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Characterisation of severe convective events using a multi-data approach

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Severe weather associated with deep convection poses a significant threat to life, property and economy. A synergetic multi-sensor approach is needed to fully observe, understand and hence predict convective weather events.
The nowcasting of severe convective events remains a challenging endeavour that suffers from relatively low skill and high false alarm rates.
A comprehensive set of various observations is used to characterise severe convective events. The observations include measurements from a lightning detection network, precipitation radar, geostationary satellite and weather stations, as well as information from an automated cell detection algorithm based on radar reflectivity which is combined with severe weather reports, and damage data from insurances.
The analysis shows the advantages of a multi-sensor and multi-source approach in characterising convective events and their impacts. Using data from various sources allows to combine the different strengths of observational data sets, especially in terms of spatial coverage or data accuracy, e.g. damage data from insurances provide good spatial coverage with little meteorological information while measurements at weather stations provide accurate but pointwise observations. Furthermore, using data from multiple sources allow for a better understanding of the convective life cycle. Several parameters from different instruments are shown to have a predictive skill for convective development, these include satellite-based cloud-top cooling rates as measure for intensive convective growth, 3D-radar reflectivity, mesocyclone detection from Doppler radar, overshooting top detection or lightning jumps to evaluate storm intensification and formation of severe weather. This synergetic approach can help to improve nowcasting algorithms and thus the warning process.