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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Hydroxyl radicals maintain the self-cleansing capacity of the troposphere" *by* J. Lelieveld et al.

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Author's reply to the comment of T. Karl on 12 July 2004:

T. Karl highlights the potentially important and poorly understood role of biogenic NMHC emissions in the cleansing capacity of the troposphere. On p. 3705 (l.12), p. 3709 (l.25) and in Table 2 we underscore that the effects of changing NMHC emissions on global mean OH are quite uncertain, both in sign and magnitude. Our estimate of the anthropogenic fraction of the global NMHC source has been based on the Integration and Synthesis Report from the IGAC project by Brasseur et al. (2003), using their Table 3.1 on p.76., consistent with the NMHC sources in our model, indicating a contribution of nearly 70%. However, by adopting the upper limit of the uncertainty range of the NMHC emission estimates from vegetations and oceans, this fraction re-

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duces to about 50%, and if we recalculate the emissions based on carbon only, this number further reduces to about 35%. The latter is not far from the estimate of 23% by T. Karl, so that we do not fundamentally disagree about the potential role of natural NMHC sources. However, we have not addressed to what degree the biosphere can be assumed in steady state, nor have we evaluated the role of natural NMHC sources if their presumed magnitude and composition have been strongly underrated. With our global chemistry-transport model we have studied the effects of changing anthropogenic emissions, whereby we have assumed that biomass burning has decreased in high latitudes and increased in low latitudes since the 19th century (Lelieveld and Dentener, 2000). Several studies have shown that the effects on mean OH are dominated by anthropogenic changes in CH4, CO and NOx, of which the sources increased by about 75%. We argue that these effects have been compensating on a global scale. On regional scales, however, large changes may have occurred based on the mix of reactive carbon and nitrogen compounds (Lelieveld et al., 2002). In our model the overall effect of NMHC emissions on mean OH are small, whereby OH is reduced near its sources, being compensated by increases at greater distance (S. Houweling et al., J. Geophys. Res 103, 10673-10696, 1998). Additional influences by land use change, especially tropical deforestation, involve changes in NMHC emissions, NOx release from soils, deposition rates, and in particular also soil hydrology and evaporation, which strongly influence the regional moisture budget and meteorology (L.N. Ganzeveld and J. Lelieveld, Geophys. Res. Lett. 31, L06105, doi:10.1029/2003GL019205, 2004). These issues are very intriguing and of tremendous importance, and are therefore high on the agenda of the new IGBP project iLEAPS (integrated Land Ecosystem-Atmosphere Processes Study).

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 3699, 2004.

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Interactive Comment