Impact of Mexico City emissions on regional air quality from MOZART-4 simulations

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An extensive set of measurements was made in and around Mexico City as part of the MILAGRO (Megacity Initiative: Local and Global Research Observations) experiments in March 2006. Simulations with the Model for Ozone and Related Chemical Tracers, version 4 (MOZART-4), a global chemical transport model, have been used to provide a regional context for these observations and assist in their interpretation. These MOZART-4 simulations reproduce the aircraft observations generally well, but some differences in the modeled volatile organic compounds (VOCs) from the observations result from incorrect VOC speciation assumed for the emission inventories. The different types of CO sources represented in the model have been "tagged" to quantify the contributions of regions outside Mexico, as well as the various emissions sectors within Mexico, to the regional air quality of Mexico. This analysis indicates open fires have some, but not a dominant, impact on the atmospheric composition in the region around Mexico City when averaged over the month. However, considerable variation in the fire contribution (2–15% of total CO) is seen during the month. The transport and photochemical aging of Mexico City emissions were studied using tags of CO emissions for each day, showing that typically the air downwind of Mexico City was a combination of many ages. Ozone production in MOZART-4 is shown to agree well with the net production rates from box model calculations constrained by the MILAGRO aircraft measurements. Ozone production efficiency derived from the ratio of Ox to NOz is higher in MOZART-4 than in the observations for moderately polluted air. OH reactivity determined from the MOZART-4 results shows the same increase in relative importance of oxygenated VOCs downwind of Mexico City as the reactivity inferred from the observations. The amount of ozone produced by emissions from Mexico City and surrounding areas has been quantified in the model by tracking NO emissions, showing little influence beyond Mexico's borders, and also relatively minor influence from fire emissions on the monthly average tropospheric ozone column.

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