

Temporal and Spatial Characteristics of Typhoon Induced Precipitation over Northern Japan

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Introduction:

Typhoons are considered as one of the dangerous weather phenomena in the earth that caused widespread flooding to the landfall regions. Over the year, plenty of typhoons have made landfall over Japan and some of them have devastated large areas and impacted millions of people by extreme precipitations (Takemi et al. 2016; Takemi, 2019). In August 2016, three typhoons [Typhoon Chanthu (T1607), Mindulle (T1609), and Kompasu (T1611)] made landfall over Hokkaido region and one typhoon [Lionrock (T1610)] made landfall over Tohoku region. All these typhoons caused widespread damages over northern Japan with excessive precipitations. However, studies are limited to understand the temporal and spatial structure of precipitation, particularly the precipitation size and duration within individual typhoons. In this study, we analyzed the precipitations induced by these four typhoons to investigate their extreme precipitation spell duration and size.

Data and Methods:

The hourly precipitation datasets from the Radar Automated Meteorological Data Acquisition System (Radar-AMeDAS) are utilized in this study to analyze the precipitations carried by each typhoon individually. We analyzed the precipitations at each grid over land in northern Japan covering 39-45E & 139-146E. There were about 6 million grid points over land. To investigate the spell duration of the extreme precipitations, we first collected independent spell durations of precipitations exceeding various percentile of thresholds starting from 50 to 99.99 percentile. Then we stratified the durations into

various duration bins. Finally, we calculated the frequency in each bin. In the similar way, we investigated the size of the precipitations.

Preliminary Results:

Figure 1 shows the probability of the duration of extreme precipitations for the Typhoon Chanthu. It shows the duration of the precipitations exceeding various percentiles of precipitation in the range between 50% and 99.99%. Results indicate that the occurrence of extremely heavy precipitations (higher than 99th percentile) are short-lived and last up to 6 hours. The extreme precipitation with intensity below 90th percentile last at least 9 hours. We also find long-lived precipitations which last 12 hours and more, although they don't occur so frequently.

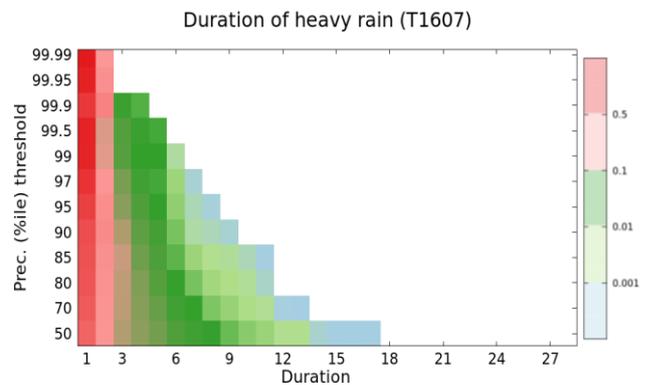


Fig 1: Frequency of precipitation durations induced by the Typhoon Chnathu

The duration of extreme precipitations induced by the Typhoon Mindulle is shown in Figure 2. It shows mostly similar feature like Typhoon Chanthu. The duration of extreme precipitation with intensity exceeding 95th percentile last up to 6 hours and that of with intensity below 90th percentiles last at least 8

hours. Similar to Typhoon Chanthu, long-lived precipitations carried by Typhoon Mindulle last 12 hours and more

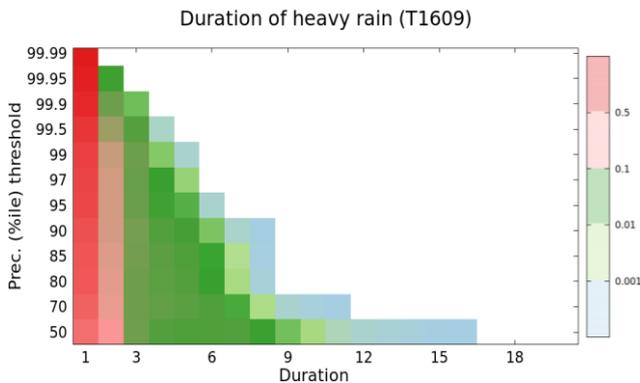


Fig 2: Frequency of precipitation durations induced by the Typhoon Mindulle

Figure 3 shows the duration of extreme precipitations induced by the Typhoon Lionrock. It shows that the extremely heavy precipitations (higher than 99%) last up to 8 hours which is nearly same as Typhoon Chanthu, while that with intensity below 90% last at least a day or more. Typhoon Lionrock also carried much longer (>1.5days) precipitations to the northern Japan.

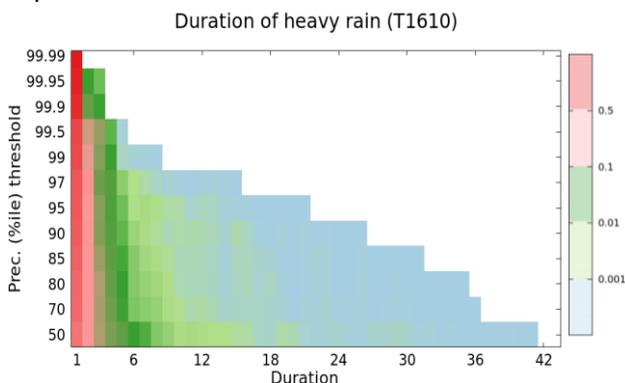


Fig 3: Frequency of precipitation durations induced by the Typhoon Lionrock

The duration of extreme precipitations induced by Typhoon Komapsu is shown in Figure 4. It shows a similar precipitation spell duration feature to Typhoon Chanthu and Typhoon Mindulle, implying robust features of the durations of extreme precipitation carried by all the three typhoons to Hokkaido region. For Typhoon Komapsu, we find that the duration of

extreme precipitations with intensity below 90th percentile last at least 12 hours, while for Typhoon Chanthu and Typhoon Mindulle it corresponds to at least 8-9 hours.

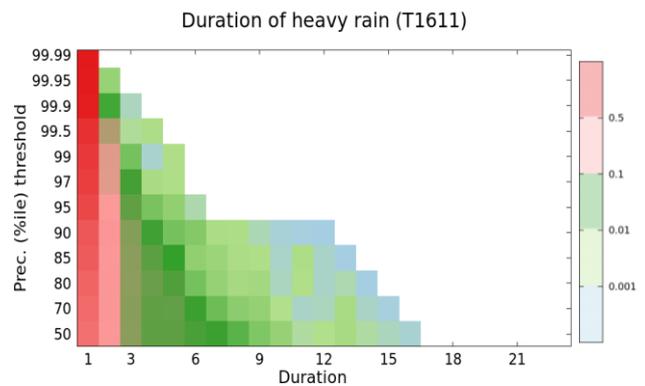


Fig 4: Frequency of precipitation durations induced by the Typhoon Komapsu

Summary:

In this study, we explore the temporal characteristics of the extreme precipitations induced by the landfalling of four typhoons over northern Japan. We find a robust feature of the durations of extreme precipitations induced by all three typhoons over Hokkaido. This study is preliminary and we would like to discuss more on this with the size of the extreme precipitations.

Acknowledgments:

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References:

- Takemi T., R. Ito, and O. Arakawa, 2016b: Robustness and uncertainty of projected changes in the impacts of Typhoon Vera (1959) under global warming. *Hydrological Research Letters*, 10(3), 88-94.
- Takemi, T. (2019). Impacts of global warming on extreme rainfall of a slow-moving typhoon: a case study for Typhoon Talas (2011). SOLA.