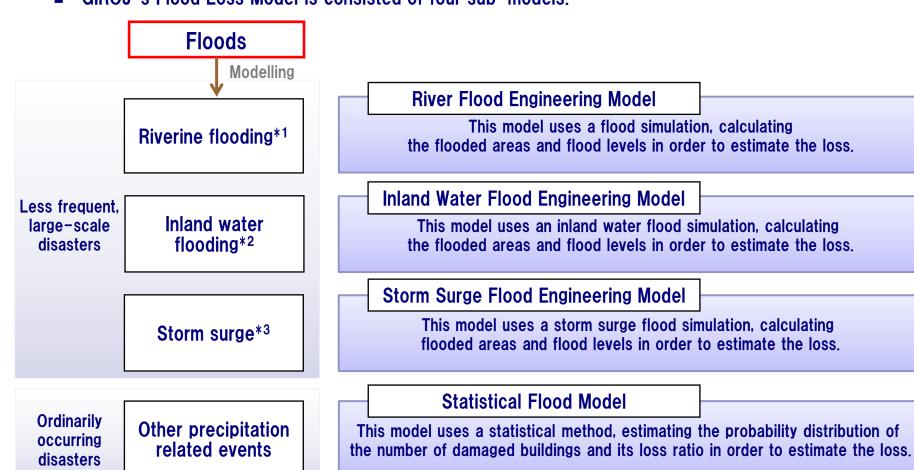
GIROJ's Flood Loss Model

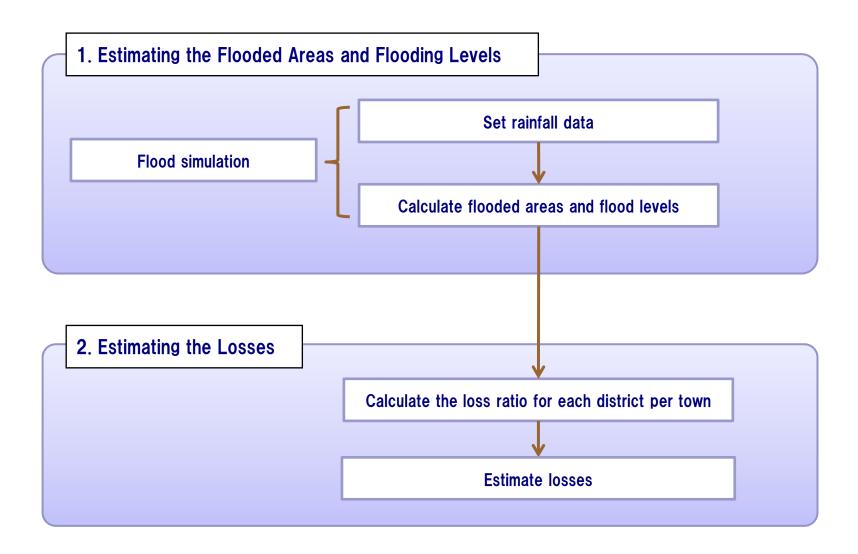
The Overview of Our Flood Loss Model

GIROJ's Flood Loss Model is consisted of four sub-models.



- *1 Floods that occur when water overflows its riverbank or when a riverbank breaches.
- *2 Floods that occur when the sewer system exceeds its capacity, causing the water to overflow.
- *3 Floods that occur when water overflows its bank or when a bank breaches, due to a typhoon or large low-pressure system approaching, resulting in a sea level rise in coastal regions.

The Overview of the River Flood Engineering Model



River Flood Engineering Model: Target of Assessment

All Class A rivers (109 rivers shown below) and some Class B rivers (about 2000 rivers) are target of the assessment.

[Hokuriku region]
Arakawa River, Agano River,
Shinano River, Sekikawa River,
Himekawa River, Kurobe River,
Joganji River, Jinzu River,
Shogawa River, Oyabe River,
Tedori River, Kakehashi River

Abashiri River, Rumoi River, Ishikari River, Shiribetsu River, Shiribeshi-toshibetsu River, Mukawa River, Saru River, Kushiro River, Tokachi Rivers

Teshio River. Shokotsu River.

