

The Los Alamos Sferic Array: Recent Improvements and Validation Studies

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LASA/NLDN LOCATION ACCURACY STUDY

Lightning locations determined by the Los Alamos Sferic Array (LASA) and the National Lightning Detection Network (NLDN) were compared. We found that locations determined by the two arrays agreed to within 2 km under favorable LASA viewing geometry conditions (i.e. within the boundary of a LASA sub-array).

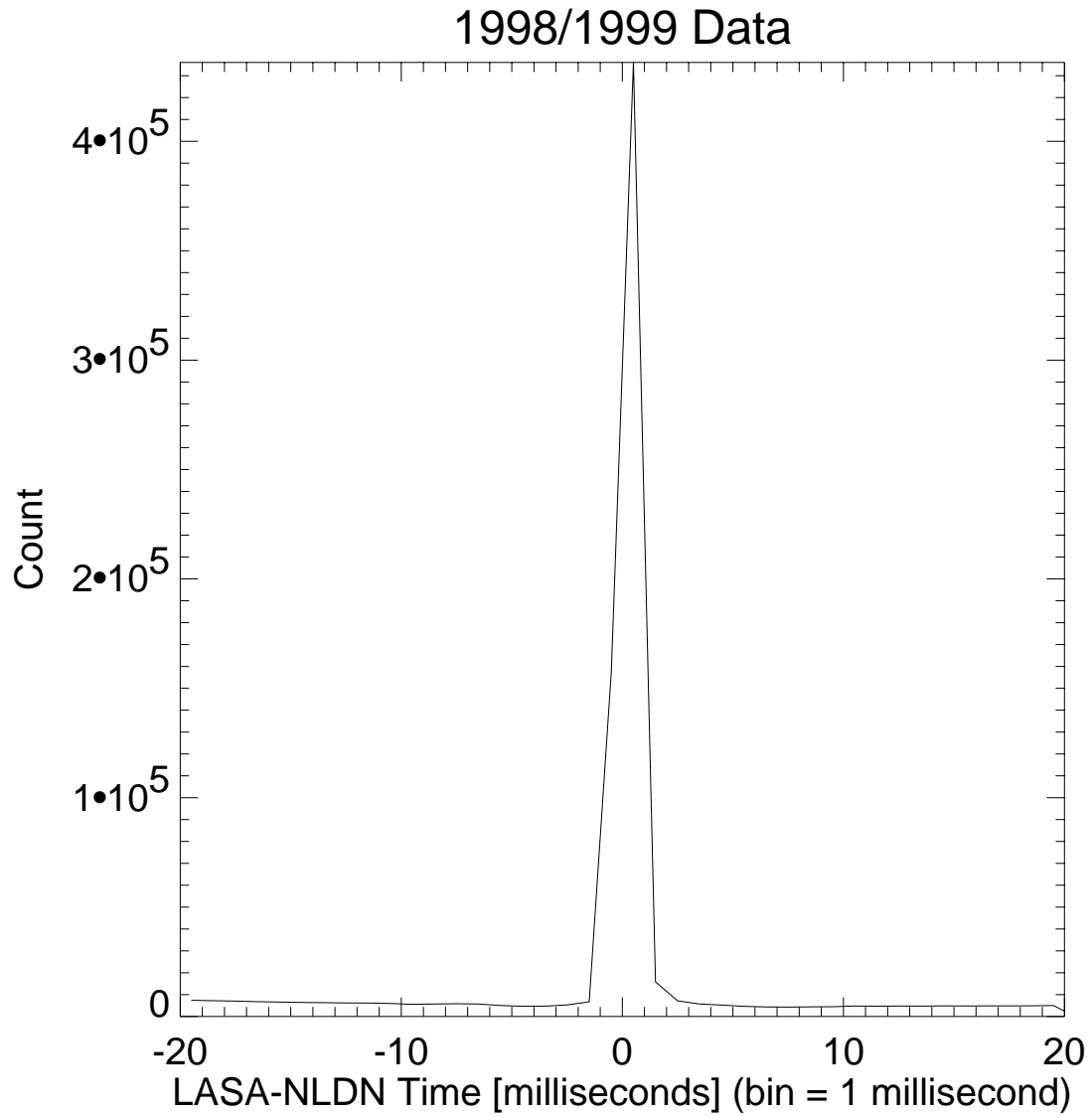


Figure 1. Coarse histogram of LASA/NLDN event time differences.

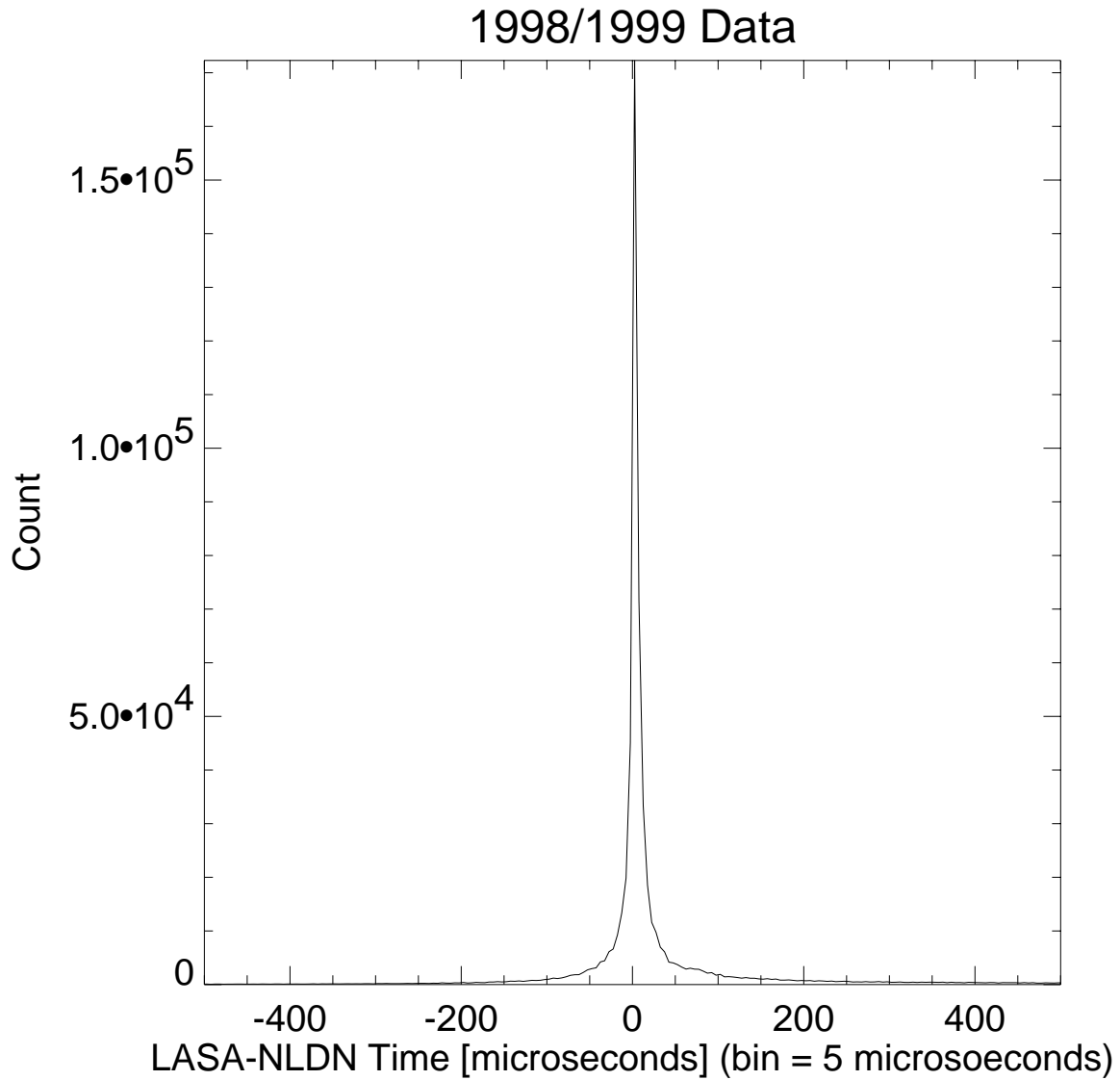


Figure 2. Fine histogram of LASA/NLDN event time differences. Time agreements within $\pm 100 \mu\text{s}$ are considered ‘coincident.’

