Radial-based severe storm climatology for Austrian complex orography related to vertical wind shear and atmospheric instability.

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Abstract

Thunderstorm development in Austria is highly influenced by orographical forcing especially in summer. The further development toward local severe storm formation depends on the strength of instability and vertical wind shear which interact with mesoscale influences. For closer insight, the temporal and spatial distribution of severe thunderstorms as a function of CAPE and deep vertical wind shear are examined. A five year period of C band weather radar data is exploited over the complex orography of Austria and linked to ECMWF ERA-Interim data for classification of synoptic flow, vertical wind shear and instability.

A minimum of severe storms over the Alps is found in high altitudes of the south-western region which corresponds to lightning data. Westernly and southerly flow classes are associated with more widespread intense thunderstorm development. One of the key results is that the strong deep-layer shear environment leads to organized, line oriented patterns over wide areas of Austria. These preferred areas for severe storm occurrence can be well used for nowcasting. Especially during low CAPE conditions the magnitude of deep-layer shear is very important for the spatial arrangement, maximum size of the convective system, and time of occurrence. For the eastern part of Austria and the Alps, high deep-layer shear tends to produce larger cell cores in terms of high radar reflectivity. For the Alps during low CAPE conditions and for the eastern part of Austria for all CAPE classifications, the strong deep-layer shear increases the frequency of severe storms and shifts the peak of occurrence from afternoon toward the evening.

Motivation

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<tr>
<th>CAPE [J/kg]</th>
<th>0 500 1000 1500 2000 2500 3000</th>
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<tr>
<td>VWS500-SFC [m/s]</td>
<td>0 5 10 15 20 25 30</td>
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Conditional Climatology of Austrian Weather Radar Data:
Shear/CAPE influence on spatial distribution, diurnal cycle and size of MCS: