Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft
Institut für Physik der Atmosphäre

On the Statistics of Lightning Strikes into Towers and Antenna Masts Measured by LINET

K. Schmidt[1], H.-D. Betz[2,3], A. Würl[2]

[1] Institut für Physik der Atmosphäre, DLR-Oberpfaffenhofen, Germany [2] nowcast GmbH [3] Ludwigs-Maximilians-Universität, Munich, Germany

Motivation

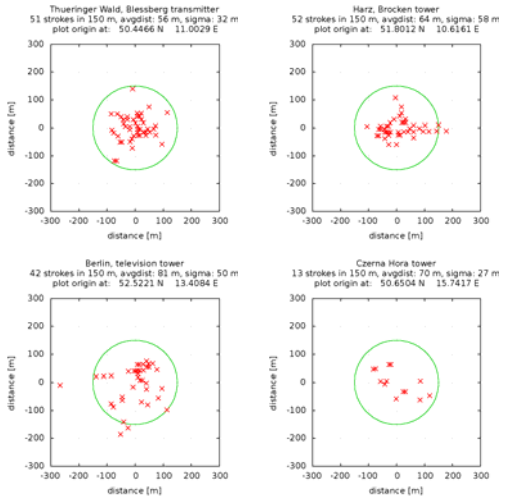
The European lightning detection network LINET, which has been operated and expanded since May 2006, can very accurately detect lightning activity over most parts of Europe. To test the location accuracy we investigated lightning strikes into elevated structures like radio or TV towers, masts or high-rise buildings. Locations of more than one hundred structures were determined and occurrence of lightning strikes at or close to these positions were analyzed for a period of three years (03/2007- 03/2010).

Table 1. Top ten of structures most-hit by lightning during this study

Location	Region	Country	msl [m]	building height [m]	hits inside 500m	hits inside 5km
Säntis	Appenzell Alps	Switzerland	2502	124	1087	1174
Gaisberg	near Salzburg	Austria	1287	100	727	953
Rigi	Swiss Alps	Switzerland	1800	95	430	497
Hornisgrinde	Black Forest	Germany	1164	206	235	284
Pic du Midi de Bigorre	French Pyrenees	France	2877		155	177
Vysilac Krasnov	near Carlsbad	Czech Republic	711	347	105	130
Crêt de l'Oeillon	Massif Central	France	1364		96	113
Scharteberg	Eifel	Germany	691	302	78	101
Brotjacklriegel	Bavarian Forest	Germany	1016	100	75	94
Ještěd	near Liberec	Czech Republic	1012	100	68	76

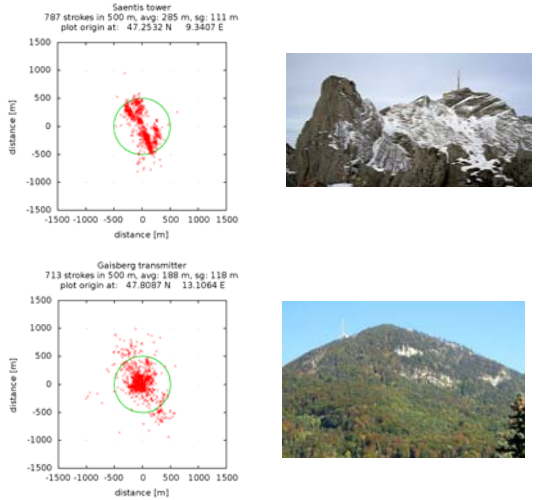
Cases of single outstanding structures

Many structures can be detected by concentrated "hot spots" with small statistical scatter. In most cases these structures correspond to isolated TV and radio towers or antenna masts.



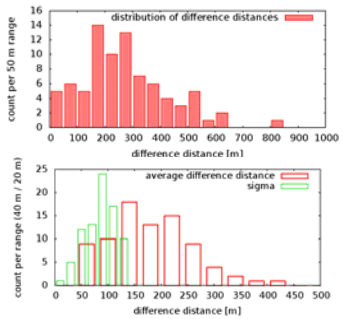
Cases of structured lightning pattern

In many cases, structured lightning patterns correspond to more than one structure or mountain peaks in direct neighbourhood. Very often, these areas are characterized by high lightning density during summer and winter.



Method

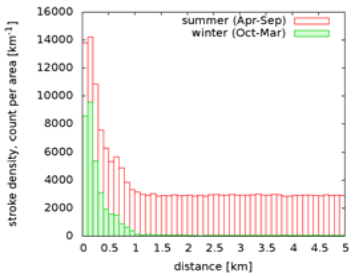
1. Calculation of centre point as distance from given structure coordinates
2. Statistics on difference distance to centre point with calculation of average distance and variance



Seasonal Statistics

Comparison of stroke density related to stroke distance from high structures for summer (red) and winter season (green)

During winter season "hot spots" are easier to detect because of lower background noise from general lightning.



Conclusion

- By analyzing lightning into isolated structures the accuracy of lightning detection network can be investigated.
- Single isolated structures allow stroke locations with small scatter, often less than 100 m.
- Larger scatter with complex lightning patterns are often caused by presence of more than one structure or mountain peak near the tower.
- Tower-induced "hot spots" are better detectable during winter season because of missing "background noise" from 'normal' storms.

Email: kersten.schmidt@dlr.de