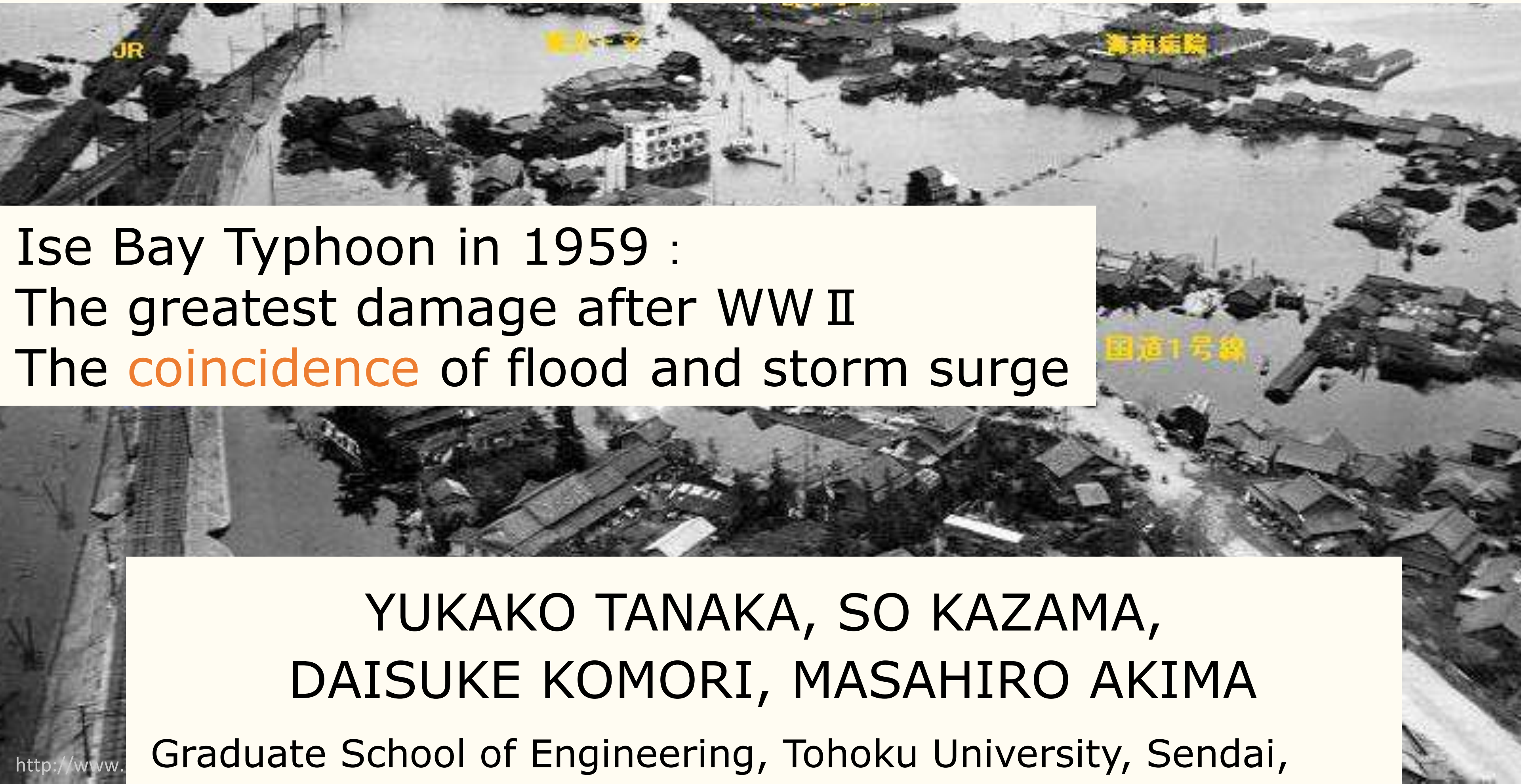
Estimation of the damage cost on compound water related disaster in Japan using 2D non-uniform flow model



Ise Bay Typhoon in 1959：
The greatest damage after WWⅡ
The coincidence of flood and storm surge

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Background

Compound

- Typhoons which brought particularly enormous damage

  Typhoon Muroto (1934)

  Makurazaki Typhoon (1945)

  Ise Bay Typhoon (1959)

…The coincidence of flood and storm surge

Single

A flood (Typhoon No. 18, 2015)
Kinu River burst its banks for the first time in 29 years

A flood (Typhoon No. 10, 2016)
The typhoon hit the Tohoku district for the first time

Background

The risk of compound disasters

enormous damage
×
low probability

>

or

<

The risk of single disasters

less damage
×
high probability

It is necessary for Japan
to evaluate quantitatively the risk of
flood, storm surge, compound disaster
and compare them

Previous studies

Floods

Flood damage estimations using the distribution of rainfall causing any return period of flood (Tezuka *et al.*,2014 etc.)

