



Total lightning activity associated with sprite events observed over France on 23 July and 28 August 2003

O. van der Velde (1), S. Soula (1), L. Knutsson (1,2), T. Neubert (3) and T. Allin (4)

(1) Laboratoire d'Aérodynamique, Toulouse, France, (2) Now at the Swedish Meteorological and Hydrological Institute, Norrköping, Sweden, (3) Danish Space Research Institute, Copenhagen, Denmark, (4) Danish Technical University, Lyngby, Denmark
(vdvo@aero.obs-mip.fr / Phone: +33 561332735)

The European research program “Coupling of Atmospheric Layers” (CAL) is devoted to multidisciplinary research on brief electrical discharges high above thunderstorm tops, known as “sprites”. As part of the CAL project, our task is to investigate conditions in thunderstorms which lead to the occurrence of sprites. During the observation campaign held in the summer of 2003, a camera installed at Pic du Midi (2877m) recorded more than a hundred sprites that occurred during 10 nights. Sprite directions were derived from the video imagery by matching visible stars with those in an astronomical sky plotting program, returning accurate directions for the sprites within view. The directions were then converted to great-circle paths. Positive cloud-to-ground lightning (+CG) was usually detected shortly (~ 100 ms) before the sprite, and is used as estimation to pinpoint the distance of a sprite along the direction from Pic du Midi. The French Météorage network provided detection of cloud-to-ground lightning, while a SAFIR interferometer system in the southeast of France detected VHF sources. Weather radar over France and IR cloud top temperatures were used to analyse the storm systems.

Two sprite nights in particular are being investigated, because of the availability of total lightning data: July 23rd and August 28th 2003, with respectively 13 and 35 events recorded. On July 23rd, sprites clustered together in time during periods of weak lightning activity, when the relative proportion of +CG flashes was elevated. During this period, the +CG flashes that preceded the sprites happened in the same small portion of the storm system, near remnants of convective cells embedded in the stratiform region. The +CG flashes that produced sprites were situated under the

highest cloud tops, as opposed to similar flashes that did not produce any sprites. There is a great variability of VHF sources recorded from sprite-associated flashes. One sprite was apparently solely associated with a very intense, rather compact intracloud flash, whereas for most of the sprites for which a +CG was detected, VHF sources were often much more sparse. VHF sources in combination with detected +CGs indicated that the lightning activity associated with most of the sprites occupied or connected areas in the order of tens of kilometres of (semi-convective) stratiform region of the storm system. Generally, events that consisted of several sprites happened in a broad region over the associated lightning activity. During the active period 21:52-22:09 UT, the direction of the most intense carrot sprite of each of 3 events was collocated with the VHF cluster rather than the +CG location, whereas no VHF sources were detected for the 2 events without carrot type sprites. For the 23:21 UT event it can be shown that the complexity of the electric field in and above the storm, as indicated by lightning activity within the second of the sprite, could have had an influence on the position and shape of the sprite.