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Atmospheric Chemistry and Physics Discussions

Interactive comment on "What can be learned about carbon cycle climate feedbacks from CO_2 airborne fraction?" *by* M. Gloor et al.

C. Le Quere

c.lequere@uea.ac.uk

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I read with great interest the paper by Gloor et al discussing the meaning of trends in airborne fraction (AF). Although I appreciate the role of emissions in determining AF trends to a first order, I am not fully convinced by the conclusions of the paper that a response of the sinks to changes in climate cannot be detected by looking at recent trends in the AF.

My problem is that I cannot fully reconcile the results presented here using a simple linear model with the results we presented in NGeo last fall using more complex models. In our paper, we forced a set of 3 ocean GCMs and 4 terrestrial models with either increasing atmospheric CO2 alone, and increasing CO2 and changes in climate. We found that when the models were forced by CO2 alone (in effect considering the role

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of time change of emissions discussed in Gloor et al), the calculated AF decreased since ∼1960. When the models were forced by both increasing CO2 and changes in climate, the calculated AF increased since ∼1960. The difference in AF trend was large (-0.8%/yr versus +0.1%/y). (See Le Quere et al. NGeo 2009, supplementary information).

I think the difference between our conclusions and those of Gloor et al boils down to the comment in Gloor et al on Section 5 (p9060) regarding the realism of a weakening of the sink efficiency by 50%. The authors argue that this is a strong feedback, probably unrealistic (my reading of their text). The authors could test the realism of their assumption by looking at the results of our models, and calculate how our model simulations translate in terms of change in sink efficiency as defined by Gloor et al. I think if they tested the more complex models, they could better quantify how large a change in sink efficiency is needed before it can be detected in the AF, rather than assume a 50% change is very large.

I have put the CO2 sinks estimated with the GCM on http://lgmacweb.env.uea.ac.uk/lequere/supp/ in case the authors are interested to follow my suggestion.

Corinne Le Quere

ps I would also appreciate it if you could correct the spelling of my name throughout the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 9045, 2010.