Storm

Analysis on storm surge inundation damage using numerical models (Suzuki, 2008 etc.)

Many studies have done on impacts on each flood and storm surge

Objectives

Estimation on the damage cost of compound disaster that flood and storm surge happened at the same time (Akima *et al.*, 2016)

! The inundation depth was estimated on the condition that highest tide level stay constant so far as the storm surge flooding calculation

! The difference between the tide level and the ground elevation was regarded as the inundation depth of storm surge

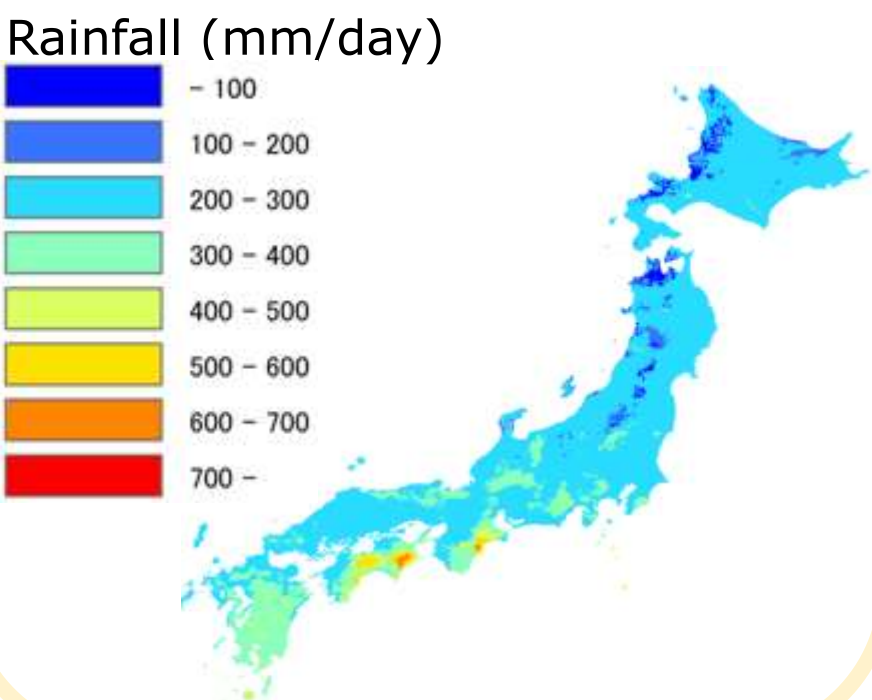
The objective of my research

to calculate the inundation depth which is more similar to the actual phenomenon

Data set ~single disasters~

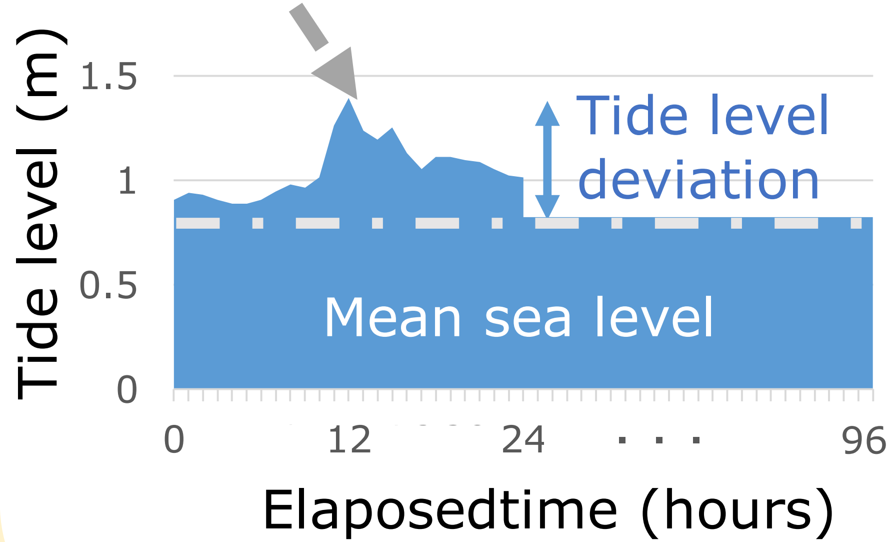
Floods

the distribution of rainfall causing any return period of flood (Tezuka et al.,2014)



Storm surges

Any return period of the tide level deviation calculated by means of frequency analysis



Data set ~compound disasters~

Compound disaster：A low pressure bring flood and storm surge one after another at the same place in 4 days

