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Temperature trends in different European mountain regions and their changes with elevation

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The manifestation of climatic change in mountain ranges differs according to elevation. In the past decade many papers show an enhanced warming in high elevations in different mountains of the world. As the main reasons the decrease of snow cover in mid- and high elevations or the increase of incoming solar radiation are mentioned. Similar behaviour of trends has been observed in the Swiss Alps, too. But, the published research is based particularly on annual mean temperatures. The question is, is the warming in the Alps uniform within the course of the year? Can we observe the increase of trends with altitude in all seasons? And can we generalize the results from the Alps to other European mountain regions?

To answer these questions, maximum and minimum temperature at lowland and mountain stations in different regions over Europe are employed. Linear trends at 92 stations for the period 1961-2010 were calculated for moving 30- and 90-day “subseasons”, each shifted by one day. The resulting annual cycle of temperature trends serves as a reliable tool to detect differences between trends in individual seasons or shorter parts of the year. The comparison of the trends in different regions and different altitudes has shown that temperature increased at all stations in summer and at many stations at the beginning of May regardless of altitude. A stagnation of temperature or weak cooling occurred during autumn in all regions particularly at higher elevations. However, there is no clear relationship between warming trends and altitude for Europe as a whole, neither for seasonal nor for monthly temperature trends. Sensitivity of trends to altitude was detected only in Central Europe in summer while in other seasons trends at mountain stations are similar to lowland trends. The behaviour of trends in the Alps and southern Europe is more varied and conclusions must be formed separately and with respect to local conditions.