Geophysical Research Abstracts, Vol. 7, 01200, 2005
SRef-ID: 1607-7962/gra/EGU05-A-01200

Temperature projections and their uncertainties in IPCC SRES and stabilization scenarios

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Estimates of impacts as well as adaptation and mitigation strategies related to anthropogenic climate change require a precise understanding of the anticipated changes as well as the uncertainties associated with it. Those ranges of uncertainties were based on expert opinion only for many years, and only recently a few new methods were suggested to objectively quantify uncertainties. Using large ensembles with a coupled model of intermediate complexity, we present probabilistic projections for a series of SRES scenarios as well as for long-term stabilization scenarios to be included in the forthcoming IPCC Fourth Assessment Report. The ensemble is constrained by the observed surface warming and ocean heat uptake over the twentieth century. We present different ways of weighting these constraints and discuss the key uncertainties like climate sensitivity, radiative forcing, ocean mixing and the carbon cycle that contribute to the overall uncertainty of future global temperature and sea level. Further, a number of studies have recently derived probability density functions (PDFs) for climate sensitivity, but the underlying assumptions are so diverse that they cannot simply be averaged to estimate the most likely range for climate sensitivity. However, since the long tails in these PDFs towards high climate sensitivities are a minor issue for the next few decades, it might be a sensible approach to estimate short-term probabilistic projections for each climate sensitivity PDF and combine those into a final projection uncertainty. Such an approach is expected to deliver more robust uncertainty estimates than studies based on single constraints or a single model only.