Yubetsu River. Tokoro River.

[Chugoku region]
Sendai River, Tenjin River,
Hino River, Hii River,
Gonokawa River, Takatsu River,
Yoshii River, Asahi River,
Takahashi River, Ashida River,
Ota River, Oze River, Saba River

[Kyushu region]
Onga River, Yamakuni River,
Chikugo River, Yabe River,
Matsuura River, Rokkaku River,
Kase River, Honmyo River,
Kikuchi River, Shirakawa River,
Midori River, Kuma River,
Oita River, Ono River,
Banjo River, Gokase River,
Omaru River, Oyodo River,
Sendai River, Kimotsuki River

[Kinki region]
Yura River, Yodo River,
Yamato River, Maruyama River,
Kakogawa River, Ibo River,
Kinokawa River, Shingu River,
Kuzuryu River, Kitakawa River

[Tohoku region]
Iwaki River, Takase River,
Mabechi River, Kitakami River,
Naruse River, Natori River,
Abukuma River, Yoneshiro River,
Omono River, Koyoshi River,
Mogami River, Akagawa River

[Hokkaido region]

[Kanto region]
Kuji River, Naka River,
Tone River, Arakawa River,
Tama River, Tsurumi River,
Sagami River, Fuji River

[Shikoku region] Yoshino River, Naka River, Doki River, Shigenobu River, Hijikawa River, Monobe River, Niyodo River, Watari River

[Chubu region]

Kano River, Abe River, Oi River, Kikugawa River, Tenryu River, Toyogawa River, Yahagi River, Shonai River, Kiso River, Suzuka River, Kumozu River, Kushida River, Miyagawa River

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

River Flood Engineering Model:

1. Assessing the Flooding Areas and Flooding Levels

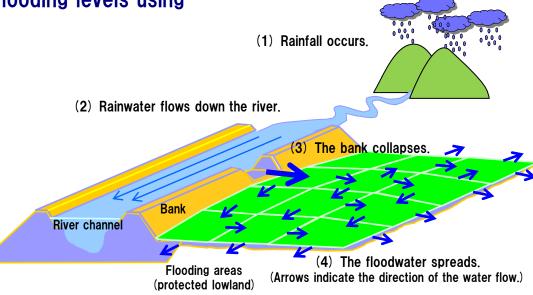
 Calculating the flooding areas and flooding levels using the Flood Simulation.

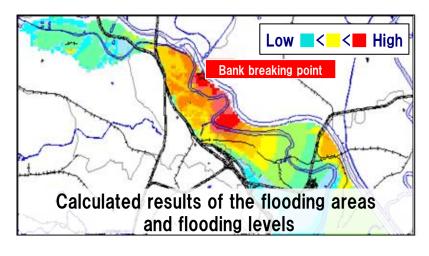
Set rainfall data

- (1) Rainfall occurs. (Rainfall pattern data)
- (2) Rainwater flows down the river. (River channel data)
- (3) The bank gives way. (Bank data)
- (4) The floodwater spreads. (Altitude data)

Calculate the flooding areas and flooding levels.