Rainfal

the rainfall causing any return period compound disaster

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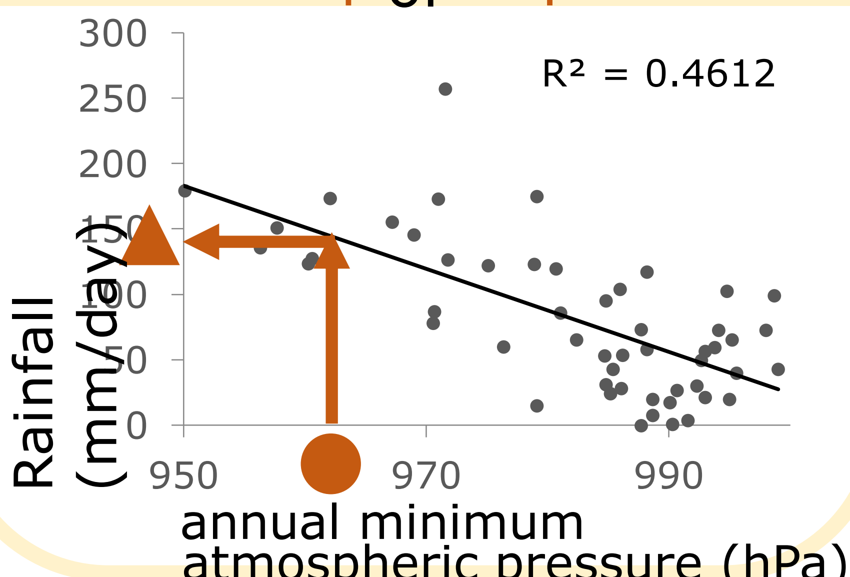
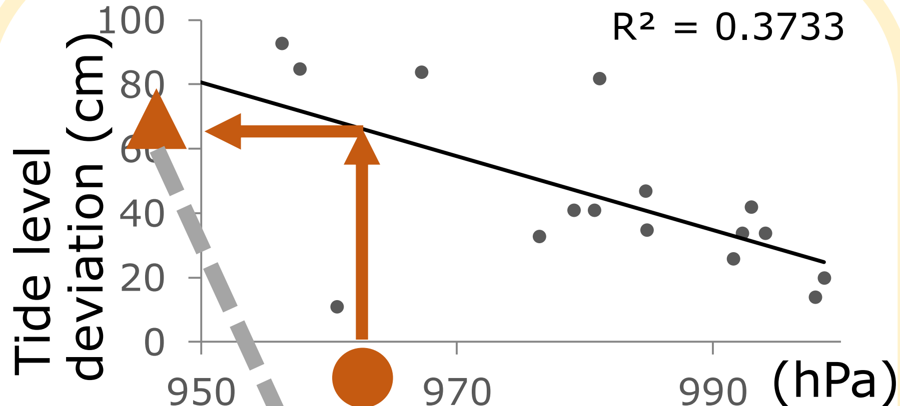
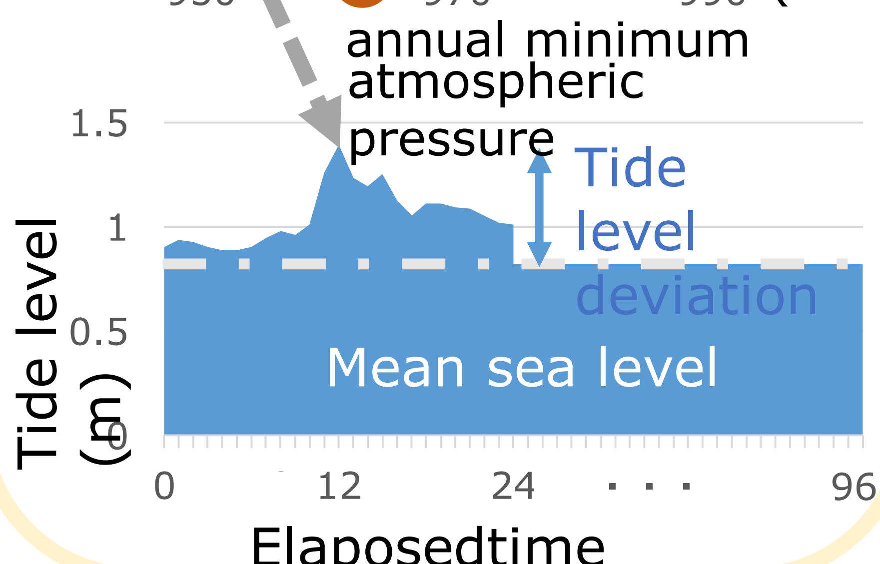
the rainfall caused by any return period low atmospheric pressure

