

Vaisala TLS200 VHF total lightning mapping for safety and nowcasting applications

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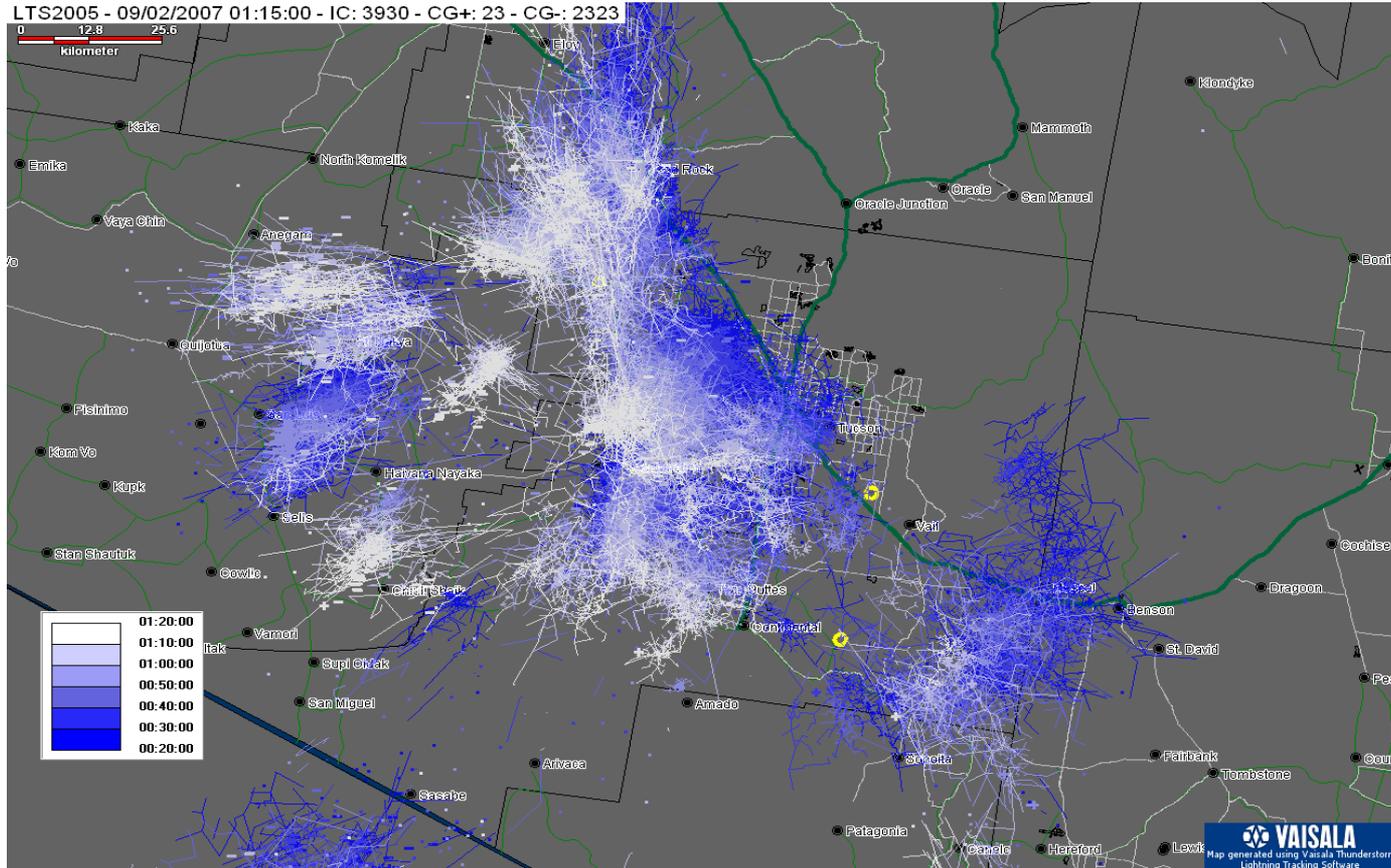
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VAISALA

VHF cloud lightning mapping example

Tucson



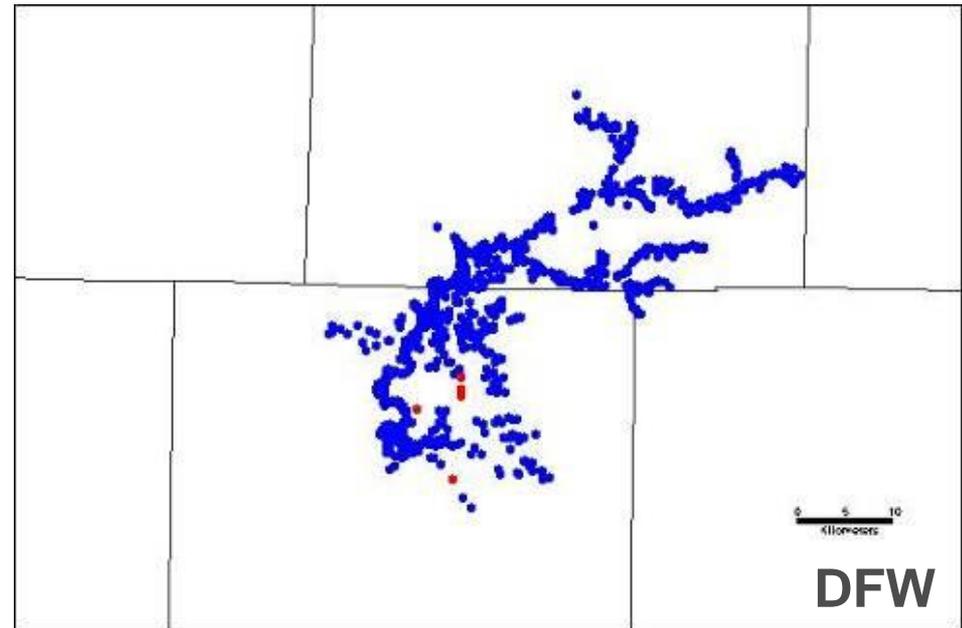
VHF total lightning mapping vs. VLF/LF cloud lightning detection

