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Climatology of convective showers dynamics in a convection-permitting model

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Convection-permitting simulations have proven their usefulness in improving both the representation of convective rain and the uncertainty range of climate projections. However, most studies have focused on temporal scales greater or equal to convection cell lifetime. A large knowledge gap remains on the model's performance in representing the temporal dynamic of convective showers and how could this temporal dynamic be altered in a warmer climate.
In this study, we proposed to fill this gap by analyzing 5-minute convection-permitting model (CPM) outputs. In total, more than 1200 one-day cases are simulated at the resolution of 0.01° using the regional climate model COSMO-CLM over central Europe. The analysis follows a Lagrangian approach and consists of tracking showers characterized by five-minute intensities greater than 20 mm/hour. The different features of these showers (e.g., temporal evolution, horizontal speed, lifetime) are investigated.
These features as modeled by an ERA-Interim forced simulation are evaluated using a radar dataset for the period 2004-2010. The model shows good performance in representing most features observed in the radar dataset. Besides, the observed relation between the temporal evolution of precipitation and temperature are well reproduced by the CPM.
In a second modeling experiment, the impact of climate change on convective cell features are analyzed based on an EC-Earth RCP8.5 forced simulation for the period 2071-2100. First results show only minor changes in the temporal structure and size of showers. The increase in convective precipitation found in previous studies seems to be mainly due to an increase in the number of convective cells.