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Ensemble of long-term CO_2 scenarios with a coupled climate model: Temperature and sea level rise

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Many aspects of changes in the atmosphere and ocean caused by changes in CO_2 concentration can only be simulated in coupled climate models with a 3D ocean component with realistic topography. Climber-3α, a new coupled global atmosphere-ocean-sea ice model, has these characteristics. Compared to fully coupled AOGCMs it provides the possibility to simulate a large number of long-term CO_2 scenarios.

We use Climber-3α to study the global and regional effects of different emission pathways with a special focus on global and regional temperatures and sea level rise due to thermal expansion. An ensemble of multicentury scenarios is presented built from standard scenarios, including SRES, and a variety of subsequent concentration paths, e.g., no emission, constant emission, constant CO_2 concentration. We discuss the role of a temporary overshooting of a CO_2 stabilization target, as compared to not exceeding the target, for sea level rise. The sensitivity to vertical diffusivity in the ocean is investigated.