



Increase of the largest hailstone diameter with melting level rise

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The primary effect of climate warming is a dilatation of the troposphere, and a direct consequence is a rise in the melting level height, $h_0^{\circ}\text{C}$. According to the projection made by the Intergovernmental Panel on Climate Change, $h_0^{\circ}\text{C}$ will rise by about 500 m within 2050 in southern Europe. This change will directly influence hailstone melting, and also the atmospheric convective parameters leading to hailstone growth. In this study, an upscaling process of point hailfall measurements made in Southwestern France over 30 years intends to look for the global effect of this rise on the hail characteristics.

In an area of about 20,000 km², the ANELFA network of 336 hail pad stations has recorded 3640 point hailfalls on 770 hail days during the 1988-2017 hail seasons. For a day with several impacted stations, the polystyrene plates often exhibit strong similarities, for example a great number of small hailstones and a small number of large ones, or the opposite. This visual observation has led to considering, for each hail day, a virtual hailstone size distribution computed from the averaged values of hailstone numbers in different diameter ranges. This upscaling process, initially devoted to the evaluation of a hail prevention project based on a large-scale silver iodide seeding from ground generators, is also appropriate to study the correlations between $h_0^{\circ}\text{C}$ and hailfall characteristics.

For a sample of 22 major hail days during which at least 8% of the hail pad stations were impacted, the day-to-day linear correlations between $h_0^{\circ}\text{C}$ and the elements of the virtual hailstone size distribution are considered. For each day, $h_0^{\circ}\text{C}$ is determined with the WRF model at the geographical center and time of the hail outbreak. The correlations indicate that an increase in $h_0^{\circ}\text{C}$ will not significantly change the frequency and the intensity of point hailfalls, but will induce a significant increase of the largest hailstone diameter. This increase is light, but the correlation has a statistical significance level better than 1%. The consequences may be important for the damage to properties, particularly to cars and grounded aircraft, and for the insurance industry in general.