An Interaction between flood and economy

of Yang-jae River in socio-hydrology perspective

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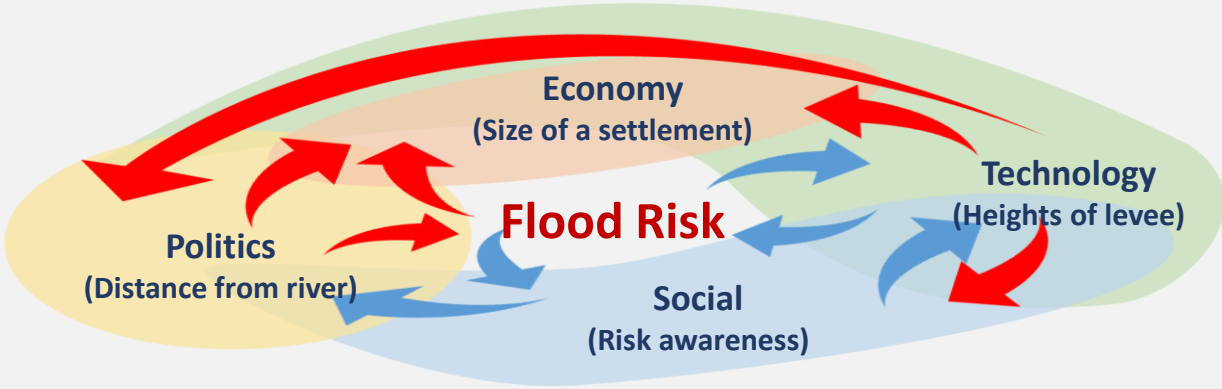
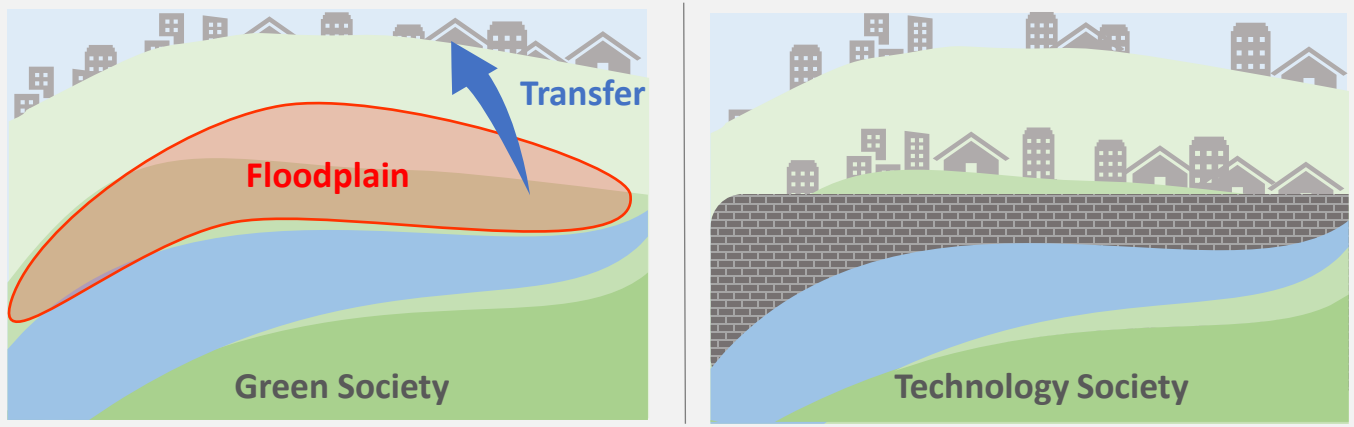
CONTENTS

WHAT IS SOCIO-HYDROLOGY

- *A complex interactions and feedback mechanisms between hydrology and social processes*
- *For example, building a levee, which is a very common flood management skill, can bring even worse disaster as a result of "Levee effect" and "Adaptation effect"*
- *To understand this mechanisms and plan effective flood management, this study propose a socio-hydrology perspective on flood management*



