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INFLUENCE OF THE WEST PACIFIC SUBTROPICAL HIGH ON LANDFALLING WINTER TROPICAL CYCLONES IN THE PHILIPPINES

ABSTRACT

Tropical cyclones (TCs) are a major feature of the Philippine weather & climate system, providing needed rainfall in maintaining the country's water balance. However, landfalling TCs also deal damages to property and loss of life through various hazards they induce. Previous studies discovered a slightly increasing frequency trend of TCs making landfall in Visayas and Mindanao but did not investigate the drivers that led to such changes. Among these drivers is the West Pacific Subtropical High (WPSH). This study investigated the impacts of the long-term changes of the WPSH on TC tracks in the Philippine Area of Responsibility (PAR) during the months of November to January for the years 1958 to 2021. Changes in TC tracks passing through the PAR were observed, particularly, an abrupt increase in TC landfall frequency in Visayas and Mindanao regions from an average of 10.2 TCs per decade since the 1950s to 23 that made landfall during the decade 2011-2020. This abrupt increase also led to higher TC-induced rainfall along the Visayas and Mindanao regions for the said decade. The increase was due to the intensification and southwestward propagation of the WPSH over the decades. The decadal mean of the 5870-gpm contour line's westernmost tip moved from 17ºN-140ºE to 14ºN-80ºE in the last six decades. Areal gpm means which depict the WPSH were calculated from the JRA55 reanalysis data. The locations for the areal means for geopotential height were selected based on comparing the WPSH intensity during TC landfall dates versus TC non-landfall recurving dates as well as the location of WPSH extent intrusion into the Philippine Sea. They show a link between WPSH strength and likelihood of TC landfall in the Philippines. Correlation maps were then used to analyze the trend and variability of the WPSH. Results show that intrusion of WPSH in the Philippine Sea is significantly correlated with sea surface temperatures (SSTs) of the East Indian Ocean (EIO; r = 0.81) and the West Philippine/South China Sea (SCS; r = 0.80). Correlation maps also show a positive correlation to the Central-Eastern Pacific, which appears like the El Niño Southern Oscillation (ENSO) tongue. Time series analysis for WPSH areal means, SST differences and the Oceanic Niño Index (ONI) also showed similar patterns with peaks and dips occurring in similar years with results showing WPSH intensity being significantly correlated with the SST difference between the EIO and the West-Central Pacific (r

= 0.59), between the West-PH Sea/SCS and the West-Central Pacific (r = 0.69), and the ONI (r = 0.59) indicating a positive relationship among SST, ENSO and WPSH intensity. Once the intensification of the WPSH intruded the Philippine's eastern sea, TCs making landfall in Visayas and Mindanao increased. Overall, these results can serve as basis for future climate projections on WPSH behavior, improve existing TC prediction schemes, and for a more direct inclusion of the WPSH in future climate outlook forums.

Keywords: *West Pacific Subtropical High, tropical cyclone tracks, northeast monsoon, Sea Surface Temperature, ENSO*