Rapidly Weakening Tropical Cyclones: Analysis and Impacts in the Philippines

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ABSTRACT

Tropical cyclones (TCs) are considered as one of the most destructive weather phenomena that can cause socio-economic damages and widespread loss of lives. Different studies were done to improve the forecasting of track and intensity changes of TCs. However, the prediction of drastic changes in intensity, both rapid intensification and rapid weakening, is still a challenge to operational weather forecasting. Improving the forecasts of TC intensity changes, especially rapid weakening of a TC before landfall, will be beneficial to avoid dissemination of false alarms and unnecessary disaster management efforts that can inflict warning fatigue and damage the reliability of the warning system to the public.

Rapidly weakening (RW) TCs are described as having drastic decrease in intensity within 24 hours over water. Varying thresholds were used to define RW, but more recent studies described RW as a 24-hour intensity decrease of at least 40 kt which approximates the 95th percentile of all 24-hour over-water weakening rates in the Western North Pacific (WNP). Previous studies have shown that most RW events over the WNP basin are concentrated to the northeast of the Philippines.

Most of the studies on RW TCs over the WNP are focused on characterizing the RW events and determining the influence of large-scale environmental parameters to RW events. However, there is still no study focusing on how RW occurrences affect the prevailing weather of the nearest landmass. This study, then, proposes to characterize RW events over the WNP including those RW TCs that affect the Philippines using TC datasets from JMA and JTWC. An intensity decrease of at least 20 kt in the JMA dataset and at least 25 kt in the JTWC dataset approximate the 90th percentile of all 24-hour weakening periods in each of the best-track datasets. These two thresholds were used as the definition of RW in this study. An analysis on how environmental conditions such as sea surface temperature (SST), vertical wind shear (VWS), and mid-tropospheric relative humidity (MTH), initiate and affect an RW event will also be performed using the ECMWF Reanalysis v5 (ERA5) data. The impacts of landfalling and non-landfalling RW TCs to the Philippines will also be determined using the power dissipation index (PDI) and by analyzing the gridded or satellite observational data on the amount of rainfall in the region and period of interest. The results of this study will be helpful in improving the intensity forecasts in

the tropical WNP basin. This will also be beneficial to proper dissemination of what weather conditions should be expected when RW TCs are near or landfalling in the Philippines.

Keywords: tropical cyclones, rapid intensification, rapid weakening, warning fatigue