國立中央大學大氣物理研究所書報討論

Date：2025/12/05
Location：S1-713
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Impact of Assimilating Uncrewed Aircraft System Observations on River Valley Fog Prediction

Abstract

The Ohio River Valley and surrounding mountain valleys are prone to localized fog, posing risks to aviation at nearby airports. Improving fog prediction is essential. This study conducts observation system experiments (OSEs) to assess the impact of assimilating uncrewed aircraft system (UAS) observations alongside conventional observations. Observational data were collected during the 2022 Frequent in situ Observations above Ground for Modeling and Advanced Prediction of fog (FOGMAP), providing high-frequency vertical profiles of temperature and moisture from the surface to 120 m near Cincinnati/Northern Kentucky International Airport. The Ensemble Adjustment Kalman Filter (EAKF) is employed to evaluate the impact of UAS assimilation on analysis and forecast fields.

Results show that only assimilating conventional observations tends to produce a dry bias, which is reduced when UAS observations are included, improving fog prediction. Comparison of two nearby surface stations indicates that UAS data capture fine-scale atmospheric features, which enhance relative humidity (RH) forecasts and fog predictability even in the face of heterogeneous environmental challenges. This study demonstrates the effectiveness of UAS observations in improving lower-level humidity and fog forecasts and highlights the need for optimized UAS observing strategies, as well as the importance of clarifying the interactions between near-surface humidity, visibility, terrain, and wind.

Keyword

Radiation and Valley Fog, Uncrewed Aircraft System (UAS)

Reference

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