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Interactive comment on "Impacts of near-future cultivation of biofuel feedstocks on atmospheric composition and local air quality" *by* K. Ashworth et al.

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The authors thank Referee #2 for their comments and suggestions.

"...what was the bSOA mechanism applied by the global model?"

The bSOA mechanism applied by the HadGEM2 model is a two-product approach, with methodology as described in Derwent et al, 2003, resulting in molar yields of 3% for isoprene and 13% for monoterpenes as given in Mann et al, 2010. The mechanism has now been described more fully in Section 2 (Model Approach) and the appropriate citations given.

"How much are the isoprene emissions scaled in the scenarios (Page 24862, Line 7; Page 24863, Line 6)? How were these scaling factors defined?"

The scaling factors were calculated by replacing the isoprene emission factors for a percentage of the appropriate current vegetation type (broadleaf trees in the oil palm scenario, and C3 and C4 grasses in the SRC scenario) with isoprene emission factors for the biofuel crop. The full method for calculating the isoprene scaling factors has now been added as an Appendix (which includes a table giving the emission factors used for each biofuel crop type), referred to from P24862, L7 and P24863, L6.

"Was a diurnal profile assigned to the bVOC emissions and the NOx emissions from the biofuel crops?"

bVOC emissions are calculated on-line at each timestep of the model, as outlined on P24860 L27- P24861 L3. NOx emissions are added to the existing anthropogenic NOx emissions input to HadGEM2, and to which a simple time profile is applied (making processing emissions high during the day and lower at night) to prevent accumulation of NOx in the model during the night. This has been added to the description of the NOx emissions in Section 2.1, P24862, L20-21.

"Why were N emissions from fertilizers included in the oil palm scenarios, but not the SRC?"

Additional NOx emissions due to fertiliser application and biofuel processing were not included in the SRC scenario, as fertiliser application rates to SRC are similar to those for agricultural crops in the mid-latitudes, and no data is available for emissions from large-scale processing of SRC to ligno-cellulosic ethanol. The mid-latitudes are also, for the most part, likely to be VOC rather than NOx limited, so the authors decided that additional NOx emissions would not play such a critical role in the atmospheric response to the changing isoprene emissions in the mid-latitude scenario as in the tropics. This has been included in the description of the SRC scenario (P24863, L11-).

"In the result section, please specify if the changes in ozone concentrations are annual averages or for another time period."

The results are predominantly given as annual means, although (particularly for the SRC scenario where monthly concentrations vary considerably) some monthly mean values have been quoted. In each case the temporal (and spatial) averaging has now been made clear in the text – and in two tables (see below).

"The results are shown in absolute changes in ozone concentrations; it may be interesting to say something about the % changes in concentrations – or a map would be interesting too." The results section has been altered to include a table showing area-weighted changes in ozone and bSOA concentrations (on both a global and regional basis) for each scenario. The % change for each region and each time period is shown in the table to put the results in context. Where appropriate % changes have also been shown in the text.

"The paper focuses on changes in isoprene emissions, but it may be valuable to comment on the impact of crop replacement of monoterpene-emitting forests?"

The Discussion section (section 5) has been expanded and now includes a discussion of the likely impact of LUC on the emissions of monoterpenes, methanol and other VOCs, as well as a consideration of their likely impacts on aerosol and ozone formation.

"Please provide more details of the modelling component of the Deposition evaluation. For example, P24869, line 13-15, how much was the leaf are and roughness length changed? (From what to what?)."

An Appendix has been added to describe the method used and show the values of roughness length and biomass density assumed for each plant type. This is referred to from P24869, L9. The Appendix reads: "Scaling factors for the leaf area index and roughness length of the biofuel crops were calculated using the approach outlined above for isoprene emission factors. The values of roughness length ($\sim$0.1*canopy

height) for the relevant plant functional types are given in Table 5. Leaf area index was scaled using relative values of maximum biomass density (i.e. the seasonality of the leaf area index was assumed to be unchanged by the replanting). These values are also shown in Table 5."

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 24857, 2011.