

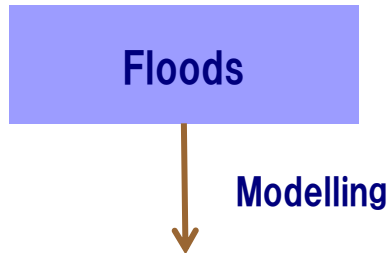
GIROJ

Flood Loss Model

General Insurance Rating Organization of Japan

Overview of Our Flood Loss Model

- GIROJ flood loss model includes three sub-models.



Riverine flooding*1

Estimate the loss using a flood simulation for calculating flooded areas and flood levels
(River Flood Engineering Model)

Storm surge*2

Estimate the loss using a storm surge flood simulation for calculating flooded areas and flood levels
(Storm Surge Flood Engineering Model)

Other precipitation related events

Estimate the loss using a statistical method for estimating the probability distribution of the number of affected buildings and loss ratio
(Statistical Flood Model)

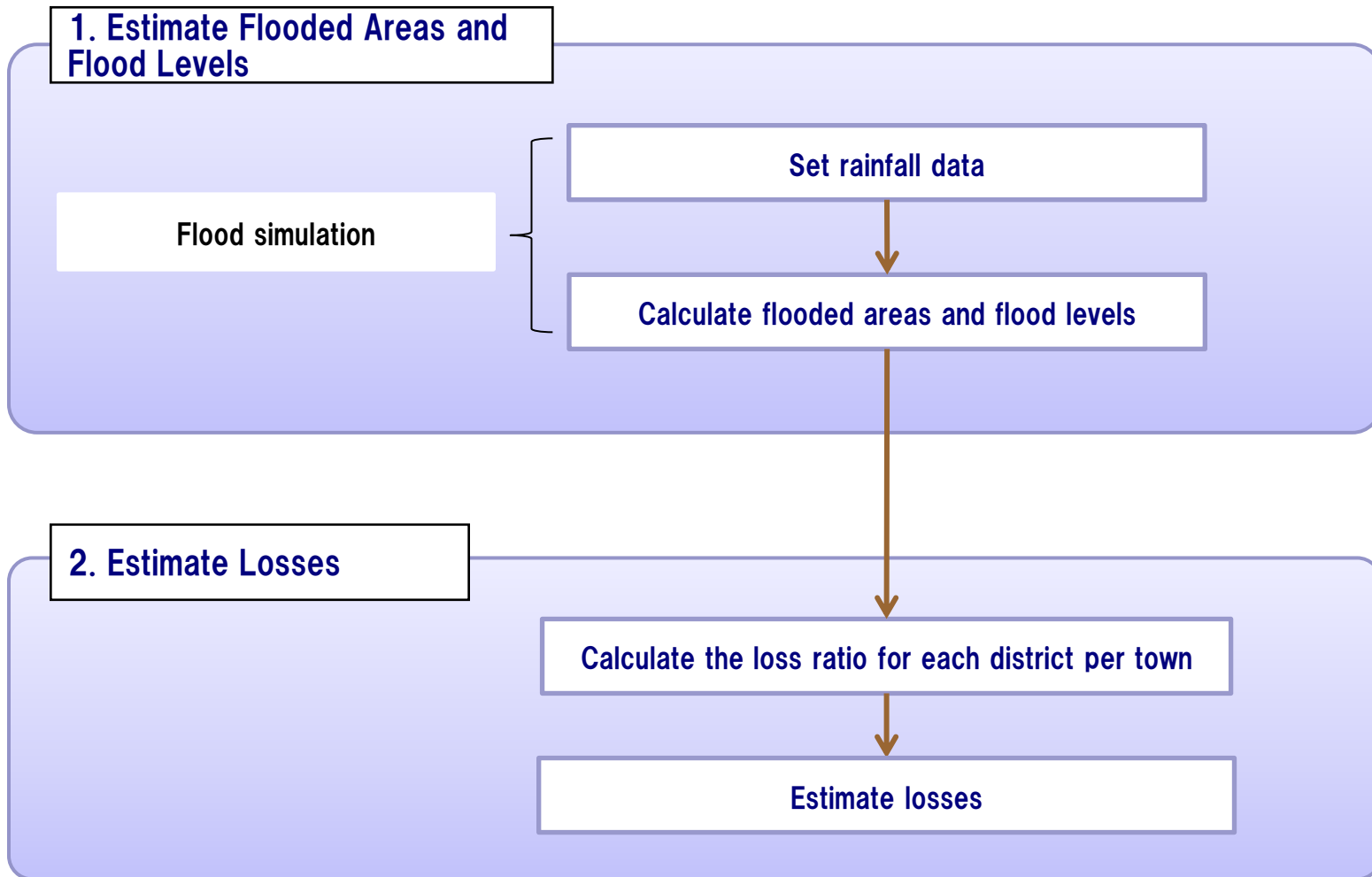
Less frequent and large-scale disasters

Ordinarily occurring disasters

*1 Floods that occur when water overflows a river bank or a river bank is breached.

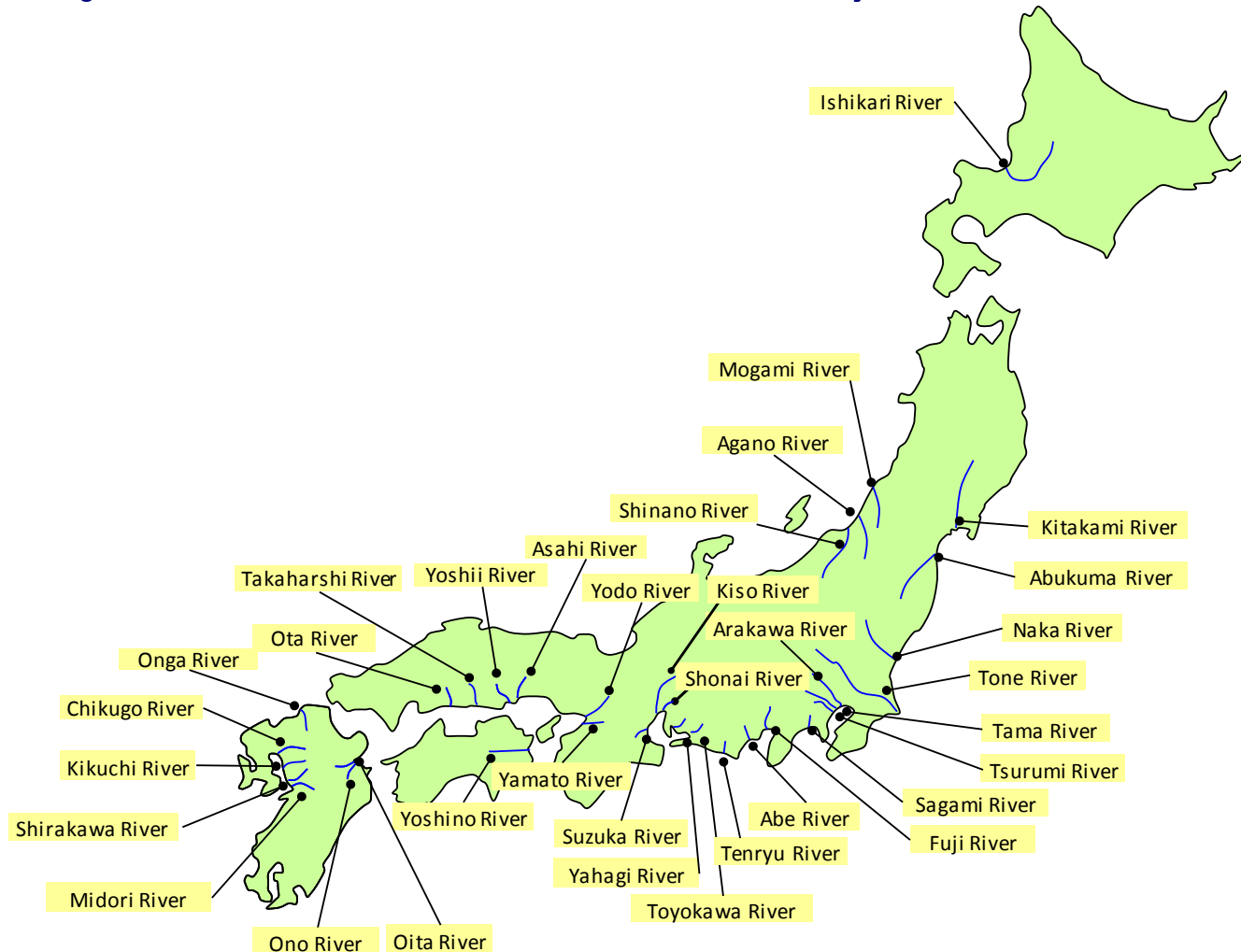
*2 Floods that occur when water overflows a bank or a bank is breached due to an approaching typhoon or large low-pressure system and a resulting rise in sea level in coastal region.