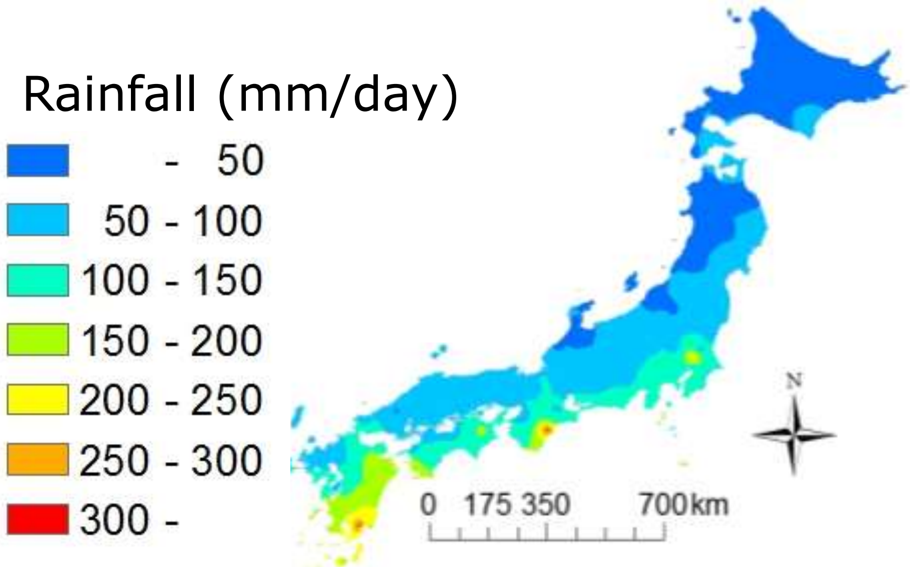


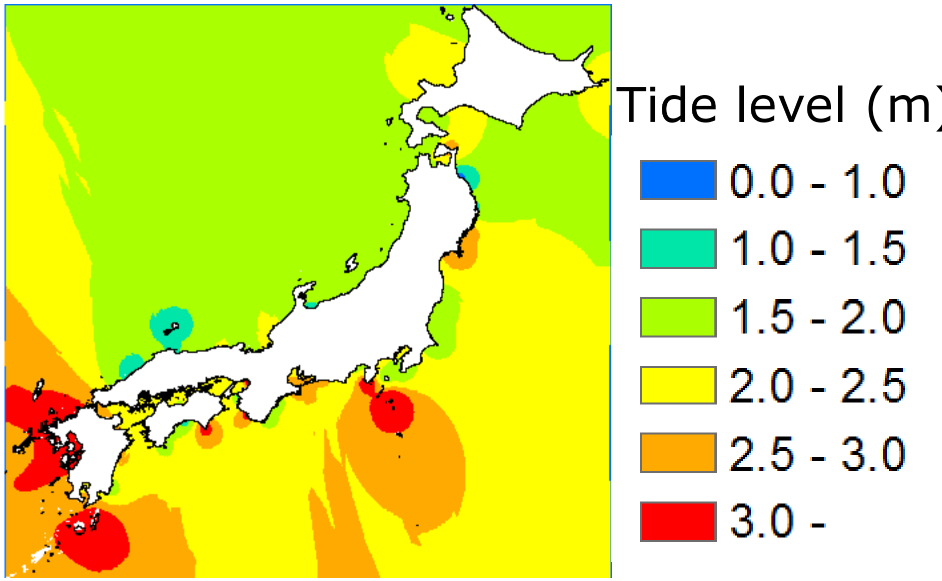
Tide level





Method





Input to
2D non-uniform flow model

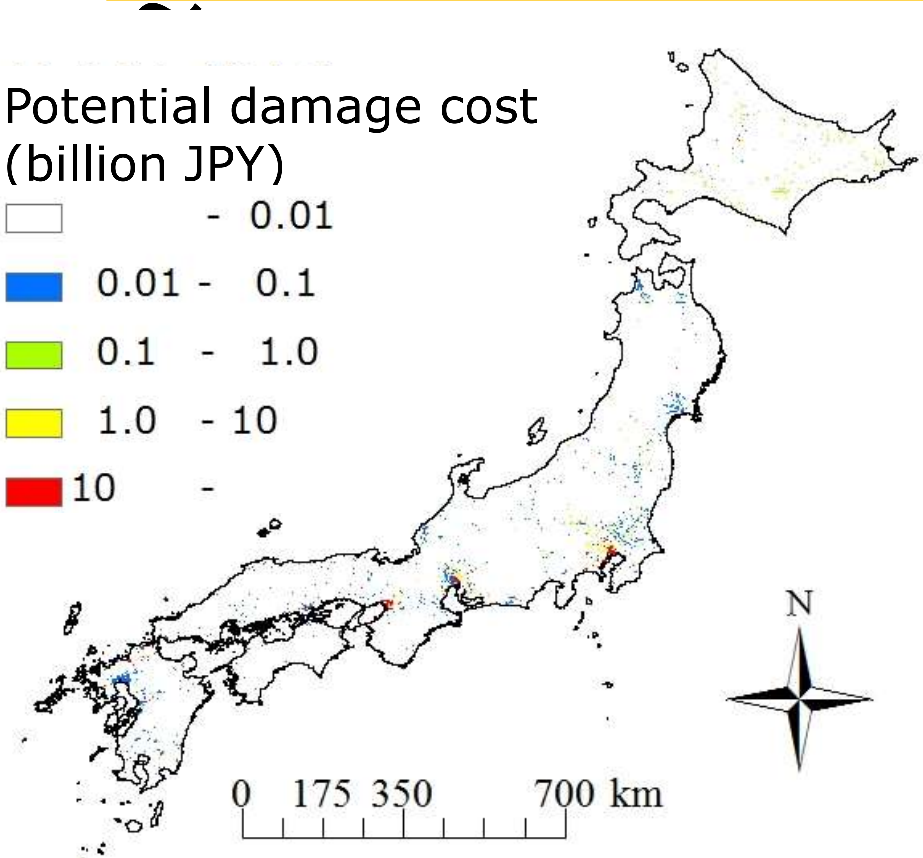
- Rainfall :
  0～24h (constant)
- Tide level :
  0～24h (time series)

