Some practical issues in thunder source arrival direction finding The session topics: Lightning Detection Technologies

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ABSTRACT:

The geometry of lightning channels can be reconstructed from thunder data obtained at three or more measuring stations. Two different techniques, named thunder ranging and ray tracing have been used to find thunder sources. The latter is generally more accurate and capable of giving more locations. In the ray tracing technique, the time difference between the arrival of acoustic features at different stations is used to determine the direction of the incoming sound wave, and that directional ray is traced back to the source by the time between the arrival of the lightning electromagnetic signal and the acoustic feature. How to efficiently obtain the direction of thunder sources is the key of the ray tracing technique. In this paper, two algorithms that realize direction estimation, namely Generalized Cross-Correlation and Frequency Domain Beamforming, are compared in bi-dimensional representation, coherence measure and error point number for several given lightning channels simultaneously recorded with thunder and high speed video photography. Comparison results showed that Frequency Domain Beamforming outperforms the other one in terms of accuracy and integrity of the thunder sources. Also, Frequency Domain Beamforming obtained more thunder sources on the top of the lightning channel which did not show in the photography. It was confirmed that all parts of lightning channel could be depicted clearly through acoustic signals with our developed techniques. Additionally, other algorithms were discussed and tried. In the final paper, we will report on the detailed results.