

Relationship between typhoon-induced hazards in East Asia, pressure and SST pattern in Pacific Ocean during the Middle to Late Holocene

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Statistical analysis of observational typhoon records revealed that Distribution and size of high SST area in low latitude Pacific are mainly controlling the location, size, and frequency of typhoon occurrence. It is also empirically revealed that pressure patterns in mid-latitude North Pacific and East Asia are mainly controlling tracks of typhoons. However, the time range of observation is too short to resolve the periodicity and potential cause of huge typhoons that cause enormous hazards, which are rarely observed in spite of their critical impact on human society. Therefore, it is necessary to evaluate whether the observed relationship between features of typhoons (tracks, sizes and frequency) and climatic conditions (SST and pressure pattern) could be extrapolated to huge typhoons and induced flood events that have never observed after instrumental observation started.

Because flood events recorded in sediment and speleothem can be traced back to geologic past beyond the instrumental observation, analyzing these records can contribute to resolving the spatio-temporal pattern of typhoon-induced hazards and relationship between huge typhoons and background climatological setting in long term.

In this study, we quantitatively reconstructed flood records in the Japan Sea side of central Japan based on the occurrence and thickness of event layers in Lake Suigetsu. It has been proved that event layers of the Lake Suigetsu sediments were formed by floods induced by typhoons and their thicknesses represent the total precipitation caused by the typhoon. As the age model of the sediment in Lake Suigetsu during the Holocene is firmly established based on terrestrial ¹⁴C dating, this record could be correlated to other records in high resolution.

Flood records in Lake Suigetsu revealed that exceptionally huge flood events repeatedly occurred with multi-centennial periodicity and shows a similar millennial-scale pattern with flood record in speleothem of South China. In the long term, the two flood records show high frequency and intensity of flood events that are associated with the eastward spreading of high SST area in the equatorial area of Pacific Ocean. On the other hand, in centennial time scale, regional difference in paleo-flood records in South China and SW Japan is observed suggesting that pressure pattern or other conditions would also control the long-term variability of tracks of typhoons, in turn, regionality of typhoon-induced flood events.

Keywords: Sediment, Lake Suigetsu, Typhoon, El Nino