



Koninklijk Meteorologisch Instituut

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Evaluating EUCLID's location accuracy using lightning strikes to tall structures



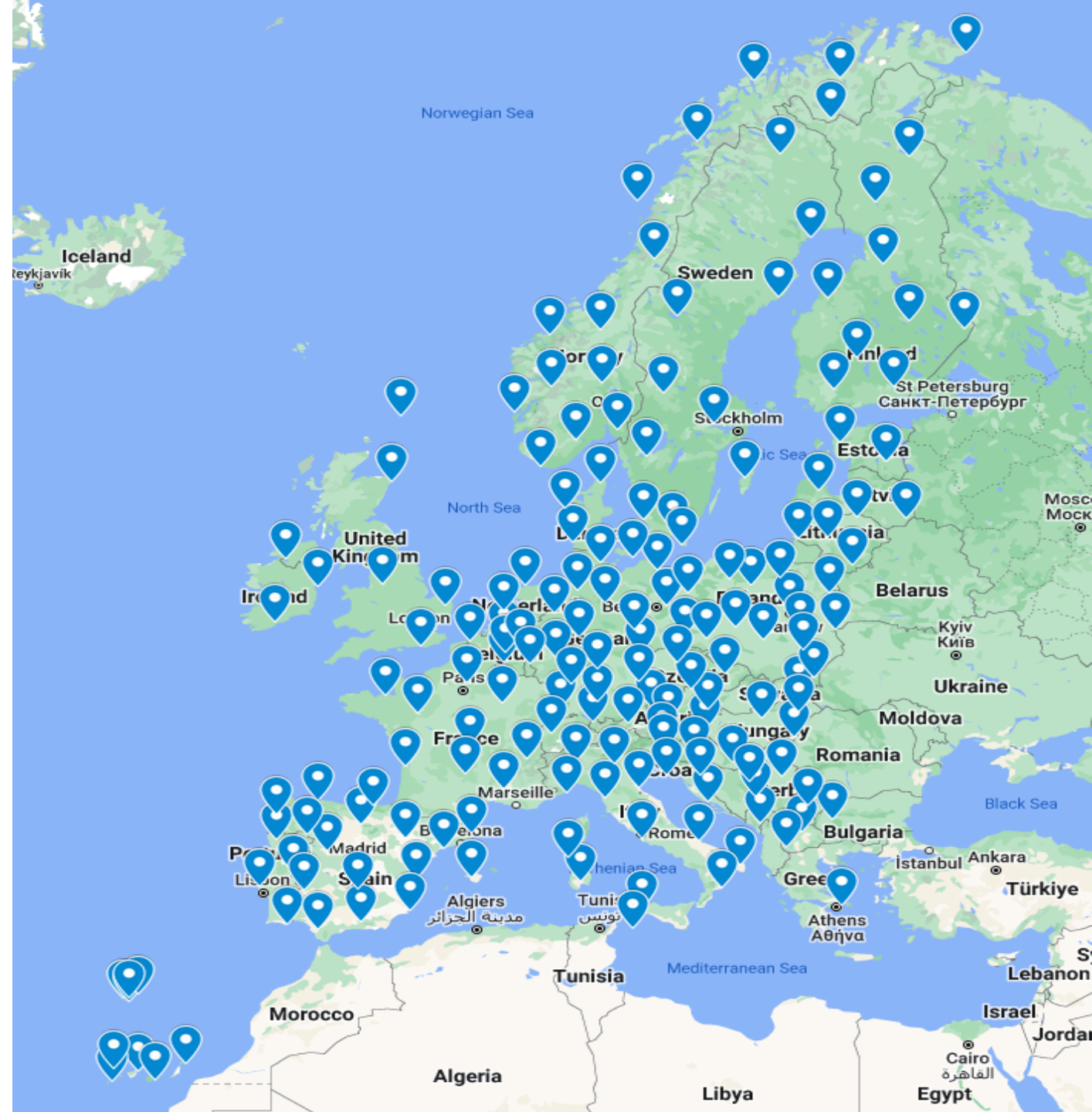
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¹ Royal Meteorological Institute of Belgium (KMI-IRM)

² Austrian Lightning Detection and Information System (ALDIS)

