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Nighttime Ozone Bias and Vertical Diffusion in Air Quality Modeling: Example Southeast Texas

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This study investigates the causes behind the nighttime ozone biases in southeast Texas, focusing on the Community Multiscale Air Quality (CMAQ) model's treatment of minimum nighttime eddy diffusivity coefficient (Kzmin). By using the default Kzmin setting (which leads to lower strength of nighttime vertical mixing), the average ozone bias is lower by 5.9 ppb for August 2015 as compared to the alternative Kzmin setting. The spatial pattern and vertical ozone profile showed remarkably different sensitivities for different sites, with minimal change in inner city and coastal sites and large bias reduction in some rural/suburban sites. The results showed that both down-mixing of aloft ozone and dilution of surface NO are important processes for nighttime ozone. The model high background ozone, outdated land cover/land use (LULC) data, model NO_x emission problems also likely have considerable effects on the nighttime biases. The impacts from uncertainties in model dry deposition and horizontal advection are likely less influential but not to be ignored.