



The advantages of using intra-cloud data for severe weather warnings

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After a period of testing, the Meteorological Service of Catalonia put in pre-operational mode on 2016 an algorithm for nowcasting severe weather (here defined as hail of size over 2 cm., strong winds associated with convection, downbursts, and/or tornadoes), based on sudden rise of total lightning rate in thunderstorms. The algorithm, called lightning jump (LJ), was adapted and modified from different works made in the USA (Schultz et al, 2009; Williams et al., 1999; Darden et al., 2010; Gatlin and Goodman, 2008). The main differences are centred in the use exclusively of lightning data, instead of the combination with other remote sensing data (radar or satellite imagery). Farnell et al. (2017) shown that in the case of severe weather, lightning activity is quite intense for being detected during a large period (more than 20 minutes). In fact, this is one of the principles of the algorithm: the maintenance of a large lightning rate per minute for more than 14 minutes. The second key parameter is a sudden increase of this activity, which, in fact, is the LJ itself. The exclusive use of the electrical activity registers allows to refresh the algorithm warning more frequently (each minute, instead of the 6 minutes for radar imagery, or 15 minutes for the satellite data), and in near real-time: the warning is triggered only one minute after the occurrence of the LJ. This fact results fundamental at the time of generate alerts to population. The Meteorological Service of Catalonia manages one of the few lightning location systems (LLS) in Europe that detects cloud-to-ground (CG), but also intra-cloud (IC) flashes in practically all the totality. This fact results providential at the time of running the algorithm, because of the influence of the IC in the total lightning activity. The present work shows the differences in the results of the algorithm, in the different LLS configurations: identifying only CG; detecting some IC; and with a whole detection of total flashes. The analysis has been made for several events of severe weather in Catalonia (NE of the Iberian Peninsula) for the period 2006-2013.