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Exploring the Climatological Characteristics of Tropical Cyclone Rapid Intensification in the Northwest Pacific Using a New Index

Abstract

In recent years, the improvements in intensity prediction remain relatively limited. One of the main sources of error in intensity prediction is rapid intensification (RI). Therefore, improving our understanding of RI and the accuracy of RI prediction is especially important. Since the environmental conditions that favor tropical cyclone formation are related to those that favor RI, this study modifies Gray's (1979) Seasonal Genesis Parameter (SGP) to investigate the long-term characteristics of RI events using large-scale environmental variables.

This study revises the exponents of the SGP parameters by fitting them to the observed frequency of RI events using the Trust-Region-Reflective Least Squares Algorithm. The resulting index, termed the Seasonal RI Index, represents the estimated number of RI events occurring in a region during a given season. Correlation analysis shows that the fitted index is highly correlated with the observed distribution of RI events.

Since the resulting formula is nonlinear (involving multiplication), the study follows the method of Li et al. (2019) to convert the expression into a linear additive form. The analysis reveals that planetary vorticity, vertical wind shear, and ocean energy play important roles during both active and inactive RI seasons. Atmospheric stability is more significant during the active RI season, while the contributions from relative vorticity and humidity are relatively small.

Keywords

Rapid Intensification(快速增強)