Los Alamos Sferic Array 1998-2003: Results, Array Status, Data Processing and Calibration

M J Heavner, S Speakman, A D Smith, M Stanley, D M Suszczynsky, X M Shao, M Pongratz
heavner@us.alaska.edu, speakman@lanl.gov, smithda@lanl.gov, stanleym@lanl.gov, dsuszczynsky@lanl.gov, xshao@lanl.gov, mpongratz@lanl.gov

Introduction

The Los Alamos Sferic Array (LASA) network of fast electric-field-change meters has operated in several configurations during the past five years, as illustrated below. This presentation describes the array operations including calibration issues and methods. The routine processing algorithms are described. Comparison of LASA lightning observations with other detection systems has been updated to cover a period of increased station sensitivity. The changes in the array operations which have been possible due to improvements in technology are noted, and directions for future array improvements are discussed.

National Lightning Detection Network Comparison

The National Lightning Detection Network (NLDN) consists of over 100 remote, ground-based sensing stations located across the United States that detect the electromagnetic signals from lightning [1]. The NLDN system allows for 20 MHz sampling with computer controlled (software) triggering.

Calibrations

Station deployment includes an absolute system calibration. The relative calibration between stations is monitored for azimuthal dependence or time dependent changes of the calibration. All pairwise station calibrations and equidistant events (within 5 km) are considered. The event waveforms at the two stations are bandpass filtered between 1-50 kHz (primarily to reduce any local noise). If the waveforms had a cross correlation greater than 0.9, the ratio of the power is considered. The ratio is plotted for two pairs of stations at left. In the upper plots, the 1998-2003 Boca Raton / Tampa stations are compared. The relative calibration between the two stations is constant and shows no azimuthal dependence. The power ratio of the two stations is 0.965. The lower plots show the Los Alamos/Socorro station pair for 1999. The Socorro station sensitivity changed dramatically on July 24, 1999. The stored calibration values used for array processing includes a mechanism for tracking such an abrupt change in station calibration factors. By checking multiple station pairs, the model and the calibration scheme can be identified and recalibrated. The table below summarizes the average calibration values for the 1998-2003 array operations.

Operations

LASA operations during 1998-1999 are described by [3]. This poster is intended as an update through 2003 operations. The geolocation and automatic Narrow Bipolar Events (NBEs) identification software has been reported [3], and some subsequent updates to event classification have also been reported [2]. Currently, the processing software attempts to identify NBEs, cloud to ground discharges (CGs), intense leader events, and non-NBE intracoud events, determining polarity for all events. For NBE events, event and ionospheric heights are determined [4]. LASA has operated in an ‘experimental’ mode as opposed to the ‘production’ mode of other systems (such as NLDN). This has allowed great flexibility for reprogramming or relocation of sensors to support other studies, such as the FORTE satellite (which LASA was originally designed to support) with variable station trigger thresholds which were lowered for satellite overpasses. The LASA ground truth campaigns have been expanded to include GPS and NASA’s TRMM satellite. LASA stations have been redeployed to support STEPS, ACES, and BLBN studies.

Acknowledgements

LASA has been funded by the Department of Energy through the FORTE project. M. Heaven’s time was provided by the University of Alaska Southeast.

References