Flash scale

- VLF/LF detects a fraction of cloud flashes (5-50%)
- Mostly in areas near initiation points of cloud flashes

VHF cloud lightning
mapping

VLF/LF cloud lightning
detection

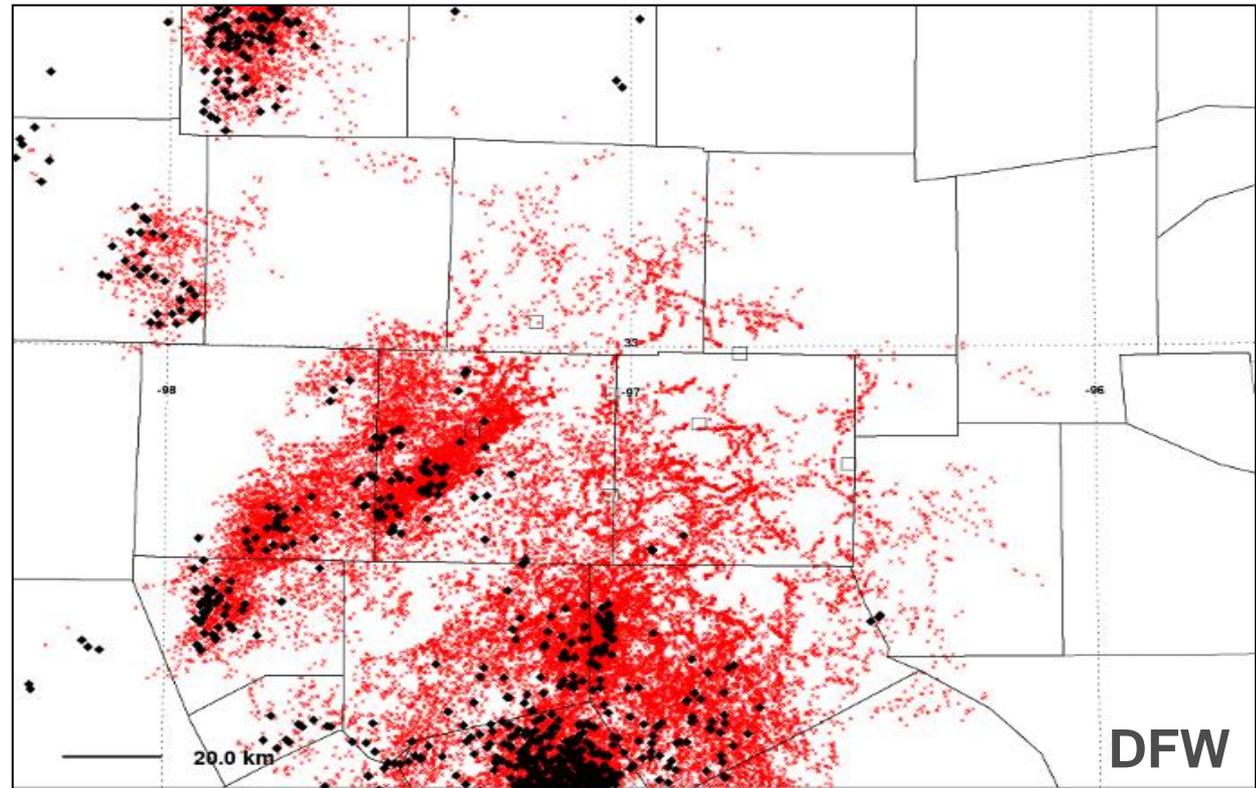


VHF total lightning mapping vs. VLF/LF cloud lightning detection

Storm scale

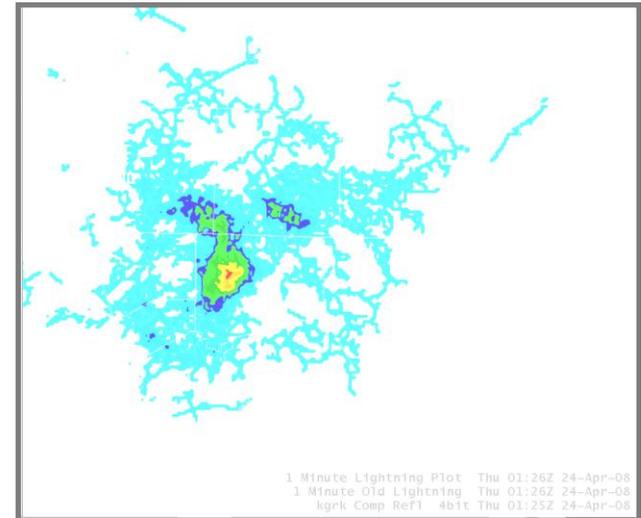
**VHF cloud lightning
mapping**

**VLF/LF cloud
lightning detection**



Total lightning mapping

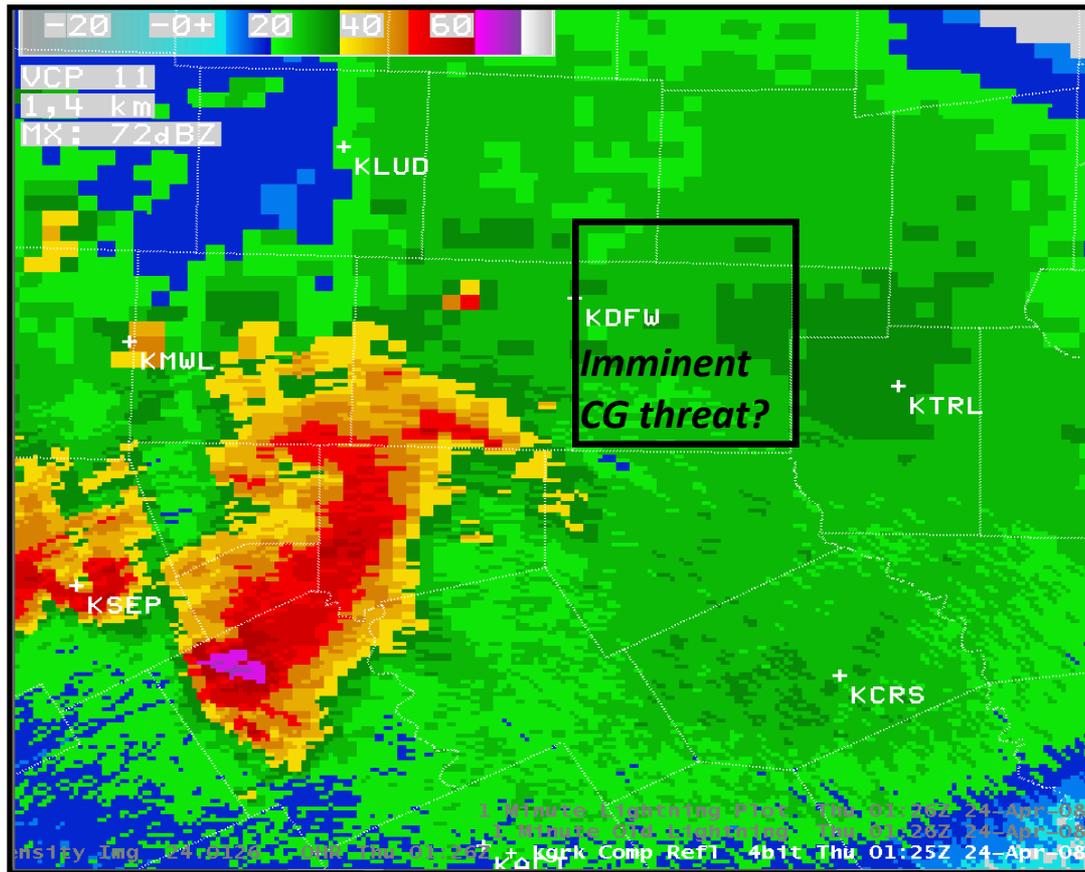
- Tens, hundreds, or thousands of points per flash
- Close in time and space by objective rules
- Horizontally spread across tens of km
- A portion of a second in duration



VHF cloud lightning mapping - essential for lightning safety and avoidance applications

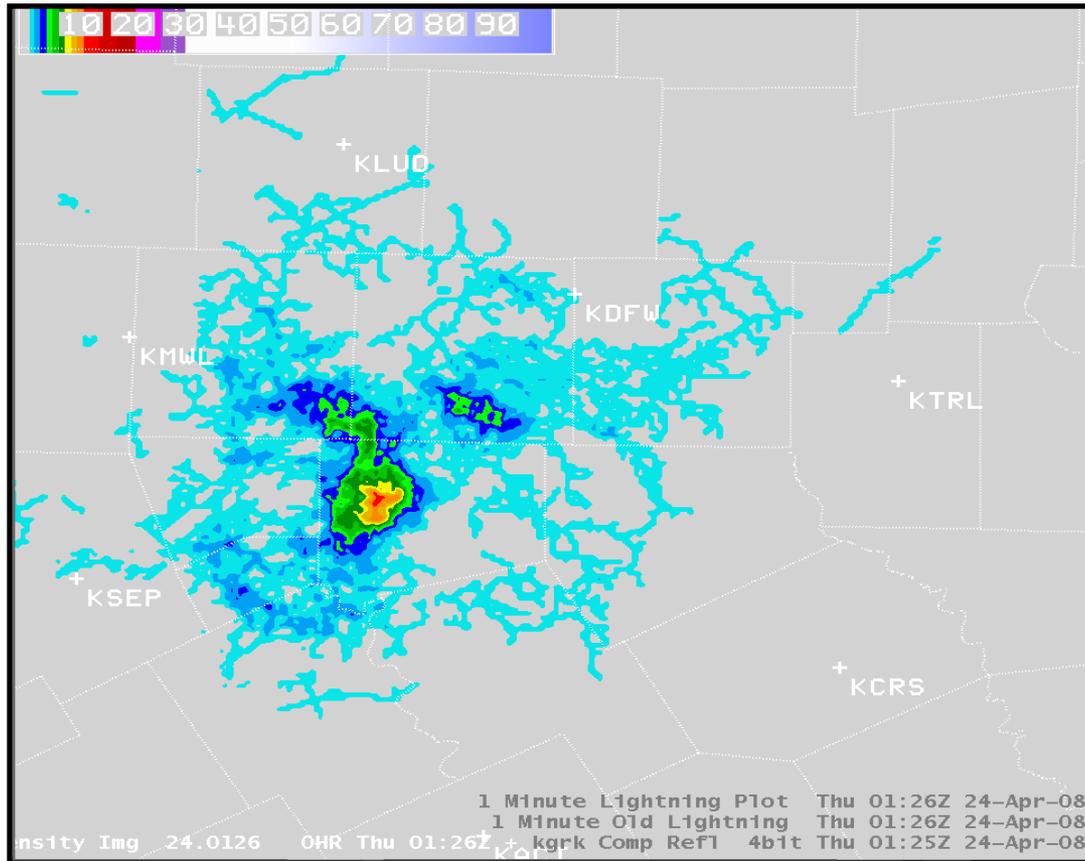
- **Cloud lightning mapping identifies all areas at risk for cloud-to-ground lightning**
- **Research shows that all areas where cloud lightning is propagating overhead are at risk for cloud-to-ground lightning**

CG lightning hazard Radar perspective (composite)

