Regional Climate Simulations with COSMO-CLM *

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INTRODUCTION

Within our projects at DKRZ, we applied the regional climate model COSMO-CLM in different domains with different setups. The simulations were done for Africa, the Mediterranean, or whole Europe, with horizontal resolutions ranging from 0.44° to 0.088°. In this poster we present our approach, and some preliminary results.

COSMO-CLM IN AFRICA I

Simulations
- CORDEX Africa domain, ERA-Interim forcing
- Horizontal resolutions of 0.44° and 0.22°

Approach
- Evaluation of daily minimum and maximum 2-m temperature
- Comparison with a new high-resolution gridded dataset

Results
- Regionally significant deficiencies in simulated temperature
- Diurnal temperature range underestimated in arid areas, and overestimated in tropics (Fig. 1)
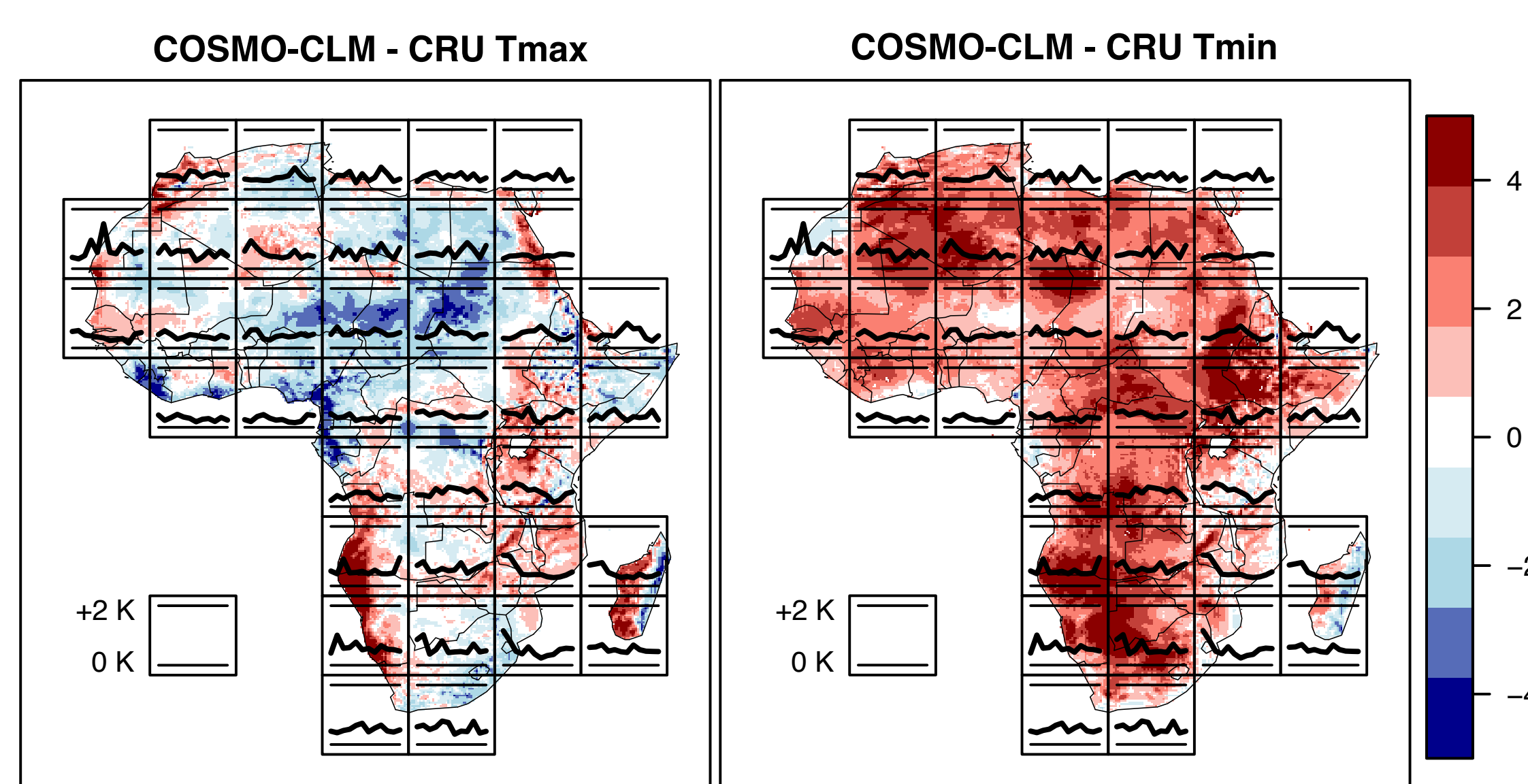- Higher resolved simulation (0.22°) on average 0.5 K warmer

Figure 1 Mean biases for the period 1990-2009 of COSMO-CLM compared to CRU data [K] for Tmax (left) and Tmin (right) biases. Thick lines show the annual cycles of the bias' standard deviations (the lower thin line indicates 0 K and the upper 2 K values).

