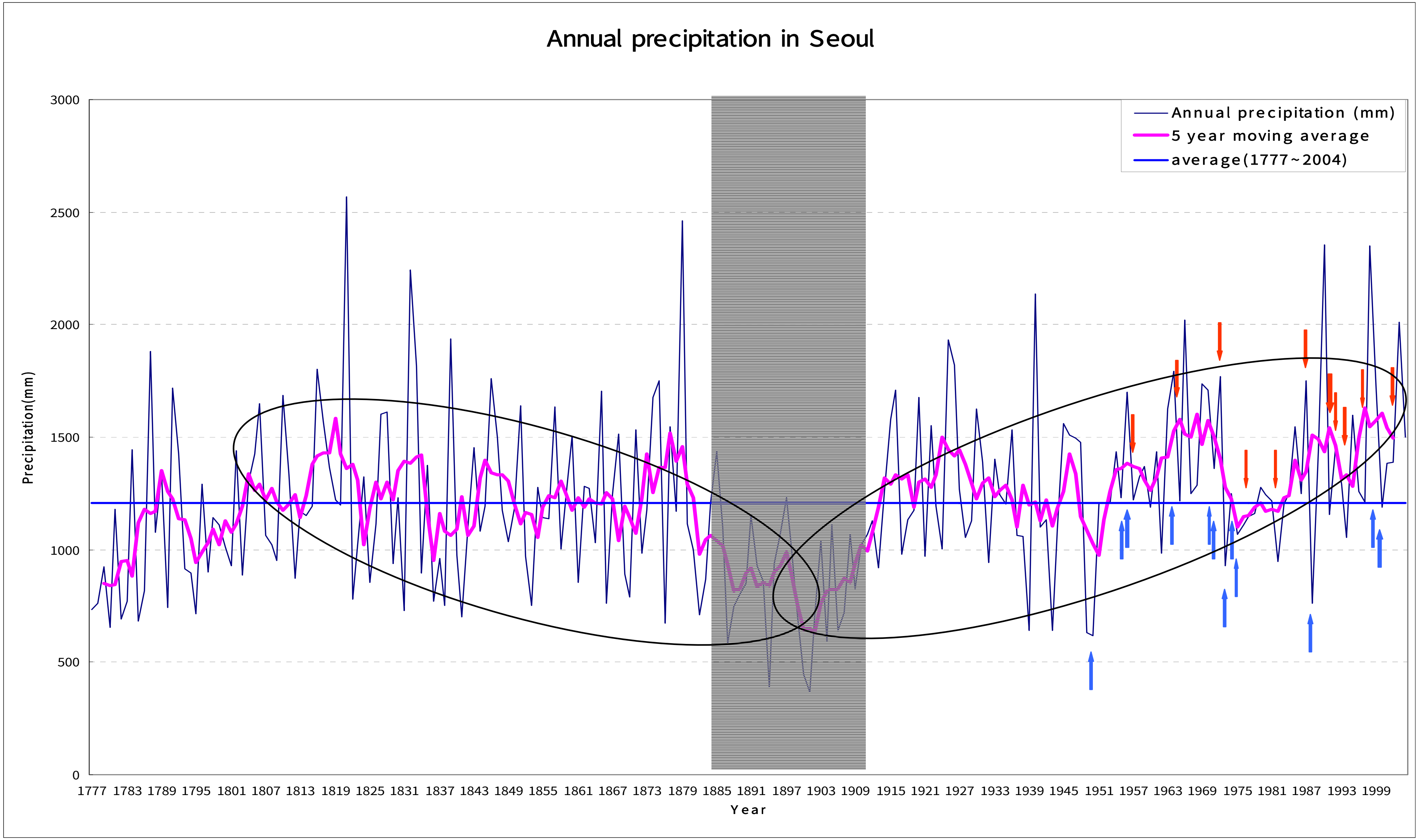
- **Water cycle variations possibly impacted by the climate change ? --- YES**
  - Evidence from past historical observation data
  - Possibilities from numerical simulation under emission scenario

- **Ongoing/planning strategies and countermeasures for the variation**
  - Continuing scientific findings for the climate change evidence
  - Planning another implementation for climate change on various water sectors

- **Problems and remedies for the climate change impact assessments**
  - Analysis of past observation data – limitation of data periods ⇨
  - Future projection of climate variability from numerical models – reducing various uncertainties

- **Need and expectation from GEOSS/AWCI**
  - Sharing various data for reducing the uncertainties of the analysis
  - Exchange ideas and experience for better understanding of climate change and their hydrologic impacts

Thank you for your attention



Interannual variation of precipitation in Seoul-the limitation of the analysis