

# sigma *extra*

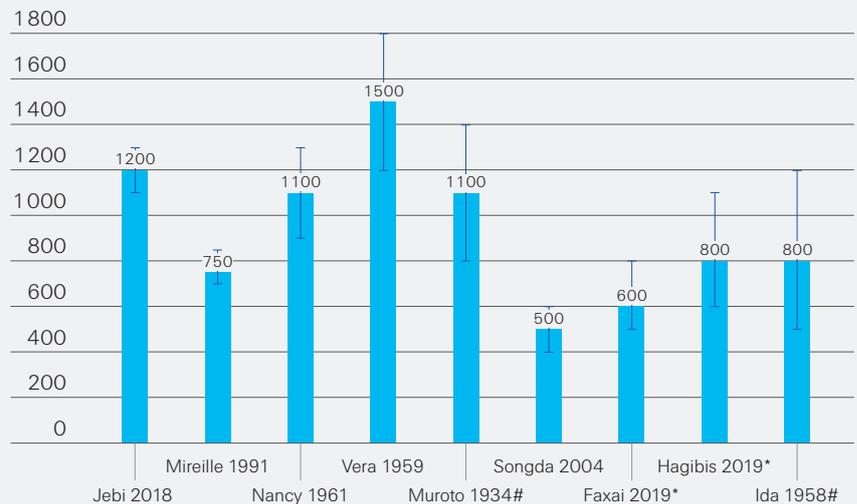
## Japan: typhoons, wind and secondary peril flood risk

**Typhoons in Japan are no surprise: the last 100 years have seen repeated occurrence of this peril. However, Typhoons Hagibis in 2019 and Prapiroon in 2018, have put a spotlight on flood risk potential in Japan. With huge investment in coastal and inland flood defences after devastating typhoon events in the 1950s and 1960s, the insurance industry has long considered flood risk in Japan to be largely mitigated. The two events challenge this assumption.**

### Typhoon Hagibis: a wake-up call

The last 100 years provide a good reference for typhoon occurrence in Japan. In terms of modelled loss events, there have been three large typhoon events in the last two years: Typhoons Hagibis and Faxai in 2019, and Jebi in 2018. There have been at least three events of similar magnitude to Jebi in Japan over the last century: Muroto (1934), Vera (1959) and Nancy (1961). Typhoons Muroto, Nancy and Jebi followed very similar tracks in battering the Osaka region.

**Figure 1**  
Japan typhoon loss experience of the last 85 to 100 years



# of events exceeding in 85 y (1934–2018)  
JPY 500 bn: 6+, less than 14y | JPY 750 bn: 5, every 17y | JPY 1000 bn: 4, every 21y

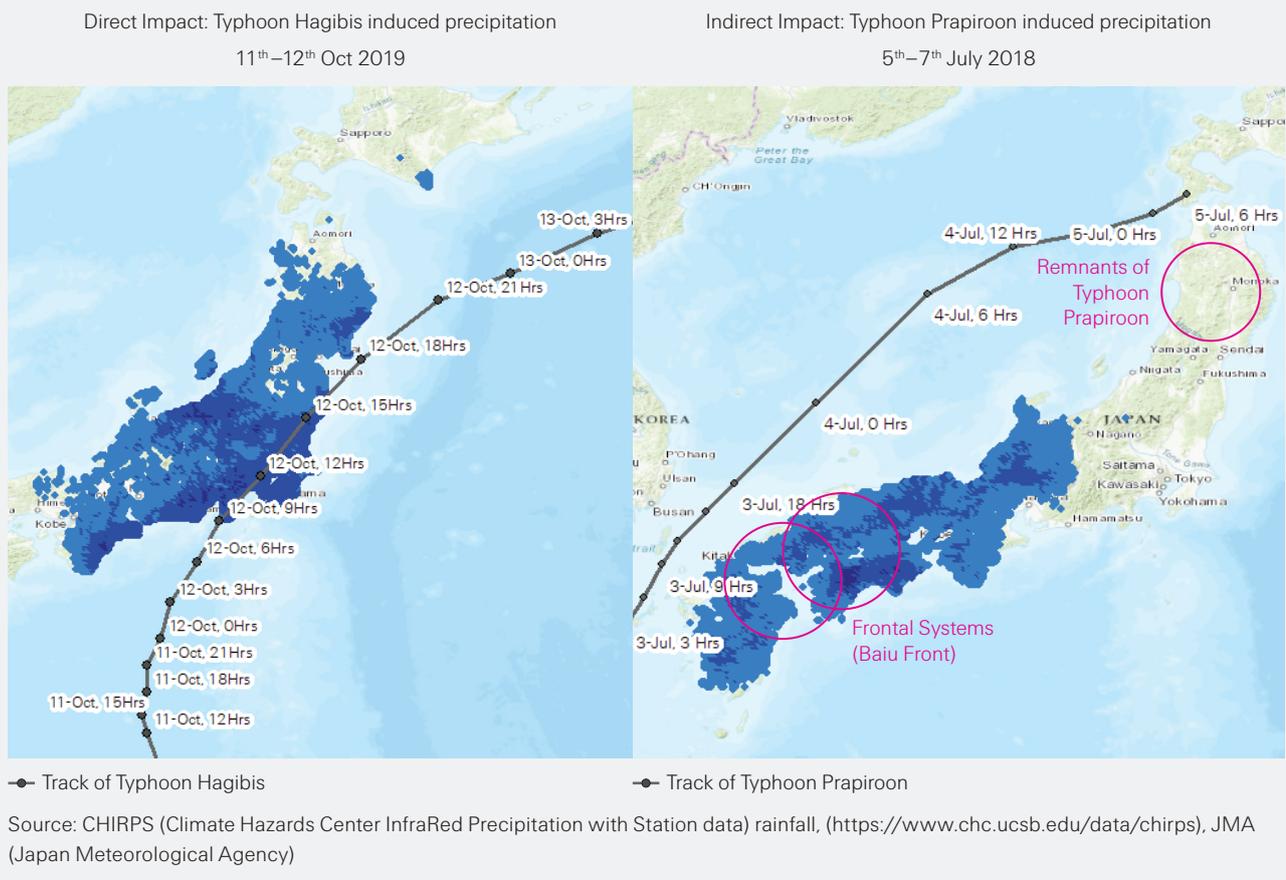
Swiss Re estimates are based on market exposure estimated using client data and do not include mutual and motor business. 2018 and 2019 event losses are based on current market estimates which are yet to be fully settled. Typhoon Muroto and Typhoon Ida losses are assumed to be same as Typhoon Nancy (2nd Muroto) and Typhoon Hagibis but with higher uncertainty. Before 1950, only Typhoon Muroto was highlighted due to high uncertainty about other events.