< Fig. 1 System dynamics of Socio-hydrology >



< Fig. 2 Societies from Socio-hydrology perspective >

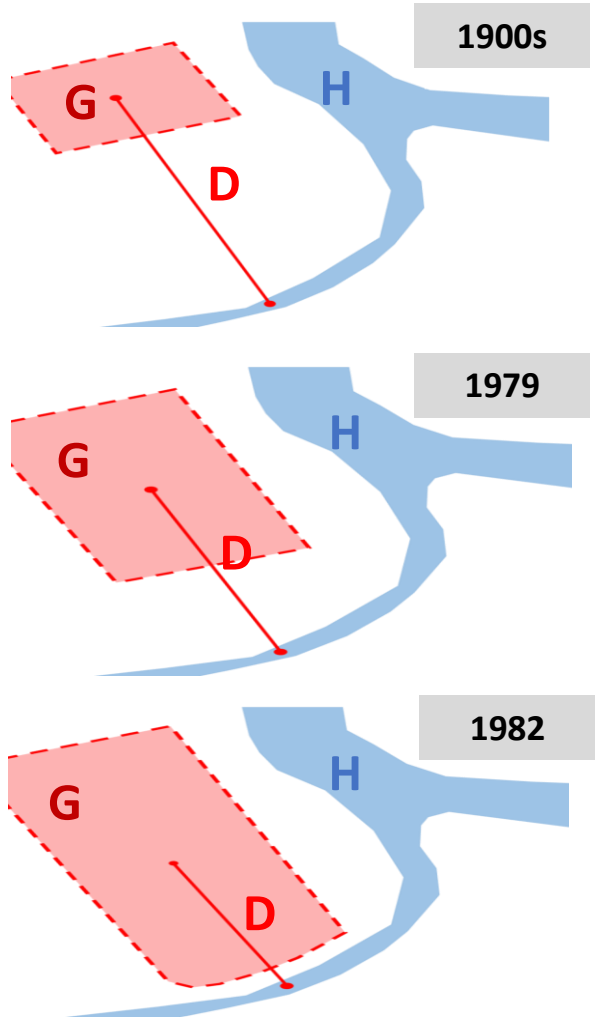
USED DATA

Hydrological Model Calibration Strategy for Climate Change Impacts Study

- *This study used data for Yang-jae river located in South Korea, Seoul Gangnam-gu*
- *Gangnam(city near Yang-jae river) is one of the biggest city in Korea which has lots of infra and population and expanded the city near river over 100 years*
- *Throughout history of city development near Yang-jae river, It was suitable to testify interactions between social and hydrology system*

< Fig. 3 Pictures near Yang-jae river in 1970s >

Year	Distance D (m)	Community Size G (m^2)	Levee Height H (m)
1900	1,300	300,000	0
1960	1,300	300,000	0
1979	1,000	630,000	4 (Estimated)
1983	820	890,000	11.74
2004	820	890,000	15.37



