



Sprites in the global atmospheric electric circuit

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The atmospheric electric field in the global electric circuit resulting from mesospheric sprite discharges is inferred from a coupled model for the global static and dynamic electric fields derived from Maxwell's equations. It is found that the global atmospheric electric field from individual sprites is $\lesssim 44$ mV/m, which can be measured with conventional ULF/ELF radio wave antennas at frequencies $\lesssim 4$ Hz with an accuracy $\lesssim 10\%$ at source-receiver distances from 8-10 Mm. The DC atmospheric electric field from an individual sprite with a charge moment of 1 kC·km, e.g., $Q = 20$ C of charge transported in a sprite of $l/2 = 25$ km vertical extent, is 4.4 mV/m. Since the largest charge moments observed on planet Earth are ~ 10 kC·km, this places an upper bound on the DC atmospheric electric field resulting from an individual sprite $\lesssim 44$ mV/m, or $\sim 3 \cdot 10^{-4} E_z$, where $E_z \approx 150$ V/m is the total global DC atmospheric electric field.