UNIVERSITY OF THE PHILIPPINES

Master of Science in Meteorology

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Rapidly Intensifying Tropical Cyclones: Landfalls and Impacts in the Philippines and Prediction Using Himawari-8 Infrared Brightness Temperature

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ABSTRACT

Rapidly intensifying tropical cyclones (RI TCs), defined as having a 24-hour intensity increase of at least 25 kt, have long been studied due to greater hazards associated with them as compared to non-RI TCs. In the Western North Pacific (WNP) basin, most of the historical RI events occurred just to the east of the Philippines, making it one of the most vulnerable countries in the WNP region. Yet, the characteristics and impacts of this phenomenon at local landfall have not been examined. Using a combined best-track data from JMA and JTWC, it was revealed that RI TCs on average have significantly higher intensity at landfall in the country. During RI TC landfall events, the country experienced heightened surface winds. In examining the upper ocean heat content (OHC) and the vertical wind shear (VWS), two of the primary factors that affect TC intensification, it was found that these parameters alone cannot determine RI since RI also occur in near-normal OHC and VWS conditions. These findings fuel the need to further look for a robust RI predictor scheme in the basin, which the study also delves into by examining the potential of using information from Himawari-8 geostationary infrared (IR) satellite imagery. To forecast TC RI, the amount of pixels exceeding a certain threshold of brightness temperature within certain radii from a TC center is examined at different lead times prior to RI events. This is to examine the amount of overshooting clouds that are known to appear before RI. Combinations of these parameters were evaluated against the RI occurrences of 79 TCs in the basin from 2015-2020 to obtain the optimal set of predictors for each of the three RI thresholds used in the study (25-kt, 30-kt, and 35-kt in 24 hours). Independent testing on 53 TCs in the same period demonstrated that a similar set of predictors can be used to forecast RI events 18 hours before it occurs. The empirically-derived RI prediction scheme shows

good RI forecast skill with low false alarm rates and probability of false detection values indicating its robustness.

Keywords: Tropical cyclones, Rapid intensification, Infrared satellite imagery