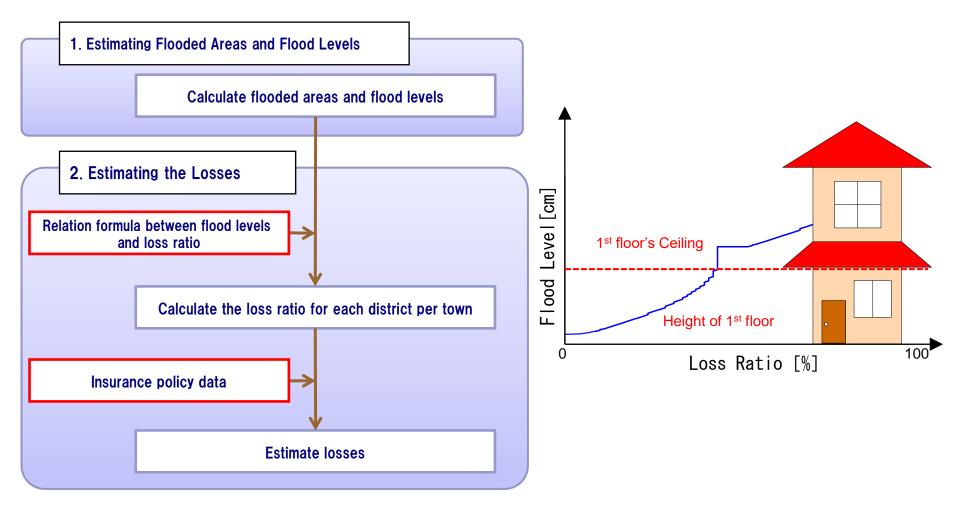
- * In step (1), heavy rainfall data, such as a 200-year return period is input.
- * The data mainly used is listed in ().



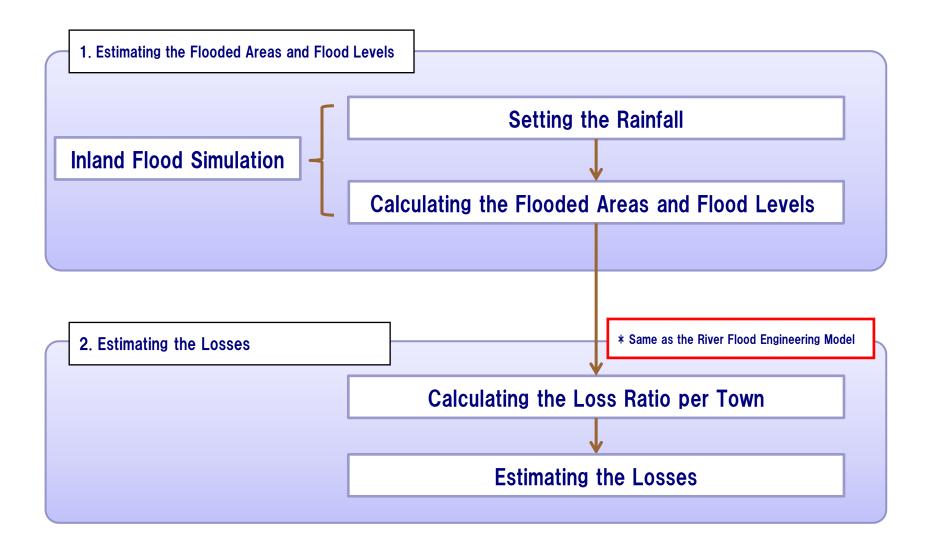


River Flood Engineering Model: 2. Loss Assessment

By combining the flooded areas and flood levels calculated by the flood simulation, and the "relation formula between the flood levels and the loss ratio", the loss ratio per town is determined, and the loss is estimated from insurance policy data.



Overview of Inland Flood Engineering Model



м

Inland Flood Engineering Model: Target of Assessment

The following cities included in the three major metropolitan areas of Japan are the



Inland Flood Engineering Model:

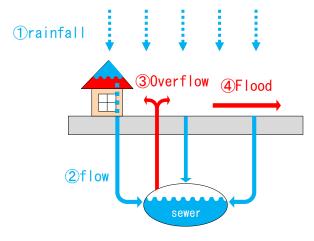
- 1. Assessing the Flooding Areas and Flooding Levels
- Calculating the flooding areas and flooding levels using the Inland Flood Simulation.

