# Unraveling the complex local-scale flows influencing ozone patterns in the southern Great Lakes of North America

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This study examines the complexity of various processes influencing summertime ozone levels in the southern Great Lakes region of North America. Results from the Border Air Quality and Meteorology (BAQS-Met) field campaign in the summer of 2007 are examined with respect to land-lake differences and local meteorology using a large array of ground-based measurements, aircraft data, and simulation results from a high resolution (2.5 km) regional air-quality model, AURAMS.

Analyses of average ozone mixing ratio from the entire BAQS-Met intensive campaign period support previous findings that ozone levels are higher over the southern Great Lakes than over the adjacent land. However, there is great heterogeneity in the spatial distribution of surface ozone over the lakes, particularly over Lake Erie during the day, with higher levels located over the southwestern end of the lake. Model results suggest that some of these increased ozone levels are due to local emission sources in large nearby urban centers. While an ozone reservoir layer is predicted by the AURAMS model over Lake Erie at night, the land-lake differences in ozone mixing ratios are most pronounced during the night in a shallow inversion layer of about 200 m above the surface. After sunrise, these differences have a limited effect on the total mass of ozone over the lakes and land during the day, though they do cause elevated ozone levels in the lake-breeze air in some locations.

The model also predicts a mean vertical circulation during the day with an updraft over Detroit-Windsor and downdraft over Lake St. Clair, which transports ozone up to 1500 m above ground and results in high ozone over the lake.

Oscillations in ground-level ozone mixing ratios were observed on several nights and at several ground monitoring sites, with amplitudes of up to 40 ppbv and time periods of 15–40 min. Several possible mechanisms for these oscillations are discussed, but a complete understanding of their causes is not possible given current data and knowledge.

存档文本



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