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WWLLN Absolute Detection Efficiencies and the Global Lightning Source Function

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The World Wide Lightning Location Network (WWLLN) has been enhanced to allow for the measurement of the waveguide propagated very low frequency power radiated for each detected stroke. This allows for the 60 station network to measure the stroke power to a 17% uncertainty alongside the location and timing accuracies of $\sim$10 km and $<$30 μs. The Earth Networks Total Lightning Network (ENTLN) is a total lightning network utilizing 550 wide-band sensors (1 Hz to 12 MHz) in North America (in 2011) allowing for a nearly 95% detection efficiency over the continental United States of CG strokes and 66% for IC strokes. ENTLN also determines the peak current of the detected strokes. The WWLLN is compared to the ENTLN to determine the absolute detection efficiency over the continental United States as well as investigate the relation between the ENTLN peak current and the WWLLN radiated power per stroke measurements over several spatial and temporal scales.

The comparison between the two networks is utilized as a validation of a recently developed relative detection efficiency model of WWLLN. Through investigating the relationship between stroke power, peak current, and relative detection efficiency the model is expanded to provide estimates of absolute detection efficiency outside the bounds of the direct comparison. The expansion of the new model allows for WWLLN to correct for both uneven global coverage and undetected strokes, the corrected data enables an estimation of the global lightning source function over several time scales ranging from hourly to monthly. The longer time scale results are compared to previous seasonal and yearly estimates of the source function and with yearly satellite averages.