< Fig. 4 Development of city near Yang-jae river >

METHODOLOGY

Hydrological Model Calibration Strategy for Climate Change Impacts Study

- **Flood Risk (F)**

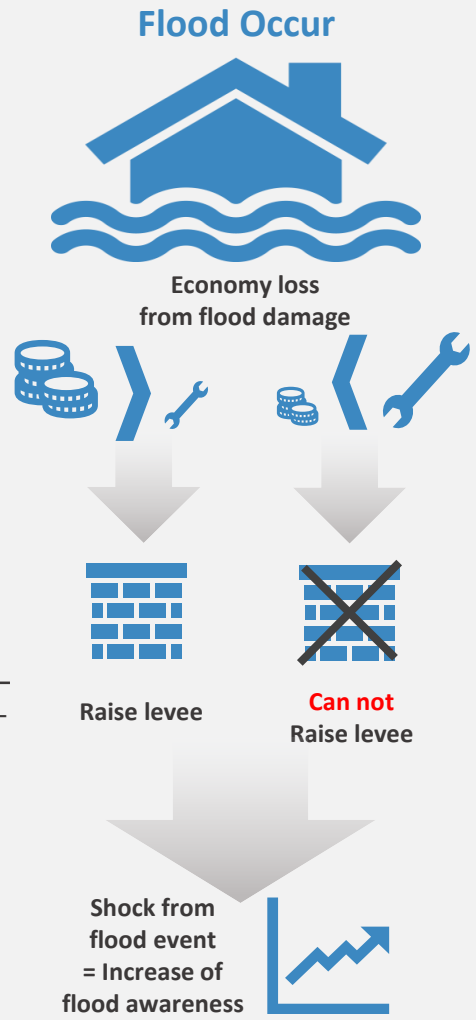
$$D = \begin{cases} 1 - \exp\left(-\dfrac{W + \xi_H H_-}{\alpha_H D}\right) & \text{If } W + \xi_H H_- > H_- \\ 0 & \text{otherwise} \end{cases}$$

- **Raised height of Levee (R)**

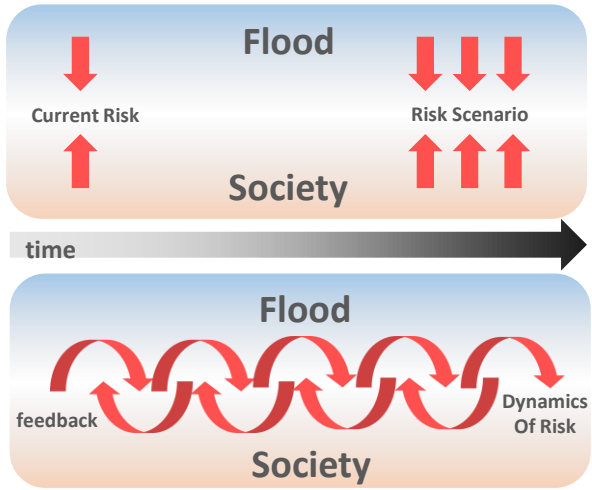
$$R = \begin{cases} \varepsilon_T (W + \xi_H H_- - H_-) & \text{If } F > 0 \text{ and } FG_- > \gamma_E R\sqrt{G_-} \\ 0 & \text{and } G_- - FG_- > \gamma_E R\sqrt{G_-} \text{ otherwise} \end{cases}$$

- **Flood Shock (S)**

$$S = \begin{cases} \alpha_S F & \text{If R} > 0 \\ F & \text{otherwise} \end{cases}$$

