COMSOL based Simulation on the Effect of Atmospheric Electric Field changes during Thunderstorm on Ground and Analysis.

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The phenomenon of lightning is accompanied by localised changes in atmospheric electric fields. In cloud-to- ground strike locations, changes in atmospheric electric fields can even be observed at the ground a few minutes prior to a strike. A lot of research has been done already on the electrostatic changes prior to lightning in the region above ground.

Through this work, we investigate into the effects of lightning electric fields on/under ground with the aid of simulations done in COMSOL Multiphysics. Horizontal and vertical profiles of voltage gradient, electric field, polarisation etc. are investigated.
Simulation experiments were conducted using a general model of lightning electric fields formed using data recorded by the Electric Field Mills(EFMs) from three diverse parts of the world-- Kennedy Space Centre (KSC),Florida (Using GHRC datasets),Sonnblick Observatory, Austria and National Centre for Earth Science Studies Trivandrum (NCESS),India. COMSOL models of the global electric circuit were developed using Sandstone as the base model for ground.

Similar works in literature have only dealt with lightning electric fields above the ground. This work is the first step towards a high-level simulation on the effects of atmospheric electric field on/below ground. The results of this simulation work can aid lightning forecasting and preparedness by opening new doors for voltage based prediction methods at ground. It is also a tool to understand phenomena such as fulgurites, corona effect etc. It also helps in the design of buried cables and improved grounding systems. This work can also be a first step towards understanding localised potential variations at the ground during lightning.

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