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Evaluation of isoprene emissions and its impact on its impacts on tropospheric chemistry in East Asia

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Abstract

Biogenic species as a major precursor during summer play an important role in the ozone and SOA formations. However, biogenic emission fluxes are highly uncertain in East Asia. While the isoprene emission fluxes from the GEIA emission inventory estimate approximately 20 Tg yr^{-1} in East Asia, those from the MEGAN and MOHYCAN models estimate approximately 10 Tg yr^{-1} and 5 Tg yr^{-1}, respectively. In order to evaluate isoprene emission fluxes over East Asia, the tropospheric HCHO columns (Ω_{HCHO}) obtained from the GOME observations were compared with the tropospheric HCHO columns from the CMAQ model simulations. In this study, CMAQ v4.5.1 model simulations with the isoprene emission fluxes estimated from the GEIA, MEGAN, and MOHYCAN were carried out in conjunction with PSU/NCAR MM5 modeling for July and August, 2002. It was found that the tropospheric HCHO columns from the CMAQ model simulations with the MOHYCAN emission inventory were spatially more consistent than the $\Omega_{CMAQ,GEIA}$ and/or $\Omega_{CMAQ,MEGAN}$, when they were compared to the tropospheric HCHO columns from the GOME observations.

Secondly, the effects of the effects of the biogenic emission fluxes on the levels of oxidants, HO_y, and particulate species during summer over East Asia were investigated. As the biogenic emission fluxes decrease from the GEIA to MOHYCAN emission inventories, the levels of OH radicals increase by factors of 1.78 and 3.92 over Central East China and South China, respectively. The increases of OH radicals influence the levels of HO_y species during summer. The HO_2/OH ratios are enhanced due to the biogenic species. Such changes in the partitioning between OH and HO_2 radicals create large differences in tropospheric chemistry over East Asia during the summer months, for example, in the NO_y chemistry and NMVOC oxidations.