Kyselý J., Huth R., Dubrovský M., 2001: Simulation of extreme temperature events using general circulation models, statistical downscaling and stochastic generator. *Meteorol. Zpr.,* **54**, 73-82. [in Czech, with summary in English]

Extreme weather and climate events severely influence ecosystems and human society. Nevertheless, relatively little work has been done as regards extremes of surface temperature in general circulation model (GCM) and downscaling studies even though it appears to be clear that impacts of climate change would result mainly from changes in climate variability and extreme events. This study concentrates on the comparison of heat wave and cold wave characteristics in (i) observation, (ii) GCM simulated control climates (ECHAM3 and CCCM2 GCMs), (iii) statistical downscaling from observation, (iv) statistical downscaling from GCMs and (v) stochastic weather generator. As for the area involved, six sites in central Europe and the nearest gridpoints corresponding to the stations are analyzed. Observations cover the period 1961-1990.

The downscaling method used is a stepwise multiple regression of 500 hPa height and 1000/500 hPa thickness gridpoint values over most of Europe and adjacent Atlantic Ocean. Two methods of enhancing the downscaled variance to become equal to that observed are compared, namely the inflation of variance and white noise addition. Synthetic daily temperature series were produced by the stochastic weather generator Met&Roll. It deals with four daily weather characteristics, maximum and minimum temperature, sum of global solar radiation and precipitation amount. Standardized anomalies of maximum and minimum temperature are modelled by the first order autoregressive model and their means and standard deviations are conditioned by a precipitation occurrence and day of the year. Two runs of the weather generator were analyzed, namely, one considering and one neglecting the annual variation of lag-0 and lag-1 correlations among maximum and minimum daily temperature and solar radiation. Since downscaled temperature series reproduce the observed means and variances, for a fair comparison between GCMs and downscaling the distributions of GCM-produced temperatures were re-sized to have the observed mean and standard deviation.

The comparison shows that none of the models yields generally better results than the others as regards the simulation of extreme temperature events in central Europe. The ECHAM3 GCM is the best among the models in simulation of cold waves (although the unadjusted temperatures are too high) and both the ECHAM3 and CCCM2 GCMs are fairly successful in reproducing frequencies and some other properties of heat waves, e.g. the temporal evolution with the highest temperature typically reached in the second half of their duration. Too low frequency of both heat and cold waves in the downscaled time series is influenced by the unrealistic symmetry of the day-to-day temperature change distribution and (if variance is retained by adding white noise) by a too high interdiurnal variability. The stochastic weather generator reproduces most of the heat wave properties in a good agreement with observations; on the other hand, the simulation of cold waves is unrealistic since the generator strongly underestimates frequencies of extreme cold days.