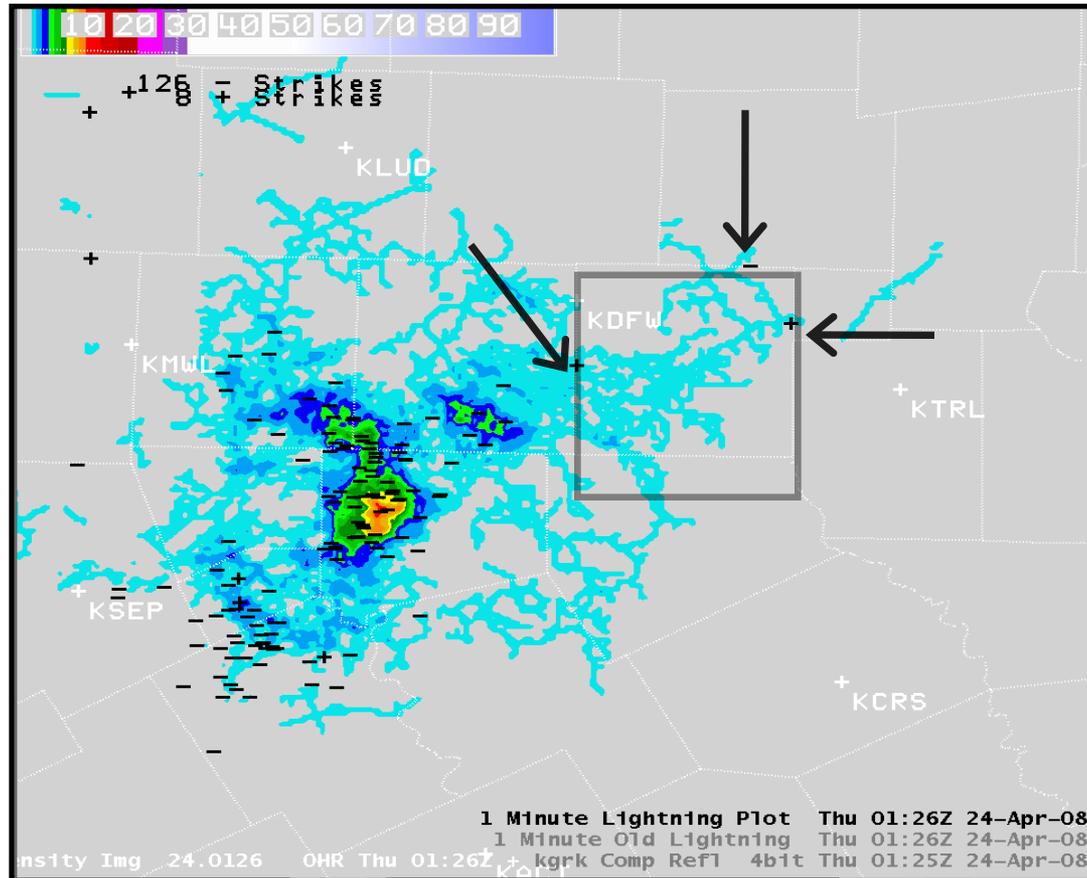


24 April
2008

CG lightning hazard VHF total lightning mapping perspective



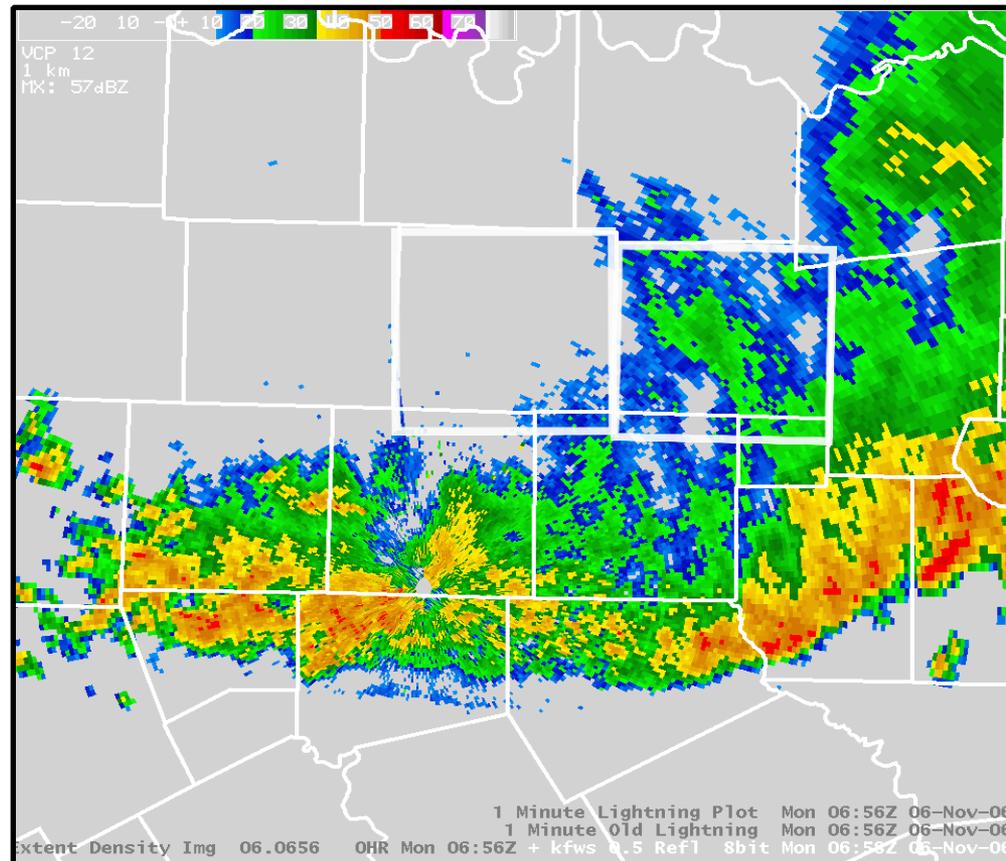
