



Anthropogenic greenhouse forcing and strong water vapor feedback is rapidly warming Europe

R. Philipona (1), B. Dürr (2), A. Ohmura (3) and C. Ruckstuhl (3)

(1) Physikalisch-Meteorologisches Observatorium Davos, Switzerland, (2) MeteoSwiss, Zürich, Switzerland, (3) Institute for Atmospheric and Climate Science, Swiss Federal Institute of Technology (ETH), Zürich, Switzerland (rolf.philipona@meteoswiss.ch)

Europe's temperature increases considerably faster than the northern hemisphere average. Detailed month-by-month analyses show temperature and humidity changes for individual months that are similar for all Europe, indicating large-scale weather patterns uniformly influencing temperature. However, superimposed to these changes a strong west-east gradient is observed for all months. The gradual temperature and humidity increases from west to east are not related to circulation but must be due to non-uniform water vapor feedback. Surface radiation measurements in central Europe manifest anthropogenic greenhouse forcing and strong water vapor feedback, enhancing the forcing and temperature rise by about a factor of three. Solar radiation rather decreases and changing cloud amounts show small net radiative effects. However, high correlation of increasing cloud-free longwave downward radiation with temperature ($r=0.99$) and absolute humidity ($r=0.89$), and high correlation between ERA-40 integrated water vapor and CRU surface temperature changes ($r=0.84$), demonstrates greenhouse forcing with strong water vapor feedback. The analysis shows the evolution of temperature and water vapor in Europe and the full radiation budget in central Europe since 1995.