# Analysis of Precipitation Distribution Associated with the Tropical Cyclones in the Northwest Pacific

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Recent satellite precipitation products allow analysis of tropical cyclones (TCs) with high spatial and temporal resolutions. Fudeyasu and Yoshida (2018) pointed out that subsequent development and tracks differ depending on the environmental factors of TC occurrence. In this study, we clarify the diurnal cycle of TC precipitation according to TC intensity and precipitation distributions according to the environmental factors of TC generation by using 1-hour precipitation data.

Precipitation data used in this study were combined Radar AMeDAS for the Japanese land area and GPM IMERG Final Precipitation for the other land and sea areas to produce 1-hour precipitation with 0.1 degree grid. TC precipitation is defined as precipitation within 1,000 km of the TC center location from RSMC Best Track Data. Precipitation distribution is analyzed for TCs occurring in the northwest Pacific Ocean from July to October in 2015 to 2019. TCs were classified into five intensity classes: tropical depressions (TDs), typhoons (defined as Tropical Storm (TS), Severe Tropical Storm (STS), and Typhoon (TY) in terms of maximum wind speed), and extratropical cyclones (ECs). In addition, the environmental factors of TC occurrence were also synthesized. In addition, TC-generating environmental factors are classified into five categories: monsoon shear line (SL), monsoon confluence region (CR), monsoon gyre (GY), easterly wave (EW), and preexisting TC (PTC).

Diurnal changes of typhoon (TS, STS, TY) precipitation by TC class are shown in Fig. 1. In TD, the maximum precipitation area is located near the center, while in TS, the strong precipitation area shifts from the center to the south. At STS, the precipitation areas were concentrated in a north-south direction. As the intensity of the typhoon increased, the shape of precipitation distribution became concentric circles at TY, and the eye of the typhoon became clearer. In addition, we compared the differences between each time period and the morning, as well as the north-south and east-west cross sections across to the center of the TCs. The STS, which showed the largest diurnal changes among the typhoons, showed heavy precipitation at the north of the center in the afternoon and evening, and heavy precipitation appeared at south of the center in the morning. Two precipitation peaks were found in the center-north and the center-south directions for the evening.

Next, analysis by environmental factors of TC occurrence shows different composite precipitation distribution each other (Fig.2). These characteristics imply that the middle and lower troposphere is relatively moist in SL and CR due to high mean precipitation, while EW is dry. In addition, GY has a wide range of precipitation at the time of TS formation, and PTC tends to be strong during the maturation period and does not remain weak, which is consistent with the previous studies.

 

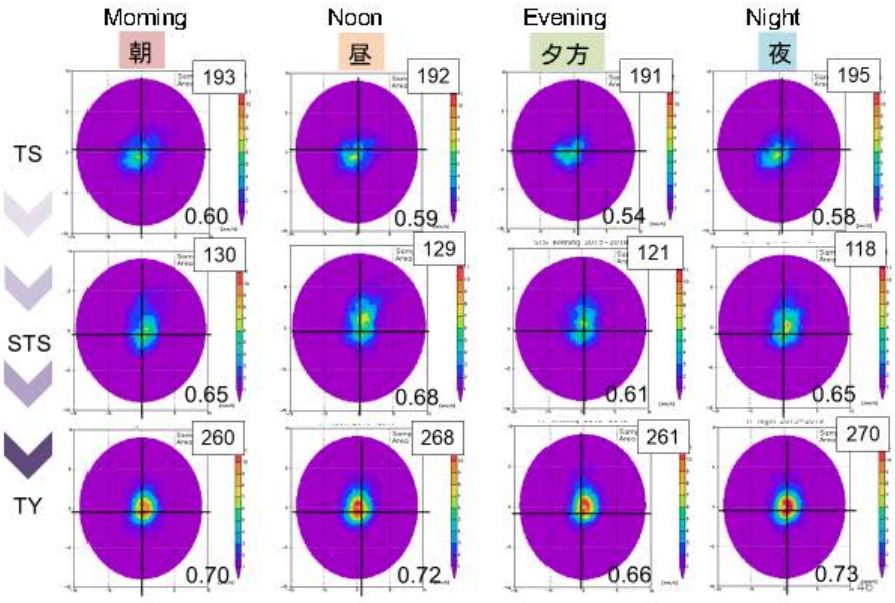


Fig.1 Composite maps of hourly precipitation according to the typhoon intensity (TS, STS, TY) and to the time-zone (morning, noon, evening, night). Number at upper-right corner of each panel shows sample number, and that of lower-right shows averaged precipitation (unit: mm/h) over the area.

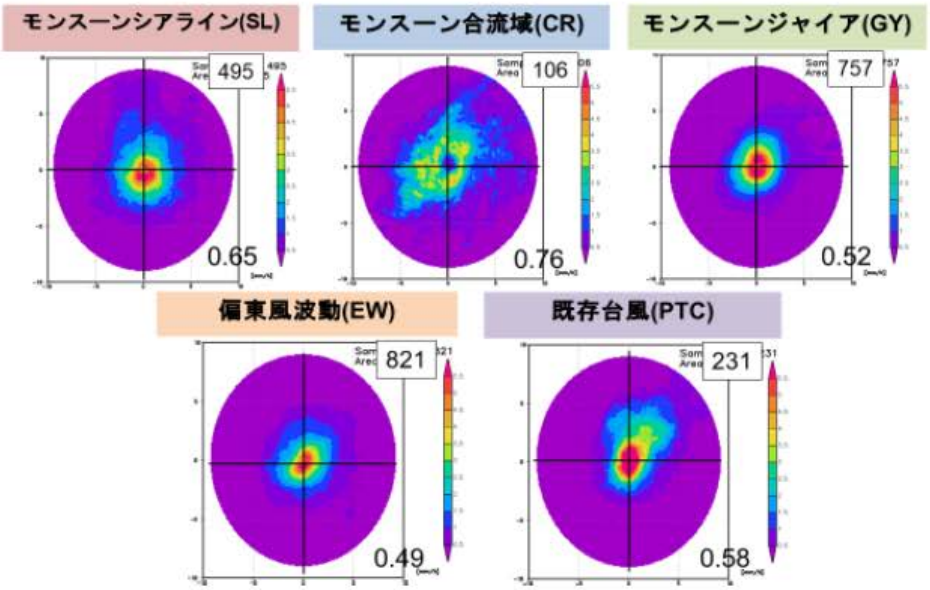


Fig.2 Composite maps of hourly precipitation according to the type of TC generation. Details are the same with Fig.1.

 