1. Abstract
Extreme climatic and hydrologic events are the major cause of Great Natural Disasters according to the United Nations. In 2008 overall losses due to flood and drought related events amounted to US$ 570 bn (Munich RE). Discharge regimes of river basins as well as top-soil moisture patterns are expected to be altered due to possible effects of climate change. For planning and water resources management, it is fundamental to estimate the probability of occurrence of extreme hydro-meteorological events as well as its intensity. Predictions of climatic variables such as temperature and precipitation are currently done with GCM and RCM for global and regional scales, respectively.

2. Research Questions
1. Are current RCMs able to reproduce the spatio-temporal variability of extreme events that were observed during the past decades?
2. Can these RCM simulations be used for reliable regional hydrologic projections?

3. Study Area and Data
   • Domain: Germany, 357,000 km²
   • Period: 1961-2000
   • Observations
     – German Meteorological Service [1]
     – Daily precipitation and temperature
     – Interpolated with external drift
     – Kriging using locally estimated variograms
   • Regional Climate Models
     – CLM, REMO, Hadrm3 [2]
     – Driven by ERA-40 reanalysis [3]
     – Resolution 25 km, aggregated to daily values
   • Extreme statistics
     – Maximum daily precipitation
     – Maximum annual precipitation
     – Number of heavy rain days per year greater than a threshold
     – Precipitation and temperature above and below a threshold value
     – Minimum air temperature in winter
     – Maximum daily precipitation in summer
     – Extreme circulation patterns (wetness index)
     – Dimensionality

4. Precipitation
   - Maximum daily precipitation
   - Minimum areal precipitation
   - Average number of heavy rain days per year (P > 40 mm)

5. Temperature
   - Number of hot days, T > 25 °C
   - Number of cold days, T < 5 °C
   - Minimum temperature in January
   - Maximum temperature in July

6. EOF of precipitation anomalies
   - Dimensionality χ(k) of the precipitation anomalies
   - λi 1st eigenvalue
   - 2-dimensional correlation matrix of precipitation anomalies

7. Extreme Circulation Patterns
   - Obs. CLM REMO
   - 1961-1990
   - 1991-2000
   - Hadrm3
   - 100 km
   - Hess and Brezowsky (1969)

8. Conclusions
   • All tested RCMs did not exhibit enough skill to predict extreme events
   • Weather anomalies (magnitude and timing) were not resolved by RCMs
   • Precipitation bias is a great issue with the evaluated RCMs
   • RCM outputs can not be used directly for hydrologic impact analysis.

References