國立中央大學大氣物理研究所書報討論

Low-Level Circulation Features of Winter Precipitation in Yilan: A Case Study by Ensemble Simulations and integrated observations

Abstract

This study investigates differences among ensemble clusters to identify key atmospheric conditions leading to wintertime precipitation over the Yilan Plain in 2021. Using observational datasets such as WISSDOM, Storm Tracker, wind profilers, and UAV, along with ensemble simulations, K-means clustering is applied to group ensemble members based on similarities in their wind and precipitation fields.

Results show that the cluster best matching the observed precipitation evolution does not necessarily produce the strongest rainfall amount. Cluster 2 most accurately captures the temporal evolution and progression of rainfall—from northeasterly winds entering the plain, to terrain-induced subsidence and westerly return flow that suppresses precipitation. In contrast, Clusters 3 and 4 produce rainfall amounts closer to observations, but show different spatial distributions due to stronger winds and different low-level circulation structures. Cluster 1, with colder and drier conditions, exhibits the weakest precipitation. The results highlight that different rainfall patterns can result from different wind structures. To fully understand precipitation development in complex terrain like Yilan, it is crucial to consider not only rainfall totals but also the underlying dynamic processes.

Keyword

Ensemble Forecasts