

Whistlers Generated by Gigantic Jets: Modeling and Observations

Kaiti Wang

Department of Aerospace Engineering, Tamkang University

Shu-Chun Chang, Sung-Ming Huang, Ruei-Ron Hsu

Department of Physics, National Cheng Kung University

J. J. Berthelier, T. Onishi

LATMOS/IPSL/CNRS/UPMC/UVSP, France

Abstract

The characteristics of whistlers generated from a gigantic jet (GJ) are modeled as well as to examine satellite observations. Modeling is based on disturbances in the electric field, as measured by NCKU ELF/VLF station, associated with a representative tree-like GJ event over typhoon Lionrock. The calculated frequency-time spectrogram shows two sequent whistlers, with the later one emitted mainly below a few kHz. Our results show that the waves are subject to greater attenuation as the frequency increases; however, a reversal occurs at lower frequencies of a few hundred Hz due to ion effects. The electric fields observed by DEMETER (Detection of Electro-Magnetic Emissions Transmitted from Earthquake Regions) satellite mission are then investigated based on the locations of tree-like GJ events observed by ISUAL (Imager of Sprites and Upper Atmospheric Lightning). Paired whistlers, detected right after the tree-like GJ event occurred closest to the satellite location among all examined events, with power distribution features on the frequency-time spectrogram resembling modeled two sequent whistlers, are found.

Introduction

According to *Huang et al.* [2012], the power spectrum of observed GJ differs from that of common cloud-to-ground lightning in its primary intensities below a few kHz and an initiating lightning on a wider frequency range. Whistlers are modeled based on the detected spectrum of signals. Detectability is also evaluated by considering the absorption of amplitudes resulted from particle collisions associated with the propagation of generated waves.

References

Huang, S.-M., R.-R. Hsu, L.-J. Lee, H.-T. Su, C.-L. Kuo, C.-C. Wu, J.-K. Chou, S.-C. Chang, Y.-J. Wu, and A. B. Chen (2012), Optical and radio signature of negative gigantic jets: Cases from Typhoon Lionrock (2010), *J. Geophys. Res.*, 117, A08307, doi:10.1029/2012JA017600.