EMS Annual Meeting Abstracts
Vol. 15, EMS2018-511, 2018

Characteristics of deep convection initiation environments in the Western Carpathians using satellite and radar observations

Róbert Kvak (1,2) and Miloslav Müller (1,2)

(1) Charles University in Prague, Faculty of Science, Department of Physical Geography and Geoecology, (2) Institute of Atmospheric Physics CAS, Meteorology, Prague, Czech Republic

Mountain meteorology has been lacking a satisfactory understanding how to explain and implement deep convection processes over complex terrain into numerical weather prediction models. Usually during warm part of the year, the atmospheric circulation over mountain slopes generates upward airflows that effect the initial and final occurrence of thunderstorms not only inside the mountains, but also through the valleys, the plains and the urban areas. An analysis of those local processes and mechanisms that initiate the unstable clouds over mountainous areas is the priority aim of our research.

The area of interest covers the geomorphological unit of the Western Carpathians while the state borders in Central Europe are ignored. Thunderstorm events in the last years are studied. Firstly, it is important to distinguish orographically modified environments (e.g. temperature profile and winds) between the effects of local topography which cause diurnal changes in airflows, and large-scale circulation, forcing the deep convection zones. Satellite (EUMETSAT) and radar (SHMI) measurements are used to study how mountain ranges and crests influence thunderstorm occurrence and life cycle of the clouds in their proximity. Thanks to these distance measurements, we are able to identify the specific triggering localities and general forcing mechanisms over complex terrain approximately in 1 km spatial resolution.

Our methods are based on combination of the products and basic morphometric characteristics (e.g. slope orientation) of the topography using DEM (digital elevation model) with the same spatial resolution. For instance, the study shows thunderstorm initiation sites for different ridgetop-level wind regimes, and for different stratification of the atmosphere with respect to blocking effects of the mountains on airflows, producing the local convergence zones. Data for examination of the atmospheric conditions come from aerological soundings and summit stations throughout the Western Carpathians and surroundings.