CG lightning hazard VHF total lightning mapping & NLDN perspective



24 April
2008

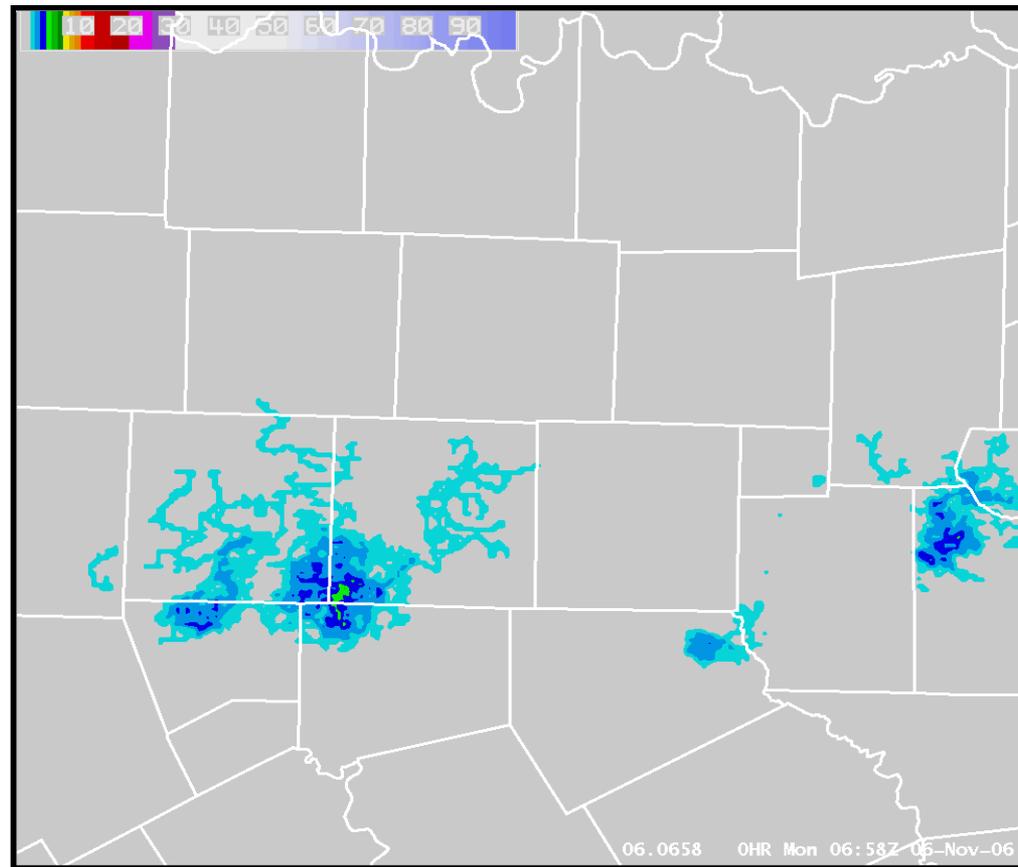
CG lightning hazard Radar perspective (base)

