We thank D. Taraborrelli for his constructive input. His comments below are in plain text, with our responses in bold italics. Citations below correspond to the reference list in the manuscript.

<u>Response to Domenico Taraborrelli</u>

The authors discuss the acetaldehyde yield from the MVK + O3 reaction. They correctly state that this yield in MCMv3.1 is 10%. However, they state that in MIM2, a reduction of MCMv3.1, no acetaldehyde source is included from MVK + O3. This is not the case. In fact, the yield from this reaction is exactly the same as in MCMv3.1 (see electronic supplement of Taraborrelli et al. (2009)).
We have removed the incorrect statement about MIM2. Thank you for pointing it out.

Furthermore, MIM2 is reported computing an acetaldehyde yield of 2% from isoprene oxidation in the context of yields calculated with a box model. This is somewhat misleading as in Taraborrelli et al. (2009) a global annual average yield for acetaldehyde was computed with the use of a 3D atmospheric model. The method of computation used (Butler (2009)) and dry deposition of acetaldehyde precursors may have played a role in decreasing the yields from box model simulations with MCMv3.1.
Good point. We now mention this distinction in the text.

In this respect, it would be interesting to know the global annual average yield of acetaldehyde from isoprene in GEOS-Chem.
Yes. In the full-chemistry 3D framework we're using it's not straightforward to track this, at least without significant modification. Given the current uncertainties in isoprene oxidation pathways (see also discussion regarding the next comment), we feel that this box-model range provides at least as useful an estimate as a 3D global average would be. Also, as pointed out, the latter is subject to separate uncertainties due to deposition etc.

It would also be interesting to know what causes the GEOS-Chem acetaldehyde yield from isoprene to go from 2.5% under high-NOx to 6.9% under low-NOx. The authors state that under low-NOx conditions the OH concentrations are a factor of two lower and reactions with O3 play a larger role. However, efficient OH-recycling routes in isoprene oxidation have recently been discovered (Lelieveld et al. (2009); Paulot et al. (2009); Peeters et al. (2009)). As a consequence, OH levels are also sustained under low-NOx conditions. Moreover, although MCMv3.1 has a too high acetaldehyde yield from MVK + O3, the overall acetaldehyde yield goes from 4.7% under high-NOx to 4.3% under low-NOx. This is significantly different from GEOS-Chem. Where do the differences between MCMv3.1 and GEOS-Chem arise from? Different propene yields? This discrepancy may be partially resolved if the GEOS-Chem yield under low-NOx was erroneously taken from the model output. In fact, from Figure 2 this yield seems to be about 4% instead of 6.9%. If confirmed, the estimate of 19 Tg/yr of acetaldehyde from isoprene oxidation under low-NOx should be reduced to about 11 Tg/yr.
We re-examined acetaldehyde formation from isoprene at low-NOx in GEOS-Chem. There is a reaction in the oxidation sequence for MVK that was not well-represented in the standard GEOS-Chem scheme. We have modified this reaction to be more consistent with present understanding. This reduces the low-NOx acetaldehyde yield significantly, and it is now more

similar to the high-NOx yield. The 10-day acetaldehyde yields from isoprene oxidation in GEOS-Chem are now 1.9% and 2.5% at high and low NOx, respectively. These values are consistent with measurements by Lee et al. (2006) (1.9 +/- 0.3%) and with the global average of 2% from MIM2 (Taraborrelli et al., 2009). The discussion in Section 2.2.2 has been revised accordingly. Thank you for raising this issue.