Low-frequency radio emissions from high-altitude sprite discharge

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When lightning strikes from a towering cumulonimbus cloud down to the ground, the electrical discharge can perturb the atmosphere's electric field, potentially triggering a second event-sprite discharge. This more elusive type of electrical discharge, which produces lightning that is red in color, initiates from high altitudes, with streamers propagating down toward the top of the cumulonimbus cloud.

Coincident with the dramatic displays, researchers have previously identified low-frequency radio emissions, which they suggest may be produced in association with the sprite discharge. Investigating this hypothesis, Qin et al. used a two-dimensional plasma model to calculate the radio emissions that should be produced by a single sprite streamer.

The authors find the frequency of the radio emissions that should be produced by a sprite streamer depends on two main factors: the air density (which decreases with altitude) and the background electric field through which the streamer is propagating. The authors find that sprite streamers that initiate from 75 kilometers (47 miles) altitude emit radio waves with frequencies from 0 to 3 kilohertz (up to the "very low frequency" range).

If the sprite streamers spawned at 40 kilometers (25 miles) altitude, they would emit low-frequency radiowaves, with frequencies up to 300 kilohertz. Further, the authors suggest that the sprite streamers branching mechanism could act as a band-pass filter, with the radio wave frequencies being lower at high altitudes than at low altitudes.

More information: Low frequency electromagnetic radiation from sprite streamers, *Geophysical Research Letters*, doi:10.1029/2012GL053991, 2012

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