The characteristics of daily rainfall events during the Indian summer monsoon simulated in a global time-slice experiment

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In a so-called time-slice experiment two simulations have been performed with the ECHAM4 AGCM at an enhanced horizontal resolution of T106, corresponding to a grid spacing of about 120 km. The first simulation (TSL-1; period 1970-1999) represents the present-day climate and the second one (TSL-2; period 2060-2089) the future climate after roughly a doubling of the atmospheric CO2 concentration with respect to the present-day climate. During the two simulations monthly mean values of the sea surface temperatures, the sea-ice extent and the sea-ice thickness originating from a transient simulation with the ECHAM4/OPYC AOGCM at a low horizontal resolution of T42 (corresponding to a grid spacing of about 300 km) have been prescribed as lower boundary forcing to the AGCM. In these simulations the concentra-tions of the important greenhouse gases have been prescribed according to observations until 1990 and according to the IPCC scenario IS92a after 1990.

The characteristics of daily rainfall events during the Indian summer monsoon are investigated on the basis of these two simulations. In addition to some basic properties of daily rainfall events, such as the frequency of wet days (defined as days with precipitation) and the mean and variability of rainfall occurring on wet days, the Gamma distribution is considered in order to describe the time series of daily rainfall in a comprehensive way. Further, the characteristics of extreme daily rainfall events are investigated by means of the Generalized Extreme Value distribution. The purpose of the study is twofold. By comparing the results based on TSL-1 with those obtained from observational daily rainfall data, such as from GPCP (period 1997-2001) and the ECMWF re-analyses (ERA, period 1979-1993) the performance of ECHAM4 with regard to the simulation of daily rainfall events is assessed. Further, the comparison be-tween TSL-1 and TSL-2 yields a prediction of the possible future change in the characteristics of daily rainfall events caused by the anticipated greenhouse gas warming.

The results show that ECHAM4 is able to simulate the characteristics of daily rainfall events during the Indian summer monsoon quite well. The results obtained from TSL-1 are actually in much better agreement with those based on GPCP than the results for ERA. Therefore, the pre-dicted future changes in the characteristics of daily rainfall events, in particular the increased intensity of extreme rainfall events, in the time-slice experiment have a high degree of credibil-ity.

Wednesday I and Tuesday IV (Talk)