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Analysis of lightning detection characteristics by comparison of a SAFIR-based and a LPATS-based sensor network

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Measurements of a local lightning detection network in northern Germany are compared to the operational national lightning network.

Since 2003, the Institute for Meteorology and Climatology (IMUK) of the University of Hannover operates a lightning detection network in northern Germany. The network is based on three SAFIR (Sureveillance at Alerte Foudre par Interférometrie Radiolélectrique) sensors that form a triangle of about 180 km side length.

SAFIR simultaneously detects lightning at two different frequency bands (LF and VHF), which allows discrimination of intra-cloud (IC) and cloud-to-ground (CG) lightning. The receiver is able to determine the incidence direction of electromagnetic signals. Hence, lightning activity is located by triangulation of simultaneous events. The location accuracy of both monitored (IC and CG) lightning types was found to be better than 1 km in an area of roughly 270 km $\times$ 280 km around the network.

BLIDS (Blitz Informations Dienst von Siemens) is a commercial lightning detection network. It uses LPATS (Lightning Positioning and Tracking System) sensors and uses time-of-arrival techniques to locate (mostly CG) lightning. BLIDS represents the German contribution to EUCLID (EUropean Cooperation for LIghtning Detection), a collaboration among national lightning detecting networks.

The total number of lightning strikes detected by SAFIR in its zone of highest sensitivity is a factor ten higher then by BLIDS for both, IC and CG lightning.

A comparison of the probability of detection (POD) of events simultaneously sensed

by both networks yielded that SAFIR is far more sensitive to IC lightning. This sensitivity however was found to strongly depend on the lightning position. In general, it decreases rapidly with increasing distance from the base triangle of the network. The sensitivity of SAFIR to CG lightning was lower that of BLIDS, as expected. For both lightning types together (total lightning, TL), the sensitivity of SAFIR is significantly higher than that of BLIDS, but shows stronger horizontal variations.

This study represents an objective comparison (i.e. without manufacturer involvement) of a lightning detection network of SAFIR sensors to an operational lightning detection system. The SAFIR was found to provide new information about TL activity. TL information, in turn, will be used in future (in combination with other observation instruments) for nowcasting of convective storm motion and development. SAFIR measurements, hence, represent a valuable source of information needed for quantitative precipitation forecasts.