COSMO-CLM IN THE MEDITERRANEAN REGION

Simulations
- In the framework of the HYMEX project
- ERA-Interim driven for time period 1989-2008
- Horizontal resolutions of 0.44° and 0.088°
- High resolution allows investigation of regional wind systems (see Fig. 2), hydrological cycles, or Medicanes
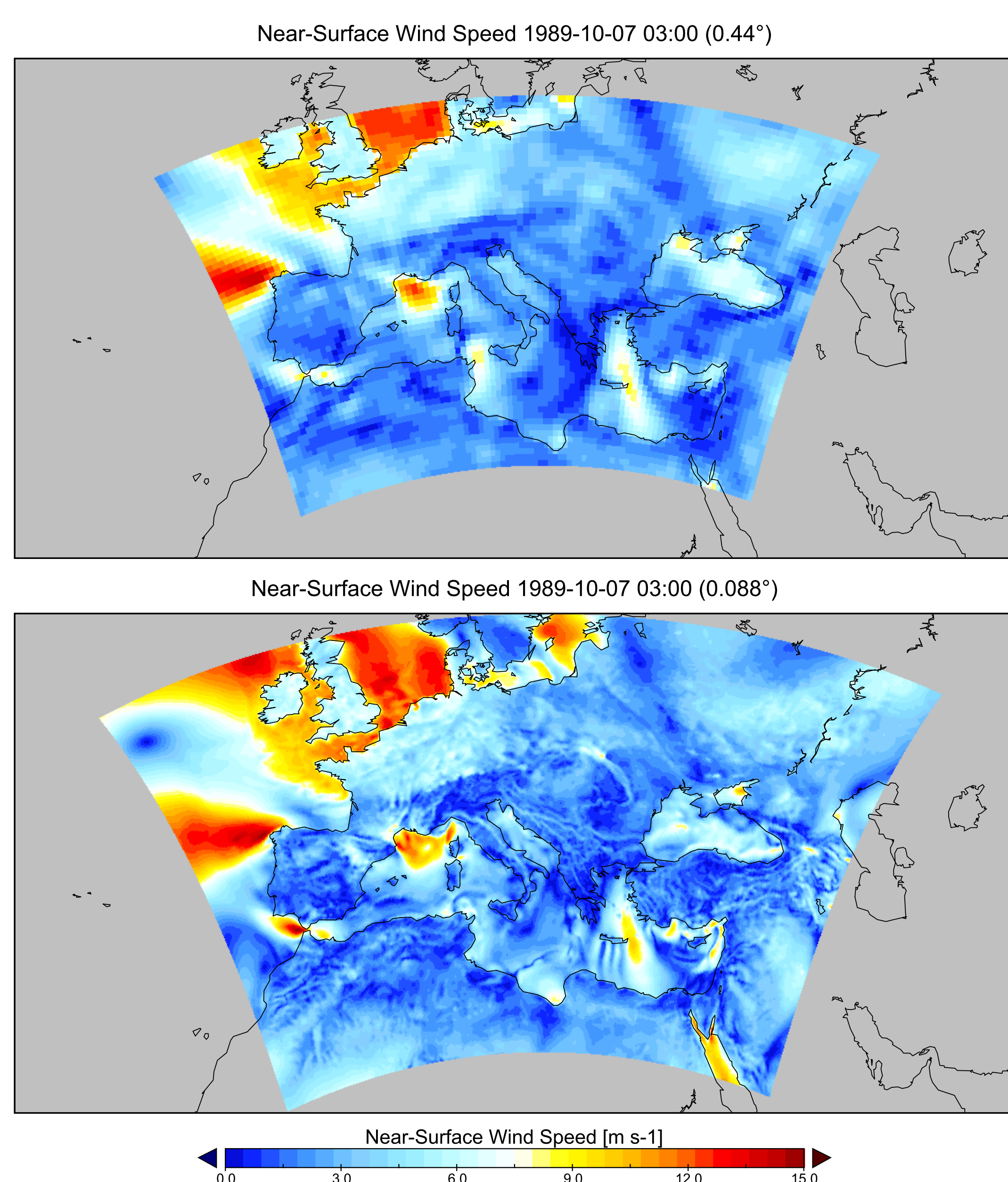

Figure 2 COSMO-CLM near surface wind speed for horizontal resolutions of 0.44° (top) and 0.088° (bottom).

COSMO-CLM IN AFRICA II

Simulation
- CORDEX Africa domain, ERA-Interim forcing
- Horizontal resolution of 0.44°

Approach
- Introduce dependency of soil thermal conductivity on soil water
- As a consequence the ground heat flux is reduced in dry regions, and enhanced in wet regions