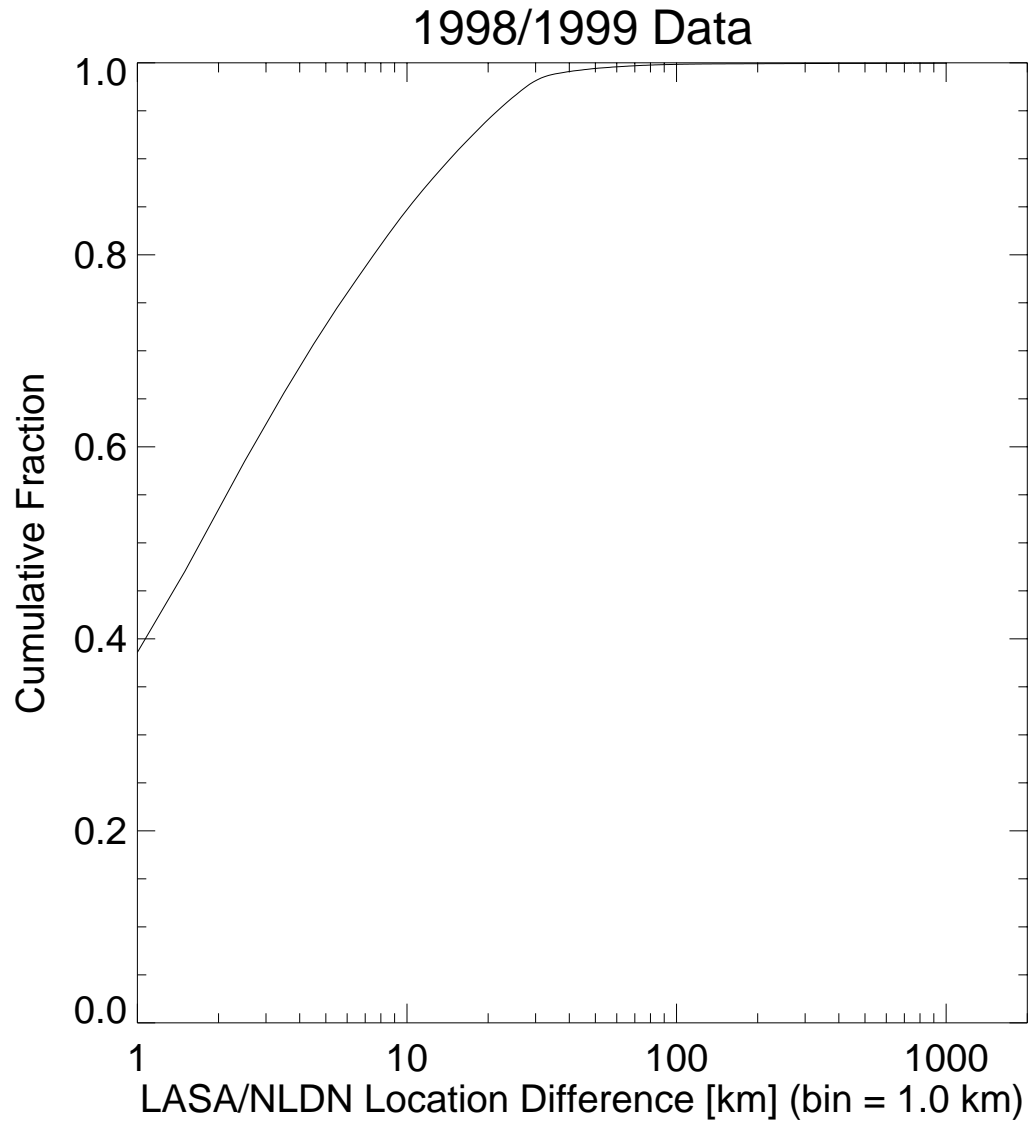


Figure 3. Cumulative distribution of log LASA/NLDN event time differences. 40% of the coincidences agree to within 1 km. 80% agree to within 10 km.