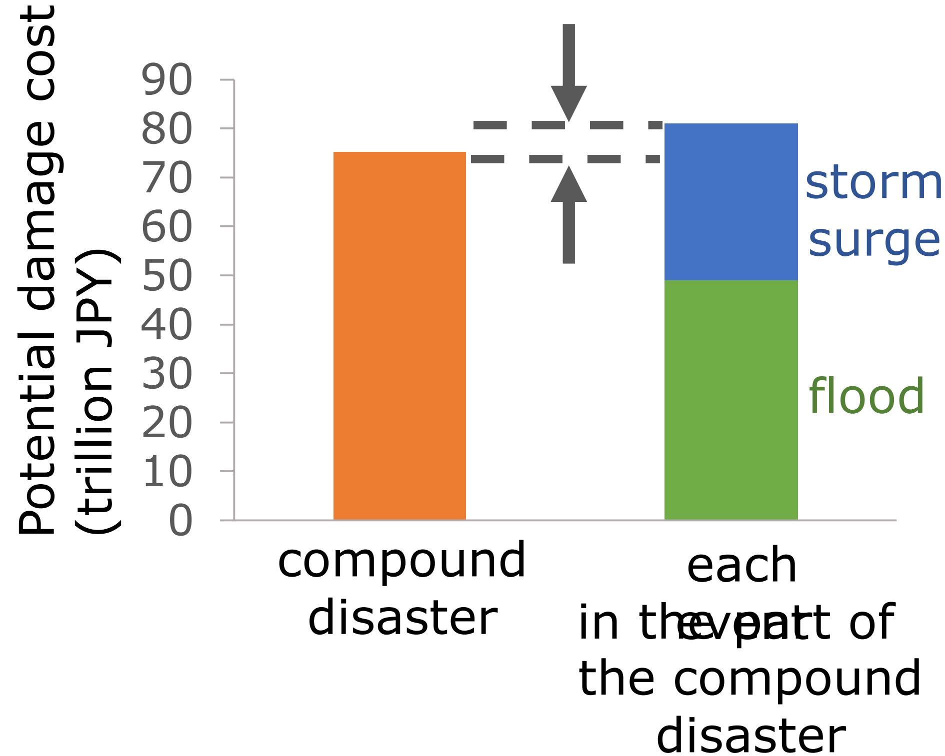
Inundation

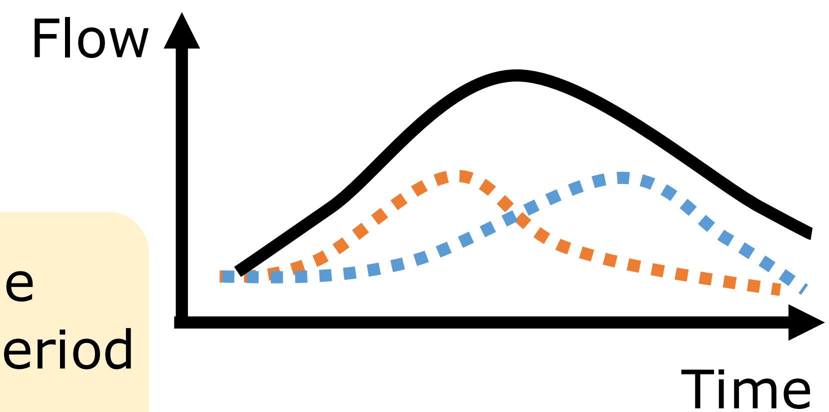
Damage cost

prices per unit of area calculated by each land use

Result ~damage cost distribution



