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ENSEMBLES GCM experiments for an aggressive GHG-emissions mitigation scenario

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The EU ENSEMBLES project has produced new global climate model results for a scenario (E1) with aggressive mitigation of greenhouse gas emissions relative to an A1B baseline scenario. The experiment provides a trial for centennial timescale elements of the proposed IPCC fifth assessment (CMIP5) experimental design, namely a low stabilization scenario (450 ppmv CO2-equivalent eventually) with several GCMs including explicit carbon cycle components but all models (with or without carbon cycle) being driven by changes in atmospheric greenhouse gas concentrations rather than emissions. Other anthropogenic forcing factors (aerosols, ozone, and in some cases land use change) are also represented in the ENSEMBLES models. In those that include an interactive carbon cycle component, the implied emissions needed to achieve the specified atmospheric CO2 concentrations can be estimated. We illustrate preliminary results from this experiment over the period 1860 to 2100. Specifically we discuss the implied carbon emissions in a version of the Met Office Hadley Centre Earth System model and compare them with those from simple climate models tuned to an international set of (C4MIP) Earth System models. We examine the spatial distribution of the implied surface carbon fluxes in the GCM resulting from the changing climate, and compare the strength of the climate-carbon cycle feedback in E1 with that previously estimated from a simulation with much higher forcing. We also summarise some lessons learnt from executing this ENSEMBLES experiment in the context of the proposed IPCC fifth assessment experimental design.