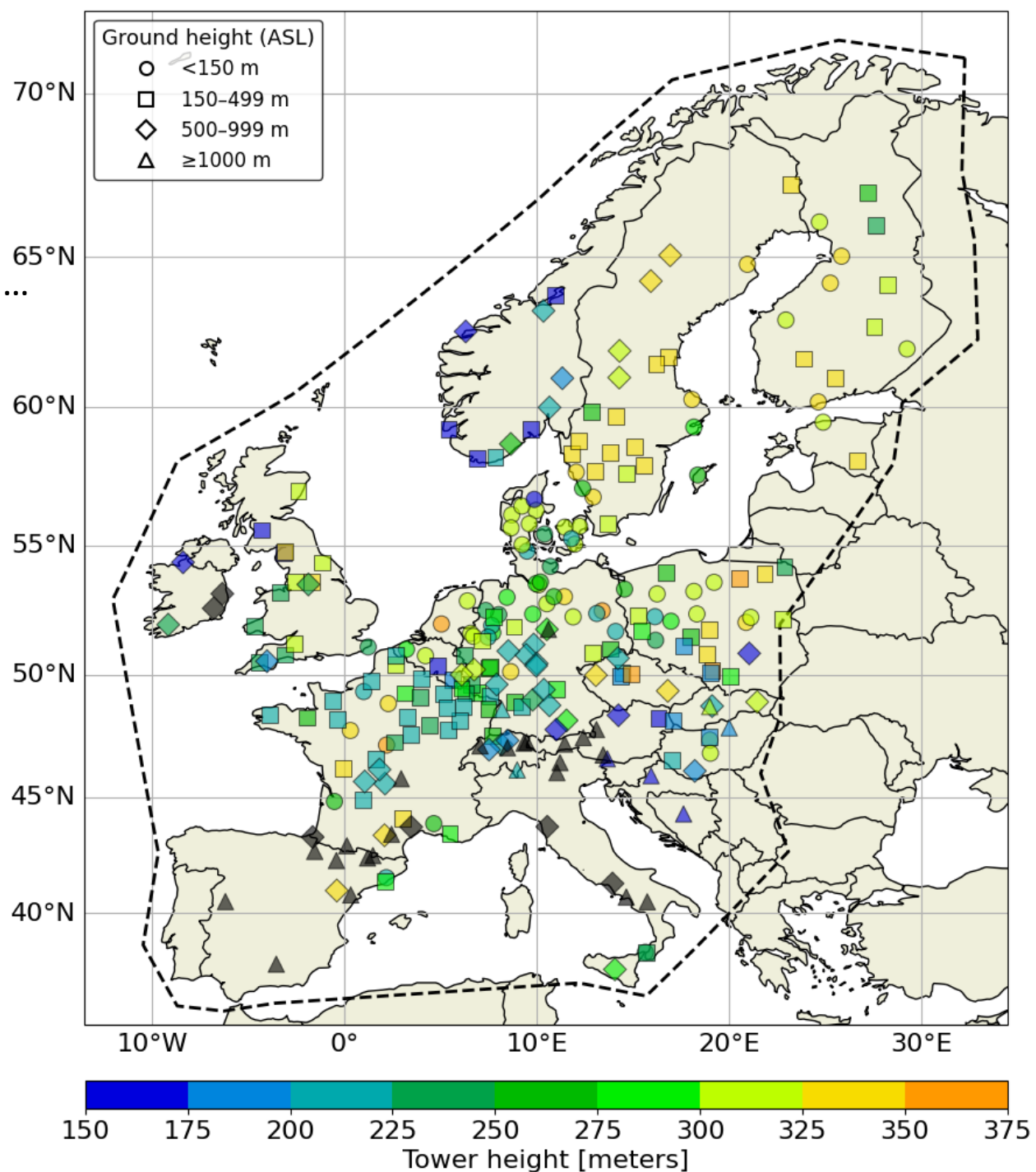
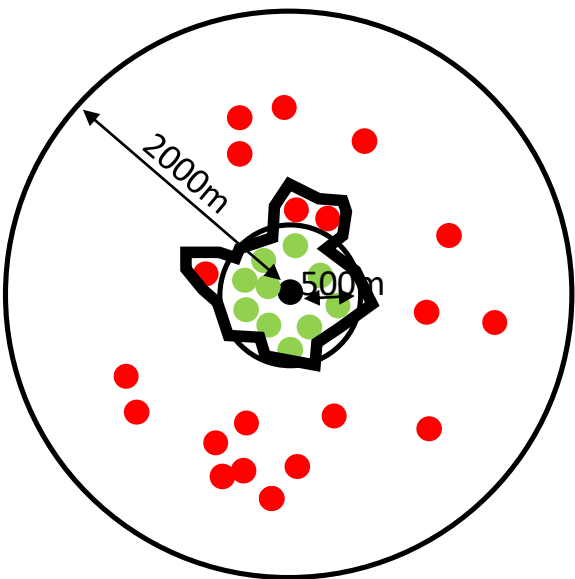
Introduction

- EUCLID operates ~170 sensors
- Network evolves, consistently upgrading from older sensor models to newer ones and optimizing sensor placement by adding or relocating sensors
- Median LA ~100m (Gaisberg)
- Stroke/flash DE of 84%/98% based on video & E-field records
- $EUCLID \propto NLDN \rightarrow CA(CG) = 92\%$
 $\rightarrow CA(IC) = 86\%$