0700–0800
UTC
6 November
2006 movie



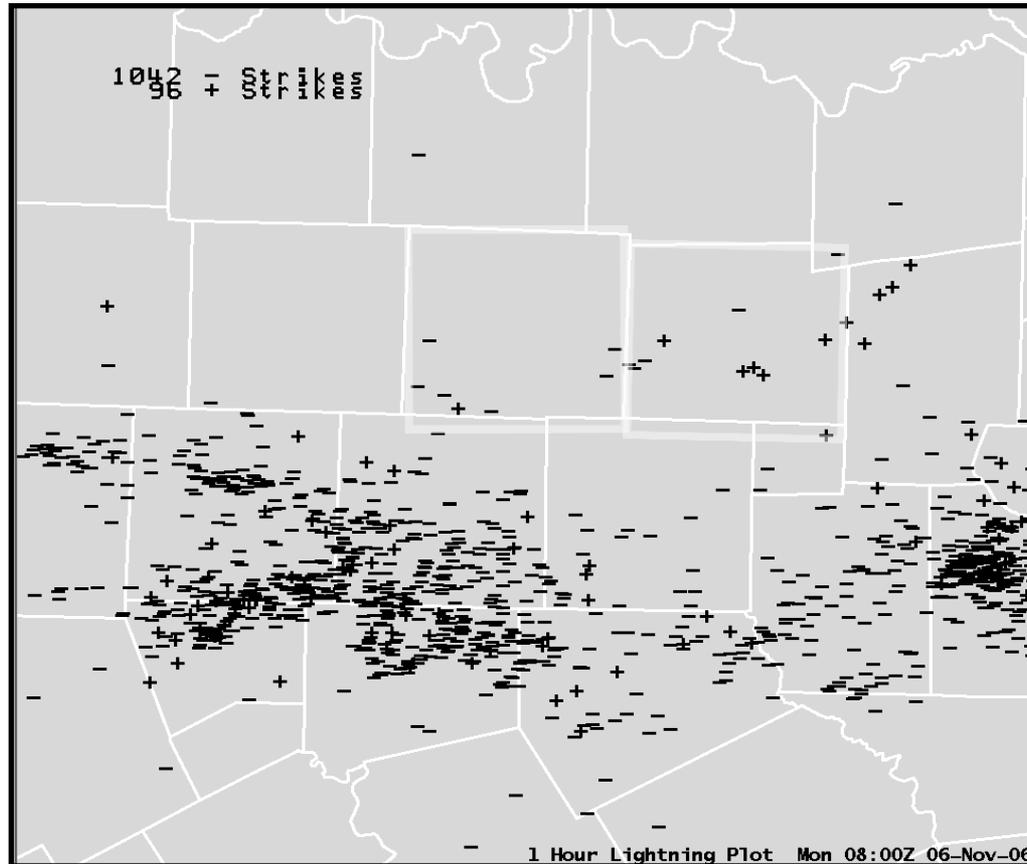
CG lightning hazard VHF total lightning mapping perspective

