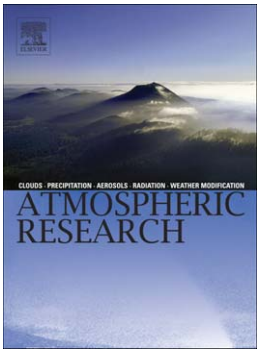

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A severe hail storm in complex topography in Switzerland - observations and processes

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Abstract

This paper studies a damaging hail storm that occurred on 6 June 2015 in the complex topography of Switzerland. The storm persisted for several hours and produced large hail resulting in significant damage. Storms of comparable severity occur on average only three times per year within the entire Swiss radar domain, but are rare events at this exact location, according to a set of over 400,000 automatically identified storms. A multitude of datasets, partly novel for central Europe, is now available to study the storm in great detail capturing its impacts, severity and development. The data we use include radar-based hail products, crowd-sourced hail reports, and insurance loss data. These independent datasets permitted a verification of both hail occurrence and hail size estimations by radar. The crowd-sourced reports agree well with radar-based hail observations and insurance data. Model data (ERA-Interim reanalysis, regional COSMO-2 analysis and WRF simulations) and radio-sounding data showed, that conditions were favourable for thunderstorm development due to an unstable and moist atmosphere over Switzerland, brought about by an interplay of large-scale pattern and local processes. Advection ahead of a cold front west of Switzerland and local evapotranspiration lead to high lower-tropospheric moisture. The large-scale flow and topographically induced Alpine pumping resulted in strong directional wind shear, and contributed to the longevity and severity of this storm. The cold front was not relevant for the vertical lifting. Using model simulations with very high resolution, we identified mountain wind systems and cold-air outflow as possible triggering and propagation mechanisms of this hail storm.

Keywords: hail, weather radar, crowd-sourcing, severe weather, complex topography, WRF

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