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Climate –carbon cycle feedback analysis, results from the C^{4}MIP model intercomparison

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Eleven coupled climate-carbon cycle models used a common protocol to study the coupling between climate change and the carbon cycle. The models were forced by historical and SRES A2 anthropogenic emissions of CO_2 for the 1850-2100 time period. For each model, two simulations were performed in order to isolate the impact of climate change on the land and ocean carbon cycle, and therefore the climate feedback on atmospheric CO_2 concentration growth rate. There is a unanimous agreement amongst the models that future climate change will reduce the efficiency of the Earth system to absorb the anthropogenic carbon perturbation. A larger fraction of anthropogenic CO_2 will stay airborne if climate change is accounted for. By the end of the 21^{st} century, this additional CO_2varies between 20 ppm and 200 ppm for the two extreme models, the majority of the models lying between 50 and 100 ppm. The higher CO_2 levels lead to an additional climate warming ranging between 0.1 and 1.5 $^{\circ}$C.

All models simulate a negative sensitivity for both the land and the ocean carbon cycle to future climate. However there is still a large uncertainty on the magnitude of these sensitivities. Eight models attribute most of the changes to the land, while three attribute it to the ocean. Also, a majority of the models locate the reduction of land carbon uptake in the tropics. However, the attribution of the land sensitivity to changes in net primary productivity versus changes in respiration is still subject to debate; no consensus emerges amongst the models.