0700–0800
UTC
6 November
2006 movie



CG lightning hazard NLDN CG lightning perspective

0700–0800
UTC
6 November
2006



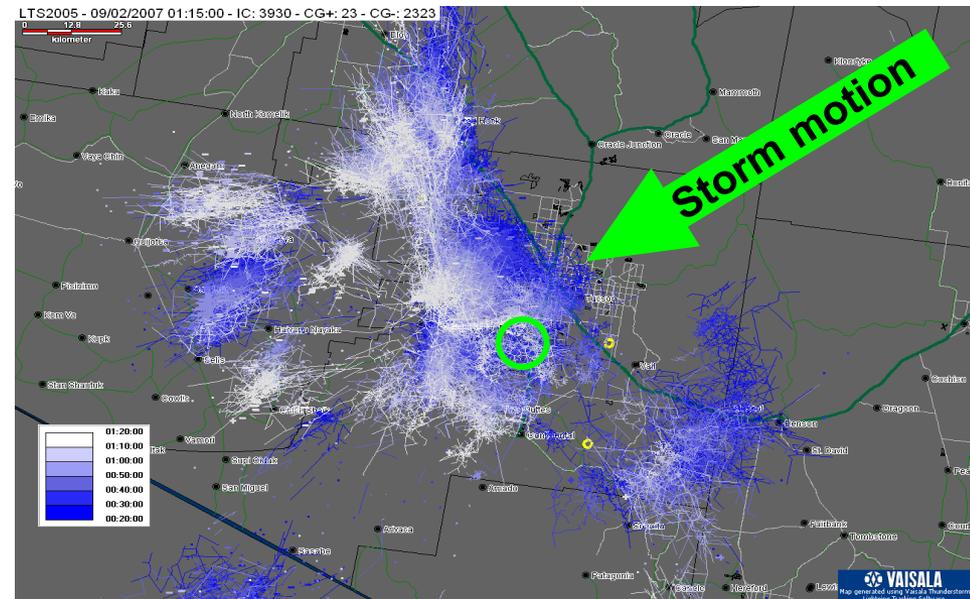
Asset compared with storm-following

- Consider a fixed asset such as an airport or outdoor event
- Most thunderstorms (70 to 90%) develop away from the asset and move toward and/or over it
- Sometimes (10 to 30%), a new overhead storm will develop over the asset

Asset perspective

Tucson airport study – Nick Demetriades, Vaisala

- Study of 29 thunderstorms at Tucson International Airport during 2007/2008 showed that LS8000 cloud lightning events provided ~20 minutes (mean 25; median 19) lead time before first CG affected the airport
- Same study showed that VLF/LF cloud lightning from the NLDN provided no lead time (mean 2 minutes late; median 0 minutes)



Storm-following perspective

- Storm-following perspective, specifically overhead thunderstorm development
- Minority of thunderstorms (~10-30%) develop overhead of the asset being protected
- Cloud lightning precedes CG lightning in ~70% of all thunderstorms. For these thunderstorms, the typical time difference between the first cloud and first CG flash/stroke is several minutes.

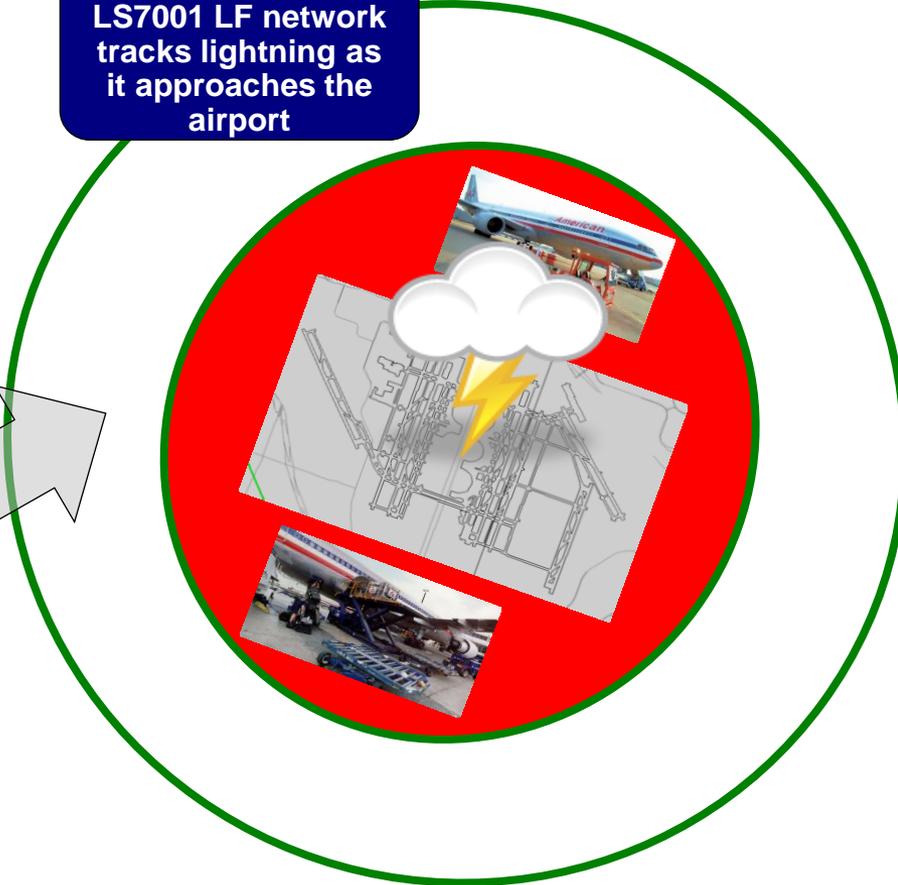
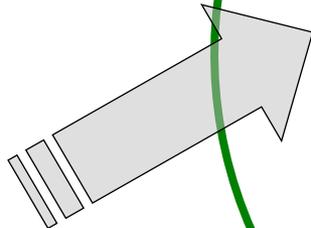
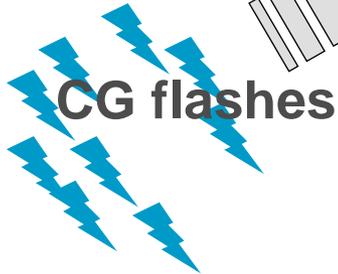
VHF cloud lightning mapping for lightning safety and avoidance applications