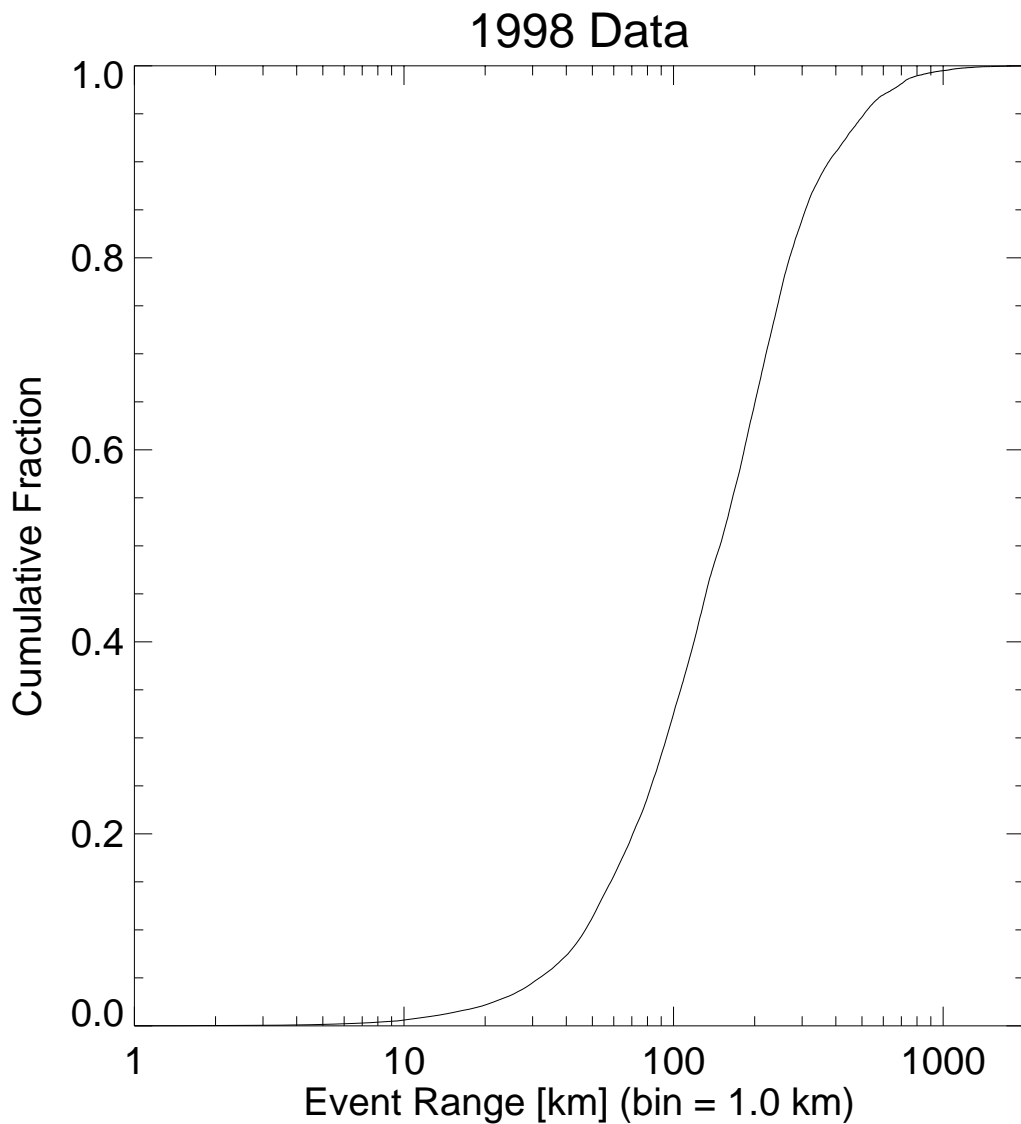


Figure 4. Cumulative distribution of log ranges from the 1998 NM LASA centroid to 1998 LASA events. On the order of $\frac{3}{4}$ of the events occurred within the perimeter of the array.

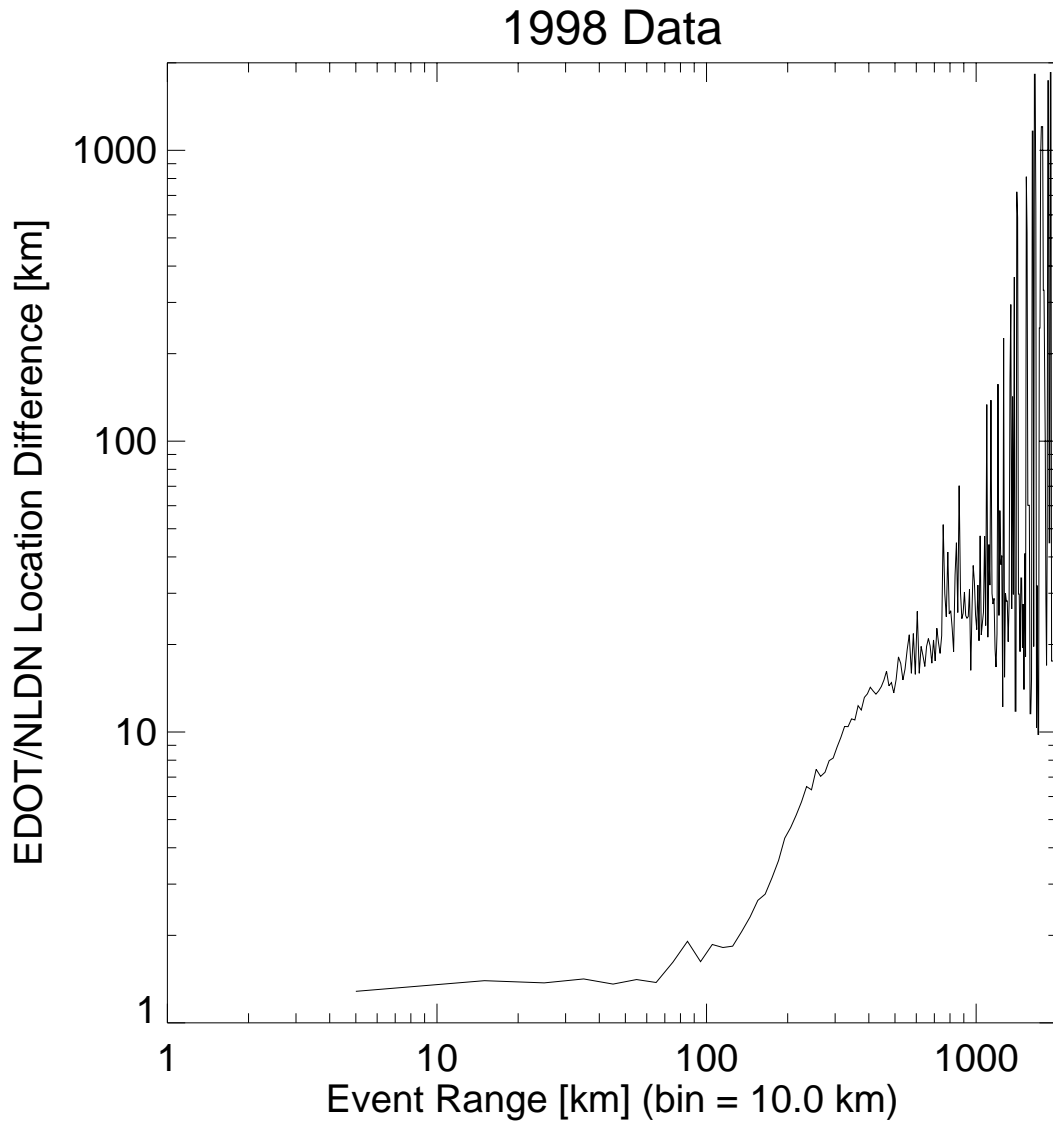


Figure 5. Cumulative log distribution of log event location difference as a function of range from the 1998 NM LASA centroid.

LASA/NLDN EVENT ID STUDY

LASA and NLDN event classifications were compared. We found that some events classified by NLDN as positive or negative cloud-to-ground strokes were classified by LASA as intracloud events (specifically energetic bipolar events).

