

Review of Bozem et al., *The influence of deep convection on HCHO and H₂O₂ in the upper troposphere over Europe*.

Summary and General Comments: Bozem and coauthors present aircraft measurements of a wide range of reactive trace gases made in the outflow of deep convection. Their observations focus on the convective redistribution of two soluble HO_x precursors, HCHO and H₂O₂. Using measurements made in the inflow and outflow region of a single storm, Bozem et al calculate that HCHO and H₂O₂ are transported with high efficiency by deep convection. The manuscript describes new results and is interpreted in the context of a photochemical model. I have a series of comments that would need to be addressed prior to publication in ACP:

- 1) Prior measurement campaigns have used the ratio of H₂O₂:CH₃OOH as an indicator of fresh convection due to the preferential scavenging of H₂O₂. Are measurements of CH₃OOH available from this flight to comment on this approach? Based on the scavenging efficiencies reported here, one would expect that ratio not to be very sensitive, yet it has been shown to work well in the remote Pacific.
- 2) The authors suggest that PBL air is transported to the UT and detrained into the UT undiluted. This seems very hard to believe. Prior aircraft studies have calculated that this ratio is of order 0.2 (from measurements of CO, CH₄, CO₂, C₂H₆, and CH₃OH (Bertram et al., 2007). Modelling studies have calculated this ratio to be closer to 0.25 (Mullendore et al., 2005). This suggests that convectively lofted PBL air is rapidly mixed on ascent or during detrainment into the UT. The authors should comment in more detail on how their measurements fit in the context of prior measurements since this is an important component of the measured scavenging efficiency for HCHO and H₂O₂.

Specific Comments:

Line 8: “~~the~~ Earth’s”

Line 71: “project included of a total of”

Line 72: Give the country (Germany) of Hohn as is done for Corsica and Kiruna

Section 2.2: Was the altitude (temperature and pressure) of convective detrainment used to drive MECCA?

Line 139: What is the evidence for this? This would be an average updraft velocity of about 1 m s⁻¹. This is reasonable, but I am curious how/if this was measured.

Line 209: Was the 30 ms⁻¹ horizontal wind speed measured? How sensitive are the model conclusions to this number.

Section 3.3: What time of day was the model initiated? At the time of convective detrainment? This, of course, makes a strong difference in photolysis and chemical lifetimes.

Line 310 and beyond: It would be helpful to be consistent in using either scavenging efficiency or retention coefficient.