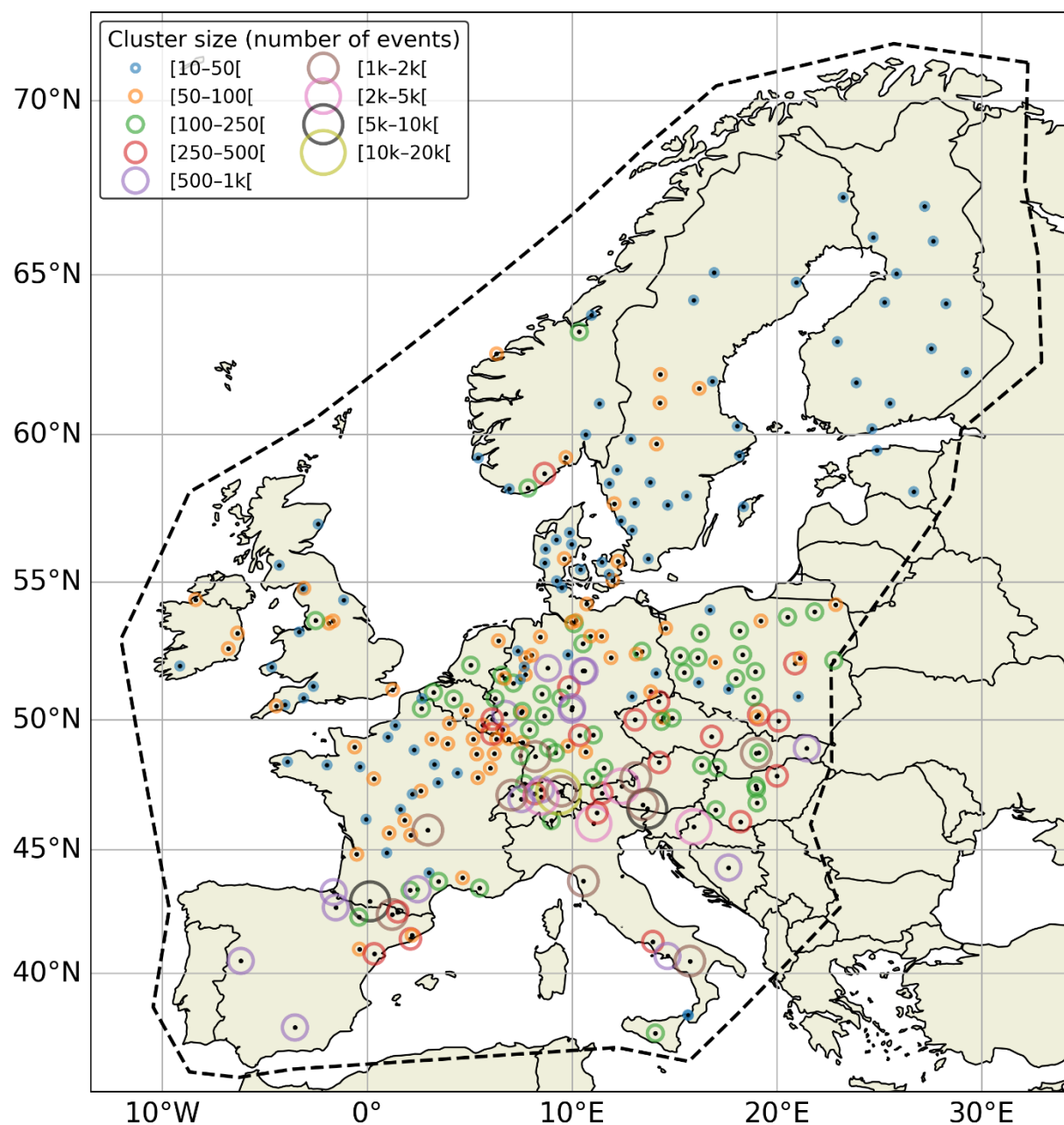
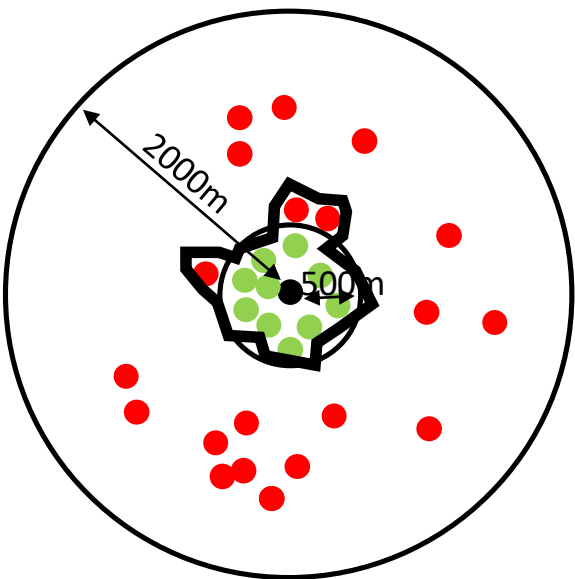
Methodology

- Collecting tall towers in Europe:
 - From Wikipedia: height >150m
 - Towers on mountain and hill tops, e.g., Säntis, Gaisberg, ...
 - Remove towers within 2km from each other
 - Extract EUCLID data from 2012/01-2025/12 within 2km
- Calculate ratio density_{Circle500m} ● : density_{Ring]500m,2km]} ●
- If ratio > 1.5: (applicable to ~260 towers)
 - Apply DBSCAN to extract most probable cluster
 - Calculate median LA

