MODELING LIGHTNING RETURN STROKES TO TALL STRUCTURES

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Recently, the interaction of lightning with tall strike-objects has attracted considerable attention among lightning researchers. A vast number of these studies focus on return-stroke modeling. Some of the return-stroke models, initially developed for the case of return strokes initiated at the ground, were extended so as to take into account the presence of a vertically-extended strike object.

The presence of an elevated strike object has been included in two types, or classes, of return-stroke models, namely the engineering return-stroke models and the electromagnetic, or Antenna-Theory (AT), models. In the engineering return-stroke models, the spatial and temporal distribution of the channel current is specified based on certain observed characteristics, such as the channel-base current, the return-stroke speed and remote electromagnetic fields. The presence of an elevated strike object in such models has been considered by assuming the object as a uniform and lossless transmission line. In Antenna-Theory-type models, better known as AT models, the strike object and the lightning channel are represented using thin wires.

In 2007, we were able to obtain simultaneous measurements of the lightning current and electric and magnetic fields at two different distances associated with lightning strikes to the Austrian Gaisberg Tower. The aim of this project is to analyze the obtained data and to use them to test the engineering and AT models.

After a brief review of lightning theory and its phenomenology, I will talk about the work I have done on the study of lightning return-stroke models, including the presence of a tall strike object.
In this part, I will explain how we can model lightning return-stroke to tall structures, that is to say by using the engineering and AT models.

I will then explain how we can include the change in field due to the downward leader phase in engineering models .This inclusion can be done for many different cases of lightning strikes.

Finally, I will use the data I obtained with the engineering and Antenna Theory models for return-strokes to make a general

comparison with the experimental data obtained at the Gaisberg Tower in Austria in 2007.

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