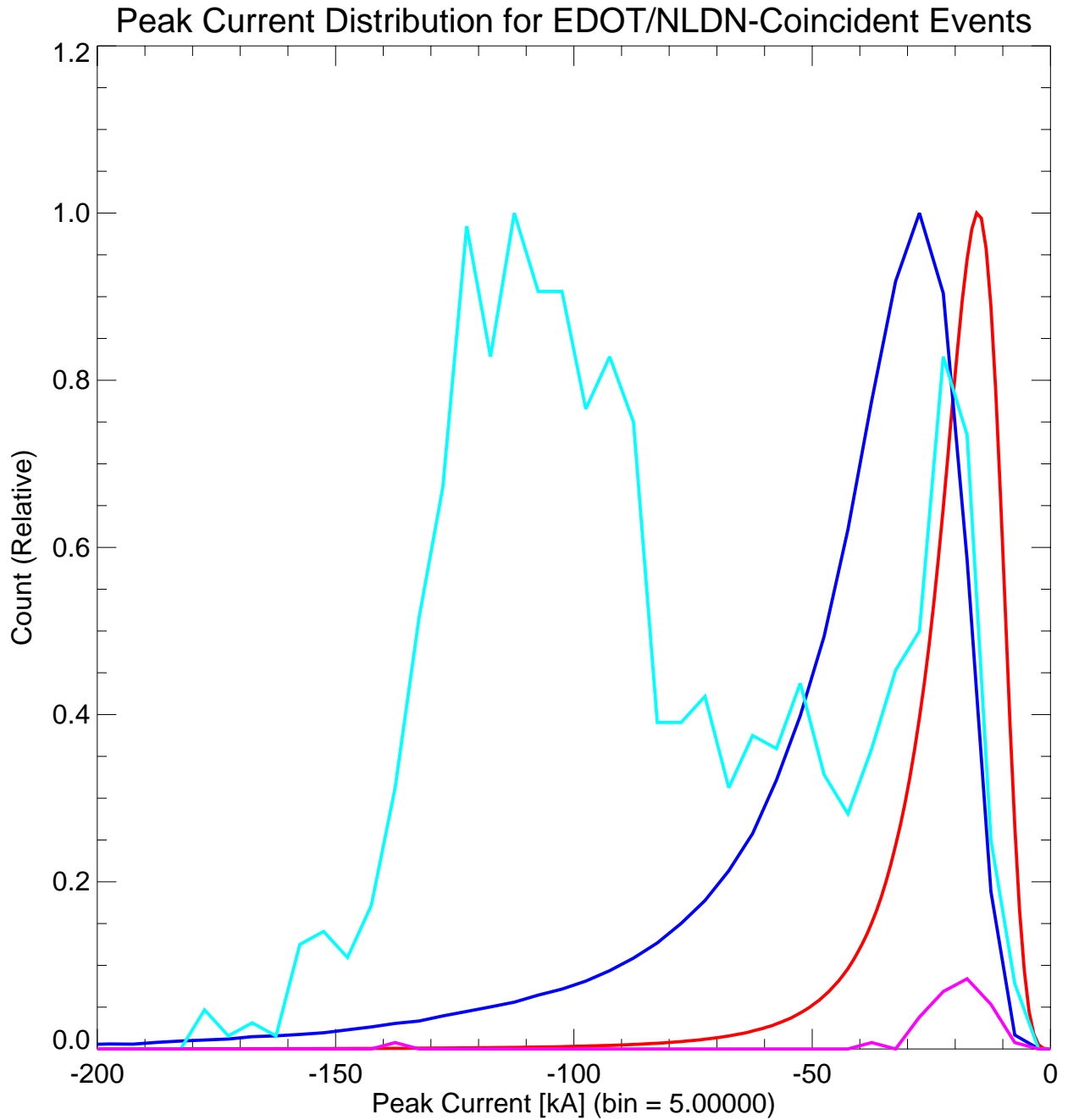


Figure 6. Normalized histograms of NLDN peak currents as a function of LASA event type. Red = all NLDN, Blue = LASA-coincident NLDN, Cyan = NNBPs, Magenta = NPBPs.

