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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of future climate and cropland expansion on isoprene emissions and tropospheric ozone" *by* O. J. Squire et al.

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We understand the referee's comments about the scenarios but we fundamentally disagree.

Our aim, as is made clear in the paper, is not to 'predict' a future state of the atmosphere but to explore a number of possible interactions. So, our experimental design involves looking at some perturbations to composition both singly and in combination. We have carried out 6 different future experiments. We are very clear about exactly what we have done. We believe the experiments are both useful and interesting as

they provide new insights into the effects of human activity on future atmospheric composition. The referee's objections focus on experimental design; we believe the important new contributions relate to our results with regard to the coupled perturbations, about which the referee only makes minor comments. Âă It is important to realise that we are not running a fully coupled Earth System Model. Instead, using offline models, we specify changes (and note that we do comment on how the use of different scenarios compared to other literature studies affects the results, e.g. on page 18323 lines 19-23) and consider how those changes impact on our focus of interest, which is atmospheric composition. This is, frankly, a commonly used approach in sensitivity studies (e.g. Wiedinmyer et al. (2006), Jiang et al. (2008), Lathiere et al. (2010) and Wu et al. (2012)), and within this approach it is not unprecedented to follow more than one scenario when investigating the effects of future land use change and climate. For example, Jiang et al. (2008) examined such effects in the Houston, Texas area - in their study climate follows the A1B scenario, but future land use is based on future patterns of population density generated with the Spatially Explicit Regional Growth Model rather than following the A1B scenario). There are also examples of sensitivity studies in which land use changes have been applied in a pragmatic manner (e.g. Wiedinmyer et al., 2006) but which are certainly valuable contributions to the field.

The referee objects in particular to inconsistency of scenarios with respect to land use change and climate for calculation of isoprene emissions. Our counter argument is that our specified change from broad-leaved trees to crops, if it were to happen, would be driven in the future largely by factors other than climate – by economic and population factors. So, we do not believe the inconsistency is an important factor.

In the atmospheric simulation, anthropogenic emissions of NOx and other trace gases follow the B2+CLE scenario which is characterised largely by emission cuts in the northern hemisphere. Our land use change scenario (A1B) is characterised mainly by cropland expansion in the Tropics, where the B2+CLE scenario simulates little change in NOx emissions. NOx emissions could increase with greater agricultural activity in

the Tropics not least due to increased fertiliser use. However, as argued in the text, this would be counteracted by the lower emission factor of crops compared to broad-leaved forest, leading to little overall change in NOx emissions in the Tropics. As such, we do not see that our anthropogenic emissions and land use change scenario are incompatible.

We acknowledge that this study, like all others, has its limitations and compromises. We have already performed a significant number of experiments and to explore a 'full suite' of future scenarios, as suggested by the referee, is beyond current scope.

This response has dealt in general with the referee's main criticism. We will wait for the second review before responding in detail to all the referee comments.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 18307, 2013.