Geophysical Research Abstracts, Vol. 8, 00499, 2006
SRef-ID: 1607-7962/gra/EGU06-A-00499

Total Lightning in the VLF/LF Regime: Results from LINET with 21 Sensor Sites and Small Baselines

H.-D. Betz (1), W. P. Oettinger (1), K. Schmidt (1), B. Fuchs (1), H. Hoeller (2)

1. Physics Department, University of Munich, D-85748 Garching, Germany
2. Institut für Physik der Atmosphäre, DLR, D-82234 Wessling

(hans-dieter.betz@physik.uni-muenchen.de)

For the 2005 thunderstorm season the Munich lightning detection network (LINET), which covers Southern Germany since 2003, has been expanded to 21 sensor sites whereby a small baseline was realized in the centre of the covered area. The network features total lightning because it exhibits the same detection efficiency for cloud-to-ground (CG) and intra-cloud (IC) sources, and localizes discharges with currents down to $\sim$1 kA with no data loss even during heavy thunderstorms. This contrasts commonly used operational VLF/LF networks which measure primarily CG strokes and up to $\sim$30% IC events with current amplitudes above $\sim$5 kA. LINET data may become a useful complementation for VHF networks which allow detection of total lightning in a much higher frequency regime.

When very low currents are considered, it is generally expected that IC discharges are much more abundant than CG strokes. This is confirmed by our data; moreover, we find a surprisingly large number of IC discharges which take place in long channels and are readily measurable in the VLF/LF regime. For this reason, ordinary VLF/LF measurements allow a quite comprehensive representation of IC activities and, together with CG identification, provide a measure for total lightning. Standard literature illuminates VLF/LF IC's not very specifically though this type of discharge turns out to be the most frequent one in the VLF/LF regime, contrasting the strong and relatively rare 'narrow bipolar events' known for a number of years. We present for the first time a quantitative and statistically significant analysis for the occurrence of weak IC events and point to characteristic differences between positive and negative IC's, indicative of charge separation processes and subsequent discharge mechanisms.

Due to the 3D-capability of LINET, especially in connection with a dense network and short baselines, the discrimination between CG and IC works extremely well in the inner part of the network. A large data basis confirms the suspicion that a certain class of IC discharges produce radiation patterns very similar to the one from CG strokes and, thus, can be easily misclassified by inspection of waveforms. The high detection efficiency allows for the first time to demonstrate the existence of a physically real maximum in CG current amplitude-distributions which is not produced by deteriorating network sensitivity. Several million lightning events which occurred during a number of days with heavy and severe thunderstorms have been analysed and characteristic results will be presented.