Setting the Rainfall

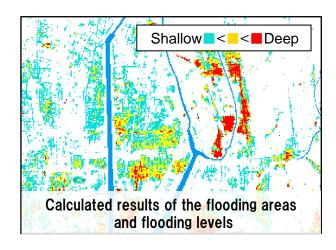
- **1**Rainfall occurs. (rainfall data)
- **②Flow:** Rain flows down the sewer. (sewer system data)
- 3 Overflow: Water overflows the ground.
 (")
- 4Flood: The overflowed water spreads.
 (altitude data)

Calculating the flooding areas and flooding levels.

- * In step①, rainfall data such as a 200-year return period is input.
- * The data mainly used is listed in ().

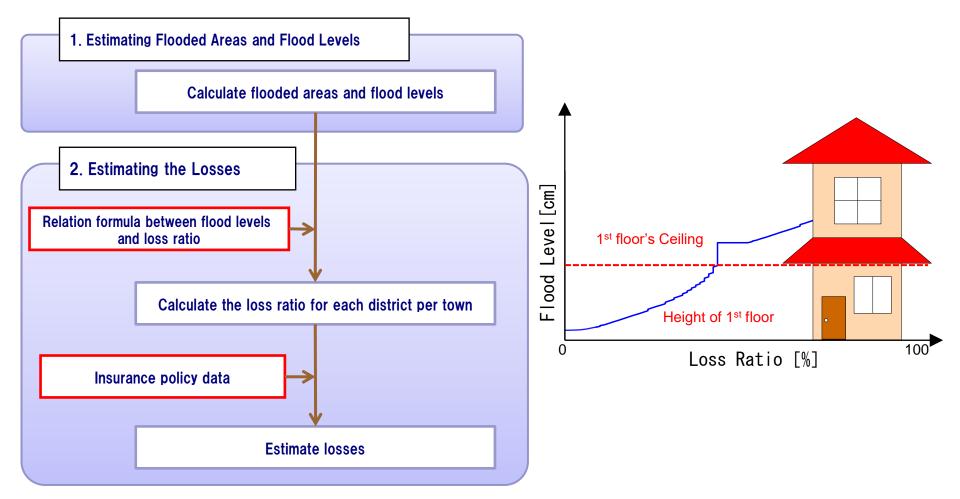


*The overflow occurs when the flowing amount of rainwater exceeds the drainage capacity of the sewer.

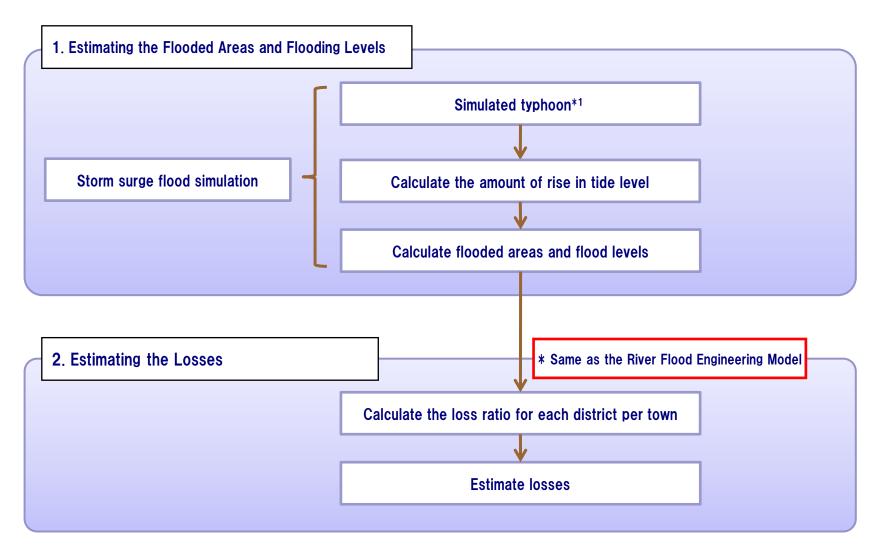


Inland Flood Engineering Model: 2. Loss Assessment

■ By combining the flooded areas and flood levels calculated by the Inland flood simulation, and the "relation formula between the flood levels and the loss ratio", the loss ratio per town is determined, and the loss is estimated from insurance policy data.