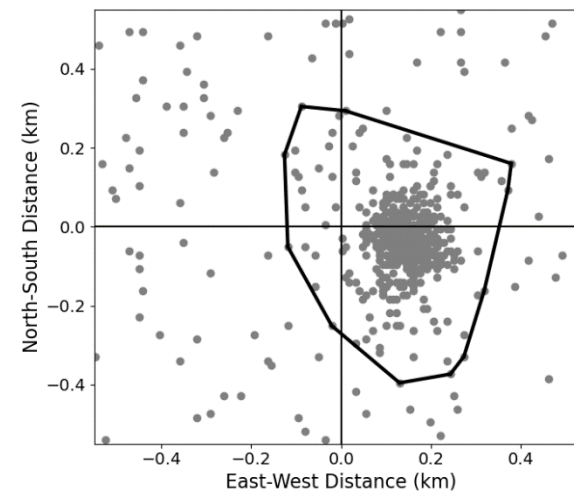
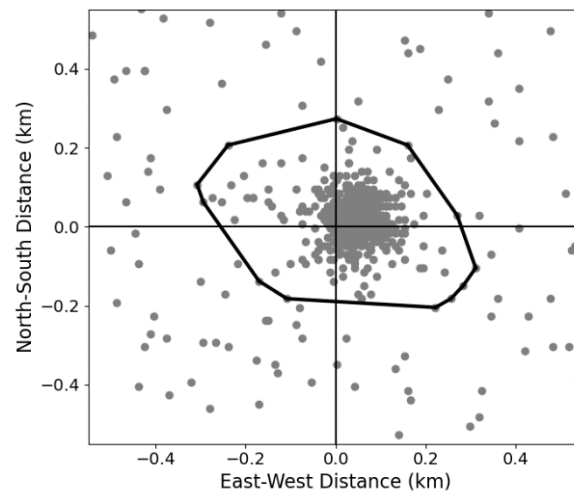
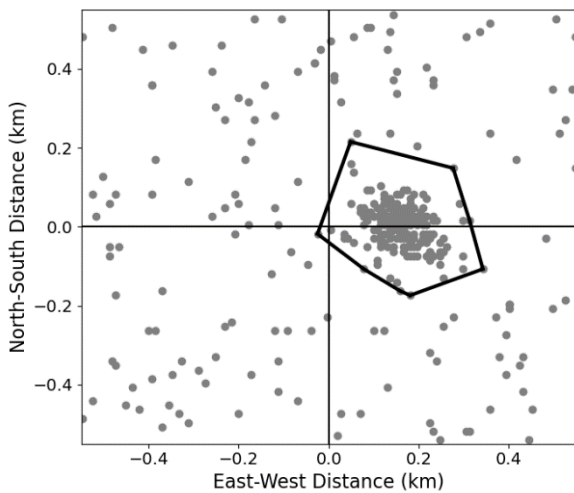
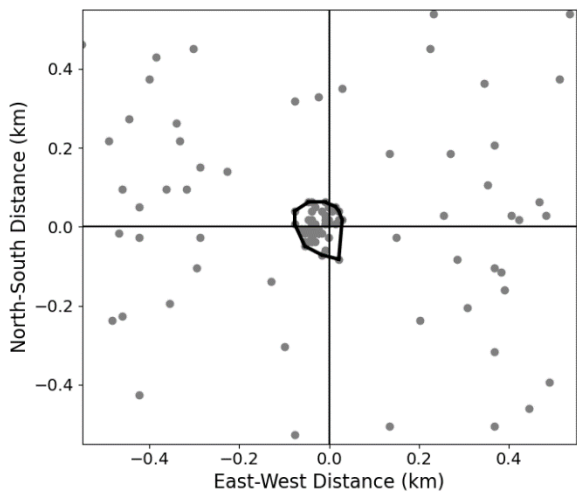
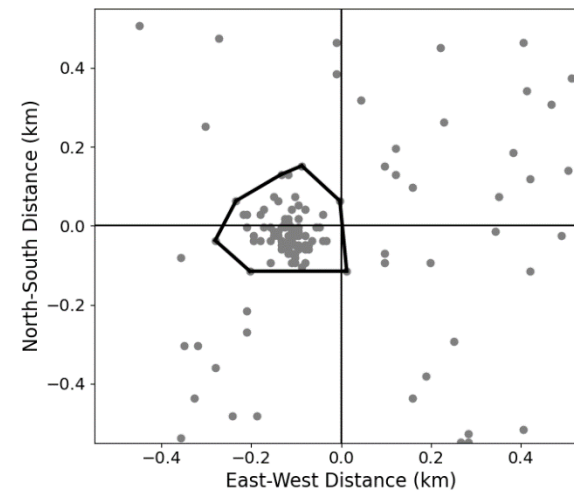
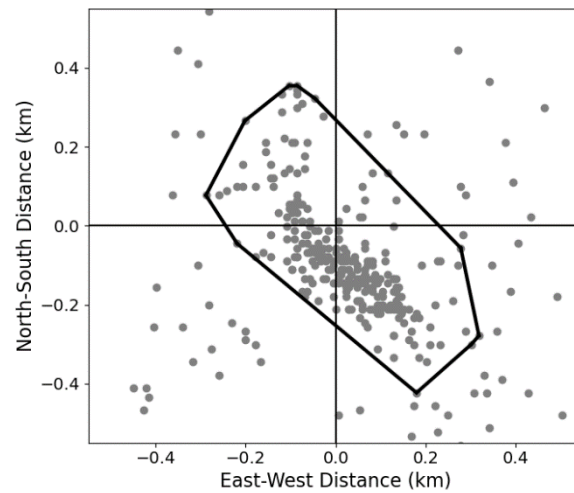
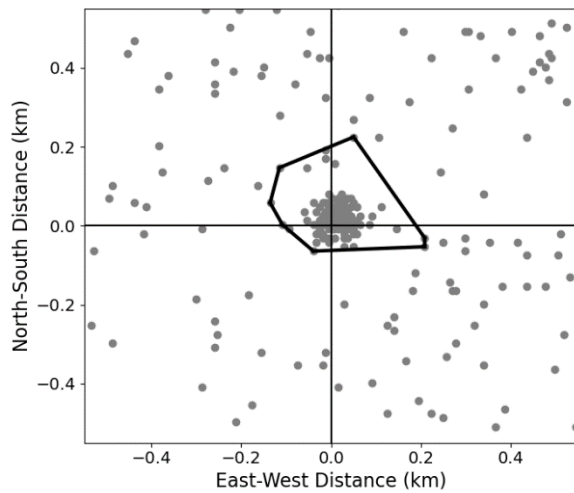
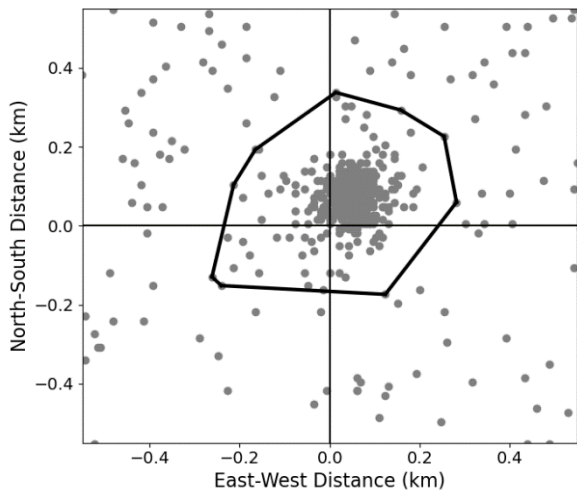


