

Relation between Lightning Activities Measured by the V-POTEKA Network and Intensity Development of Western North Pacific Typhoons

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Lightning activity is a good proxy representing the precipitation and updraft intensities in thunderclouds. Recent studies suggest that the monitoring of the lightning activities has a high potential to predict the maximum wind speed and minimum sea-level pressure of the tropical cyclone by one or two days before, though the prediction error of typhoon intensities by the recent meteorological model is getting worse in the past 30 years. Many countries in the western north Pacific region suffer from the attack of tropical cyclone (typhoon) and have a strong demand to predict the intensity development of typhoons by means of a cost-effective way. Thus, we have developed a new automatic lightning observation system (V-POTEKA) and installed this system in the Philippines, Guam, Palau, Jakarta, Okinawa, and Sapporo since September 2017. Using the V-POTEKA data, lightning locations are estimated by using the time-of-arrival geolocation software. We have compared the relation between the lightning activities measured by the V-POTEKA network and the intensity variation of the western north Pacific typhoons in 2018 and 2019. In 2018 and 2019, a total of 29 and typhoons occurred, respectively. As for the 2018 typhoons, we selected 11 of 29 typhoon events and conducted cross-correlation analysis between lightning activities and typhoon intensities. We confirmed that the time variations of the detected lightning event numbers and typhoon intensities (maximum wind speed and center pressure) are highly correlated. Especially, there is clear time lag (~1.5 days) between lightning activities and typhoon intensities in the category 1-3 typhoons, that is, the peak of lightning activity comes first, then the peak of the typhoon intensity comes next. However, as for the super typhoons (category 5 typhoons), this relation is not always clear. At the presentation, we will also show the detailed results derived from this cross-correlation analysis between lightning activities and intensity development of the 2019 typhoons.

Keywords: Lightning activity, Typhoon, Intensity prediction