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Interactive Comment

Interactive comment on "Improved simulation of isoprene oxidation chemistry with the ECHAM5/MESSy chemistry-climate model: lessons from the GABRIEL airborne field campaign" *by* T. M. Butler et al.

T. Karl

tomkarl@ucar.edu

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Butler et al. show that still much needs to be learned about the impact of isoprene on regional and global atmospheric chemistry. Among other things they hypothesize that the effective reaction rate constant between isoprene and OH could be 50% smaller than under well mixed conditions due to segregation effects. Their hypothesis is rationalized based on work published by Verver et al. (2000) and Krol et al. (2000), who suggest that the intensity of segregation in the planetary boundary layer (PBL) could be as large as 30%. We point out that results

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Interactive Discussion

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by Krol et al. (2000), and Verver et al. (2000) are based on a simple chemical mechanism. Whether their findings still hold true for more complex chemical schemes remains to be seen. As discussed recently during an ILEAPS workshop (http://www.atm.helsinki.fi/ILEAPS/surface-processes/index.html) Barth et al. (personal communication) for example have shown that more complex chemistry schemes can drastically dampen the effect of segregation in the PBL (e.g. reducing the effect to 2-5%). By including an artificial OH source based on the recycling of Isoprene-derived RO2 with HO2, Butler et al. collocate a significant fraction of the OH production rate with isoprene. One would expect that this collocation would reduce the intensity of segregation dramatically. A more likely "artificial" effect of segregation introduced in regional/global models might be caused by the fact that variations in PBL height as well as clouds are not resolved in these models. Particularly under cloudy conditions the PBL in these models is therefore ill-defined. As a consequence, a well-mixed grid-cell average would underestimate the true variability (and possible segregation) of reactants occurring in the real atmosphere. We inferred an intensity of segregation in a cloud layer based on fast isoprene and H2O measurements (Karl et al., 2007) by scaling these to OH observations in- and outside of clouds (Mauldin et al., 1997). Lower limits of this "artificial" intensity of segregation were calculated to be on the order of -0.2 to -0.4. These values are similar to LES model results based on a volume-average defined segregation effect (Barth et al., personal communication). Compared to the PBL height / cloud effect, heterogeneous isoprene emission patterns could potentially also introduce segregation effects of similar magnitude (e.g. Krol et al., 2000). Whether these effects really matter in the real atmosphere, in particular in the tropical PBL, will have to be answered by field measurements combined with detailed LES analysis.

Thomas Karl, Mary Barth, Ned Patton, NCAR, Si-Wan Kim, NOAA/ESRL

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