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Parameterization of HONO sources in Mega-Cities

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Nitrous acid (HONO) plays an important role in the photochemistry of the troposphere because the photolysis of HONO is a primary source of the hydroxyl radical (OH) in the early morning. However, the formation or sources of HONO are still poorly understood in the troposphere; hence the representation of the HONO sources in chemical transport models (CTMs) has lack comprehensive consideration. In the present study, the observed HONO, NO_x, and aerosols at an urban supersite T0 during the MCMA-2006 field campaign in Mexico City are used to interpret the HONO formation in association with the suggested HONO sources from literature. The HONO source parameterizations are proposed and incorporated into the WRF-CHEM model. Homogeneous sources of HONO include the reaction of NO with OH and excited NO_2 with H_2O. Four HONO heterogeneous sources are considered: NO_2 reaction with semivolatile organics, NO_2 reaction with freshly emitted soot, NO_2 reaction on aerosol and ground surfaces. Four cases are used in the present study to evaluate the proposed HONO parameterizations during four field campaigns in which HONO measurements are available, including MCMA-2003 and MCMA-2006 (Mexico City Metropolitan Area, Mexico), MIRAGE-2009 (Shanghai, China), and SHARP (Houston, USA). The WRF-CHEM model with the proposed HONO parameterizations performs moderately well in reproducing the observed diurnal variation of HONO concentrations, showing that the HONO parameterizations in the study are reasonable and potentially useful in improving the HONO simulation in CTMs.