EMS Annual Meeting Abstracts
Vol. 15, EMS2018-772, 2018

Elevation-dependent warming in European mountains and its possible causes

Lucie Pokorná (1,2) and Monika Kučerová (1)

(1) Institute of Atmospheric Physics CAS, Department of climatology, Prague 4, Czech Republic (pokorna@ufa.cas.cz), (2) Dept. of Physical Geography and Geoecology, Faculty of Science, Charles University, Prague, Czech Republic

Projected temperature changes in mountain ranges are of concern due to their magnitude and possible impacts. Greater and faster warming in high altitudes is expected in comparison with lowlands all over the world. However several studies for European Alps suggest that recent warming is faster in lowlands and climate models do not capture this phenomenon. To better understand the discrepancy the causes of temperature trends should be identified.

This contribution focuses on causes of trends in observed temperature in six European mountain regions during the period 1981-2010; the regions are the Alps, Black Sea region, Norway, Central Europe, and Spain. Linear trends at 85 stations were calculated for moving 30-day sliding seasons shifting during the year with a one-day step. Elevation-dependent warming was uncovered only for few short parts of the year; the causes of different magnitude of trends are discussed only for spring and summer episodes. Additionally the trends of sunshine duration (SS), interdecadal changes of snow cover (SD), and the character of atmospheric circulation were analysed for individual sliding seasons. Circulation indices of flow direction, flow strength, and vorticity were computed using the Jenkinson-Collison method modified for individual regions. Series of SS are available except the Black Sea region; SD is not measured in Spain.

The changes in circulation and SS explain a large proportion of temperature trends in Central Europe, Spain, and Norway. SS has larger effect on temperature changes in the Alps in comparison with circulation due to frequent occurrence of low stratus and fogs during anticyclonic conditions and complex orography that can modulate both flow strength and direction. The effect of SD was not confirmed.