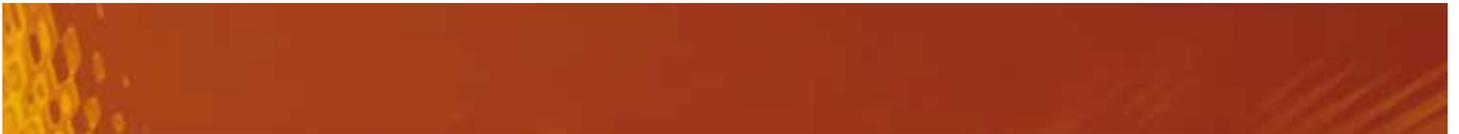


# Vaisala's NLDN<sup>®</sup> U.S. National Lightning Detection Network<sup>®</sup>

/ ADVANCED TOTAL LIGHTNING<sup>™</sup>. SCIENTIFIC ACCURACY.  
PROVEN RELIABILITY.

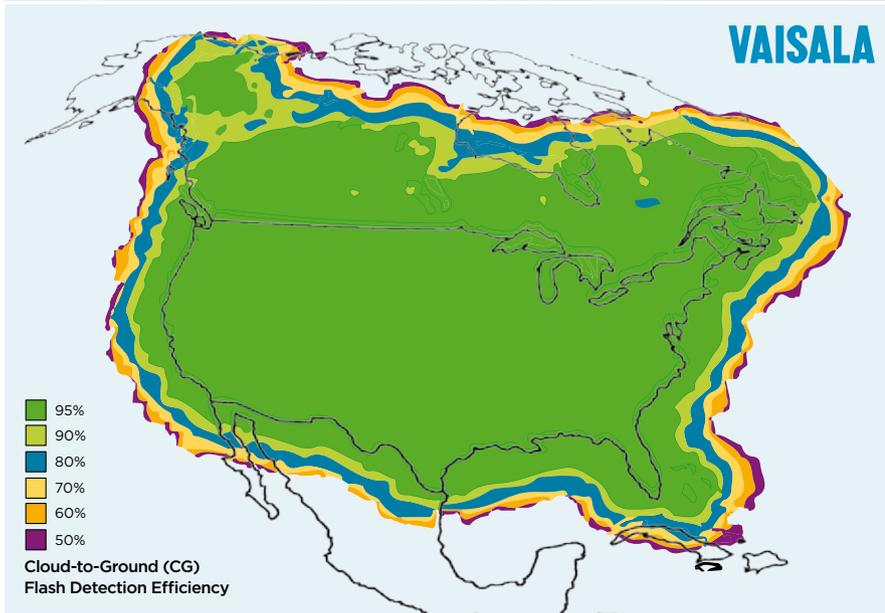


**VAISALA**

# Setting the Standard for Accuracy and Reliability

Lightning Information You Can Trust

## North American Lightning Detection Network (NALDN)



The Vaisala NLDN is built on technology proven to deliver industry-leading performance.

- Total lightning with accurate differentiation between cloud and cloud-to-ground lightning
- Best-in-class cloud-to-ground flash and stroke detection efficiency
- Uniform performance coverage across the continent
- Accurate peak current estimates
- Precise location accuracy with confidence ellipses
- Greater than 99.9% network and data center uptime

For over 30 years, the NLDN has provided researchers with insight into lightning characteristics and behavior resulting in thousands of scientific publications and articles. Moreover, NLDN data has significantly contributed to personnel safety, cost savings via improved damage response times and enhanced lightning mitigation designs. Constant improvements in sensor technology and strict quality control have made the NLDN consistently the most accurate and reliable large-scale lightning detection network in the world.

NLDN sensors use both magnetic direction finding and time-of-arrival measurements to provide multiple identifiers for each lightning event. Highly refined algorithms, the result of over 35 years of lightning research, are used to process sensor information and geolocate lightning accurately. Ground-truth video and rocket-triggered studies conducted by the University of Arizona and the University of Florida have validated the accuracy of the data. Finally, the Network Control Center, located in Tucson, AZ, uses state-of-the-art satellite telecommunications

equipment and protocols to provide a stable and reliable data hub. It is for these reasons that major government agencies, municipalities, private companies and universities have chosen NLDN data as their primary source for lightning information.

## Global Leadership in Lightning Systems

Customers worldwide rely on Vaisala's recognized expertise in lightning systems to deliver the highest standards of accuracy and reliability in lightning detection technology, central processing, application software, and customer support. Vaisala's over three decades of pioneering leadership is affirmed by its current

worldwide customer base, its diverse portfolio of lightning detection technologies, and its full suite of processing and application software.

Vaisala supports its lightning products and services with training, service, warranty, and spare parts programs that can be tailored to meet each customer's needs.



Lightning information needs are served by Vaisala lightning detection networks in more than 50 countries.

# 24/7 Lightning Tracking Across the Continental U.S.

*Vaisala's National Lightning Detection Network (NLDN) is the leading lightning information system tracking both cloud and cloud-to-ground lightning activity across the continental United States, 24 hours a day, 365 days a year.*

The NLDN's verified standard of accuracy and reliability continually sets the benchmark for lightning information services. NLDN information is used for both monitoring current conditions and studying past events. Weather forecasters use real-time lightning maps from the NLDN to monitor thunderstorm development, strength, and paths closely.

Electric power utilities, airports, telecommunications, and explosives handling operations rely on NLDN lightning data and individual lightning strike characteristics to manage risk and identify which facilities have been compromised.

The NLDN has been providing continental-scale lightning data since 1989. Today, the NLDN reports close to 250 million cloud

and cloud-to-ground lightning events each year including about 85 million cloud-to-ground strokes. The NLDN has created a comprehensive archive of lightning data used for statistical, reliability, and forensic analysis. Usage of NLDN historical data has improved data models, engineering designs, claim verifications, and operational efficiency.

## The NLDN provides:

- Thunderstorm detection efficiency of close to 100%
- Cloud-to-ground (CG) flash detection efficiency greater than 95%
- CG stroke detection efficiency of 80-85%
- Cloud (IC) flash detection efficiency of 50-60%
- Median location accuracy of 150-250m or better using standard 300-350 km baselines
- Full redundancy in sensor, communication, and IT systems for continuous data delivery
- Network uptimes nearing 99.95%
- Data feed uptimes of better than 99.9%
- Event timing precision of 0.5 microsecond RMS or less
- Accurate peak current estimates resulting from magnetic field measurements
- Geolocation of lightning discharges with as few as 2 sensors
- Geolocation of multiple pulses in lightning pulse bursts or trains
- Lightning type classification (IC versus CG) accuracy of about 90% using lightning waveform analysis
- Latency (time between lightning occurrence and delivery of the data) of less than 15 seconds

## How the NLDN Works



*U.S. NLDN consists of the latest advanced ground-based lightning sensor technology from Vaisala.*



*Sensors instantly detect the electromagnetic signals produced when cloud and cloud-to-ground lightning occurs.*



*Sensors send raw data via satellite or internet to the Network Control Center (NCC) in Tucson, Arizona.*

Date/Time	Lat	Lon	kA
2003-08-26 11:03:58.480	39.1551	-77.4376	-3.071
2003-08-26 11:05:30.021	39.1204	-77.3602	-3.478
2003-08-26 11:07:05.583	39.1206	-77.3709	-5.106
2003-08-26 11:16:21.953	39.1006	-77.376	-5.0505
2003-08-26 11:18:19.382	39.1609	-77.2416	-10.9455
2003-08-26 11:21:35.033	39.2202	-77.2089	-5.7905
2003-08-26 11:21:51.516	39.1622	-77.2864	13.986
2003-08-26 11:21:51.550	39.1643	-77.2976	-18.7405
2003-08-26 11:21:51.847	39.1727	-77.2497	-9.4165
2003-08-26 11:21:51.894	39.1614	-77.2962	-14.023
2003-08-26 11:21:51.894	39.1638	-77.2963	-21.286
2003-08-26 11:23:01.415	39.2006	-77.1681	7.844
2003-08-26 11:24:10.567	39.1616	-77.2916	-16.095
2003-08-26 11:24:10.599	39.144	-77.2942	-12.7095
2003-08-26 11:26:29.946	39.124	-77.2603	-9.7917
2003-08-26 11:28:30.056	39.1643	-77.3152	-5.7917
2003-08-26 11:28:00.571	39.1613	-77.2561	-5.772
2003-08-26 11:28:00.538	39.1263	-77.1847	-13.3015
2003-08-26 11:28:54.789	39.1356	-77.2146	-10.989

*Within seconds, the NCC's central analyzers process information on location, time, type, polarity, and amplitude of each lightning event.*



*Lightning information is sent to users across the country.*

## Over 30 Years of Continuous U.S. NLDN Improvements

1984-1989

- Three isolated networks using early direction finding sensors are developed and operate at various locations.