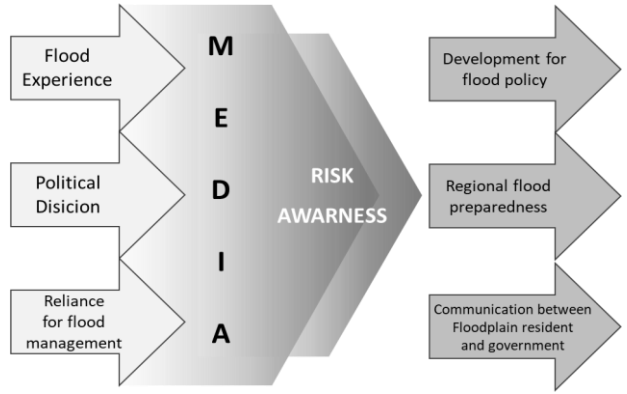


< Fig. 5 Socio-hydrology model >



Socio-Hydrology perspective

< Fig. 6 Mechanisms of Socio-hydrology >

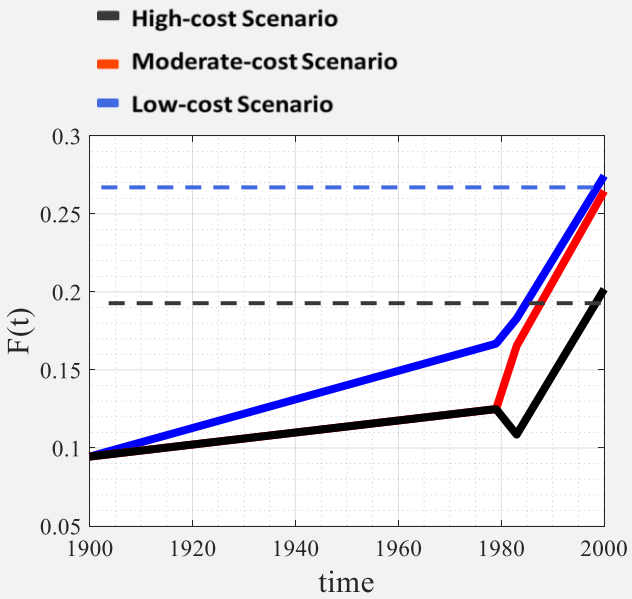


< Fig. 7 Factors affecting risk awareness >

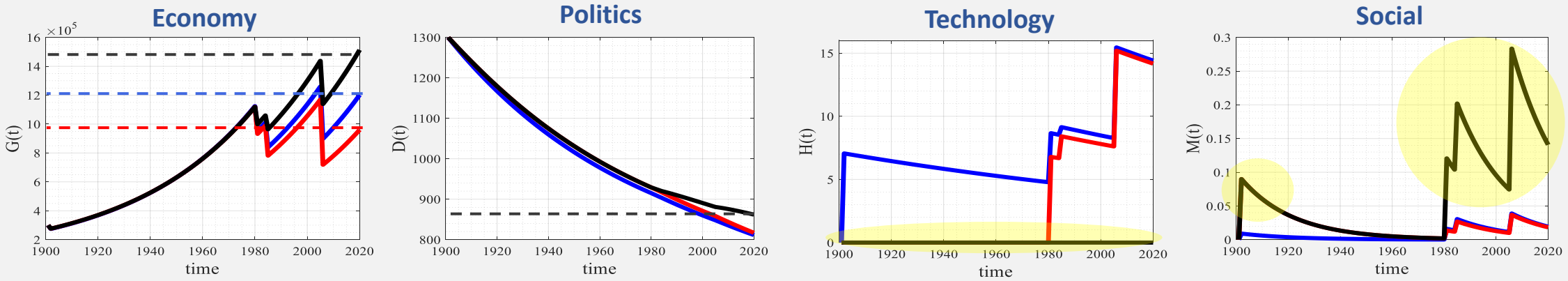
RESULTS

Hydrological Model Calibration Strategy for Climate Change Impacts Study

- *We considered economy growth, slope of the city, threshold, and reliance to levee as a parameter in socio-hydrology model*
- *Repairing levee was divided into 3 scenarios (High-cost, Moderate-cost, Low-cost)*
- *Results of this study shows that repairing levee reduces people's awareness of flood and may cause enormous loss due to high risk of flood*
- *High-cost scenario never constructed levee and result as lowest risk of flood as people maintaing high flood awareness*
- *Compare to real data South korea tends to follow low-cost scenario*



< Fig. 8 Flood risk from 1900 to 2000 >

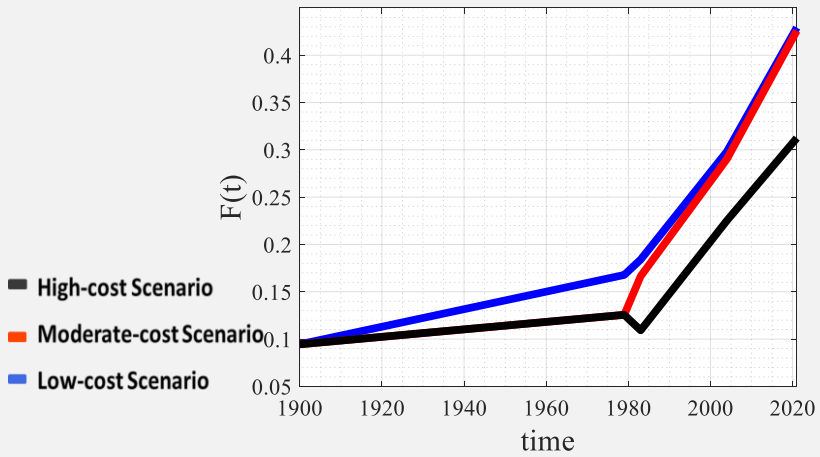


< Fig. 9 Evolution of Gangnam near Yang-jae river depending on levee repair cost >