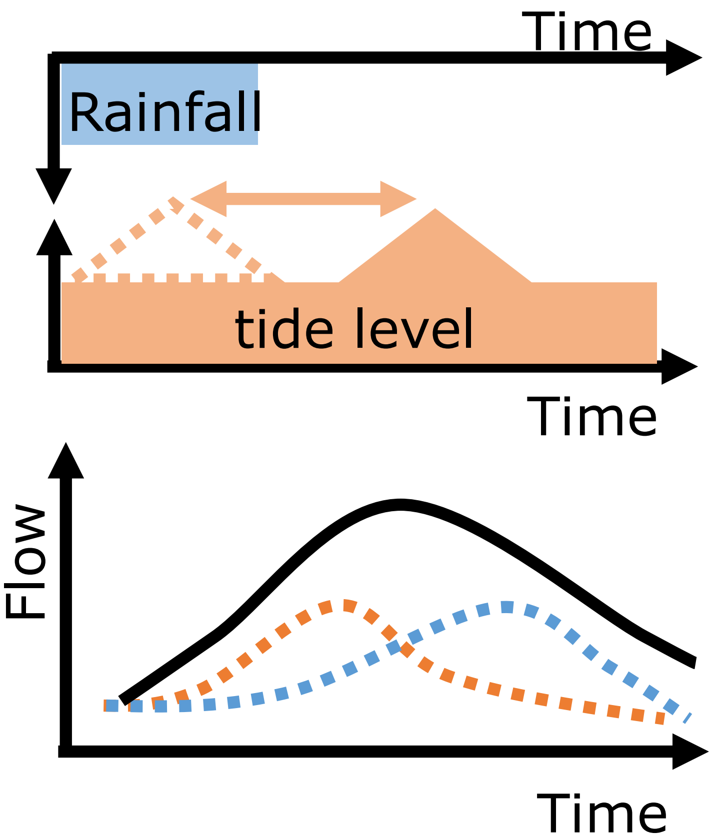


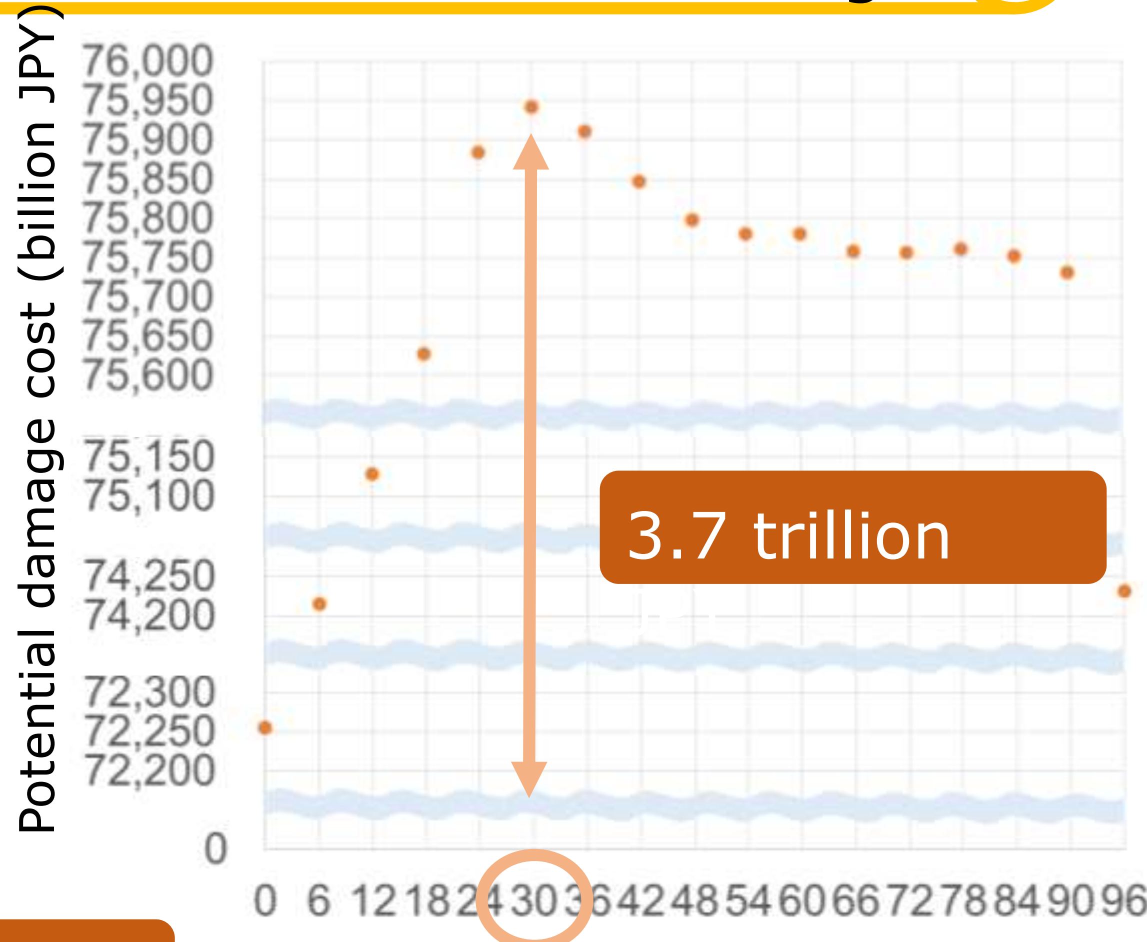


75 trillion JPY

Total amount of the potential damage cost in whole Japan for 50-years return period of compound disaster

