THE INFLUENCE OF TROPICAL INDIAN OCEAN SEA SURFACE TEMPERATURE VARIABILITY ON PHILIPPINE SEASONAL RAINFALL AND TEMPERATURE

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ABSTRACT

The Philippines, situated in the Indo-West Pacific region, is highly vulnerable to extreme weather and climate events, including tropical cyclones (TC), floods, and droughts. Seasonal rainfall and temperature variability significantly impact agriculture and water resources. Thus, a deeper understanding of the climate variability and extremes in the Philippines is crucial for disaster risk management, agriculture, and water resources.

While the Philippine climate is primarily influenced by monsoon systems, El Niño Southern Oscillation (ENSO), TCs, and the Madden Julian Oscillation (MJO), recent studies highlight the significant role of the two dominant modes of Tropical Indian Ocean (TIO) Sea Surface Temperature Anomaly (SSTA) variability—the Indian Ocean Basin Wide (IOBW) and Indian Ocean Dipole Mode (IODM)—on modulating global and regional climate. However, the influence of the IOBW and IODM on Philippine climate remains underexplored.

This study utilizes observational data from DOST-PAGASA and European Centre for Medium-Range Weather Forecasts reanalysis (ERA5) from December 1980-November 2022. Various statistical methods, including total correlation, partial correlation, linear regression, partial linear regression, and composite analyses, were employed to examine the influence of IOBW and IODM with or without ENSO on the Philippines' seasonal rainfall and temperature.

Results indicate that IOBW has a moderate relationship with rainfall in JJA with temperature variability across most seasons, with ENSO amplifying its impact on rainfall in DJF and MAM. During a warm IOBW event, upper-level divergence over the TIO strengthens an Anomalous Anticyclone (AAC) over the Western North Pacific (WNP), leading to its westward extension. This pattern contributes to year-round warming and weakened Southwest monsoon in JJA over the Philippines. This effect is further intensified with the presence of a weakened Walker Circulation in DJF and MAM, modulating rainfall patterns.

In contrast, IODM primarily affects rainfall in SON, with its impact over the Philippines being strongly linked to ENSO. A positive IODM combined with a weakened Walker Circulation enhances subsidence and dry conditions over the Philippines in SON, while the IODM alone drives a dipole-like climate pattern over the Indian Ocean, affecting localized rainfall patterns in the south of SEA.

Keywords: Indian Ocean Basin Wide, Indian Ocean Dipole Mode, Southwest Monsoon, Philippine climate, ocean-atmosphere interaction