Results
- Average diurnal range of 2-m temperature is increased in arid regions (Fig. 3c)
- Improvement in large parts of Sahara and Sahel (Fig. 3a,b)
- Might improve simulation of convective systems during the West African Monsoon
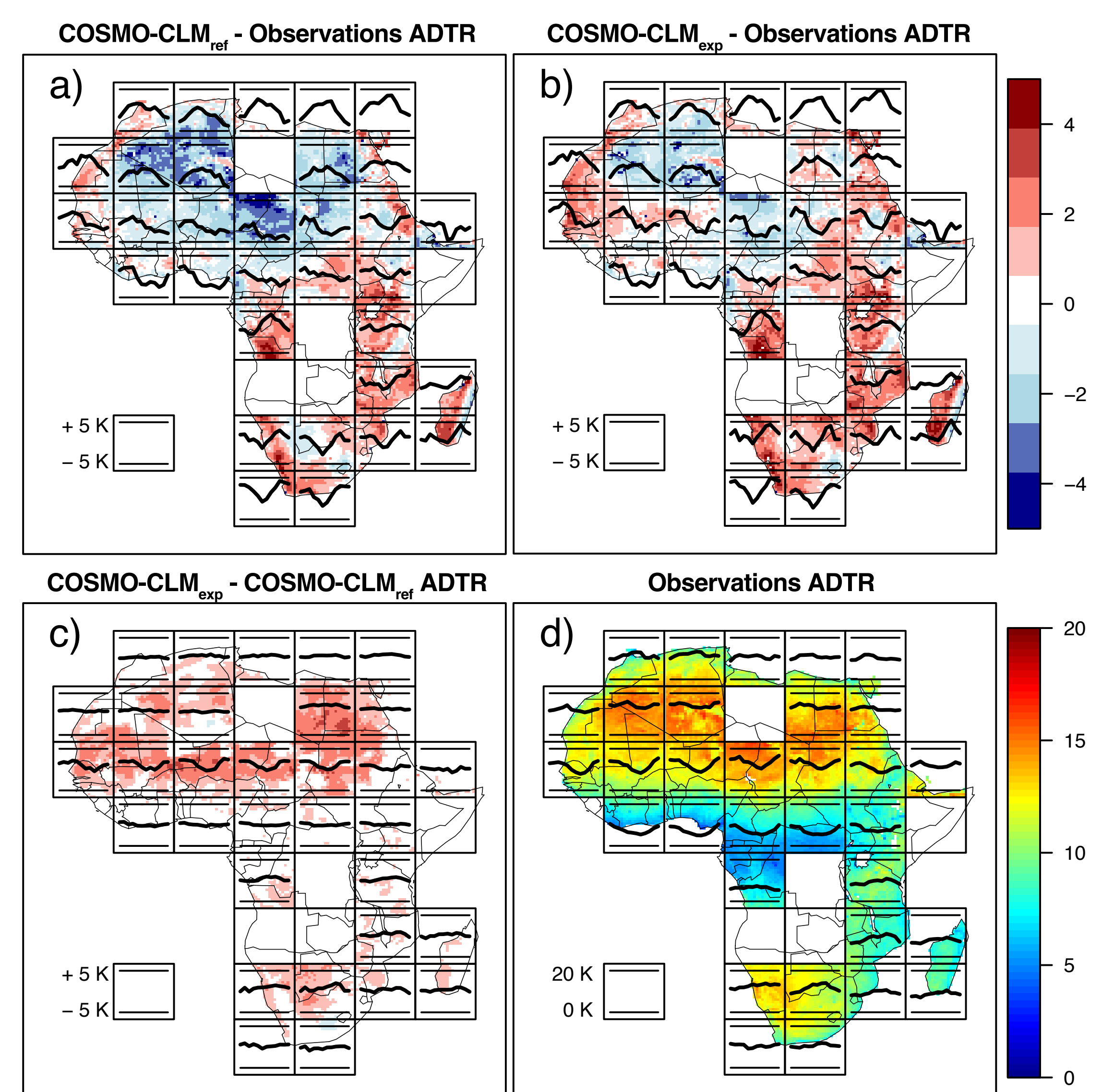

Figure 3 Average diurnal temperature range (ADTR) [K] for the period 2008-2010: a) COSMO-CLM reference minus observation, b) COSMO-CLM with modified soil model minus observation, c) difference new minus new simulation, d) observation. Thick lines show the annual ADTRs cycles.

COSMO-CLM WITHIN MIKLIP

Within the framework of MiKlip (http://www.fona-miklip.de/), the projects *DecReg* (Europe) and *DEPARTURE* (Africa) will assess the predictability of climate forecasts on a regional decadal scale. For that, an ensemble of high resolution decadal predictions with the COSMO-CLM is created by downscaling several global model simulations (mainly ECHAM6).

Contribution of the Goethe University Frankfurt
- COSMO-CLM decadal simulations, and evaluation runs
- Horizontal resolutions of 0.44° or 0.22°
- MPI-ESM-LR and ERA-Interim forcing
- Improvement of soil initialisation using sequential ensemble-based data assimilation techniques

REFERENCES

Krähenmann, S., S. Kothe, H.J. Panitz, B. Ahrens (2013). Evaluation of daily maximum and minimum 2-m temparature for Africa as simulated with the regional climate model COSMO-CLM. Submitted

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HyMeX HYdrological cycle in Mediterranean EXperiment   **FONA** Social Climate Prediction BMBF   **MiKlip**   **Biodiversität und Klima** Forschungszentrum