Overview of River Flood Engineering Model



River Flood Engineering Model: Estimate targets

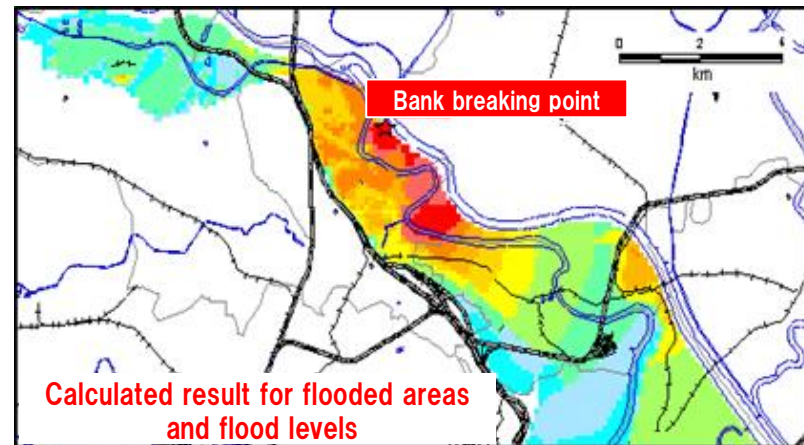
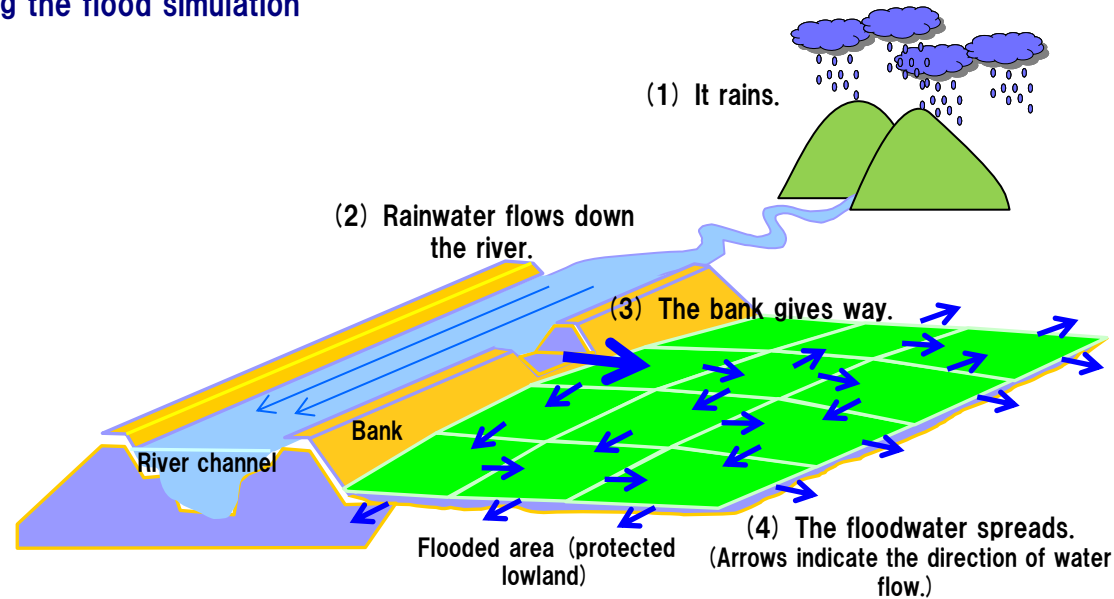
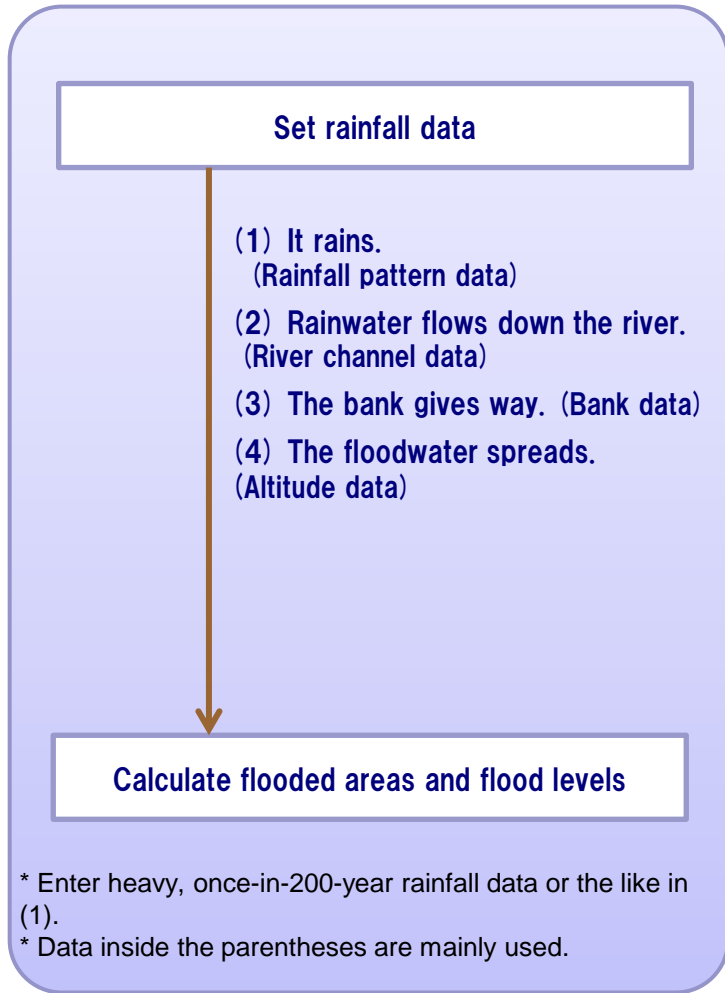
- Estimate targets are 34 Class A rivers for which there are many insurance contracts.



* For Tone River, Arakawa River, Tsurumi River, Shonai River, and Yodo River, GIROJ's flood simulation results are used for risk estimate. For the other rivers, flood simulation results by the Ministry of Land, Infrastructure, Transport and Tourism are used for risk estimate.

