SPATIO-TEMPORAL VARIATION OF EXTREME WAVE HEIGHTS DUE TO THE PASSAGE OF TROPICAL CYCLONES

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ABSTRACT

Tropical cyclones (TCs) can directly cause a disturbance along its path on land and ocean such as damaging winds, torrential rain, storm surge, and breaking waves. Meanwhile, previous studies have shown that non-landfalling TCs, TCs that enter the Philippine Area of Responsibility (PAR) without passing through the Philippines, located along northwest to northeast of Luzon can influence the monsoon flow during southwest monsoon (May-September). There is no existing literature yet of the effects of the TC-enhanced monsoon winds on the ocean wave climate over the major seas surrounding the Philippines, namely, the Philippine Sea (PS) and the South China Sea (SCS). TCs induce strong winds that transfer energy to the ocean surface and cause waves. Swells are then generated when waves continue to propagate beyond the generation area. Extreme cases of waves bring hazard to marine ecosystem, navigation, and coastal structures. Therefore, understanding the relationship between extreme wave events and TCs can lead to better marine conservation efforts and improvement of coastal design. The objectives of this study are (1) to identify and analyze the spatial and temporal patterns of TC-induced extreme wave heights in PAR and (2) examine the relationship between the two main TC tracks, landfalling (TCs that make a landfall in the Philippines) and non-landfalling TCs, and the extreme wave heights together with its wind wave and swell components. High percentile cases (upper 85th, 95th, and 99th) of significant wave H_s from WAVERYS dataset by Copernicus Marine Environment Monitoring Service (CMEMS) during the period 1993-2020 are taken as the extreme wave heights. The data of TCs formed in the western North Pacific (WNP) basin is obtained from the International Best Track Archive for Climate Stewardship (IBTrACS). The 28-year extremes are analyzed in quarterly periods (December-February (DJF); March-May (MAM); June-August (JJA); and September-November (SON)) to account TC track seasonality and monsoon that could impact the distribution of extreme wave heights. The relationship between TCs and extreme wave heights is quantified using Pearson's correlation while characteristics of TCs coincident to extremes are also determined. The contribution of the wind wave and swell components to the combined extreme wave heights due to TCs are computed to analyze both components separately.

Keywords: *tropical cyclones, extreme waves, southwest monsoon, the Philippines, reanalysis dataset*