Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09193, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09193
EGU General Assembly 2008

Probability of warm Summerdays in Europe in Relation to the large-scale Circulation

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A new statistical method that optimally links local temperature extremes to large-scale atmospheric circulation structures is applied to an ensemble of climate model simulations over the period 1950-2100 under the SRES A1b scenario with the ECHAM5/MPI-OM coupled GCM. Daily July-August streamfunction fields at 500 hPa over the Euroatlantic region are used to identify large-scale circulation structures that favor warm days in the Netherlands. Two patterns are identified (called Extreme Associated Functions); the most important one corresponds to a blocking high pressure system leading to subsidence and calm, dry and sunny conditions. The second EAF corresponds to a rare, easterly flow regime bringing warm, dry air into the region. The patterns simulated by the model compare very well to the patterns identified in the ECMWF reanalysis dataset (ERA40) over the 1958-2000 period. Over the future period 2071-2100 the same patterns are still responsible for the warm extremes and their probability of occurence has not changed significantly. However, the corresponding local temperature extremes have warmed due to an increased net solar flux at the surface (due to reduced cloud cover) and a decreased evaporative cooling due to reduced soil moisture and more so for the stronger extremes. The same analysis is applied to eight more sites in Europe (Spain, Greece, Scandinavia, Romania, Poland, England, France and Russia). For several sites changes in the probability of occurence of the EAFs do contribute to the simulated changes in the local temperature extremes.