# CHANGES IN PRECIPITATION INTENSITY UNDER CLIMATE CHANGE CONDITIONS OVER MAJOR CATCHMENTS IN EUROPE

Katharina Bülow, Daniela Jacob, Ralf Podzun
Max-Planck-Institute for Meteorology, Bundestr. 53, 20146 Hamburg, Germany, buelow@dkrz.de

## INTRODUCTION

During the last 10 to 15 years extreme weather events seem to appear more often and sometimes intensified in Europe. The severe drought connected to a heat waves in summer 2003 covered large parts of southern and central Europe. The time period June-August 2003 was up to 5 °C warmer then the 1961-90 average, making 2003 the warmest summer in the above mentioned area since at least 1864 (Fink, 2004, Schaer et al 2004, Bader, 2003).
Extreme precipitation, defined as days with more than 30 mm precipitation, can lead to devastating land-slides and to summer flooding like the Elbe flooding in August 2002.
Precipitation was observed at Hohenpreissenberg, Germany since 1879. The annual precipitation sum shows an increasing trend. The temperature increases around 0.9 °C at Hohenpreissenberg and around 0.6 °C in the mean in Germany in the 20. Century (www.dwd.de/research/mohp/hp2/gaw/gaw.htm).

## MODEL AND EXPERIMENTS

The three-dimensional hydrostatic climate model REMO (REgional MOdel (Jacob, 2001)) was used to study the hydrological cycle over Europe, with special focus on the Elbe and Rhine drainage basins. To address the reliability of climate change studies it is important to analyze a set of three regional simulations: for today's climate, control and future climate. For all experiments REMO, version 5.1, using the physical parameterization schemes from the global climate model ECHAM4 was run on 0.5° as well as on 0.16° horizontal resolution covering Europe. For today's climate REMO has been driven at the lateral boundaries by re-/analyses data from ECMWF, the so-called perfect boundaries, to investigate the quality of the REMO results through a detailed comparison against observations, which turned out to be in very good agreement (Milliez, 2003).

To investigate the influence of climate change on the hydrological cycle concentrations of greenhouse gases and sulphate aerosol are chosen according to IPCC (International Panel on Climate Change Scenario) scenario B2 (Houghton, 2001). Two more experiments are necessary: a control run and a scenario run. The difference between these results can be attributed to the climate change signal. Data from the coupled global climate model system ECHAM4-OPYC3 have been used to drive REMO on 0.5° horizontal resolution, which in turn was used as lateral boundaries for REMO 0.16° horizontal resolution.

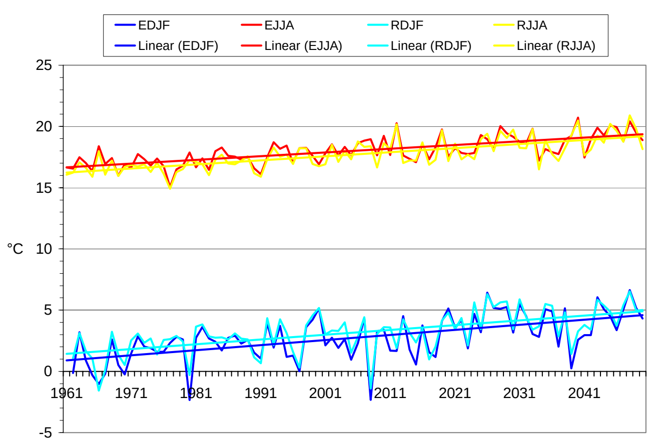
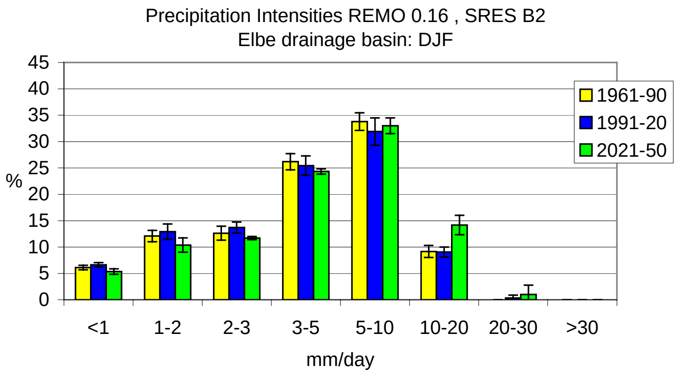



Figure1: Rhine and Elbe drainage basins: seasonal mean Temperature (REMO 5.1, 0.16 °, SRES B2)

RESULTS

In the period 1961-2050, the mean summer (JJA) temperature will rise around 2-3 °C in both drainage basins (Figure 1). The winter temperature (DJF) will rise at least around 3 °C. The variability of the mean winter temperatures are greater (~5 °C) than of the summer temperatures (~3 °C).

The daily precipitation intensities of the Elbe drainage basin show a clear increase from more than 5 % (10-20 mm) in the winter (DJF), but do not show any significant changes in the summer (JJA).



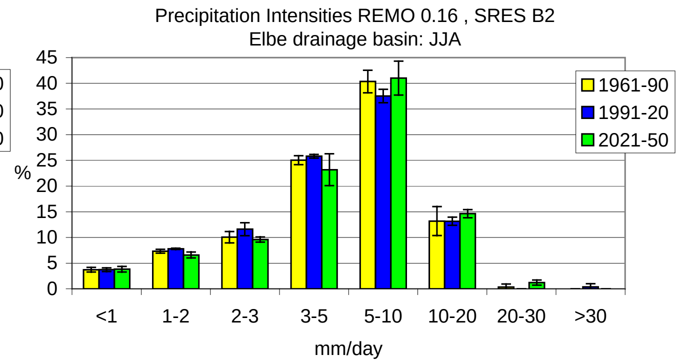




Figure 2: Simulated precipitation intensities (mm/day) for the Elbe basin (REMO 5.1, 0.16 °, SRES B2)

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