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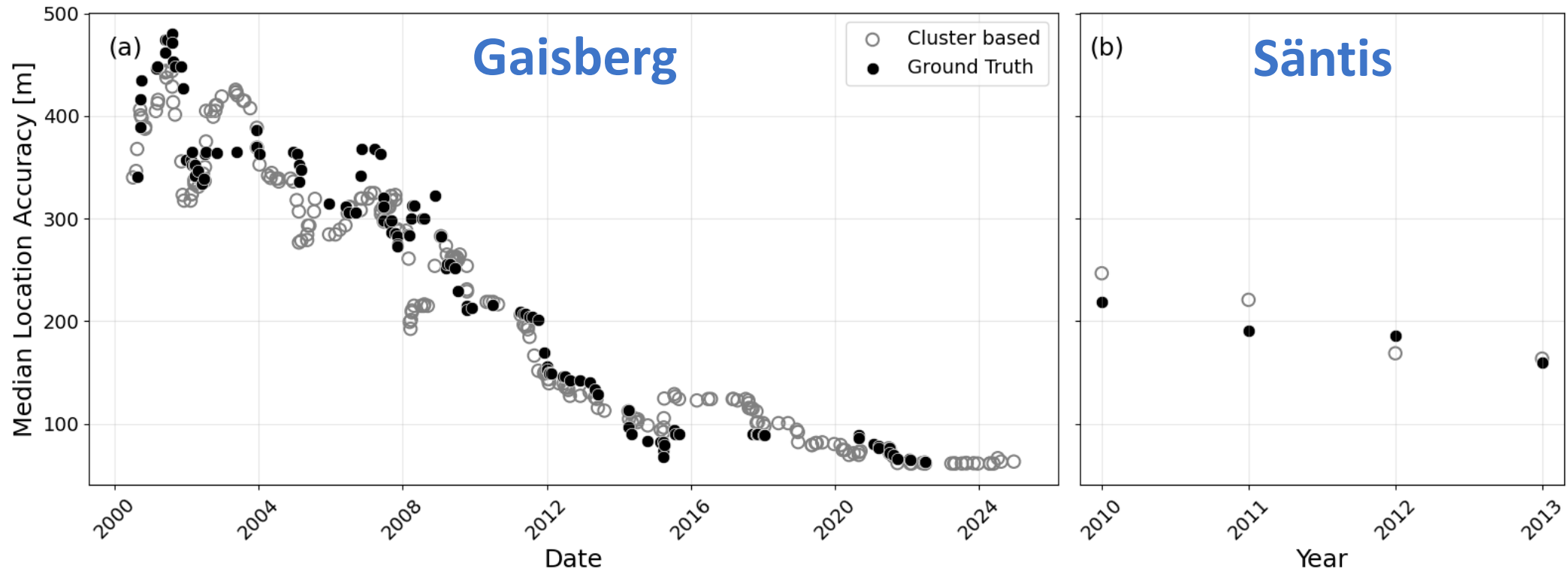
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Example output

