

A Study on the Response of Microwave Radiometer Observations to Lightning-Superheated Column

Intended for the Lightning Detection Technologies Topic

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Based on the theory for microwave thermal radiation and its transfer in the atmosphere, the response of a ground-based microwave radiometer to a lightning-superheated column in atmosphere is studied and the theoretical expressions are given for the relationship between brightness temperatures and parameters such as distance, size, duration and temperature of the lightning-superheated column. The results from simulated calculations show that it is quite possible for a lightning-superheated column to be observed by a microwave radiometer working in the 50~60GHz bands with a sensitivity of 0.5K as normally required for atmospheric temperature profile sounding. The brightness temperature observed with any one of the channels in the band increases as the distance between the lightning and the radiometer decreases. Lightning in short distance would make the brightness temperature observed with channels near to 60GHz increase more and a far lightning would make the brightness temperature observed with channels near to 50GHz increase more. The feature of this can be possibly used as the gist in retrieving the lightning parameters from brightness temperature observations. Very limited data from barely a radiometer has been used for practice but more information from independent observation systems is really needed to show a success. Also discussed in the paper are the difficulties for a ground-based radiometer to observe a lightning.

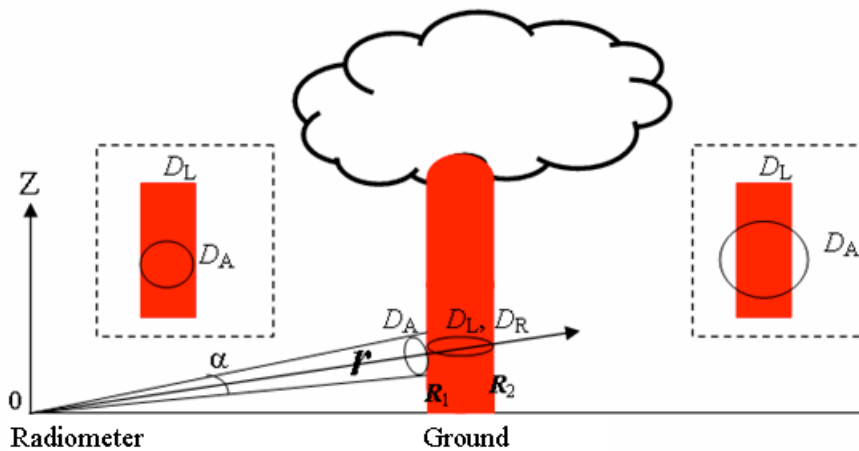


Fig. Ground-based microwave radiometer observing a lightning-superheated column