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Climatic changes associated with a global "2 ºC-stabilization" scenario simulated by the ECHAM5/MPI-OM coupled climate model

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The objective of Article 2 of the United Nations Framework Convention on Climate Change formulated in 1992 is "to achieve stabilization of greenhouse gas concentrations in the atmosphere that would prevent dangerous anthropogenic interference with the climate system". The convention further suggests that "such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner". In accordance with this, the Council of the Ministers for the Environment in the European Union laid down in a statement dated October 17, 2002, that in order to obtain this objective "global efforts should be guided by a long-term objective of a global temperature increase of 2 ˚C over pre-industrial levels and a stabilization of CO_2 concentrations below 550 ppm.".

In this study, concentrations of the well-mixed greenhouse gases as well as the anthropogenic sulphate aerosol load and stratospheric ozone concentrations are prescribed to the ECHAM5/MPI-OM coupled climate model so that the simulated global warming does not exceed 2 ˚C relative to pre-industrial times. The climatic changes associated with this so-called "2 ˚C-stabilization" scenario are assessed in further detail, considering a variety of meteorological and oceanic variables. The climatic changes associated with such a relatively weak climate forcing supplement the recently published 4^{th} assessment report by the IPCC in that such a stabilization scenario can only be achieved by mitigation initiatives. Also, the impact of the anthropogenic sulphate

aerosol load and stratospheric ozone concentrations on the simulated climatic changes is investigated.

The future changes in climate associated with the 2 ºC-stabilization scenario show many of the typical features of other climate change scenarios, including those associated with stronger climatic forcings. Some of the climatic changes associated with the 2 ºC-stabilization are relatively strong with respect to the magnitude of the simulated global warming, i.e., the pronounced warming and sea-ice reduction in the Arctic region, the strengthening of the meridional temperature gradient at the northern high latitudes and the general increase in precipitation. Other climatic changes, i.e., the El Niño like warming pattern in the tropical Pacific Ocean and the corresponding changes in the distribution of precipitation in the tropics and in the Southern Oscillation, are not as markedly pronounced as for the scenarios with a stronger global warming.