

Role of meteorological processes in two New England ozone episodes during summer 2001

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We examined the impact of dynamical processes on spatial variability in ozone (O_3) mixing ratios at closely spaced air monitoring sites in southern New Hampshire (NH) during two O_3 episodes, July 21–25 and August 2, 2001. The Meso-scale Meteorological Model (MM5) and the Community Multiscale Air Quality (CMAQ) photochemical model were applied together with ground-based atmospheric chemistry observations conducted by the Atmospheric Investigation, Regional Modeling, Analysis and Prediction (AIRMAP) program at the University of New Hampshire. Observations and model simulations suggested that during the July episode long-range transport via the nocturnal low-level jet (LLJ) played an important role in producing elevated daytime mixing ratios of O_3 . The marine site Isle of Shoals experienced the highest level of O_3 , possibly a result of having more diverse upwind sources and less ventilation compared to continental sites. Our model results suggest that during daytime the shallow sea breeze circulation contributes to high levels of O_3 at coastal and marine sites while the channeling effect of the Appalachian Mountains influences inland locations. In contrast to the July event, the event on August 2 was characterized by weak and transient synoptic flows, indicating insufficient time for transport of O_3 and its precursors from distant sources to inland sites in NH. Backward trajectories for both events showed that O_3 -rich air masses from the Boston metropolitan area can contribute to the high levels of O_3 (>120 ppbv) at coastal and marine sites in southern NH. Our results suggest that the International Consortium of Atmospheric Research on Transport and Transformation (ICARTT), an international field campaign based in the northeastern United States in summer 2004, should coordinate mobile platforms to investigate the vertical structure and chemical composition of the LLJ, the sea breeze, and the terrain-forced flows, and estimate the influx of O_3 and its precursors to central New England.