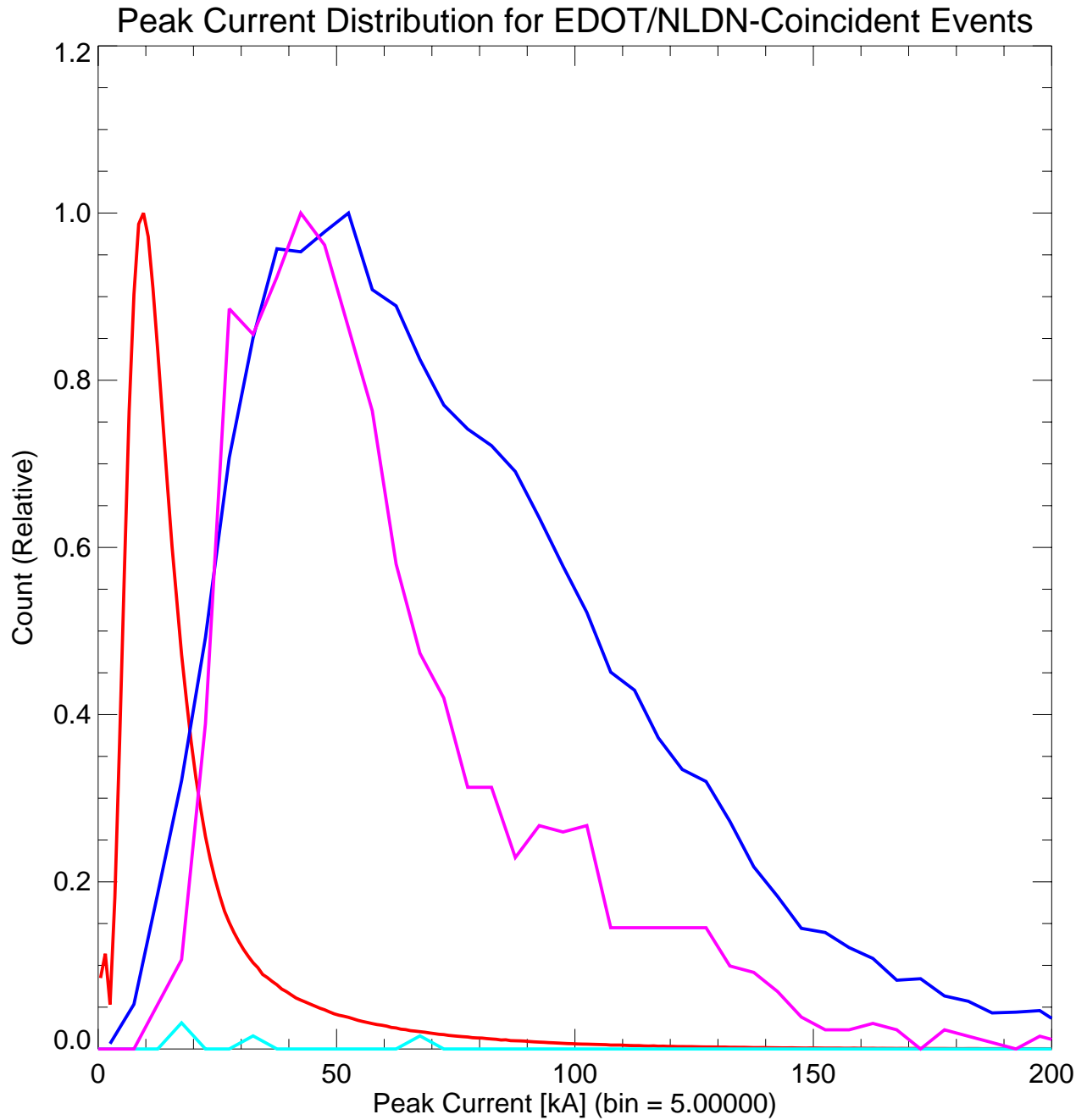


Figure 7. Normalized histograms of NLDN peak currents as a function of LASA event type. Red = all NLDN, Blue = LASA-coincident NLDN, Cyan = NNBP, Magenta = NPBP.

