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A Study on Local-Scale Thermal and Dynamical Mechanisms in the Initiation of a Squall Line Under Weak Forcing

Abstract

For Localized heavy rainfall under weak synoptic forcing, there were difficulties in capturing and understanding the CI process. On the late afternoon of June 26, 2009, in Beijing under weak forcing conditions, a storm was triggered and evolved into a squall line. The author utilized VDRAS to investigated the CI mechanism by assimilating the radars and dense surface observations. From the VDRAS analysis, the study stated that the CI was triggered due to the contributions containing the local cold air mass and the outflows from a dissipating storm propagating on the western mountains. The local cold air mass produced by the cumulus congestus clouds in the late morning blocked the southerly flow and veered it to form a weak convergence zone in which moisture was accumulated. The CI was initiated due to enhanced convergence when the outflows from the weaken storms occurring in the late afternoon moved to the existing convergence zone. To further confirm the crucial role played by the local cold air mass, the author conducted the sensitivity experiments using WRF-FDDA. The results indicated that the local cold air mass along with the southerly environmental wind and storm outflows exerted a dominant influence on the CI.

Keywords

Convection Initiation (CI)

WRF Four-dimensional Data Assimilation(WRF-FDDA)

Reference

Xiao, X., Sun, J. Z., Ji, L., Zhang, L. N., Ying, Z. M., Chen, Z. X., Chen, M. X., & Xu, C. Y. (2022). A Study on Local-Scale Thermal and Dynamical Mechanisms in the Initiation of a Squall Line Under Weak Forcing. *Journal of Geophysical Research-Atmospheres*, ***127*****(5)**. https://doi.org/10.1029/2021JD035561