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The severe hailstorm in Germany on 28 July 2013: Characteristics and meteorological conditions

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At the end of July 2013, a series of violent thunderstorms with large hail, severe gusts and heavy rain affected several parts of Germany. These storms were triggered by pre-frontal convergence zones that formed within unstable air masses ahead of a low pressure system named Andreas. They marked the end of a short, but intense heat wave with temperatures up to 38°C.

On 28 July, two supercell thunderstorms formed in the Rhine valley upstream of the Black Forest Mountains and moved almost parallel over the Swabian Jura and Bavaria. While the northern cell was weaker, the southern cell substantially intensified in the first hours and created hailstones with diameters of up to 8 cm. The hail fell mainly over a heavily populated region between the cities of Reutlingen and Tübingen with a high concentration of exposed assets. The track of that supercell ended in the north of Czech Republic and had a length of 500 km. Approximately 80,000 buildings were severely damaged by this major hailstorm. In total, insured loss was estimated to amount around 2 bn EURO, which is even higher than that related to the June flood in Germany in the same year.

In this paper we investigate the temporal evolution and the characteristics of the most damaging supercell on 28 July by combining different data from remote sensing instruments such as radar, satellite, and lightning detection systems with ground-based observations and reports from eye-witnesses and a crop insurance company. Additional simulations with the Consortium for Small Scale Modelling COSMO-DE model with different setups reveal the important role of the cold pool for the triggering of the most severe hail cell. It will be shown that a major problem for simulating the storm was its initiation, while, once triggered artificially by "warm bubbles", its track could be simulated rather well over several hours. Moreover, the operational COSMO version has some problems to simulate the observed reflectivity structure of the hailstorm, while a two-moment microphysical scheme yields results in very good agreement to the observations. Finally, a historical context is provided by comparing that event with other severe hailstorms that occurred over recent decades in Germany.