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Meteosat-based Characterization of the Initiation and Growth of Severe Convective Storms over Central Europe

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The initiation, the growth phase and the transition to the mature phase of severe convective storms over Central Europe is investigated based on an extended case database for the years 2012 to 2014. Using data from the SEVIRI imaging radiometer aboard the geostationary Meteosat satellite, dynamical and microphysical properties of developing storms are collected and combined. Several satellite-based storm properties, e.g. cloud-top temperature, cloud-top cooling rate and cloud particle effective radius, are studied following storm tracks. In addition, onset and time rate of lightning, as well as changes in precipitation magnitude and heavy precipitation areas in vicinity of the storm tracks are considered.

Several distinct times within the life cycle of developing storms are considered for synchronization of their tracks: time of the maximum cloud-top cooling rate, time of maturity (when growth in the vertical is significantly slowed down), time of first lightning and onset of heavy precipitation. The majority of studied storms show a distinct maximum in cloud-top cooling rate. The cloud growth phase is divided into an initial updraft intensification period before the maximum cooling and a continued growth period afterwards. The initial updraft intensification period is very variable and strongly depends on the initiation mechanisms. The continued growth period is more confined lasting between half and one hour. Connections between time rate of cloud-top cooling, anvil area changes, and changes in top-cloud microphysical properties are presented.