

The effect of aggressive mitigation on sea level rise and sea ice changes

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With an increasing political focus to limit global warming to no more than 2°C above pre-industrial levels consequences of this target on the climate system especially on a regional scale need to be investigated. Here we compare 21st century projections in a "business-as-usual" scenario (A1B scenario, from the IPCC Special Report on Emission Scenarios) with those under a scenario with large reductions in greenhouse gas concentrations leading to a temperature increase of less than 2°C compared to pre-industrial levels, the E1 scenario developed within ENSEMBLES. Projections are given from eight coupled ocean-atmosphere global circulation models. Analysis focuses on sea level rise and Arctic and Antarctic sea ice changes. At the end of the 21st century the model simulations show that global mean steric sea level rise is reduced by about a third in the mitigation scenario compared with the A1B scenario. Nevertheless, temperature alone is a poor indicator of sea level changes. Differences in the expansion are related to substantial differences in the heat uptake and the efficiency with which the uptake can be translated into expansion. Sea ice extent is projected to decrease in 21st century, independent of the season or scenario. Moreover, in the Arctic our results suggest an amplification of the seasonal cycle. By the end of this century the majority of the models simulate an ice free Arctic in September in the A1B scenario, whereas in the mitigation case an ice free Arctic can be avoided according to most models. Nevertheless, even in the E1 scenario Arctic sea ice is projected to decline by 42 % of the present September extent. Results for Antarctic sea ice changes reveal a large initial biases and a significant correlation between projected changes and the initial extent. This highlights the necessity for further refinements in Antarctic sea ice modelling for more reliable projections of future sea ice.