Source: Reported losses from the General Insurance Association of Japan losses, market and Swiss Re estimates

Typhoon-induced rainfall is responsible for the majority of flooding in Japan. This can manifest either primarily from a typhoon, or as a combination of typhoon with other weather systems present at that time. The severity of precipitation depends on several factors such as intensity, speed, size, topography, and existing weather conditions. Japan's mountainous geography encourages precipitation by forcing moist air to rise after typhoons make landfall and travel inland. Slower moving and larger cyclones can lead to increased precipitation over a wider area. With its large size, Typhoon Hagibis caused high intensity rainfall over a large area of Japan.

Many times, the interaction of cyclones with existing weather systems (eg. upper-level trough and cold frontal systems) is the main driver of intense rainfall. This can induce heavy rainfall in distant areas often when interacting with other weather systems. Typhoon Prapiroon in 2018 initially produced rainfall in south-western Japan as it passed over the Sea of Japan. It then interacted with the seasonal "Baiu" front to cause enhanced and widespread precipitation in western Japan (see right side of Figure 2). This combination of typhoon and local weather systems results in a heavy rainfall event.

**Figure 2**  
Precipitation from Typhoons Hagibis and Prapiroon



While not unexpected, the events of the last two years have challenged the current insurance industry view of tropical cyclone wind and flood risk in Japan. In particular, flooding from Typhoons Hagibis and Prapiroon has put a spotlight on the flood risk potential. With huge investment in coastal and inland flood defences in Japan in the 1950s and 60s, flood risk has been largely assumed to be mitigated. Typhoon Hagibis in particular has challenged this assumption: while flood protection

measures successfully prevented major havoc in the denser portions of Greater Tokyo, at least 55 levee breaches and overflowing rivers illustrated a substantial flood risk only partially mitigated. Out of the USD 8 billion in insured losses, an estimated 60-70% stemmed from flood losses. Today's flood defences mitigate the impact, but certainly not entirely.

Historically many typhoon events in Japan have caused severe flooding, most prominently Typhoon Kathleen (1947) and Ida (1958). Both caused severe flooding in Greater Tokyo and the surrounding regions, despite low wind speeds. A recurrence of Kathleen and Ida could potentially trigger higher losses than Hagibis. Typhoons Jebi and Hagibis are a wake-up call for the industry to review the adequacy of the underwriting of this peak peril, both from wind and flood risk perspective. In turn, Typhoons Prapiroon and Hagibis underscore the severity potential of typhoon-induced flooding. Despite market perceptions that such large-scale events are a 1-in-50-year occurrence or longer, historical data shows a much shorter 25 to 30-year period, highlighting a material gap in assessing this risk.

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