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Modeling the flash rate in thunderstorms: an implementation into the CRAMS model.

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In this work it is described the implementation of a simplified form of the approach of Dahl et al. (2011) to simulate the flash rate of thunderstorms in the CRAMS (Calabria Regional Atmospheric Modeling System).
The CRAMS model is derived from the RAMS model (Pielke at al., 2002), the main difference being the inclusion of a data-assimilation system tailored for the model (Federico, 2012).
Simulating lightning is not new. Nowadays, advanced three-dimensional cloud models are equipped with sophisticated electrification schemes. These make use of results from laboratory experiments, which have revealed the magnitude and direction of charge transfer during hydrometeors' collisions. In these schemes, the dielectric breakdown is modelled explicitly by initiating lightning channels that exhibits realistic branches propagation.
On the other hand, there are comparatively simpler schemes that provide the storm lightning frequency. The approach followed in this work also computes the lightning frequencies, without distinguishing between intra-cloud and cloud-to-ground flashes.
The applications of these simulations are manifold. Lightning not only poses a threat to life and property, but it also influences the atmospheric chemistry by its ability to create nitrogen oxide. Moreover, the comparison between observed and simulated lightning provides a way to gain insight into how realistically the model is simulating convection.
The theoretical approach is based on the idea that the flash rate is not only determined by the charging rate, but also by the geometry dependent strength of each lightning flash.
The methodology, whose implementation in the CRAMS model will be discussed in detail, has been applied to a case study of intense precipitation occurred over Rome on 20 October 2011, in the morning.
The modelled flash number and spatial distribution are compared with those measured from the LINET network (Betz et al., 2009). The network detects signals in the very-low frequency/low frequency (VLF/LF) range and uses the time of arrival technique to determine the three-dimensional position of the discharge.
The comparison for the case study shows that the total number of flashes is well simulated by the model. Nevertheless, the measured pattern of the flashes shows convective activity over the sea, which is not properly modelled by CRAMS.

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