

Artificial neural network application in an implemented lightning locating system

Abstract

Time difference of arrival (TDOA) technique is one of many bases to determine lightning strike location employed in a lightning locating system (LLS). In this technique, at least four measurement sensors are required to correctly locate a lightning strike. Usage of fewer number of sensors will result in non-unique solutions to the generated hyperbolas, and hence wrong lightning strike point. This research aims to correctly determine the strike point even if only three measuring sensors are utilized. An artificial neural network (ANN) based algorithm was developed for a 400 km² coverage area in Southern Malaysia using time of arrival data collected at the three measuring stations over a certain period. The Levenberg–Marquardt algorithm is demonstrated to correctly identify the lightning strike coordinates with an average error of 350 m. The algorithm has helped the three-station TDOA-based LLS to successfully locate the lightning strike point with a remarkable accuracy comparable to that of commercial systems.