River Flood Engineering Model: 1. Estimate Flooded Areas and Flood Levels

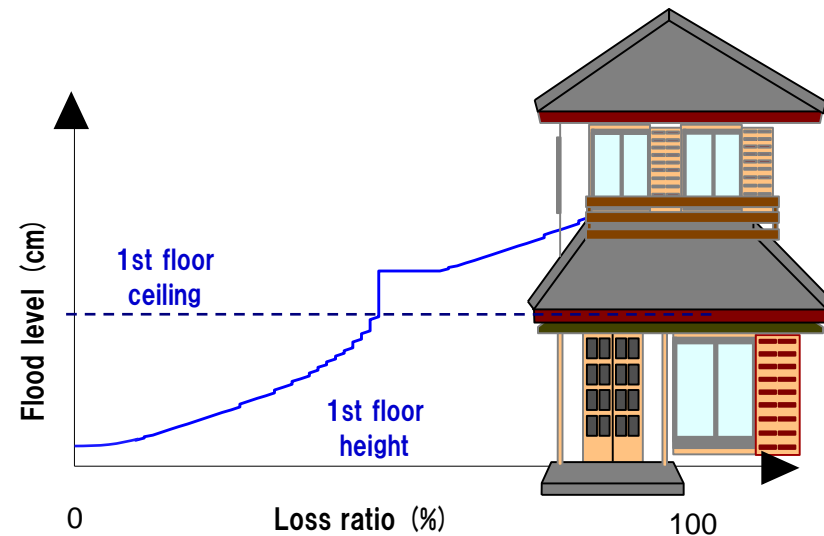
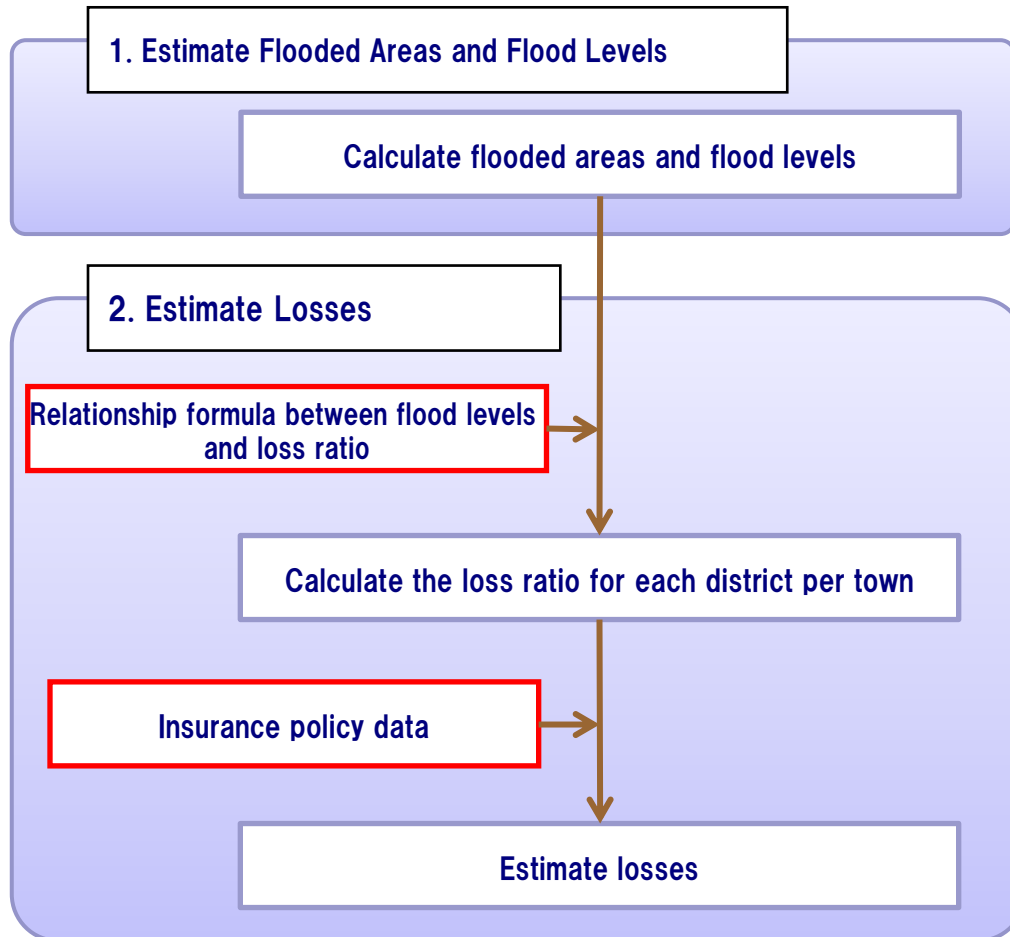
- Calculate flooded areas and flood levels using the flood simulation



