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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Drivers of column-average CO_2 variability at Southern Hemispheric total carbon column observing network sites" *by* N. M. Deutscher et al.

N. M. Deutscher et al.

n_deutscher@iup.physik.uni-bremen.de

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During the period that this paper has been in open discussion, new CarbonTracker data assimilation results have been released, which correct errors identified in the CT2011 run. The CarbonTracker team provided us with new analysed fluxes and special column output to check against the results published here. This comment addresses a comparison between what is published in the original discussion paper and the updated analysis with the new CT2011_oi results. Our intention is, of course, to update the analysis for the final revised paper as well.

Firstly, we note that the major difference between CT2011 and CT2011_oi is the exclusion of one of the ocean modules from the data assimilation. Analysis of the trends in our CT2011_oi results reflects this - the trend in the ocean tracer is now a larger negative value, reflecting larger ocean uptake. Trends in the other tracers show only small differences, meaning that there is a smaller annual increase in X_{CO_2} derived for the CT2011_oi run compared to CT2011, but the new estimate lies within the uncertainties of the original derived trends.

A straightforward comparison of the smoothed CT2011_oi xCO2 values sampled at the FTS measurement times illustrates that at Darwin and Wollongong this is the most obvious difference between the CarbonTracker versions. At Lauder, however, there appears to be some seasonality in the differences, whcih typically vary between $\pm$ 0.5 umol/mol.

These differences are illustrated in the attached figures. Figure 1 illustrates the differences between CT2011_oi and CT2011 for each site when smoothing and sampling at TCCON measurement times. Figure 2 is an updated version of Figure 2 from the discussion paper, altered to also include the new CT2011_oi values (purple) and the difference between the FTS and these values. On these scales, the differences between between the old and new model data are small. Figure 3 is an updated version of the paper's Figure 4, showing the Mean Seasonal Cycles for each site decomposed by source process. The figure also shows the previous MSCs in thin dashed lines, in most cases these are not visible because of the similarities between the two runs. Again, the differences with the original figure are minimal: a small increase in interannual variability in February in Darwin; the absence of a strange October dip at Wollongong; a slightly larger seasonal cycle amplitude at Darwin; and a small shift in the seasonal cycle at Lauder, driven by a slight increase in the seasonal cycle amplitude of the ocean tracer (which is evident at all sites, but relatively most important at Lauder).

We also re-analyse the pulse flux runs and the yearly fluxes, as shown in Figures 10, 11 and 13 of the discussion paper. Figure 4 is an update to Figure 11, showing the optimised tropical Australian fluxes separated by year. There are very few differences from the CT2011 runs in either these optimized fluxes or the pulse runs.

In summary, the updated CT2011_oi model output produces some small differences in our analyses, but none that affect the conclusions presented in the publication.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 14331, 2013.

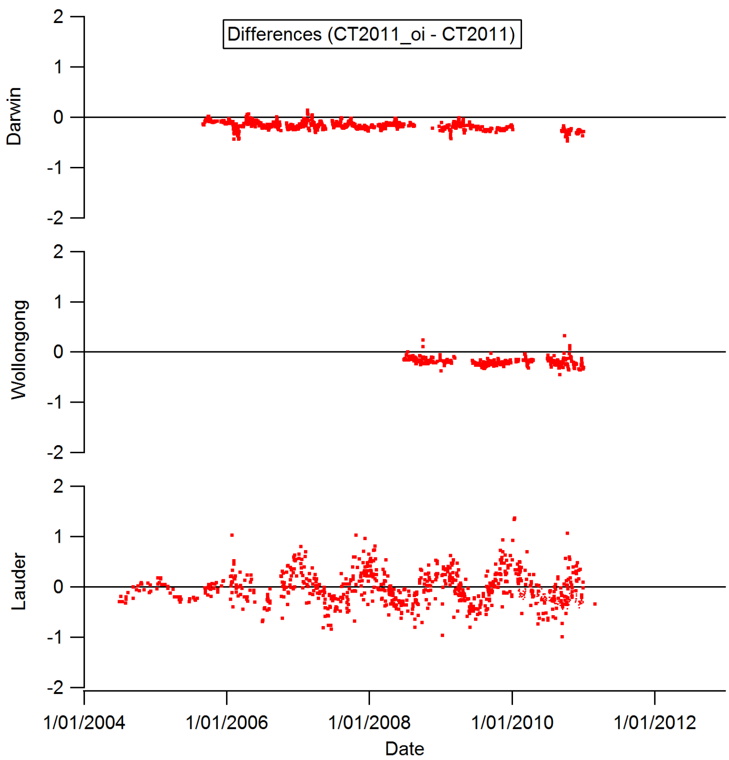

Fig. 1. Differences in the smoothed CarbonTracker model output at the Southern Hemisphere TCCON stations for CT2011_oi compared to CT2011.

