5.043 On quantification of hydroxyl in chemistry-climate models.

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Abstract:

Hydroxyl (OH) radicals are in the heart of tropospheric air pollution chemistry. Yet no consensus is established between the atmospheric chemistry-transport model (CTM) simulated global mean abundance of OH and that estimated by proxy method using the decay rate of methyl chloroform (CH_3CCl_3) concentration. The CTM simulations probably overestimate global mean OH concentration by about 10% (Naik et al., 2013). The northern to southern hemispheric (NH/SH) ratio of OH simulated by the CTMs are in the range of 1.1 to 1.4, while the measurements and modelling of CH_3CCl_3 inter-hemispheric differences suggest a parity in OH between the two hemispheres (Patra et al., 2014). I will review the present status of defining the global and hemispheric OH concentration using simulations of CH_3CCl_3 by an online-transport and offline-chemistry model, i.e., JAMSTEC's ACTM.

The bias in the NH/SH OH ratio has direct impact on the estimation of regional emissions by inverse modelling of the species that are oxidized in troposphere by reaction with OH, such as methane, carbon monoxide. As an example, methane emissions are estimated to be about 10% higher for USA and China if the NH/SH OH ratio is 1.26 compared to a case of NH-SH OH parity. Further, I will use the simulations of OH and related species from the ongoing CCMI model inter-comparison for testing the parity of NH/SH OH ratio. Various emission scenarios will be implemented for simulating the CH_3CCl_3 decay rate for the CCMI modelled OH in the period 2000-2012. Finally, different sensitivity simulations of CCMI models and specially designed experiments by CHASER CTM will be explored for understanding feedback between OH concentrations and the chemistry of hydrocarbons.

Acknowledgements. The support of NOAA, AGAGE and HIPPO measurement teams, and availability of CCMI model simulations of OH and related species is greatly appreciated.