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The Roles of Local Circulation and Boundary Layer Development in Tracer Transport over Complex Topography in Central Taiwan

Abstract

The Taiwan Vector Vorticity Equation Cloud-Resolving Model, known as Taiwan VVM, is utilized to simulate the transport of pollutants in central Taiwan. The study focused on how local circulation, synoptic conditions and the development of the planetary boundary layer affect the movement and accumulation of pollutants in central Taiwan throughout the day. Thus, the study designed three types of wind directions to simulate the northeast monsoon, which is crucial for comprehending how pollutants are transported by wind patterns. Moreover, the study also regarded local non-traffic emission sources as tracer emission sites such as power stations and factories to make the simulations more realistic. By resolving the local wind patterns and terrain, it was able to observe how the development of the planetary boundary layer influences tracer transport in the Puli basin.

The results of the study indicate that both sea breezes and lee vortices play significant roles in the transport mechanism of tracer around central Taiwan. It was shown that high concentrations of tracer in Puli at night are mainly caused by a decrease in the depth of the mixed layer, which traps tracer near the surface. Furthermore, the simulations also indicated that the synoptic wind's direction can influence the origin of tracer. In other words, when central Taiwan is under a northeasterly due east (due north) wind pattern, tracer from the southern source (northern source) may lead to high concentrations in Puli during the night.

Keyword

Tracer transport

Lee vortex

Reference

Hsieh, M.-K., Y.-W. Chen, Y.-C. Chen, and C.-M. Wu, 2022: The roles of local circulation and boundary layer development in tracer transport over complex topography in central Taiwan. *J. Meteor. Soc. Japan*, **100**, 555–573, doi:10.2151/jmsj.2022-028.