An Analysis of ELF Sferics Produced by Rocket-Triggered Lightning

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Abstract

Lightning regularly generates ELF radio atmospherics (sferics) in the 5-500 Hz frequency range. The processes that produce ELF sferics have been studied for more than 50 years. Rocket-triggered lightning experiments at the International Center for Lightning Research and Testing (ICLRT) located at Camp Blanding, Florida provide a unique data set for comparing the source characteristics of a lightning return stroke to the ELF sferic measured at great (>3,000 km) distances. In this paper, we present experimental observations of rocket-triggered lightning observed at the ICLRT, including the lightning channel-base current and lightning mapping array sources, together with observations of the ELF sferics detected at Sondrestromfjord, Greenland and at Stanford, California. These observations are critically compared with model predictions (using a modified version of the Long Wavelength Propagation Capability code). We demonstrate that the effective length of the lightning channel varies between return strokes and has a detectable influence on the amplitude of the ELF sferic observed at great distances. Additionally, we demonstrate that the lateral distribution of vertical sources (within the cloud) can reproduce the relative differences in sferic amplitudes observed at Sondrestromfjord and Stanford.