



Assessing short-term anthropogenic climate changes using an ensemble of climate change experiments performed with ECHAM5/MPIOM AO-GCM

J-S von Storch

Max-Planck Institute for Meteorology (jin-song.von.storch@zmaw.de)

Most of previous studies on anthropogenic climate change focused on changes over long time period (e.g. over one century) and left the question of how climate responds to a greenhouse gas forcing over a short time period (e.g. a few years to a decade) open. This question is considered in the present study. The consideration is important not only because projections over short lead times are of immediate economic interests, but also because the consideration of the question provides a more detailed analysis of the time-evolution of climate responses.

Studying short-term anthropogenic climate changes faces however the problem that the signal-to-noise ratio is low, due to the fact that the anthropogenic forcing is generally weak at short projection times and the coupled atmosphere-ocean system needs some time to respond to the given anthropogenic forcing. To overcome this problem, an ensemble of climate change experiments are used. The ensemble size is 50. The model used is the ECHAM5-T31/MPIOM-GROB30 model developed at MPI in Hamburg. The greenhouse forcing corresponds that of a 3%-increase in CO₂-concentration per year. The length of experiments is 10 years.

The ensemble experiments allow the identification of the weak climate change responses within the first 10 years after switching on the 3% per year increase in CO₂-concentration. The main features are a) the strengthening and southward shift of the wind system over the Southern Ocean due to the non-uniform warming in the troposphere, b) the net gain of heat by the ocean of about 400 TW over 10 years and the strengthening and southward shift of zonal wind stress in the Southern Hemisphere at the sea surface, and c) no reduction of the MOC but an enhancement of the Deacon cell in the Southern Ocean.