**Diurnal Temperature Variations in Low Mountain Ranges - Comparison of Model Data and measured Warming and Cooling Rates**

G. Ketzler (1), O. Käsmacher (1), M. Buttstädt (1), H. Merbitz (1), A. Schomburg (2), and C. Schneider (1)

(1) Department of Geography, RWTH Aachen University, Germany, (2) Meteorological Institute, University Bonn (MIUB), Germany

**SFB / Transregio 32**

Within the subproject „Scale-consistent Two-way Coupling of Land-Surface and Atmospheric Models“ of the SFB / Transregio 32 temperature data of several automatic weather stations at distinct locations in the low mountain ranges of the project area are analysed and compared with model output from COSMO - the DWD model formerly known as „Lokal-Modell“ (LM) - with a horizontal grid resolution of 400 m with respect to the underlying processes that trigger the diurnal courses.

Warming and Cooling Rates

Based on a first approach by Oke and Maxwell (1975) in urban climatology, warming and cooling rates can be interpreted as representing the hourly sensible heat flux into an air volume and can therefore be used to characterize effects of the station surroundings; a possible field of application was expected in model validation (Ketzler, 1996).

In this investigation, measured diurnal courses of air temperature in different relief positions in a low mountain area are analysed and compared with model data. Except station „AC-Hörm“ all stations are in rural surroundings, „Wildenhof“ lies on the shore of lake Runsee.

For this first study, data from the first period in 2008, with the complete station network running, were used.

### Average Diurnal Courses

Fig. 3 shows average diurnal courses of warming and cooling rates calculated from measurements (september 2008), fig. 4 the average daily extremes for the stations (same period). Maximum warming and cooling rates are both higher at the rural sites as urban sites, although the differences between the stations are partly different from the average diurnal courses. The course of the warming and cooling rates calculated from the model temperatures generally does not differ much from the measured values.

However, except the urban and the lakeside AWS, in all cases at least one of the extreme values simulated is significantly smaller than the measured one. Especially the simulated maximum warming rates are too small and the time of their occurrence is too early in two cases.

A difference in the maximum warming rate of 1-3 K/h leads to a significant deformation of the diurnal course of air temperature and is probably coupled with a general underestimation of turbulent fluxes near the ground.

These differences probably have two main reasons. The model resolution leads to a generalization of topography and other variables like soil type or land use. The interpretability and comparability of measured data and model output therefore becomes problematic for some areas with high relief energy. Additionally, effects of the weather situation must be taken into account.

### Comparison Measured/Modelled (19.09.2008)

The results for a single day in a clear sky situation (19.9.2008) are compared with model data (fig. 5 and fig. 6, table 1). The measured values are again higher for the rural sites than for the urban station, although the differences between the stations are partly different from the average diurnal courses. The course of the warming and cooling rates calculated from the model temperatures generally does not differ much from the measured values.

However, except the urban and the lakeside AWS, in all cases at least one of the extreme values simulated is significantly smaller than the measured one. Especially the simulated maximum warming rates are too small and the time of their occurrence is too early in two cases.

### Conclusion

The findings are going to be used for further validation of model output as well for the topo-climatic characterization of the different surroundings of the AWS-locations. Therefore the small scale topo-climatic influence at the various station sites needs to be further analyzed in consideration of different weather situations.

### References