The Overview of Storm Surge Flood Engineering Model



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



Estimate targets are Tokyo Bay, Ise Bay, and Osaka Bay that adjoin the three major metropolitan

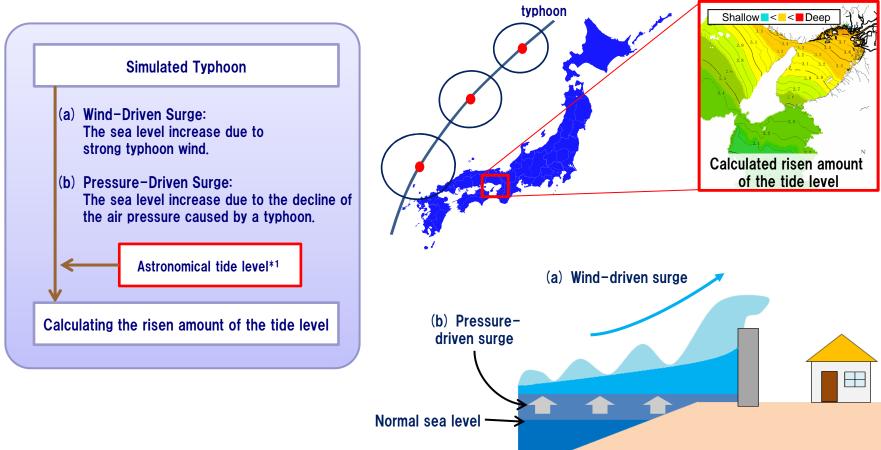
areas in Japan. Osaka Bay Tokyo Bay Ise Bay

Storm Surge Flood Engineering Model:

1. Estimating Flooded Areas and Flood Levels

■ The storm surge flood simulation, calculates the risen amount of the tide level (sea level) for each typhoon (Simulated Typhoon) generated by GIROJ's Typhoon Loss Model.

Simulated



^{*1} The periodically changing amount of sea level caused by the gravitation of the moon and sun.

Storm Surge Flood Engineering Model:

1. Estimate Flooded Areas and Flood Levels

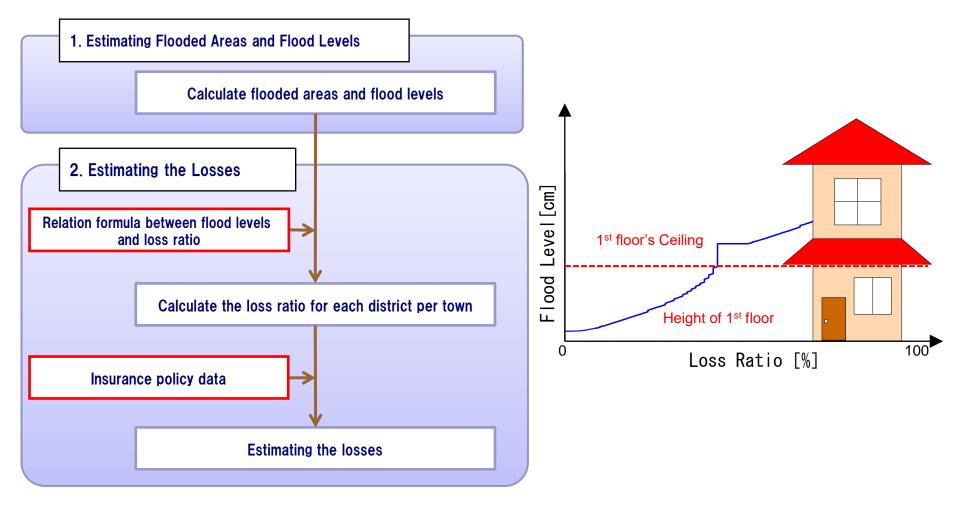
Calculate the amount of seawater inundating land based on the rise in tide level and how the seawater spreads on land, thereby determining flooded areas and flood levels.