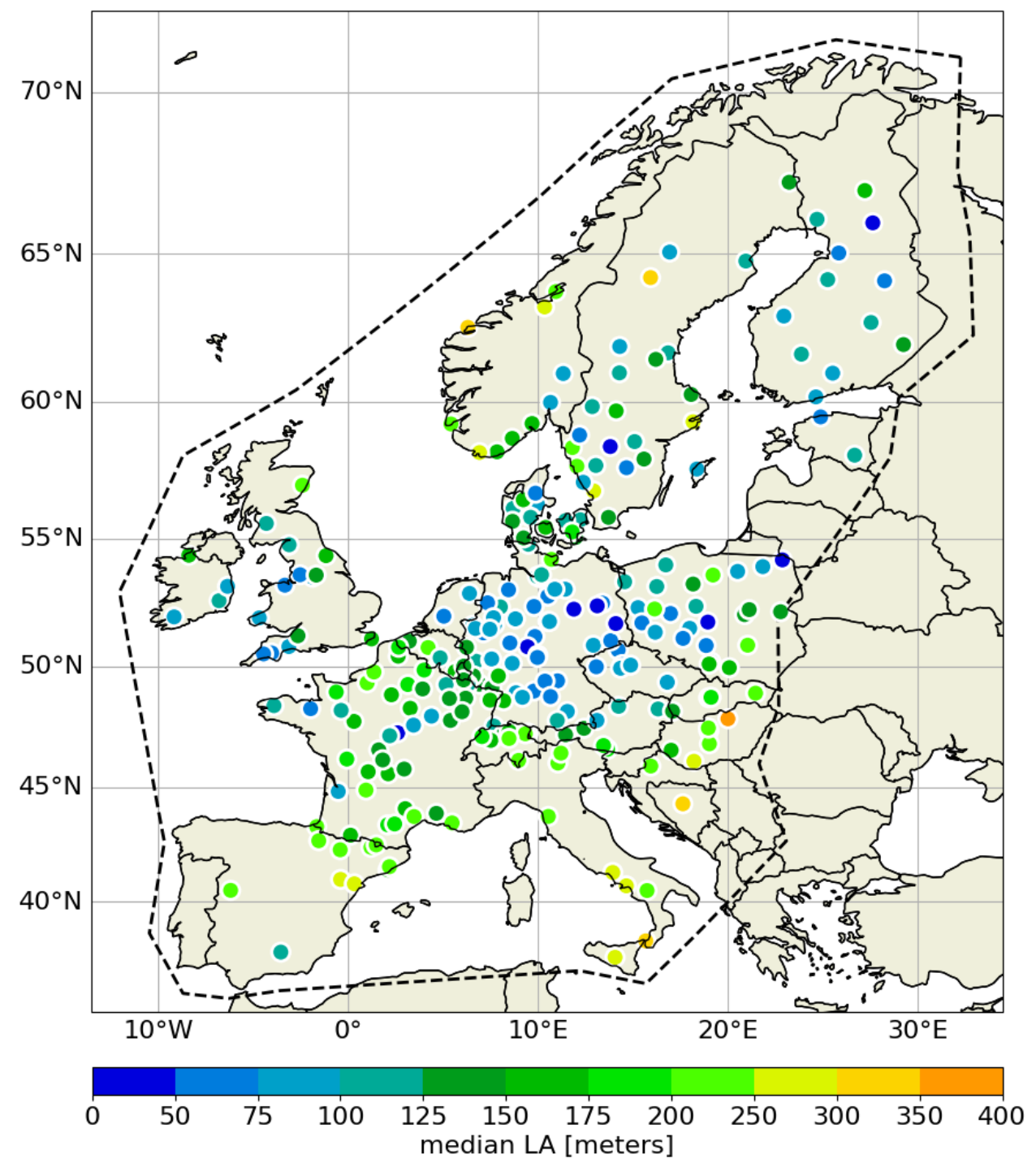


Cross validation against instrumented towers



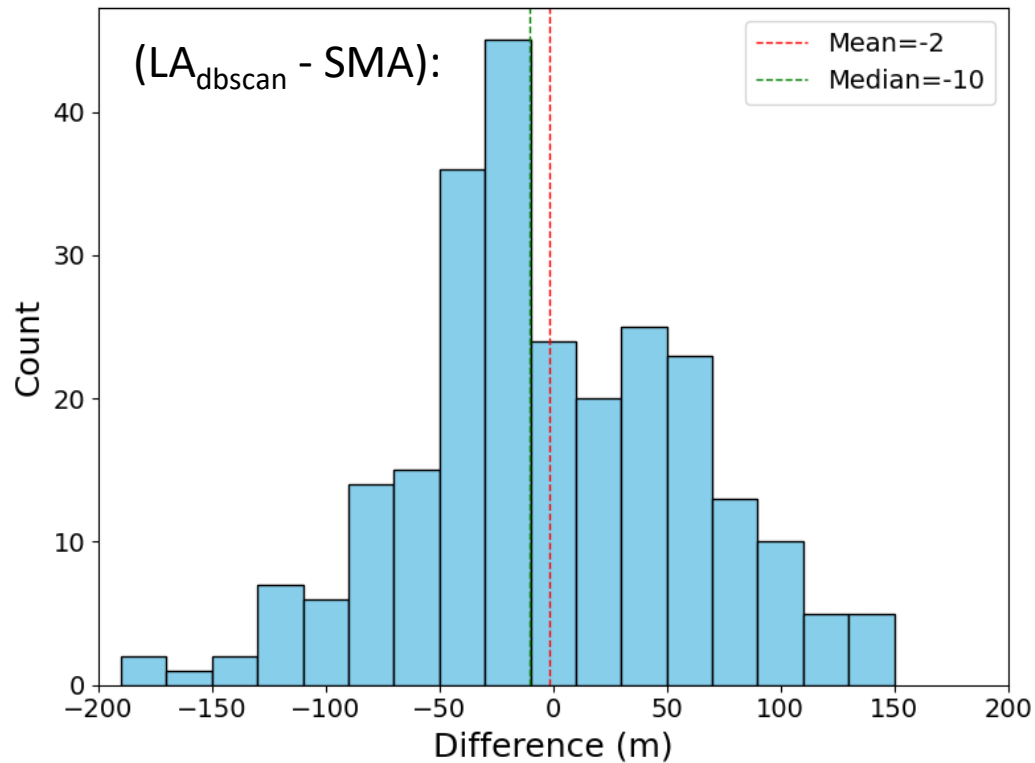
Results

- The average and median location accuracies are 137m and 124m, respectively, with