18–22 September 2017, Pula, Croatia
ECSS2017-10

Analysis of orographic influence on hail parameters in NW Croatia

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Deep moist convection often yields hail, which is a subject of this work, as a significant precipitation form in many parts of the world. Located in the mid-latitudes of the northern hemisphere, Croatia is exposed to frequent occurrence of thunderstorms and hail, especially in its continental part. In the second half of twentieth century, in order to reduce the risk of damage in agricultural production, a hail suppression system (HSS) was established in the area. Total number of hail cases recorded on HSS stations in time period 1981-2016 is 13995. With the goal to obtain objective and precise hailstone measurements for research studies, hailpads were installed in 2001 on all hail suppression and main meteorological stations. In addition, in 2002 a dense network of hailpads (polygon) was built in the northwest of the continental part of Croatia.

In this study, hail suppression station data, radar data, lightning data and hailpad polygon data are used in order to test the hypothesis about the quantitative influence of orography on the spatio-temporal distribution of hail (2002-2016). Comparison of average hailfall duration per season on all hail suppression stations in Croatia and on the polygon shows that the duration on polygon is by 50 % longer than in the whole continental part of Croatia. While hail suppression stations data, radar data and lightning data indicated the orography influence in rather descriptive way, we also use a more objective approach for testing the hypothesis, namely, the Empirical Orthogonal Function (EOF) analysis on the polygon data. EOF analysis is a method that is used for identification of variation patterns that are common to a certain group of data The EOF approach is for the first time applied to such kind of data and the results have confirmed the influence of orography on the distribution of hail. Since elevations of our mountains are below 1500 m, and since they are almost parallel and relatively close to each other, our results suggest that the hailstone distribution over our polygon may be caused by the channelling of the flow between mountain ranges with stagnation and growth of Cb-cells at front of the mountains superimposed.