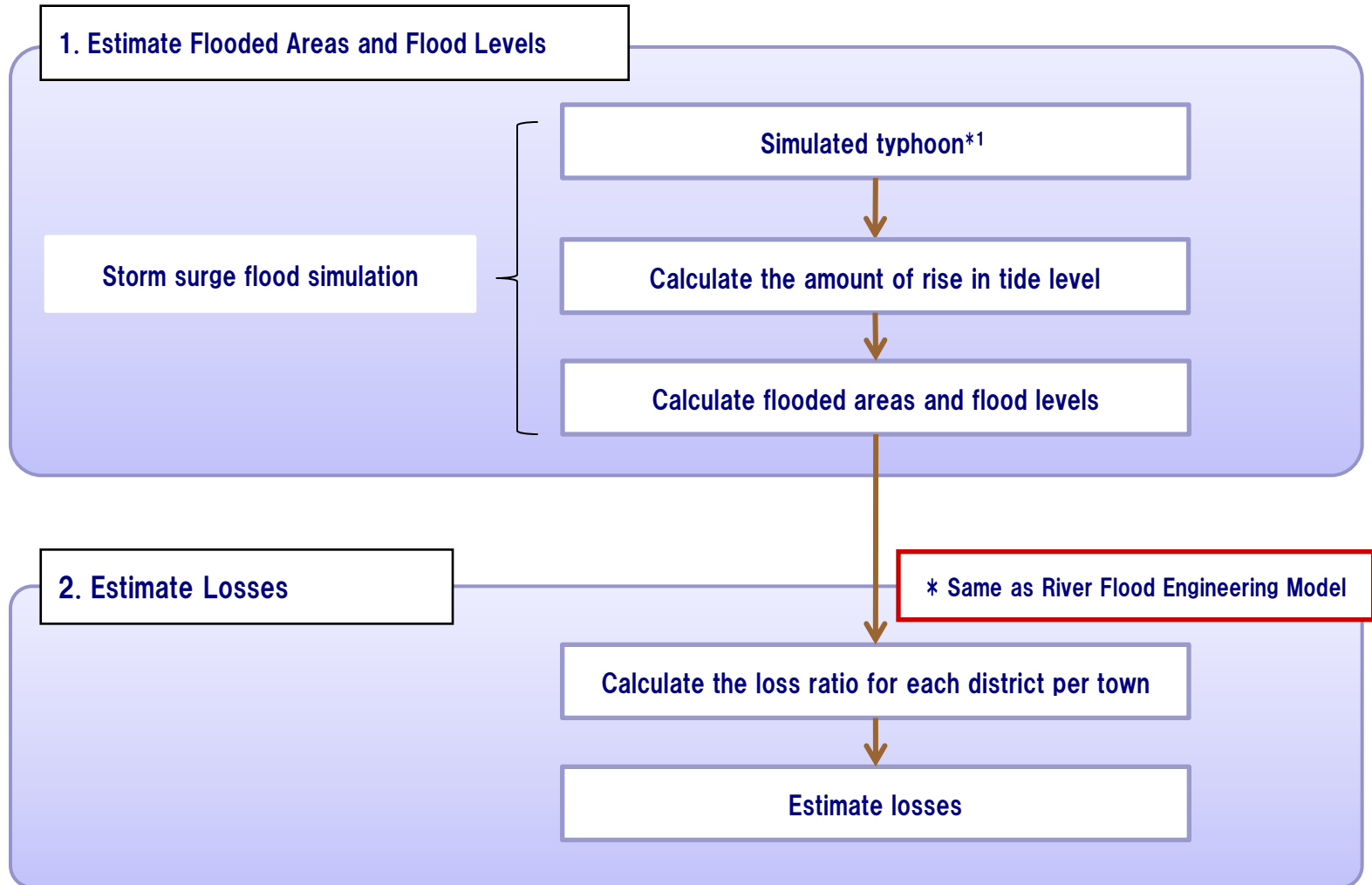
Low ■ < ■ < ■ High

River Flood Engineering Model: 2. Estimate Losses

- For the flooded areas and flood levels calculated using the flood simulation, determine the loss ratio for each district per town using a relationship formula between flood levels and loss ratio, and estimate the loss from insurance policy data



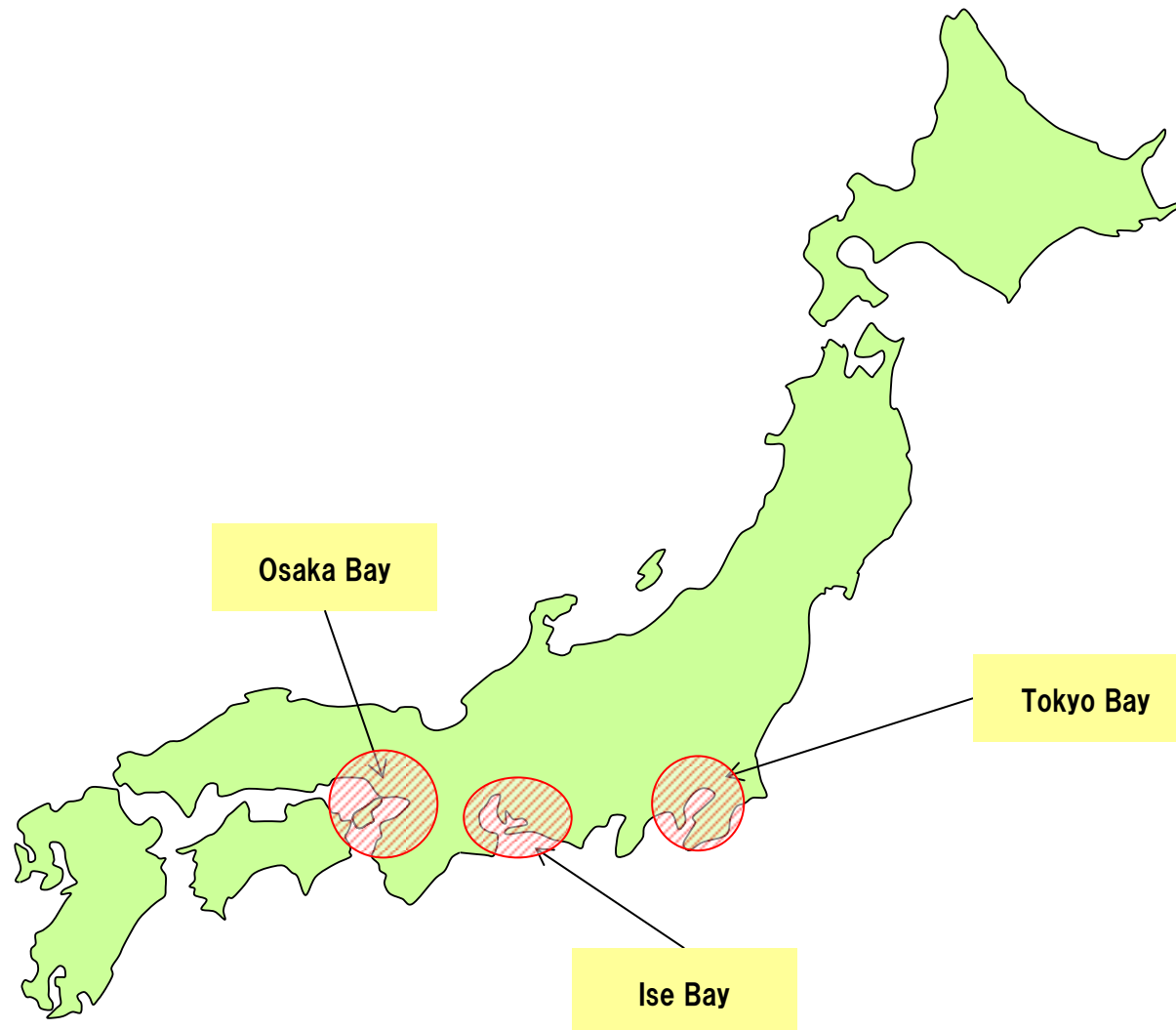
Overview of Storm Surge Flood Engineering Model



*1 A typhoon generated by a simulation that is used in GIROJ's typhoon loss model

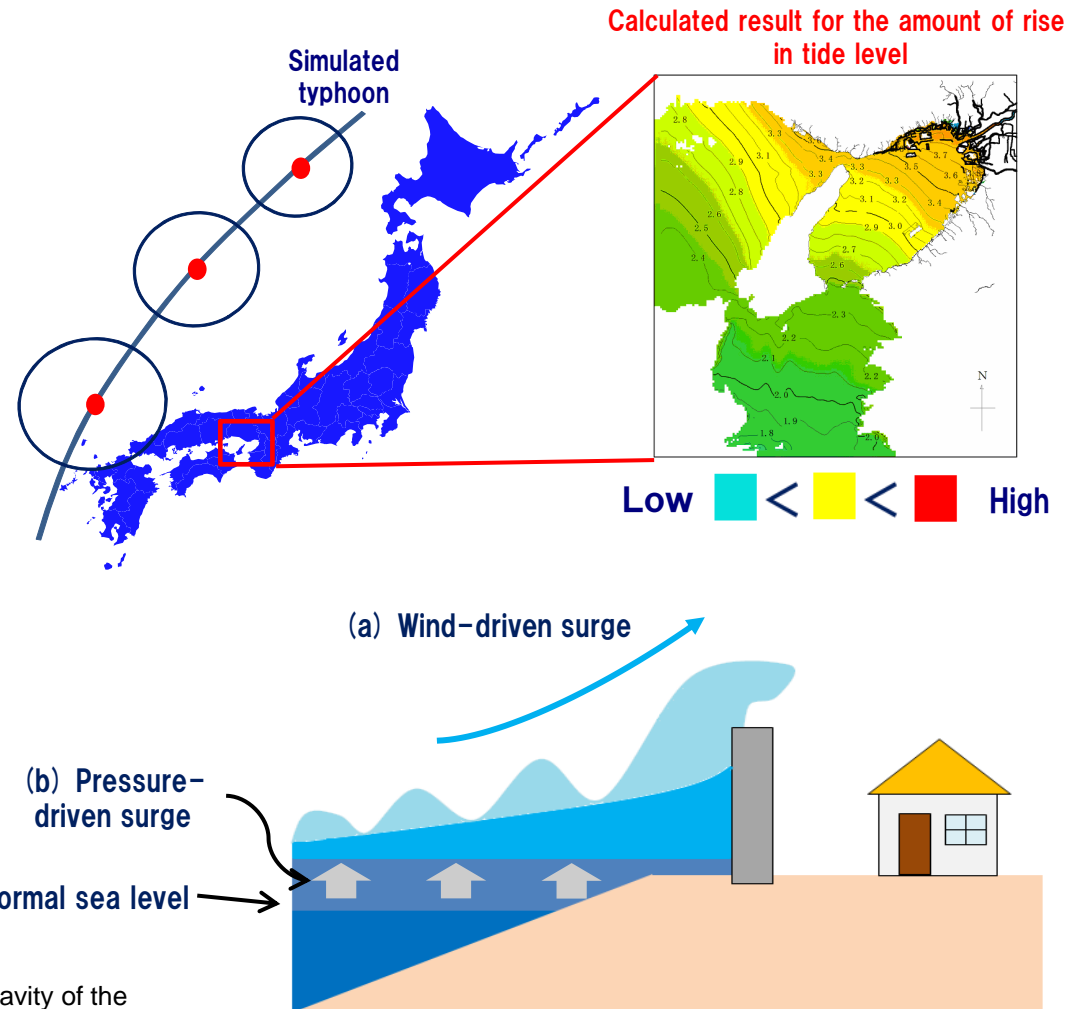
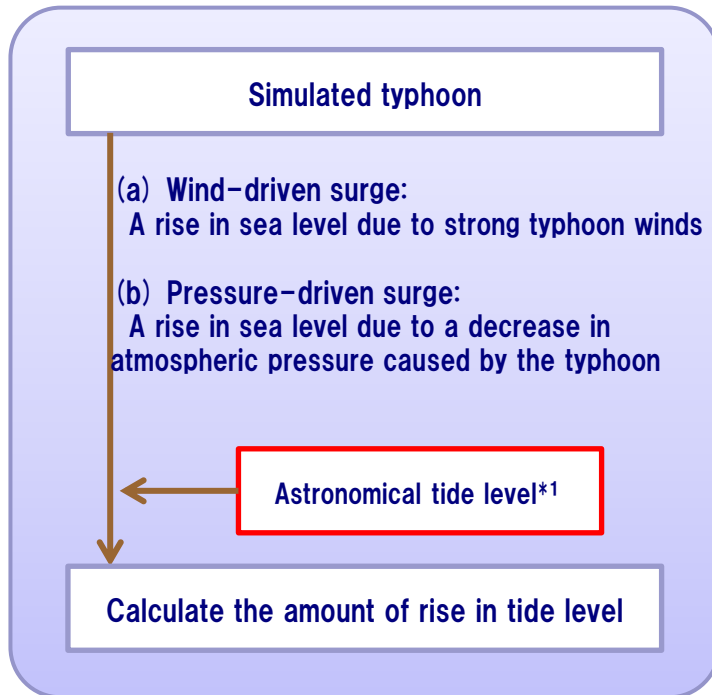
Storm Surge Flood Engineering Model: Estimate targets

- Estimate targets are Tokyo Bay, Ise Bay, and Osaka Bay that adjoin the three largest metropolitan areas.



Storm Surge Flood Engineering Model: 1. Estimate Flooded Areas and Flood Levels

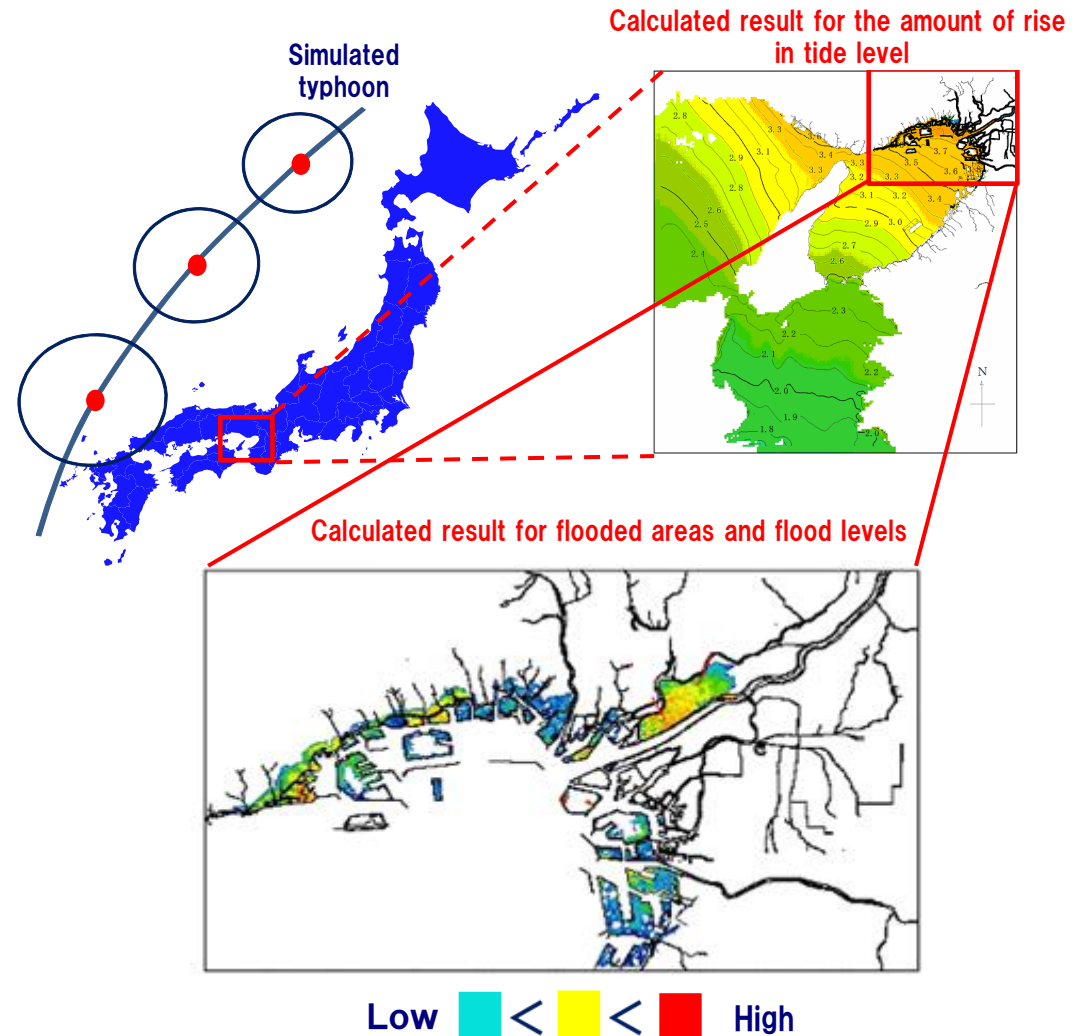
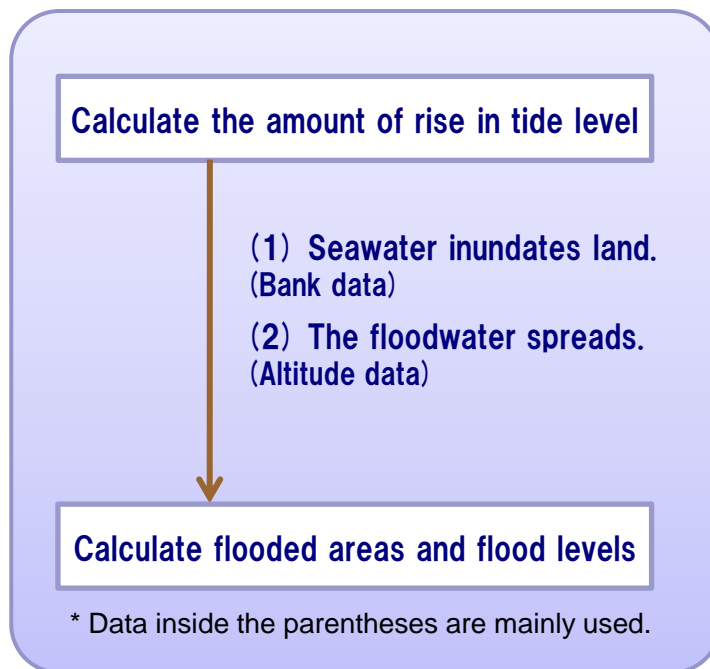
- By the storm surge flood simulation, calculate the amount of rise in tide level (sea level) for each typhoon (Simulated typhoon) generated using GIROJ's typhoon loss model.