Result ~difference in the time of storm surge~



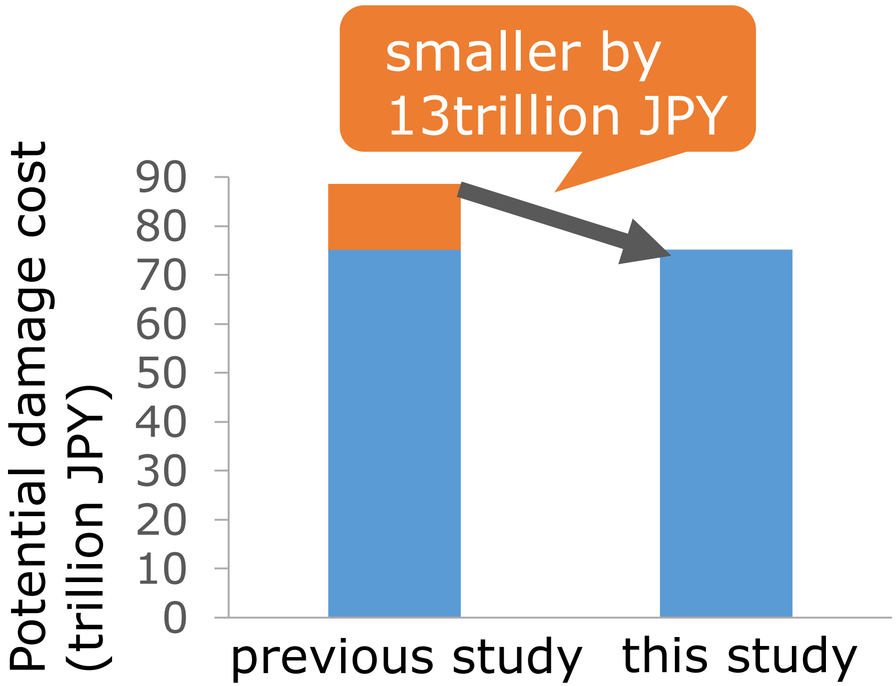


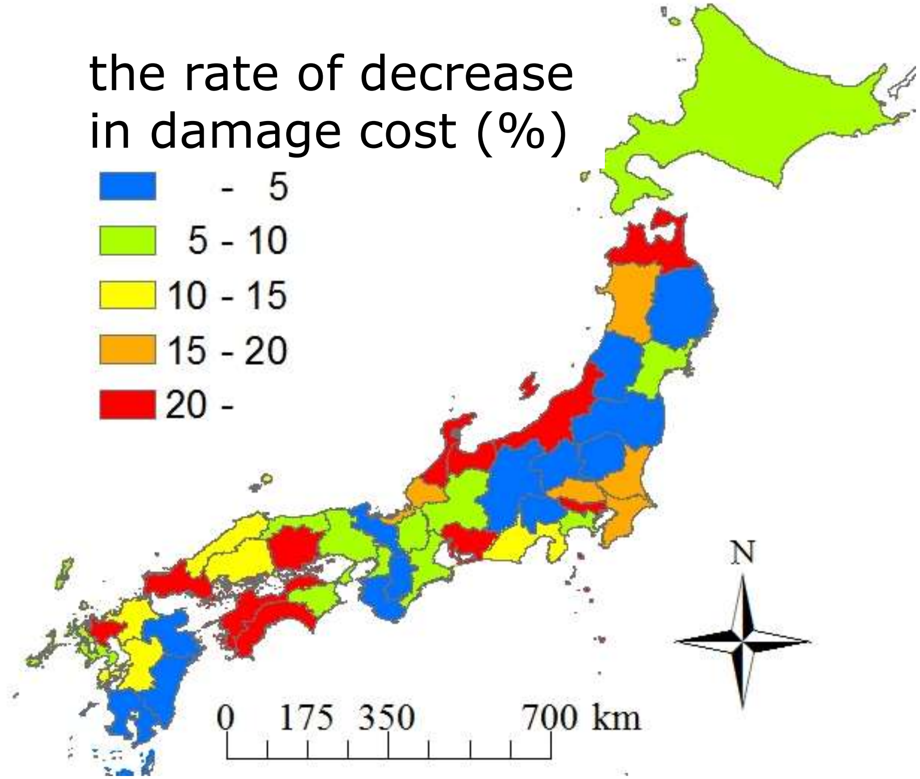
The time set the highest tide level (hours)

30 hours after rain started

The time at that the highest tide level is set when the damage cost of compound disaster reaches a peak

