Performance Comparison between Different Lightning Datasets during CHUVA Campaign

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Outline

• Introduction
  – WWLLN
  – CHUVA Region

• Background results

• Comparison results
  – Location Accuracy
  – Detection Efficiency
  – Peak Current and Energy

• Conclusions
World Wide Lightning Location Network (WWLLN)

- 64 stations
- VLF radio waves from lightning
- Time Of Group Arrival (TOGA)

http://wwlln.net/
• Center: São Paulo (-23.56, -46.49)
• Radius: 666 km
Background results

- From Nov. 1 2011 to Mar. 30 2012:
- BrazilDat (BTLN) detected $11.8 \times 10^6$ strokes, 11.2% (88.8%) is observed over ocean (land), and 18.5% (81.5%) is Cloud-to-Ground (In-Cloud) strokes.
- WWLLN detected $0.65 \times 10^6$ strokes, 21.3% (78.7%) is observed over ocean (land).

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Ocean</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTLN</td>
<td>11,796,769</td>
<td>1,322,057</td>
<td>2,182,727</td>
</tr>
<tr>
<td>WWLLN</td>
<td>653,271</td>
<td>138,831</td>
<td>NA</td>
</tr>
</tbody>
</table>
Comparison

• Since BTLN has detected most strokes, we set it as a reference to compare other datasets.

• We use a 0.5° box and 2 ms time window as the matching criteria here. (Δlatitude & Δlongitude < 0.5, Δt < 2ms)

• Then, we can calculate the detection efficiency (DE) of WWLLN, especially the DE of ocean/land strokes or CG/IC strokes.
Location Accuracy

- The location accuracy of WWLLN is within 1km in median, and within ~4 km on average.
Detection Efficiency (DE)

- Set BTLN as reference,
- The DE of CG strokes is 14.8% for WWLLN.
- 4.4% of BTLN’s strokes were detected by WWLLN.
- 7.9% of BTLN’s ocean strokes were detected by WWLLN, about 2 times over land.

<table>
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<th>CG</th>
<th>IC</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWLLN</td>
<td>4.4%</td>
<td>7.9%</td>
<td>4.0%</td>
<td>14.8%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>
Detection Efficiency (DE)

- ~60% when > 20kA; ~80% when > 40 kA.
Background Peak Current

- BTLN detected more negative CG strokes than positive strokes.
• WWLLN also detected more negative than positive current strokes.
Energy Distribution

BTLN events detected by WWLLN

Energy (J)

$10^4$
Energy vs Peak Current

\[ E = 99.01 \cdot |I|^{1.05} \]

\[ E = 42.47 \cdot |I|^{1.32} \]

Cor strokes

Cor CG strokes
Conclusions

Compared to BTLN:

• WWLLN has a ~15% CG detection efficiency in CHUVA region.
• The strokes detected by WWLLN is about 2 times over ocean than over land.
• The location accuracy of WWLLN is within 4 km on average.
• The peak energy has a nice fitting relationship with peak current in CHUVA region.
Thank you!

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