*1 Amount of periodic changes in sea level under the action of gravity of the moon and sun

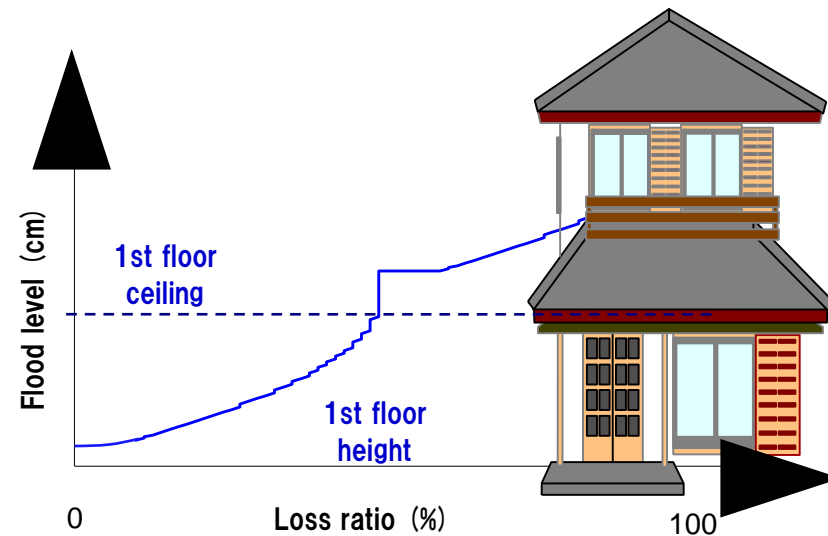
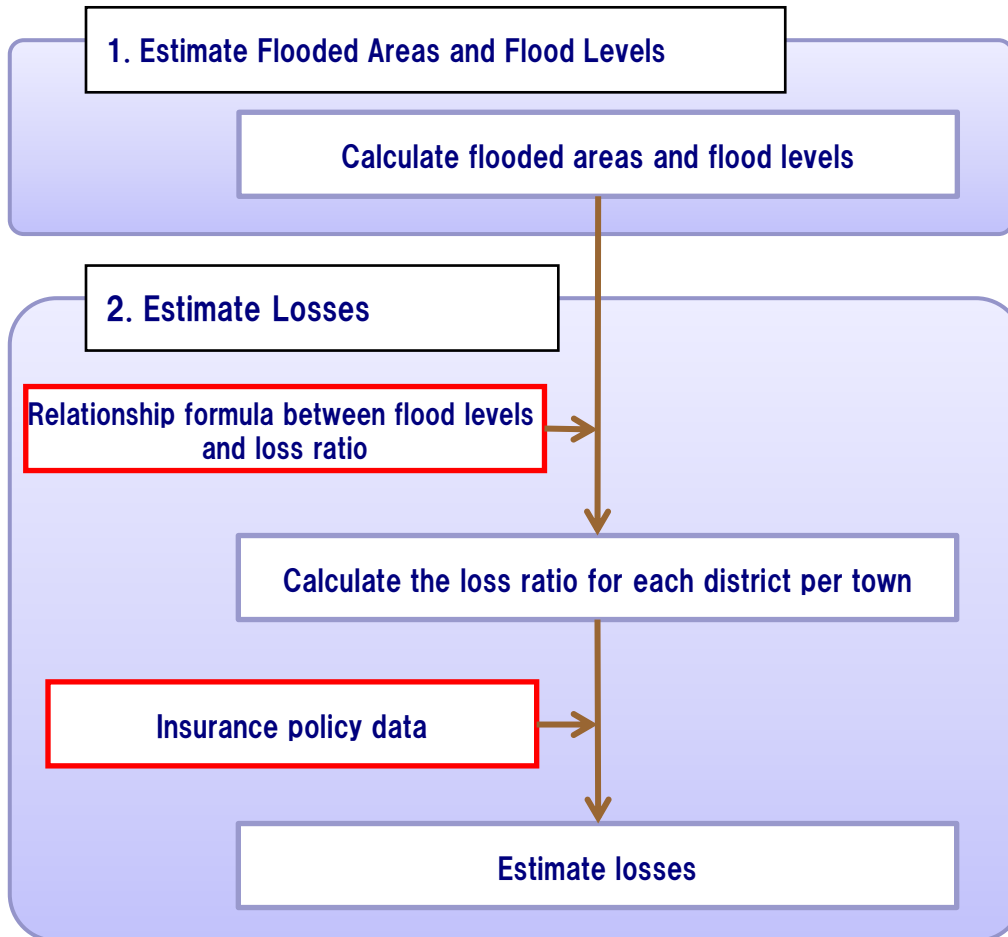
Storm Surge Flood Engineering Model: 1. Estimate Flooded Areas and Flood Levels

- Calculate the amount of seawater inundating land based on the rise in tide level and how the seawater spreads on land, thereby determining flooded areas and flood levels.