Result ~difference from previous studies~





15.2% decrease

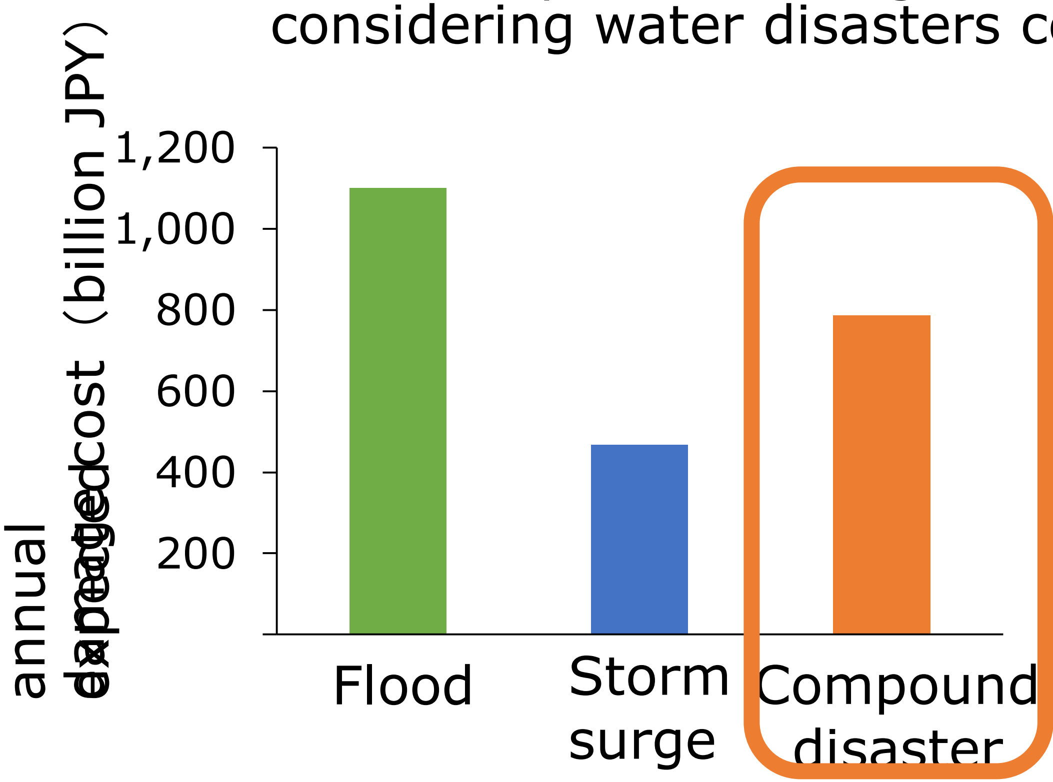
The damage cost of compound disaster in this study is smaller than that in previous study (Akima *et al.*, 2016)

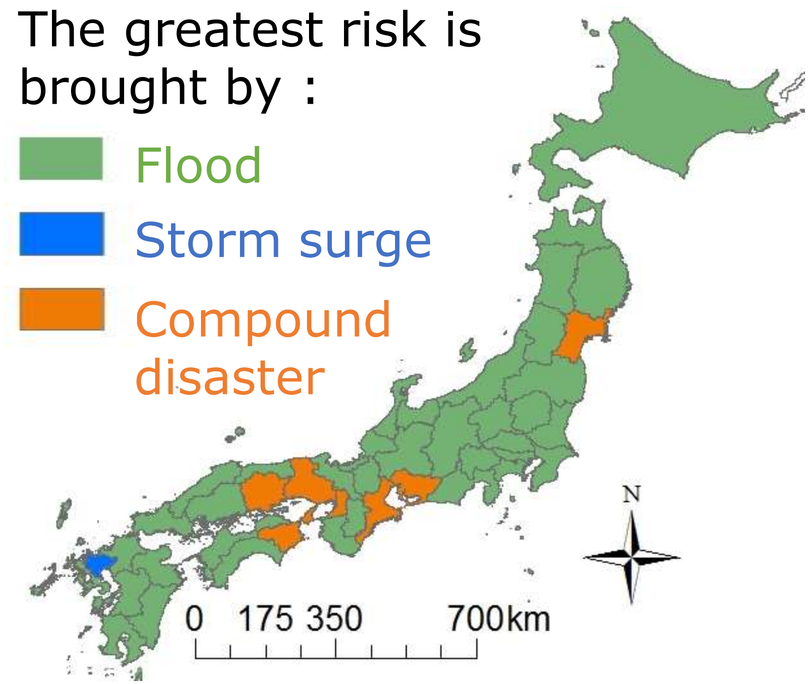
This difference could be caused by the difference in infiltration of tidal waves to the land

Niigata, Ishikawa, Kochi…particularly overvalued

Result～comparing the risk of each event～

Annual expected damage cost ware estimated considering water disasters control projects





Floods pose the greatest risk

80% of prefectures: Storm surge＜Compound disaster＜Flood
Useful for efficient adaptation method against water disasters

Conclusions

Objective

to evaluate quantitatively the risk of water related disaster and compare them

Results

1. Improvement of Flood simulation

time series variation of tide level was taken into the mode

2. Change in the arrival time of storm surge

damage cost reaches a peak on the condition that the time of the highest tide level is set at 30 hours after rain started

3. Comparison of the risk of each disaster

Storm surge＜Compound disaster＜Flood