Calculate the amount of rise in tide level (1) Seawater inundates land. (Bank data) (2) The floodwater spreads. (Altitude data) Calculate flooded areas and flood levels * Data inside the parentheses are mainly used.

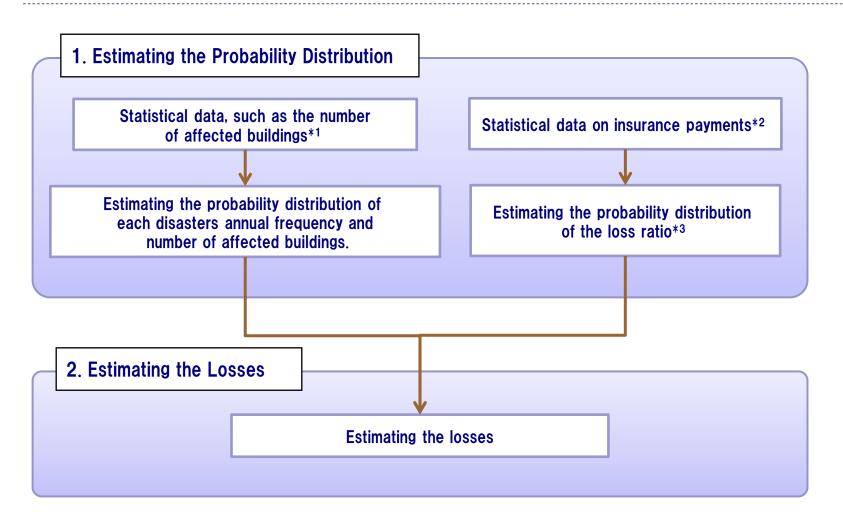
Simulated typhoon Calculated amount of the tides water level Shallow < Deep Calculated result for flooded areas and flood levels

Storm Surge Flood Engineering Model: 2. Loss Assessment

By combining the flooded areas and flood levels calculated by the Storm Surge flood simulation, and the "relation formula between the flood levels and the loss ratio", the loss ratio per town is determined, and the loss is estimated from insurance policy data.



Overview of Statistical Flood Model



^{*1} Flood Damage Statistics Survey (Ministry of Land, Infrastructure, Transport and Tourism) etc. is used.

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

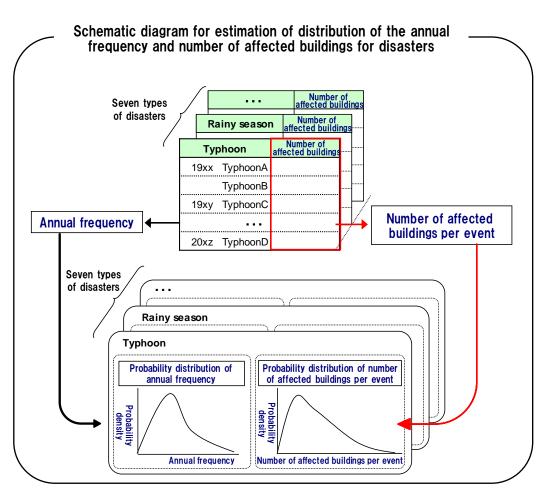
^{*3} Loss ratio = amount of loss / insured value

Statistical Flood Model: 1. Estimating the Probability Distribution

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

■ Based on statistical data of the number of affected buildings etc, the probability distribution of the annual frequency and the number of affected buildings are estimated according to each seven types of disasters (1.typhoon, 2.rainy season, 3.heavy rain, 4.wind and waves, 5.snow melting, 6.landslides, and 7.other extraordinary disasters).