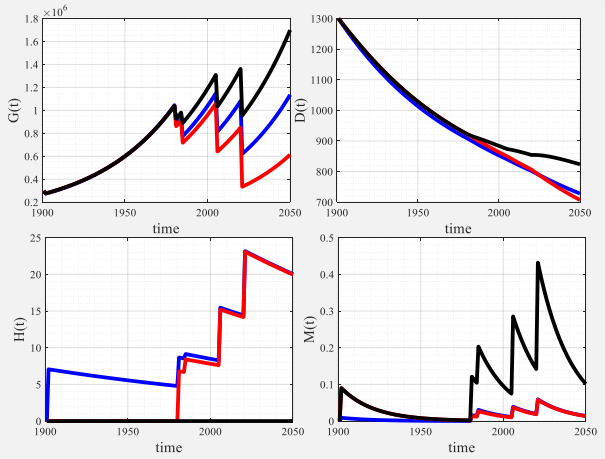
RESULTS

Hydrological Model Calibration Strategy for Climate Change Impacts Study

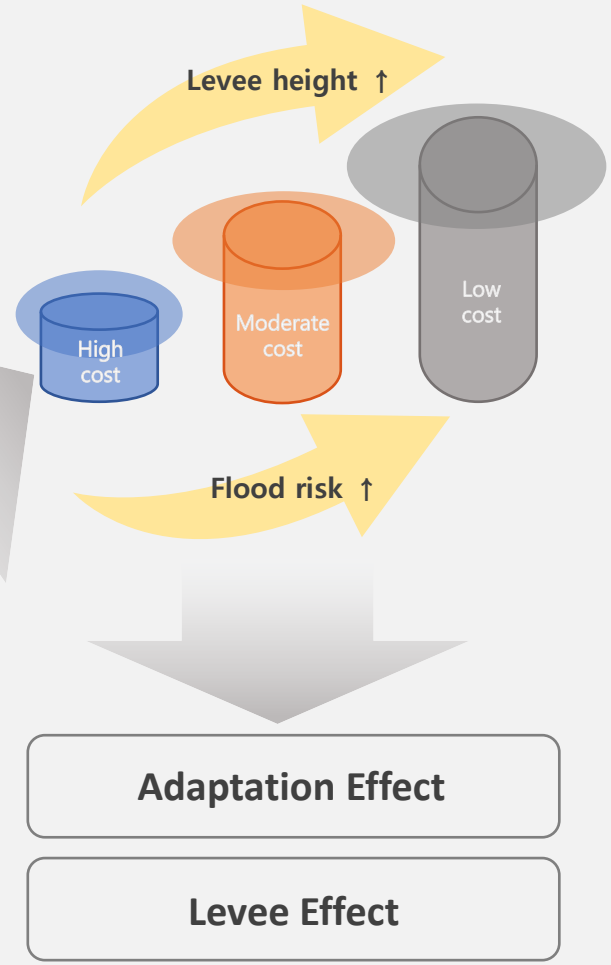
- *Enormous rainfall in 2020 resulted in increasing flood risk*
- *Socio-hydrology model estimated until 2050, economy gap between each scenario will be more intense*
- *As levee gets higher, flood risk tend to increase and people move near to river*
- *This study shows the evidence of Adaptation effect and levee effect*
- *Due to climate change socio-hydrology will be essential and more diverse case study is needed to understand complex interaction of each systems*



< Fig. 10 Flood Risk 1900 to 2020 >



< Fig. 11 Evolution of Gangnam from 1900 to 2050 >



< Fig. 12 Conclusion of this study >

Thank You