1989

- Regional networks share data to create a national network, NLDN. The national project is funded by the Electric Power Research Institute (EPRI) and is operated by State University of New York at Albany. Live lightning data feeds are turned on for users across the country.

1991

- Real-time and historic lightning information becomes commercially available.

1993

- NLDN Network Control Center is moved to its current location in Tucson, Arizona.

# Real-time Lightning Data for Immediate Precautions

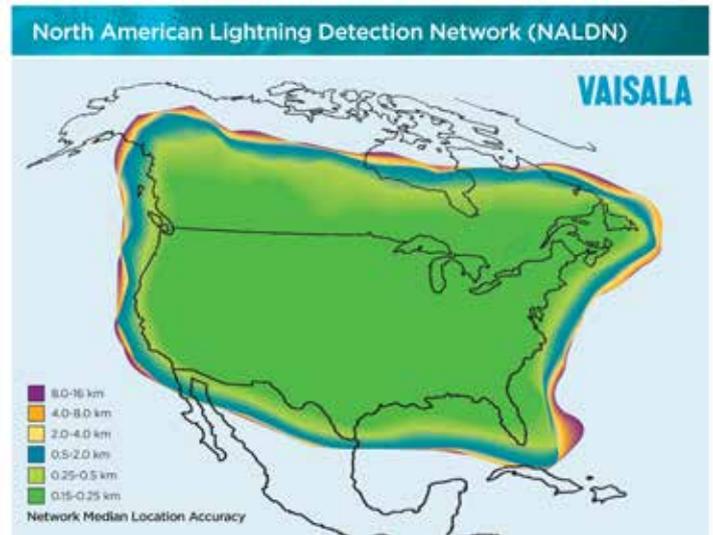
## Live Lightning Tracking to Save Lives and Protect Property

Meteorologists in both public and private sectors use real-time NLDN data to monitor thunderstorm development, strength, and paths closely for issuing severe weather warnings. Lightning can also help identify hazardous weather where other observations are not available, such as in mountainous areas prone to radar blockage.

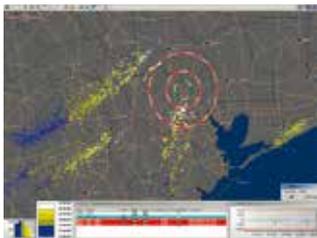
Managers responsible for human safety, property protection, risk management, and productivity use NLDN data for early warning of lightning and thunderstorm threats. By knowing when and where lightning is active, planned precautions can be taken early to reduce vulnerability and risk.

Real-time lightning information is available by subscription and is delivered by:

- Web-based Vaisala Thunderstorm Manager or Vaisala AviCast for Airports
- Satellite broadcast or TCP/IP and used with Vaisala LTS2005 Real-time Lightning Tracking Software or Vaisala Thunderstorm Warning System TWX300
- Licensed resellers in select applications



*Vaisala Thunderstorm Manager is a web based application that helps you track approaching storms in real time.*



*Vaisala Thunderstorm Warning System TWX300 tracks lightning and monitors overhead lightning potential and automatically sends lightning warnings and all clears to remote alarm displays.*

### Key applications for NLDN lightning data

- **Weather forecasting:** detects and helps predict severe weather for public warning
- **Electric power:** pre-position field crews to respond to approaching storm threats or re-route power to alternative transmission lines. Reliability and forensic analysis of lightning data supports engineering, planning and performance enhancement, as well as electric fault locations
- **Air traffic control:** re-route aircraft around hazardous thunderstorms
- **Airports:** suspend high-risk activities such as ramp operations and fueling during lightning threats
- **Insurance and arson:** investigate lightning to determine the cause of property damage or fire
- **Power-sensitive operations:** prepare for storm-caused power outages by switching to back-up power before operations are impacted
- **Mining and hazardous materials handling:** warn personnel working near explosives and flammable materials to evacuate
- **Forestry:** dispatch firefighting crews to suspected fire starts for more successful initial attack, narrowing the patrol and search areas
- **Golf and outdoor recreation:** warn players and spectators to seek safety from storms
- **Aerospace:** monitor weather for safest conditions for satellite launches
- **Wind Farms:** identify turbines that may have been affected by lightning in order to target maintenance.

