



On 3D detection of lightning discharges and associated events with a small scale interferometric network of radio receivers

A. Mezentsev and M Fullekrug

University of Bath, Bath, United Kingdom (andrew.mezentsev@gmail.com)

Lightning discharges cause different phenomena in the atmosphere such as sprites, gigantic jets and runaway electron beams. Lightning discharges and their associated events exhibit characteristic electromagnetic signatures in a wide range of frequencies. These electromagnetic signatures are detected and recorded with radio receivers for a detailed investigation.

This work uses a small scale network of wide band digital radio receivers, which record vertical electric field strengths in the frequency range from ~ 4 Hz to ~ 400 KHz, with a sampling frequency of 1 MHz, an amplitude resolution of $\sim 35 \mu\text{V/m}$ and a timing accuracy of ~ 12 ns.

The small scale interferometric network consists of eight radio receivers, which are separated by distances ranging from 1 km up to 30 km. The network was deployed in Southern France from July to September 2011. Three additional receivers served as remote reference measurements at distances from 300 km up to 1000 km. The small scale interferometric network enables the detection of lightning discharges and associated events in three dimensions for nearby thunderstorms which are less than 500 km away.

The network operated successfully during several nearby sprite producing thunderstorms. The recorded waveforms are very consistent and exhibit small time delays which reflect the propagation of the electromagnetic waves across the network. These time delays are used to determine the bearing and elevation angle of the arriving electromagnetic energy. The first results obtained with the interferometric network are presented.