

Interactive comment on “Quantification of chemical and physical processes influencing ozone during long-range transport using a trajectory ensemble” by M. Cain et al.

M. Cain et al.

mc692@cam.ac.uk

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The authors would like to thank all the reviewers and the editor for their comments and suggestions for this manuscript. Responses to specific points from reviewer #1 are below. All other points made by reviewer #1 have been amended in the final manuscript exactly as suggested.

Page 3025 line 25 Was the ozone overestimated because NO_x was diluted and therefore became more efficient at producing ozone?

–Yes. Wild et al (2003) used 2 different CTMs which had different mixing schemes. The model with more efficient mixing diluted the precursors quicker and generated ozone
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more efficiently. This explanation has been added to the text.

Page 3031 line 14 When you say the composition is constant below the lowest latitude data point, are you just extrapolating the chemical measurements all the way down to the surface?

–Yes, this is correct. The text has been amended to clarify this point.

Page 3035 line 17 You say that there are no emissions over the ocean, but what about ship emissions? According to the work by J. Corbett, U. of Delaware, ship emissions account for 10-15% of global anthropogenic NO_x emissions. What effect does the neglect of ship emissions have on your results?

–We chose to exclude emissions in this case because the coarse emissions grid caused land emissions to influence the simulation over the ocean. This does mean that any legitimate emissions sources over the ocean, like shipping, are excluded. Figure 1d shows that the modelled NO is lower than that observed.

Page 3056 line 1 This sentence is not constructed properly and needs to be rewritten.

–This was a cut-and-paste error in the manuscript and has been removed.

Page 3056 Ideally, couldn't you improve the chemical composition of the shadow trajectories by referencing the shadow trajectories with the off-line output of a Eulerian chemical transport model? This could be a way to have the best of both worlds, the detailed chemistry and mixing of a Lagrangian model and Eulerian estimates of species for all locations and all times.

–Yes, the background could be initialised by a 3D model run. This has been indicated in Sect. 3.2.2.

Figures 1-5, and 9 It would be much easier on the reader if you can replace the Julian days on the x-axis with the corresponding days of July.

–The dates of the Lagrangian matches have been added to the plots so that both the

date and the day of year is on the plot.

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