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## The summer 2021 Switzerland hailstorms: major impacts and unique observational data

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From June 18 to July 31, 2021, a series of exceptional hailstorms occurred over Switzerland, causing major damages to buildings, cars, and crop fields. The available estimates from the insurance companies suggest that these events will be among the most expensive of the last decades. At the same time the events provide a unique research opportunity as the hailstorms were well captured by various observing systems: a newly set-up network of automatic hail sensors that report the size and kinetic energy of individual hail stones with very high temporal and size resolution, the crowdsourcing function of the MeteoSwiss app, and two radar-based operational hail products. The recently established radar-based Swiss hail climatology shows that the events of 2021 were extreme with high return periods both in terms of the reported hail stone sizes and in their spatial extent. Using the data captured by those complementary hail-dedicated observing systems, we review the hail activity in Switzerland during the period of interest and investigate two particularly intense hail days: June 28 (HD1) and July 8 (HD2). On HD1, the storms originated in western Switzerland, moved along the northern flank of the Swiss Alps in a Southwest to Northeast motion, and one storm evolved in a mesoscale convective system. On HD2, the storms originated in Northern Italy and moved over Southern Switzerland (Ticino) in a South to North motion. We look at the synoptic-scale situation, mesoscale environment, and storm tracks of HD1 and HD2 in details and demonstrate their exceptional character with respect to the climatology. We touch upon the new research avenues opened by the automatic hail sensors measurements both individually, as they allow to capture the time evolution of the hail stones size distribution, and in combination with the crowdsourcing and radar data (cross-validation of the radar-based hail algorithms).