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The Pacific Decadal Oscillation Modulates Tropical Cyclone days in the North Pacific Ocean

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Tropical cyclones (TCs) in the North Pacific Ocean claim a major socio-economic toll on a yearly basis, and their impacts are projected to be exacerbated due to climate change and increased exposure and vulnerability. Recent examples of Typhoons Mangkhut (2018) and Hagibis (2019) are a reminder of the devastating impacts these storms can have. While the TC activity in the West North Pacific (WNP) and East North Pacific (ENP) has been the subject of intense investigation, these basins are generally treated separately, rather than considering the storm activity in the North Pacific as a single basin. The influence of climate processes, such as the Pacific Decadal Oscillation (PDO) , that operate across the entire North Pacific may not have been considered by focusing on the sub-basins, especially if we are interested in multi-annual and decadal changes. It is reasonable to hypothesize that a climate mode like the PDO could play an important role in terms of TC activity in this basin. However, there is limited evidence that connects these storms and the PDO. Our expectation is that the number of TC days is related to the PDO through the modulation of this climate mode of the SST in the regions where these storms develop. In particular, during the positive phase of the PDO, warm waters close to the equator would lead to conditions favorable to the development of longer-lasting storms compared to the negative PDO phase, which is characterized by lower SST values. We believe that this connection has not been sufficiently considered in the literature because the North Pacific Ocean was not considered as a single basin but broken up into WNP and ENP, confounding the detection of a potential PDO signal. Therefore, in this work we focus on the potential role of the PDO in modulating TC activity, with emphasis on the number of TC active days in the entire North Pacific Ocean. We have selected this metric because the number of TC days provides an integrated information about TC genesis, lifespan, and tracks, and because it exhibits substantial decadal-scale oscillations in TC activity compared to other metrics used to highlight TC activity. We aim to verify the effects of different SST patterns on the spatial distribution of TC genesis in the North Pacific leading to conditions that are more/less favorable for long-lasting TCs under positive/negative PDO phases. A larger number of TC days for storms that tend to develop along the tropics during the positive PDO phase is found. When we stratify the years according to the sign of the PDO phase, the years associated with the positive phase tend to have storms that form at a lower latitude and that last longer compared with the negative phase. On average, these storms tend to form around 14°N and to result in 240 TC days; during the negative PDO phase, TCs tend to form around 16°N, for a total of 160 TC days.