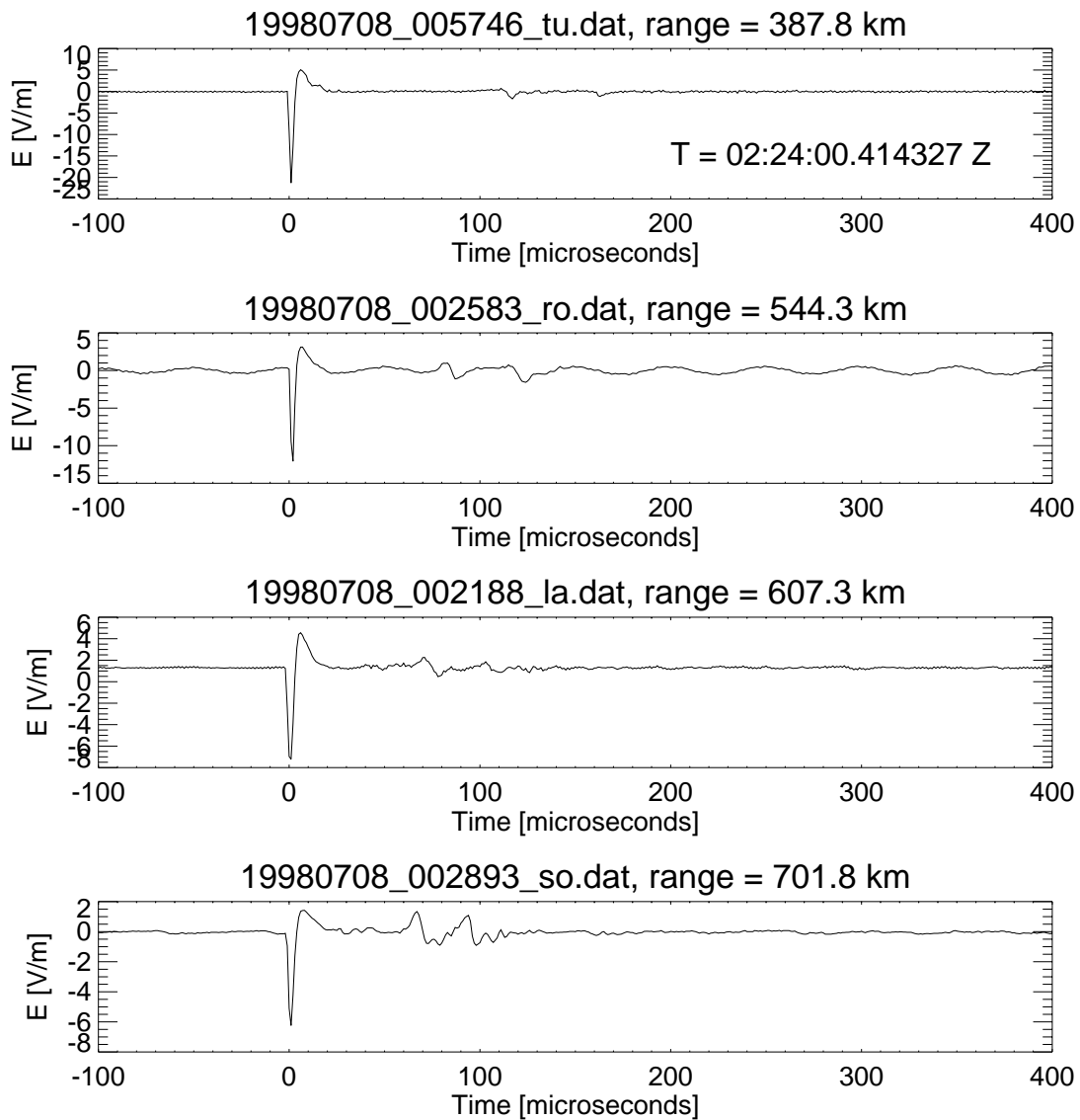


Figure 8. Waveforms from an event classified by LASA as an intracloud Narrow Negative Bipolar Pulse (NLDN 114 KA – CG). The event occurred at a height of 18.7 km altitude as determined from the delays of the ionospheric reflections.