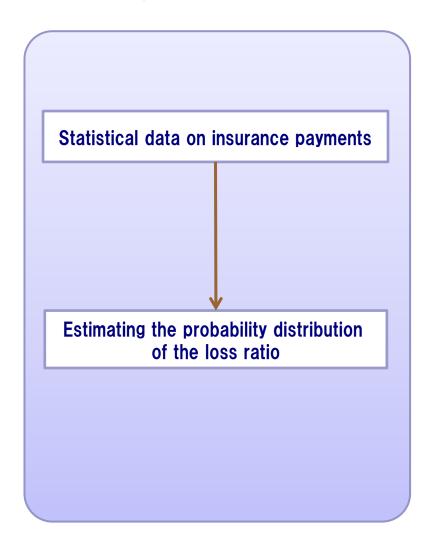
Statistical data, such as the number of affected buildings Classify into seven disaster types based on disaster names Estimate the probability distribution of the annual frequency and number of affected buildings for each disaster

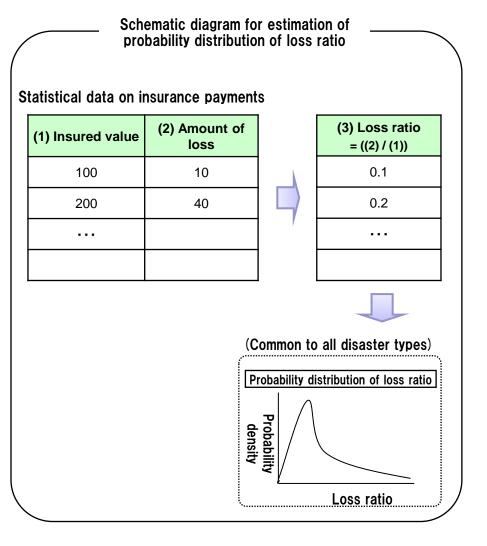


Statistical Flood Model: 1. Estimating the Probability Distribution

(about the distribution of the loss ratio)

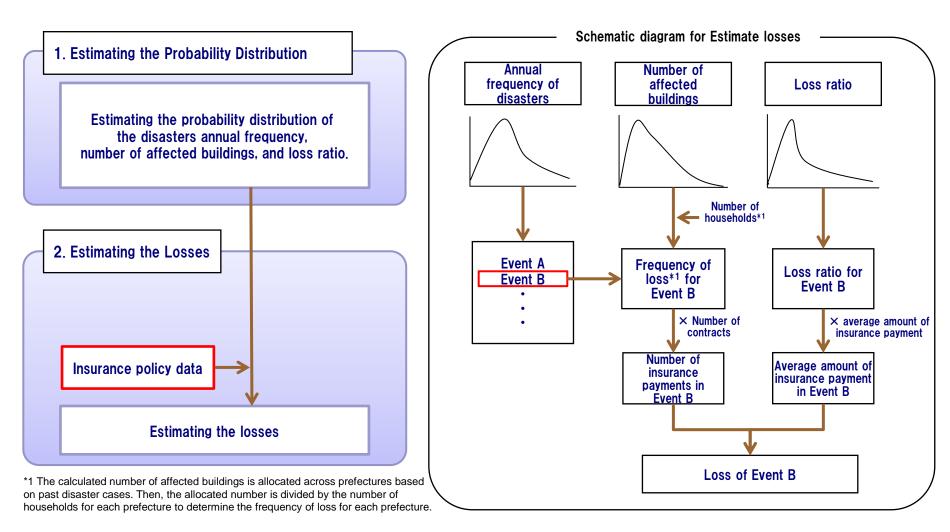
Estimating the probability distribution of the loss ratio common to all disaster types based on statistical data on insurance payments.





Statistical Flood Model: 2. Estimate Losses

■ Calculating the disasters annual frequency, number of affected buildings, and the loss ratio based on the estimated probability distribution. Then, after determining the number of insurance payments and the average amount of insurance payments using the insurance policy data, the loss is estimated per type of disaster, per prefecture.





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