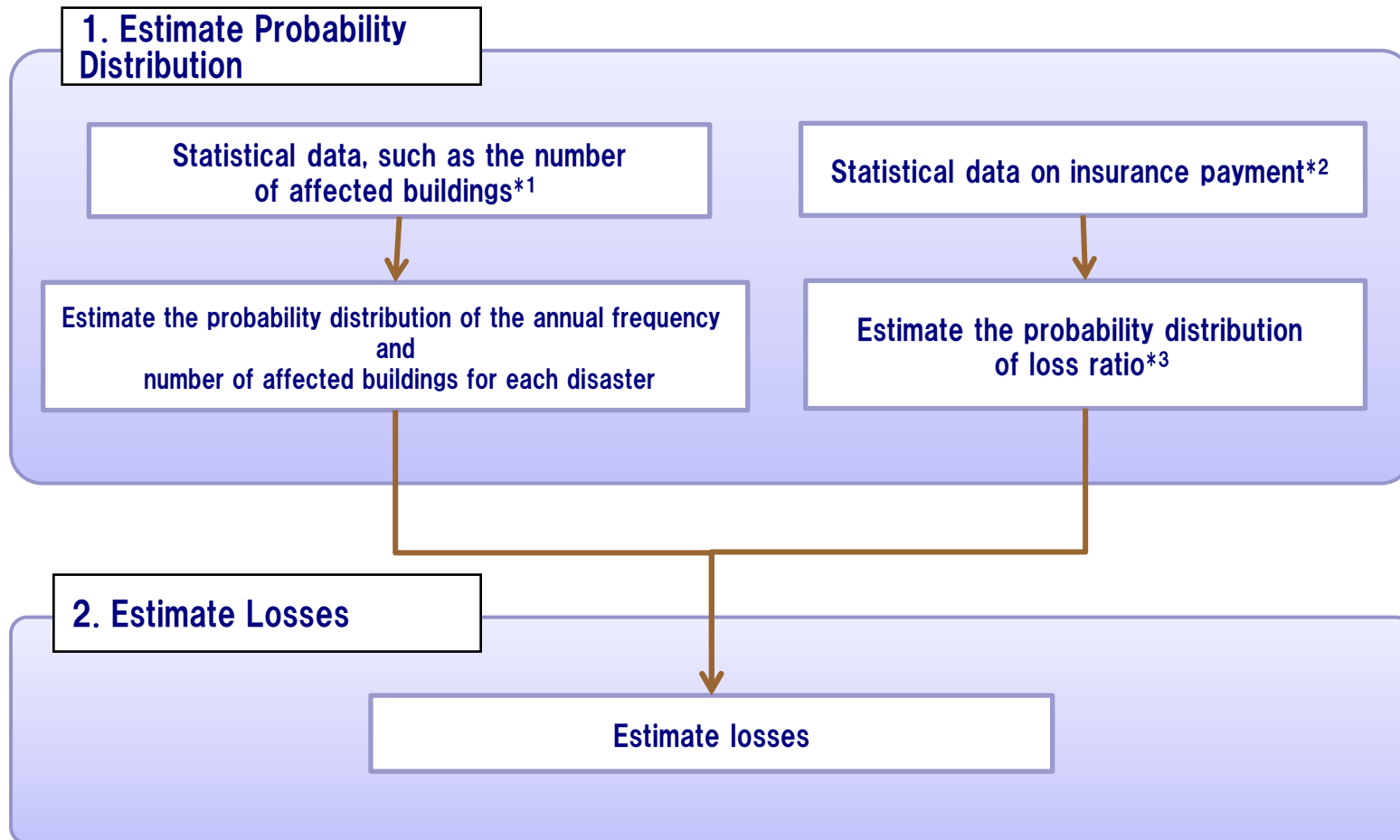


Storm Surge Flood Engineering Model: 2. Estimate Losses

- For the flooded areas and flood levels calculated using the storm surge flood simulation, determine the loss ratio for each district per town using a relationship formula between flood levels and loss ratio, and estimate the loss from insurance policy data



Overview of Statistical Flood Model



*1 Flood Damage Statistics Survey (Ministry of Land, Infrastructure, Transport and Tourism) or the like is used.

*2 Fire insurance statistics (General Insurance Rating Organization of Japan) is used.

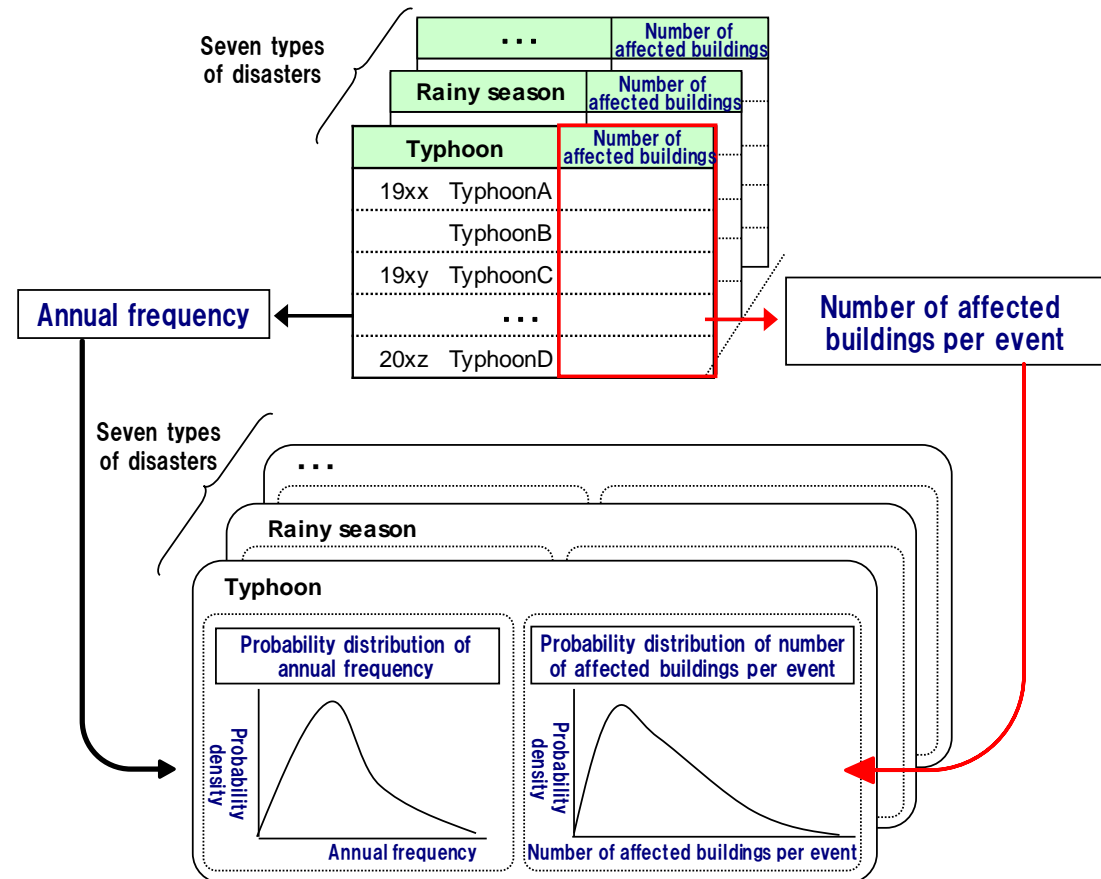
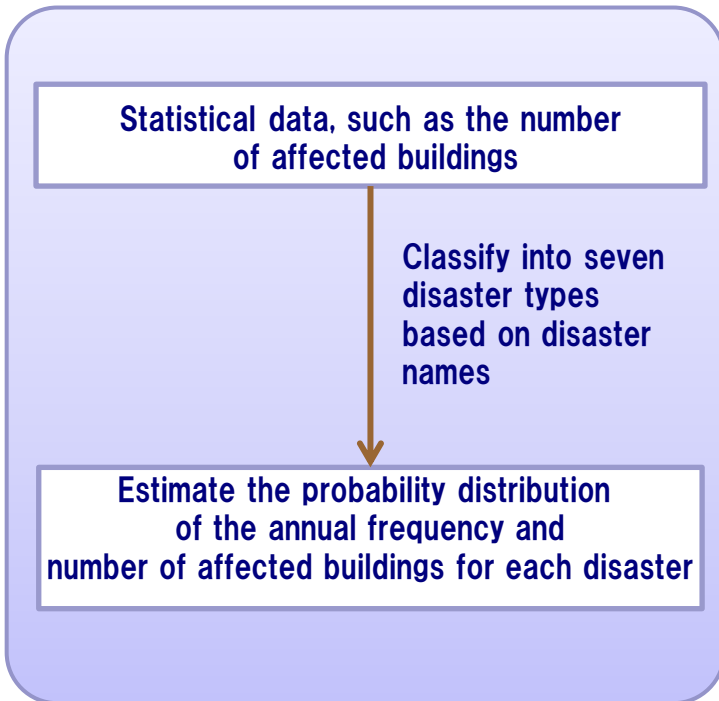
*3 Loss ratio = amount of loss / insured value