the 95th percentile at 258m.



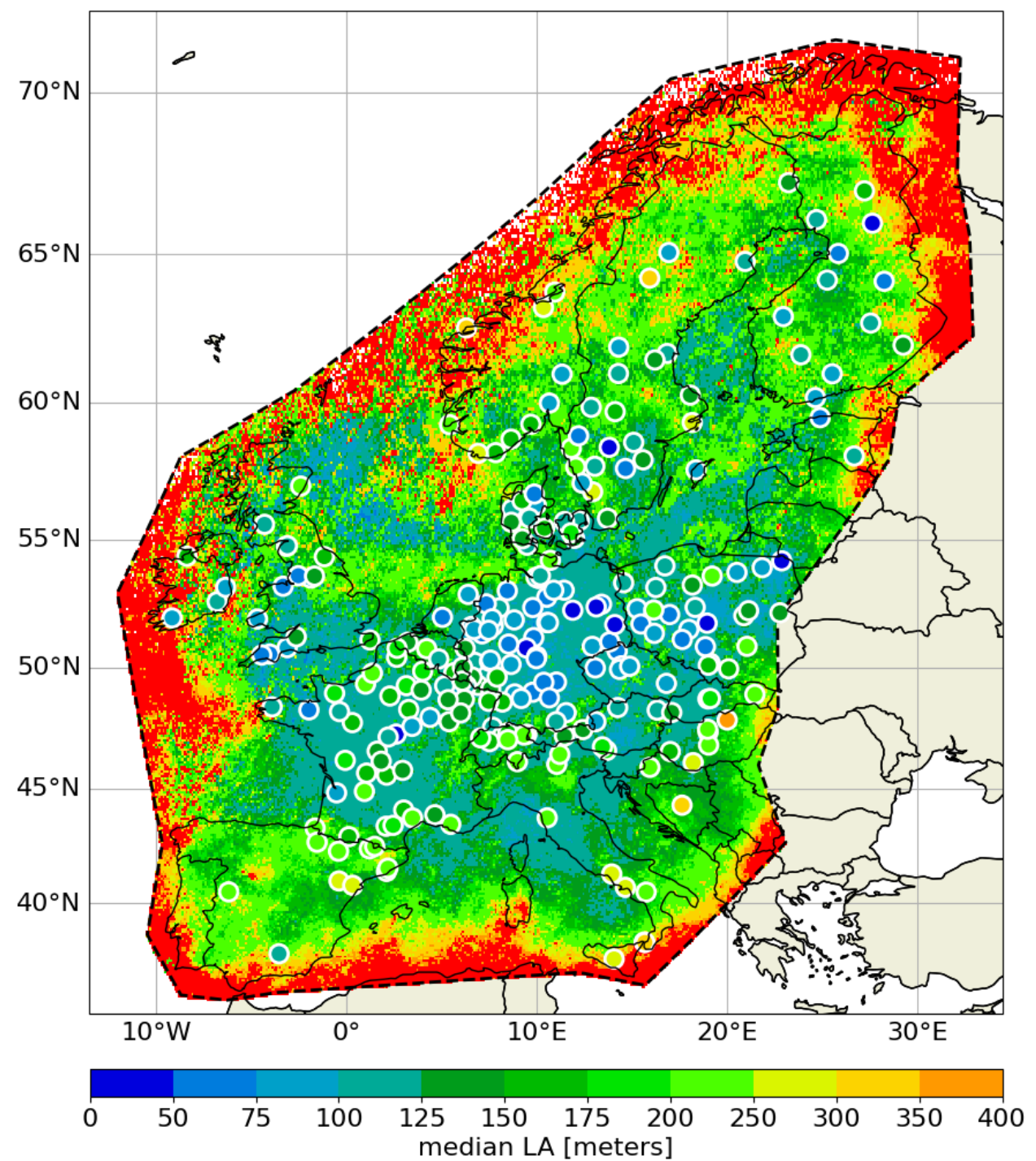
Results

- The average and median location accuracies are 137m and 124m, respectively, with the 95th percentile at 258m.
- Comparison with SMA:

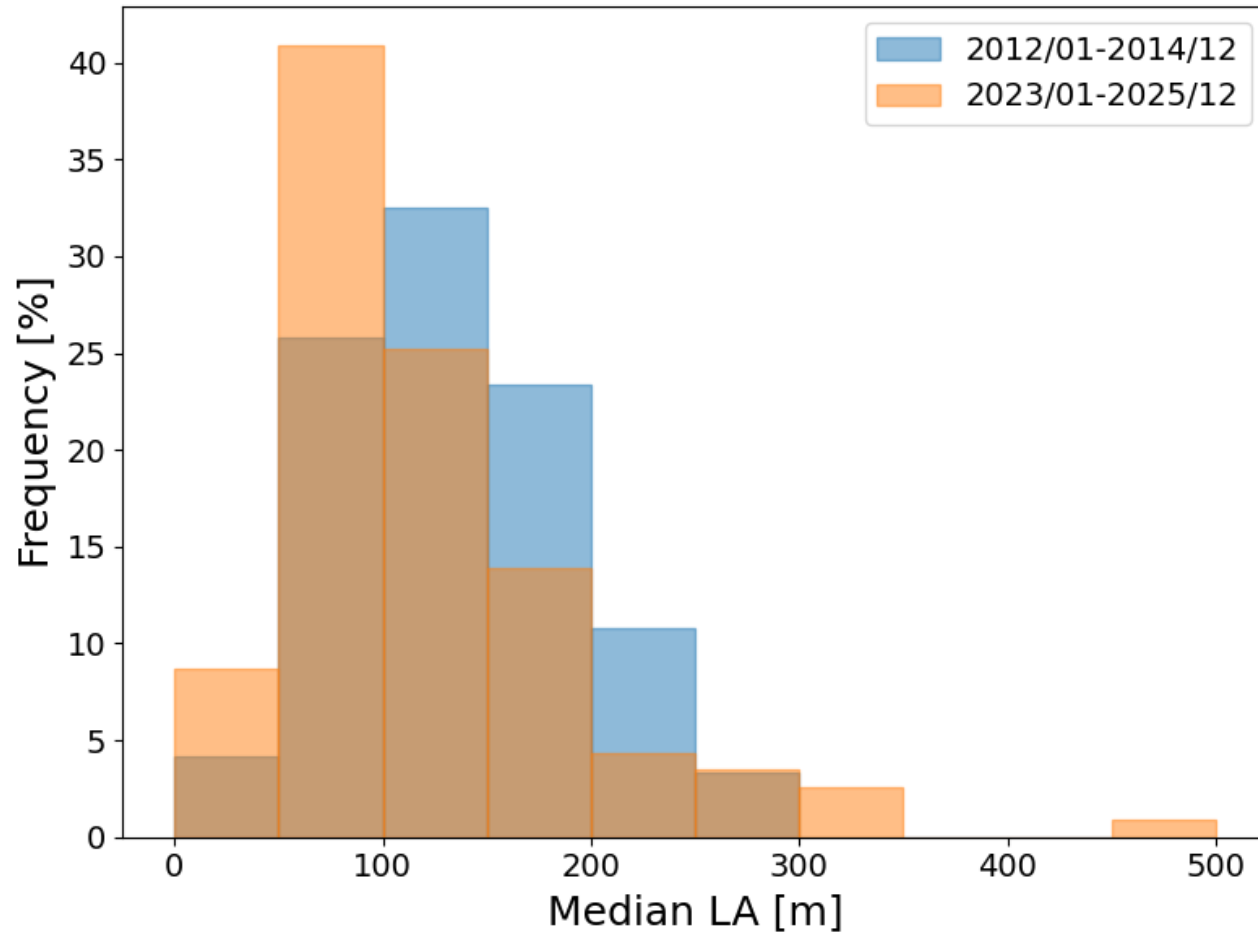


P25 = -42m, P75 = +47m, IQR= 89 m

P5 = -111m, P95 = +109m



Results



	2012/01-2014/12	2023/01-2025/12
Mean LA [m]	135	119
Median LA [m]	126	100

Takeaways



Overall Performance

Analysis of the full 2012-2025 dataset reveals strong network geolocation capabilities

Median LA = 124 m

Mean: 137 m | 95th % = 258 m



Consistency with SMA

Strong alignment with EUCLID SMA, with near-zero bias

Mean diff: -2 m | median diff: -10 m, IQR: 89 m



Temporal Improvements

Continuous upgrades yield measurable geolocation gains

2012-2014

126 m

2023-2025

100 m