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Simulating lightning into the RAMS model: two case studies

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In this paper we show the results of the implementation of a tailored version of a methodology already presented in the bibliography to simulate flashes into the Regional Atmospheric Modeling System (RAMS).
The method gives the flash rate for each thundercloud, which is detected by a labelling algorithm applied to the output of RAMS. The flash rate is computed by assuming a plane capacitor model, which is charged by the non-inductive graupel-ice charge separation mechanism and is discharged by lightning. The method explicitly considers the charging zone and uses the geometry of the graupel field to redistribute the flashes.
An important feature of the method is that it gives the position and time of occurrence of each flash, allowing for a detailed and comprehensive display of the lightning activity during the simulation period.
The method is applied to two case studies occurred over the Lazio Region, in central Italy. Simulations are compared with the lightning detected by the LINET network. The cases refer to a thunderstorm characterized by an intense lightning activity (up to 2800 flashes per hour over the Lazio Region), and a moderate thunderstorm (up to 1600 flashes per hour over the same domain).
The results show that the model is able to catch the main features of both storms and their relative differences. This feature is promising because the method is computationally fast and gives a tool to the forecaster to predict the lightning threat.
Nevertheless there are errors in timing (O(3h)) and positioning (O(100km)) of the convection, which mirrors in timing and position errors of the lightning distribution. These model shortcomings presently limit the use of the lightning forecast; nevertheless the method can take advantages of future development of the model physics, initialization techniques, and ensemble forecast. A useful application of the method in an ensemble forecast is already suggested.