Adaptation Measures for Extreme Floods in Japan, Using Huge Ensemble of High-Resolution Climate Model Simulation

Hokkaido University Tomohito J. Yamada

Recent heavy rainfall in Japan

- 2015 (Kanto): More than 2500 houses were flooded, about 50 lives were lost.
- 2016 (Hokkaido): 4 helicopters, 6 to 8 aircrafts were used, and 18000 houses were damaged.
- 2017 (Kyushu): Many sediments and soil floods were the factors to worsen flood damage.
- 2018 (Western Japan): Worst flood in the past 30 years (More than 200 fatalities).

Flood risk assessment

- AGCM: Hadley Centre for Climate Dynamics Laboratory
- NHRM: National Center for Atmospheric Research
- NHRCM: Max-Planck-Institute for Meteorology
- NOAA-GFDL: National Oceanic and Atmospheric Administration
- CSIRO: Australian Climate Research Centre
- MIROC: Institute for Global Environmental Research, Japan
- MRI-CGCM3: National Institute for Environmental Studies
- MIROC5: Geophysical Fluid Dynamics Laboratory
- HadGEM2-AO: Hadley Centre for Climate Dynamics
- CCSM4: National Center for Atmospheric Research
- GFDL-CM3: Geophysical Fluid Dynamics Laboratory

Process to adaptation

- Large ensemble climate dataset
  - Thousand years climate data under past and warmer(+2K and +4K) climate made by high resolution atmospheric models

- Flood risk assessment
  - Future changes in precipitation extremes (frequency, amount, spatiotemporal character and factor)
  - Flood damage (mortality, number of fatalities, number of flooded house, etc.)

- Far-sighted efficient flood control plan
  - Committees held by national and regional governments.

Frequency of annual maximum rainfall over Tokachi river basin

- Past
- 2K
- 4K
- Maximum value in recorded history is 252mm.
- Over 50 percent.

Probability evaluation of heavy rainfall occurrence

- Past
- 2K
- 4K
- 50 percent probability rainfall Actual: 252mm
- Historical climate simulation: 583mm
- Future climate simulation: 352mm

Frequency of overtopping

- Past
- 4K
- Frequency: Upper: over left side bank
- Middle: over high water level
- Lower: over right side bank

Frequency of inundation

- Past
- 4K
- Frequency: Lower: over flood plain
- Middle: over high water level
- Upper: over embankment

Adaptation

- Committee: 2017 - Projection of future flood risk in Hokkaido, Japan (Hokkaido development bureau and Hokkaido prefecture)
- 2018 - Projection of future flood risk and consideration of nationwide adaptation plan with climate change (MLIT)

Discussions are based on the large ensemble climate dataset and the risk assessment results.

This study was supported by Si-CAT (Social Implementation Program on Climate Change Adaptation Technology), the Ministry of Education, Culture, Sports, Science, and Technology, Japan.