- **Goal: Reduce false alarms and the warning area associated with cloud-to-ground lightning warnings**
- **This can only be done using VHF cloud lightning mapping**
 - **Large improvements in false alarm rates**
 - **Maintains high safety standards**

CG plus VLF/LF cloud warning methodology



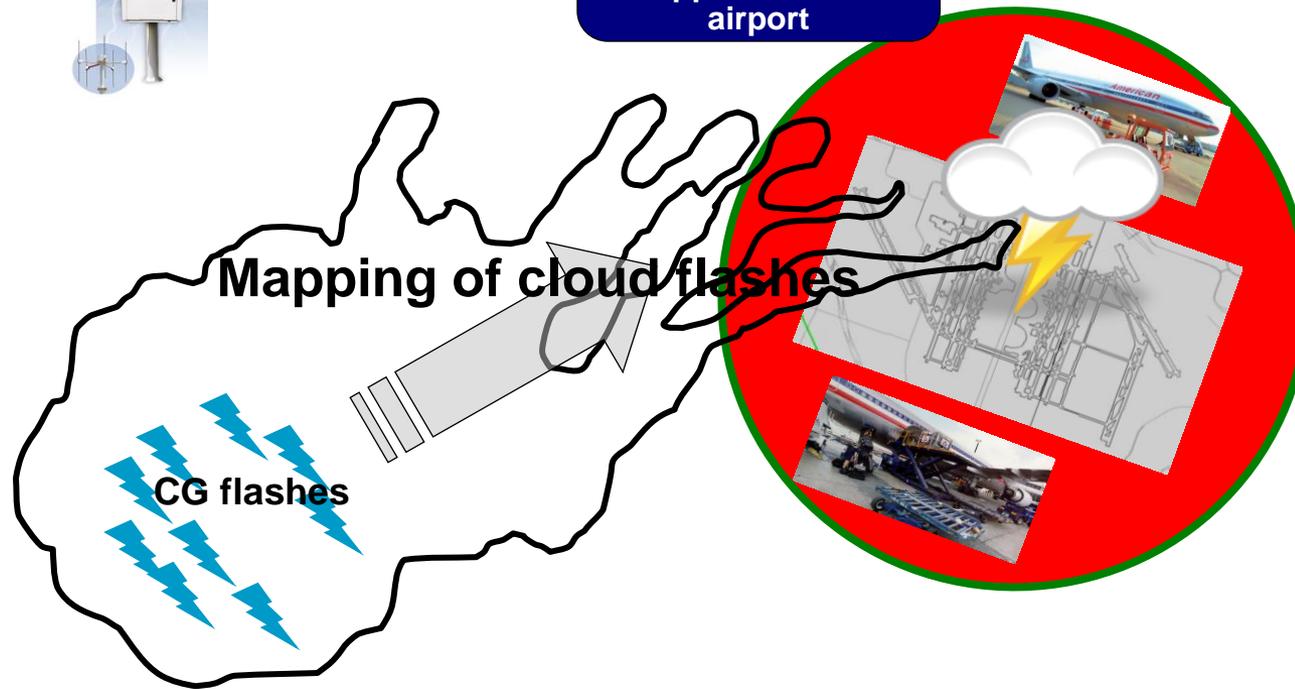
Vaisala NLDN® or LS7001 LF network tracks lightning as it approaches the airport



VHF cloud warning methodology



Vaisala TLS200
VHF/LF network
tracks lightning as
it approaches the
airport



Performance statistics

Definitions

- **Probability of detection (POD2)**
 - Percentage of thunderstorms that produced CG lightning on airport property (3 miles) where a warning was issued with at least two minutes lead time
- **False alarm rate (FAR)**
 - Percentage of all issued warnings that did not produce CG lightning on airport property (3 miles)
- **FAR duration**
 - Number of unnecessary minutes the ramp was shut down due to false alarms
- **Number of ground stops**
 - Total number of times the ramp was shut down for CG lightning warnings

Improved operational efficiency

DFW results (1 March – 4 August 2008)

- TLS200 total lightning mapping reduces size of warning area necessary for generating cloud-to-ground lightning warnings
- High safety with greatly improved operational efficiency

CG lightning warning method	POD2	FAR	FAR duration	Number of ground stops
CG-only	93%	63%	1066 min.	60
VHF total lightning mapping	95%	41%	584 min.	35

Safety applications of Vaisala's VHF total lightning mapping data - Summary

- Provides better identification of areas at risk for CG lightning
- From an asset protection perspective, cloud lightning mapping provides significant lead time before arrival of cloud-to-ground lightning
- From a storm-following perspective, 90% cloud flash detection efficiency maximizes early warning of CG lightning hazard by cloud lightning
- Reduces warning area needed for cloud-to-ground lightning warnings leading to significant false alarm rate reductions while maintaining high safety standards

2012 ILDC/ILMC

- 22nd International Lightning Detection Conference
- 5th International Lightning Meteorology Conference
- April 2-5, 2012
- Renaissance Boulder Flatiron Hotel, Broomfield, Colorado
- **Theme: The value of lightning information for safety and asset protection**



Boxes

