Sprite altitudes determined from simultaneous measurements

Ryan Haaland [1], Geoff McHarg[2], Hans Nielsen[3], and Takeshi Kanmae[3]

[1] Fort Lewis College, Durango, CO USA
[2] United States Air Force Academy, CO USA
[3] University of Alaska, Fairbanks, AK USA

We report the results of a campaign to measure sprite altitudes by triangulation using observations from two different ground locations. We describe the technique used during a summer 2007 campaign in New Mexico, the equipment used, and preliminary results from ten simultaneous events.

Our methodology consists of observing cameras at a fixed site, in this case Langmuir Laboratory (operated by New Mexico Institute of Mining and Technology in Socorro NM) and a roving platform whose location is set based on thunderstorm patterns for a given day. The fixed-site equipment consists of a 1/2-inch CCD, TV-rate camera co-aligned with an intensified, high-speed imager. The TV-rate camera has an 12 - mm, F0.8 lens and serves as the scene camera for intensified imager. We record video data digitally with a GPS time stamp overlayed. The portable platform consists of the same TV-rate camera and lens. The camera feed is recorded digitally, again with GPS location and time-stamp overlay on the video signal.

The viewing azimuth and elevation for the fixed-site camera are set based on the storm track and lightning activity from the National Lightning Detection Network (NLDN). We position the portable platform based on the storm track and attempt to maximize the observation baseline for a given storm. The portable site reports its location back to the fixed site. Based on this location, the storm track, and lightning data, we determine the viewing azimuth and elevation for the portable camera. The viewing angles for the portable equipment are set with a transit attached to the portable camera. Any further adjustments to the fixed-site camera are updated and reported to the roving site.

We compare the fixed-site scene-camera and roving camera data and look for co-incidental sprite events based on GPS time stamps. The viewing angles for the roving site camera are approximate. We refine those measurements by comparing star fields immediately before or after the sprite event. By matching the scene star field to a database, we determine the azimuth and elevation of the sprite from two different locations. With these data, we triangulate the altitude of each sprite.

For the night of 22-23 June 2007 (UT), we recorded ten simultaneous sprite events with the fixed-site camera at Langmuir Laboratory and the roving camera east of Las Vegas, NM. We will report the altitudes for these ten events based on the methodology described above.