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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Hydrogen peroxide in the marine boundary layer over the southern Atlantic during the OOMPH cruise in March 2007" *by* H. Fischer et al.

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Dear Laurens,

Thank you very much for the thorough review of our manuscript that helped us to detect a flaw: due to a scaling error the deposition velocities for H2O2 cited in the manuscript were too high by an order of magnitude. The actual deposition velocities calculated by the model varied between 0.5 cm/s at a wind speed of 5 m/s and 1.8 cm/s at 10 m/s. The sensitivity study was done limiting the maximum wind used in the deposition calculation to 5m/s (resulting in a maximum deposition velocity of H2O2

of around 0.6 cm/s). These values are in good agreement with those derived from airborne measurements in the marine boundary layer over the Atlantic Ocean off the coast of South America during GABRIEL 2005 (Stickler et al., 2007). Based on H2O2 observations and an assumption for the entrainment from the free troposphere Stickler et al. estimated an H2O2 deposition velocity of 1.3 cm/s (range <0.1 to >1.8 cm/s, depending on the assumptions for the entrainment rate) at a wind speed of 6 m/s. The single column model used in the study of Stickler et al. (2007) gave a maximum deposition velocity of 0.5 cm/s at that wind speed, which is in good agreement with the EMAC results.

Specific comments:

Abstract: The transport of free tropospheric air into the MBL was indeed observed only on one particular occasion.

Introduction: The purpose of the comparison of the observation to the EMAC simulations is indeed to test our understanding of the chemical and physical processes that affect the mixing ratio of those species in the MBL.

Results, page 30555: As pointed out above, it was indeed a one-time event.

Page 30556: Indeed we are referring to the overall trace gas trends that are reproduced by the model.

Page 30557: As suggested, an underestimation of entrainment from the troposphere would also explain the underestimation of the H2O2 and O3 mixing ratios during the first phase of the campaign. But this leads to a contradiction with the MHP data, which would be affected by the same transport. Similar to H2O2 and O3, MHP mixing ratios increase with altitude and show a maximum above the boundary layer (Stickler et al., 2007, Klippel et al. 2011). Thus one would expect that underestimated transport from the free troposphere in the simulations would also produce an underestimation of the simulated MHP concentrations in the MBL, but the opposite is the case: the model

overestimates MHP significantly. Therefore we conclude that different processes are responsible for the temporal underestimation of H2O2 (during the first part of the campaign) and the time independent overestimation of MHP, as most clearly expressed in the time series of the ratio of these two species in Figure 6.

Page 30558: The error in the deposition velocities for H2O2 was addressed above. In the revised manuscript we will follow your suggestion to clarify the discussion of deposition processes and their dependency on transfer velocities and solubility for individual species.

Page 30560: We will follow your suggestion and discuss the reasons for the boundary layer height variations following the introduction of Figure 7.

Summary: We replaced “overestimation” by” underestimation”.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 30547, 2014.