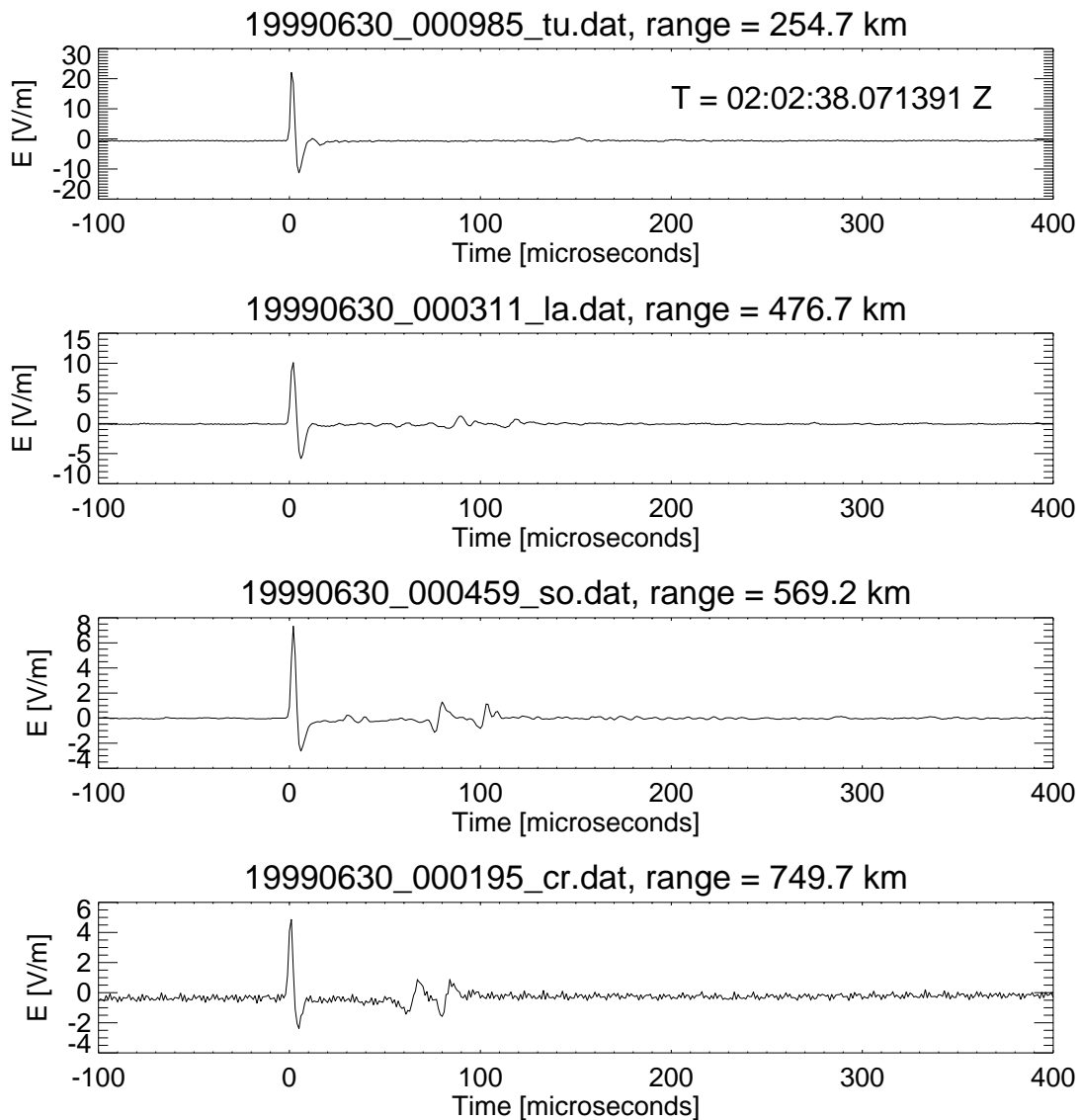


Figure 9. Waveforms from an event classified by LASA as an intracloud Narrow Positive Bipolar Pulse (NLDN 120 kA +CG). The event occurred at a height of 14.0 km altitude as determined from the delays of the ionospheric reflections.

LASA/NLDN PEAK CURRENT STUDY

LASA/NLDN peak current estimates were compared. We found that LASA overestimated currents by 50%, probably due to the assumption of a simple $1/r$ range-law and electric field enhancements due to LASA sensor locations. In the future we will apply correction factors based on the NLDN comparison.

LASA/NLDN Peak Current Comparison

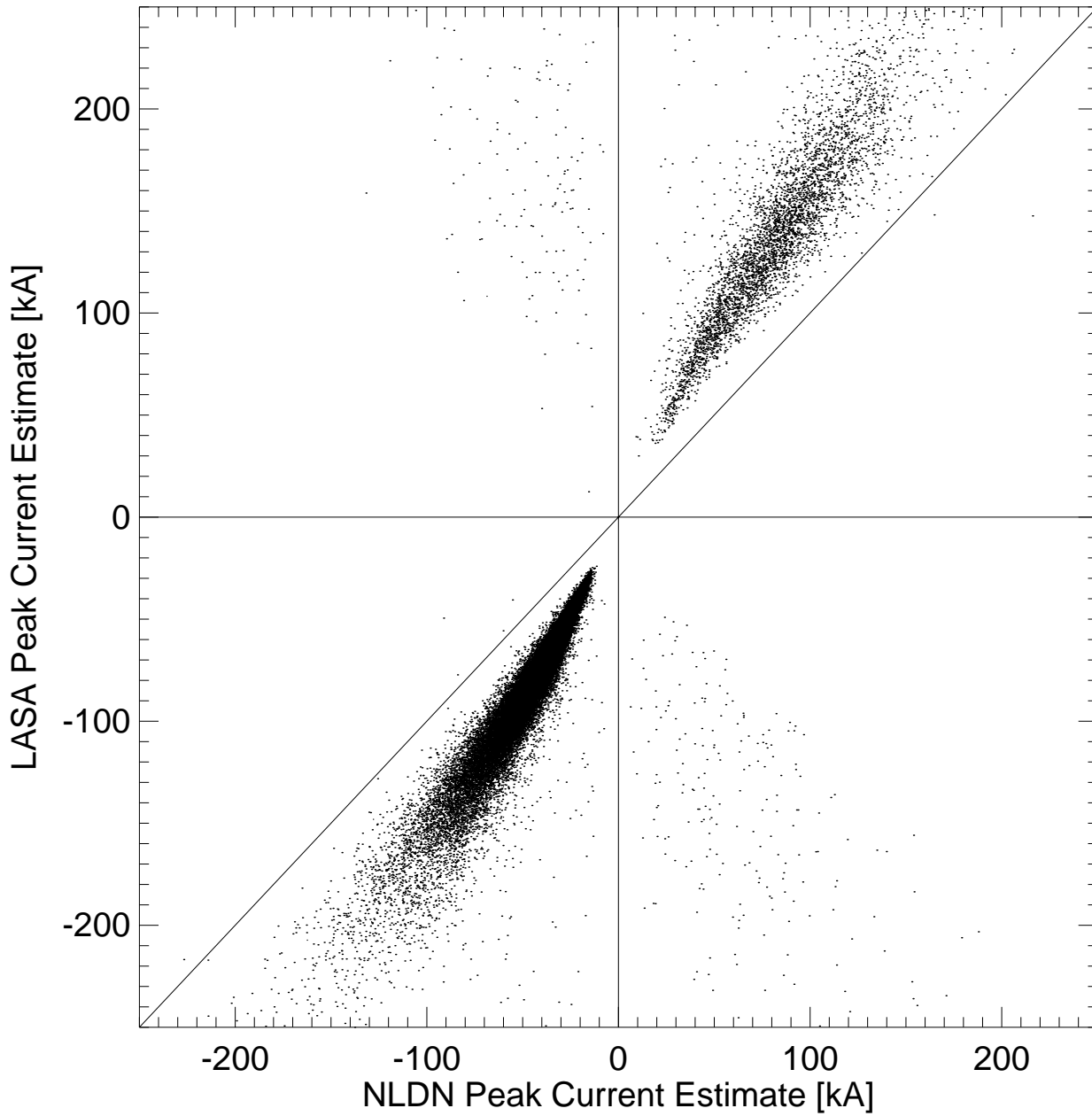


Figure 10. Comparison of LASA and NLDN peak current estimates. LASA overestimates the currents by ~ 50%.