Statistical Flood Model: 1. Estimate Probability Distribution

(about distribution of the annual frequency and number of affected buildings for disasters)

- Based on statistical data on the number of affected buildings or the like, estimate the probability distribution of the annual frequency and number of affected buildings for each disaster with respect to each of the seven disaster types (typhoons, rainy season, heavy rain, wind and waves, thaw, landslides, and other extraordinary disasters)

Schematic diagram for estimation of distribution of the annual frequency and number of affected buildings for disasters

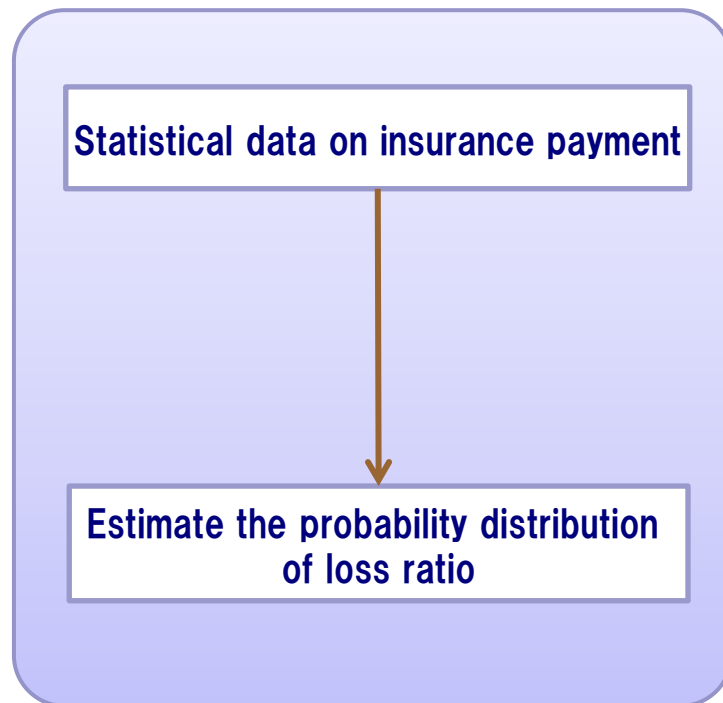


Statistical Flood Model: 1. Estimate Probability Distribution

(about distribution of loss ratio)

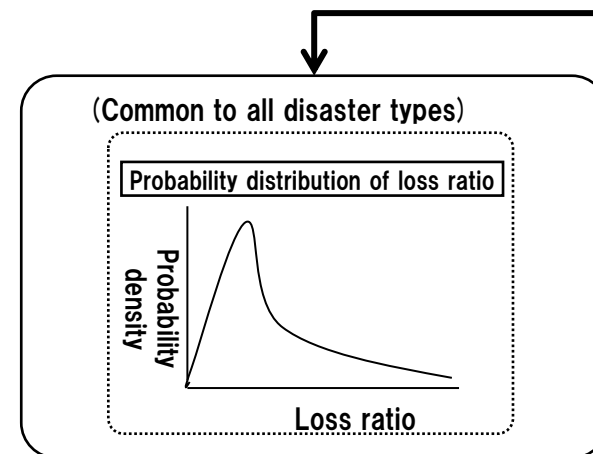
- Estimate the probability distribution of loss ratio common to all disaster types based on statistical data on insurance payment

Schematic diagram for estimation of probability distribution of loss ratio



Statistical data on insurance payment

(1) Insured value	(2) Amount of loss	(3) Loss ratio = ((2) / (1))
100	10	0.1
200	40	0.2
...		...



Statistical Flood Model: 2. Estimate Losses

- Calculate the annual frequency, number of affected buildings, and loss ratio of a disaster based on random numbers that conform to the estimated probability distribution. Determine the number of insurance payments and average amount of insurance payment taking the insurance policy data into account, and estimate the loss for each disaster type and each prefectures.

1. Estimate Probability Distribution

Estimate the probability distribution of annual frequency, number of affected buildings, and loss ratio of a disaster

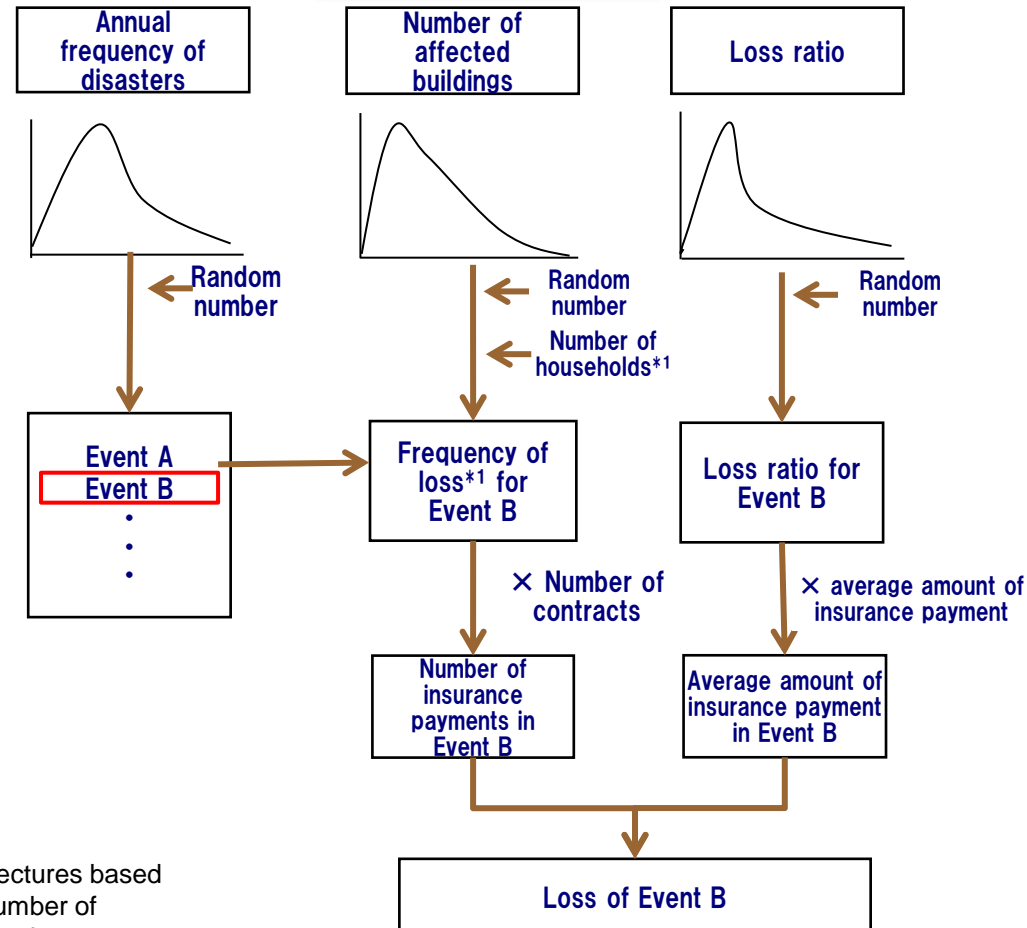
2. Estimate Losses

Random number

Insurance policy data

Estimate losses

Schematic diagram for Estimate losses



*1 The calculated number of affected buildings is allocated across prefectures based on past disaster cases. Then, the allocated number is divided by the number of households for each prefecture to determine frequency of loss for the prefecture.

Contact Information

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