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Analysis of modeled hail parameters obtained by numerical mesoscale WRF-HAILCAST model

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In Croatia, knowledge about the hail characteristics is extremely disproportionate between continental and coastal parts. Due to the long history of hail suppression activities in the northern (lowland) part of Croatia, hailpads were placed at main meteorological stations, locations used for hail suppression activities as well as on the specially designed polygon in northwestern part of Croatia. Parameters that can be determined by hailpads are: (i) diameter and number of hailstones and (ii) the kinetic energy (KE) of hailstones. KE represents the basic variable since it is a measure of hail intensity and it is directly related to the degree of damage of various crops. The existing analysis of measurements showed that parts of western and central Croatia have the highest frequency of hail occurrence characterized by large intensity, and most of these events are observed near the western isolated mountains. In Istria (western part of Croatia), similar frequency of days with hail was observerd, which is comparable with those in the continental part of Croatia.
Therefore, two selected hail events are simulated using the WRF-HAILCAST model. HAILCAST consists of a 1D, steady-state cloud model coupled with a time-dependent hail growth model. It underwent further changes in the last decade thanks to convection-permitting models which allow the use of prognostic atmospheric variables. The more physically realistic updraft (described by the nearby atmospheric temperature, moisture, and thunderstorm vertical velocities) predicts the hail, its size and evolution over time throughout a convective life cycle. Here, a set of numerical WRF experiments are performed to study processes leading to hailstone growth, to assess the sensitivity of results to model setup and to provide guidance for tuning of hailcast results. The results are verified by observational (hailpad, hail observations) data as well as with radar measurements where available.