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QUANTIFICATION OF UNCERTAINTIES AND IMPROVEMENT OF REGIONALIZATION METHODS

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1 Aim of the research within QUIRCS

The proposed work intends to supply future regionalization activities with quantitative information about accuracy and errors of regionalization methods with respect to different variables (wind, temperature, precipitation, ...) and climate parameters (mean values, standard deviations, extremes, frequencies, return rates etc.). This will help to select the most appropriate regionalization method and to assess the reliability of regional climate estimates. Moreover, it will be possible to better estimate the reliability and accuracy of different procedures. Above all those groups will benefit, which are involved in climate change estimates, climate prediction, and climate impact research.

2 Recent and completed activities

The results of the first common model experiment are just being made available by MPI. In order to test the regionalization method and related evaluation tools, the results of an older RCM simulation (10 years of double nested REMO runs, nested in ERA15 analysis data 1979-1988) have been used up to now.

The application of the statistical-dynamical approach (Fuentes and Heimann, 2000) shows that only 9 % of the full information (84 selected days out of 920) are needed to reproduce the summer mean temperature with an error of less than ±1 K. This demonstrates the potential of the statistical-dynamical approach of saving computer time in regional climate modelling without loosing too much accuracy.

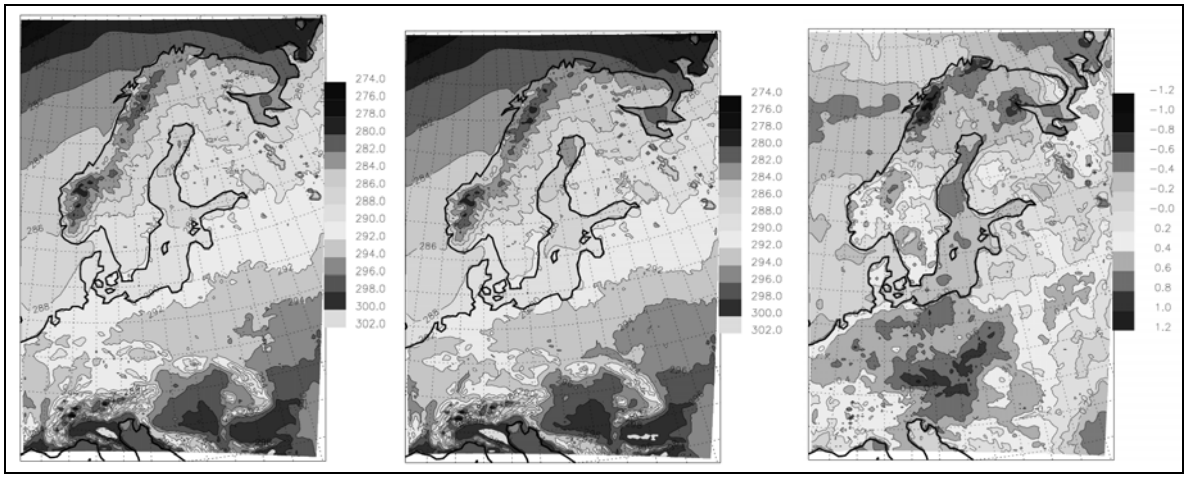

Figure 1. Evaluation of a REMO test data set. Left: JJA mean 2 m GND temperature (K) based on the complete set of REMO results (920 days). Centre: JJA mean 2 m GND temperature (K) based on selected REMO results of 22 typical episodes (84 days). Right: Deviation in K.

The statistical-dynamical approach can also be used as a diagnosis tool in regional climate modelling. It is possible to determine to what degree regional climate changes are caused by a shift in large-scale circulation patterns (weather types). With the help of the REMO test data set this was shown for the year-to-year variability of the mean summer precipitation and temperature. 77% (precipitation) and 71% (temperature) of the variance can be explained by a changing statistical frequency of large-scale circulation patterns.

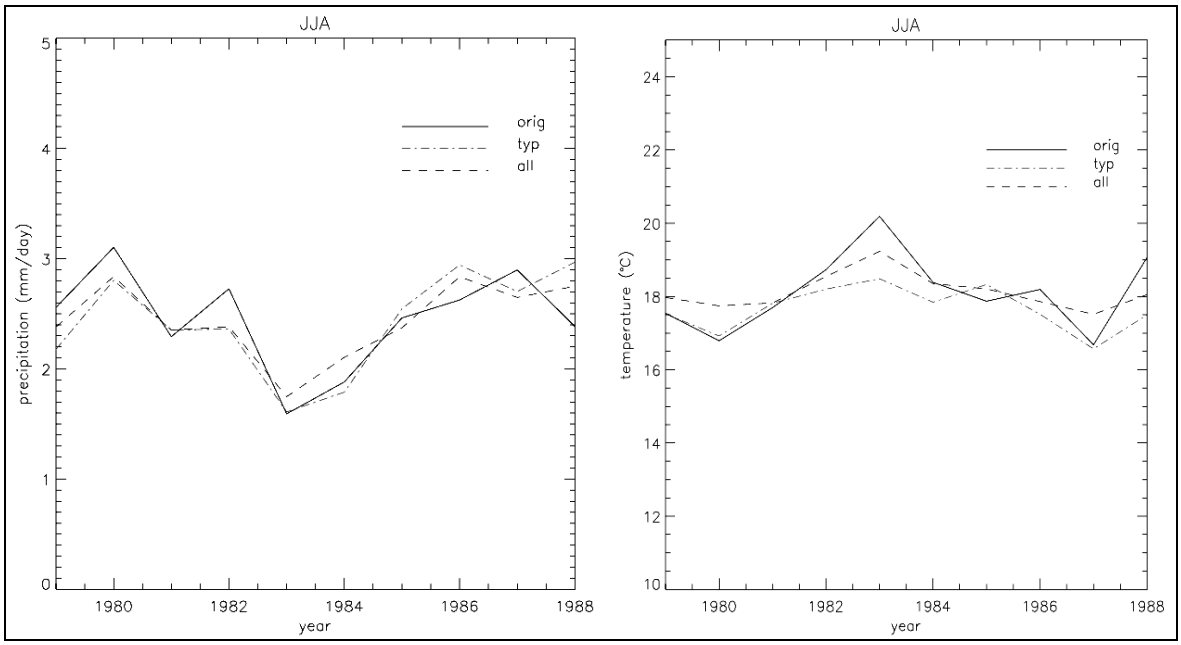

Figure 2. Evaluation of a REMO test data set. Solid curves: year-to-year variability of the JJA mean precipitation (left: in mm/day) and mean temperature (right: in °C) based on the complete set of REMO simulations. The dashed and dash-dotted curves show two different predictions of the year-to-year variability which were based on the year-to-year shift in the frequency of occurrence of large-scale circulation patterns ("Großwetterlagen").

3 Principle results and Conclusions

A complete 10-year set of preliminary RCM results was used to test the quality and the potential of statistical-dynamical predictions of long-term mean values and the year-to-year variability.

4 Planned activities

The statistical-dynamical downscaling tools will be applied to three 15-year data sets of coupled GCM/RCM (analysis: ERA15 + REMO, present day climate: ECHAM4 + REMO, climate scenario: ECHAM4 + REMO) generated in QUIRCS. The activities will serve to achieve the goals mentioned in Section 1.

References

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