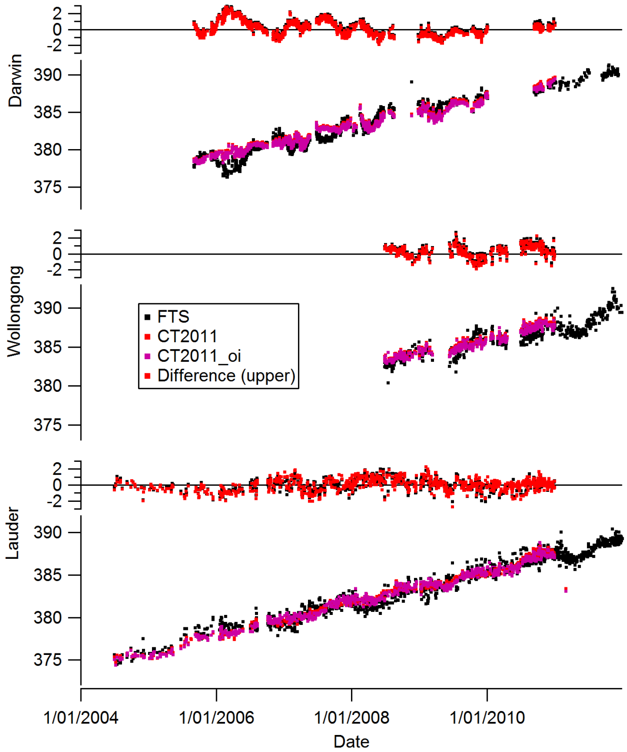

Fig. 2. Comparison between the TCCON measured XCO2 and the smoothed CarbonTracker time series. This figure corresponds to Figure 2 from the discussion paper.

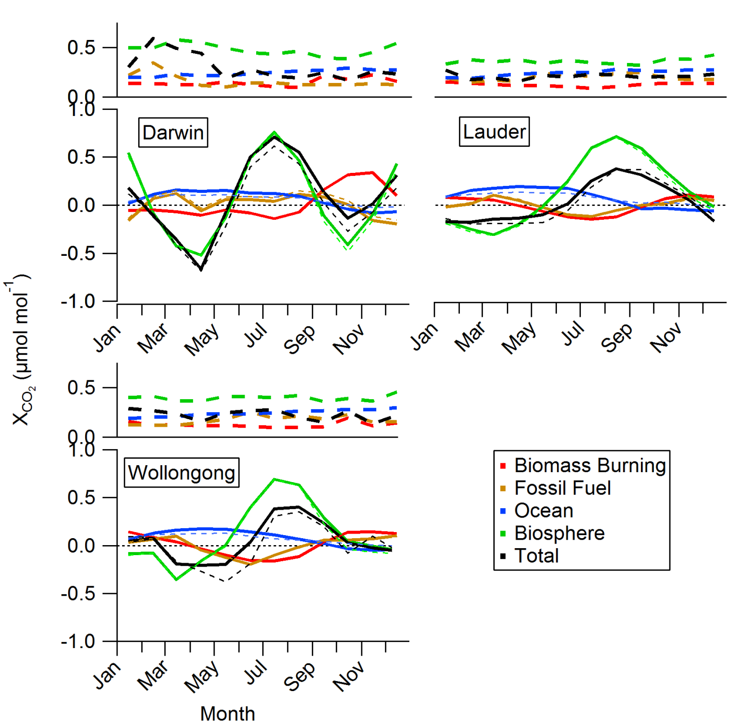

Fig. 3. The Mean Seasonal Cycles re-calculated for each site using CT2011_oi. The original CT2011 Mean Seasonal Cycles are also shown in thin dashed lines for reference.

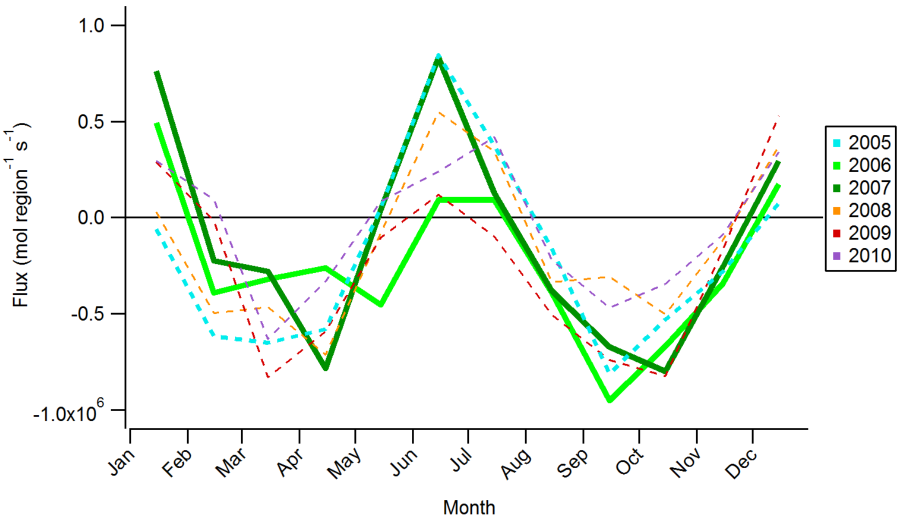

Fig. 4. The optimized CT2011_oi tropical Australian biosphere fluxes.