1995

First major network-wide upgrade is completed with project partner EPRI. Upgrade added sensors that combined time-of-arrival and magnetic direction finding. NLDN begins reporting individual strokes within a flash. Flash detection efficiency increased to 80-90 % with median stroke location accuracy of 500 meters.

1996-1999

Commercial uses of historic lightning data proliferate in electric power, insurance and other industries with improved location accuracy and application-specific software developments.

1998

Canadian Lightning Detection Network, owned by Environment Canada, completed; CLDN operated in NLDN Network Control Center in Tucson, AZ.

2000

NLDN real-time and historic data is available on the Internet in several application-specific formats.

# Historic Lightning Data for Critical Decisions

## Historic Lightning Information for Research and Analysis

Seasonal or multi-year studies of lightning trends are important for risk assessment, site selection and optimal protection schemes. Electric power, arson investigators, insurance companies, and land management agencies use historic NLDN data to correlate and document suspected lightning damage with recorded lightning activity. Lightning incidents can be researched within any area and for any time period across the Continental U.S.

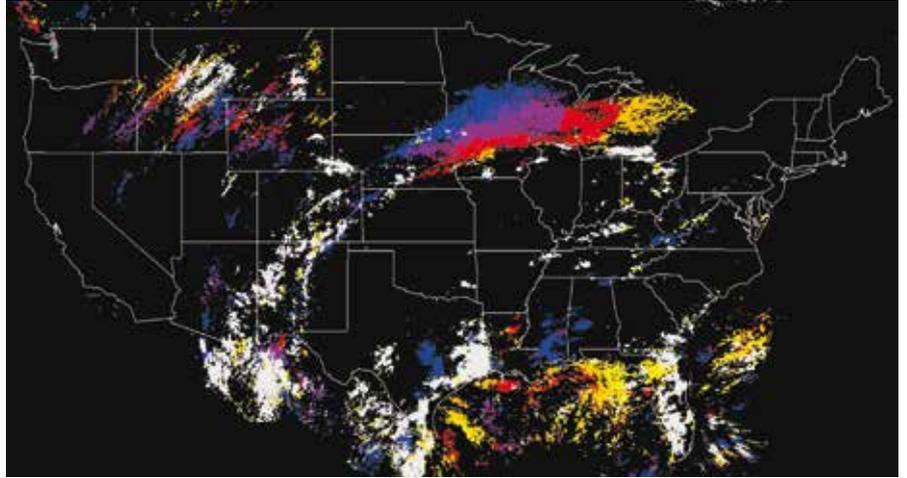
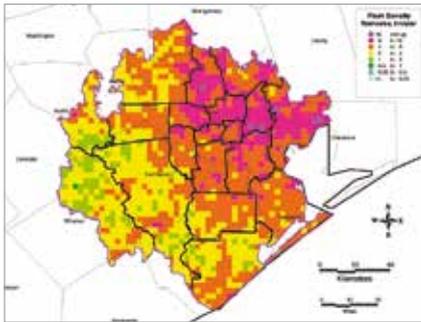


Image shows 24 hrs. of lightning data from Vaisala's U.S. National Lightning Detection Network



Vaisala FALLS<sup>®</sup>, Fault Analysis and Lightning Location System, uses NLDN historic data to analyze lightning density relative to fixed assets to design better lightning protection schemes.

## How to Access Historic NLDN Lightning Information

Vaisala's NLDN lightning information is available through a variety of channels. Historic lightning information is available via:

- CD or traditional Internet protocols and used with Vaisala Fault Analysis and Lightning Location System (FALLS)<sup>®</sup>
- Custom lightning reports, such as Vaisala FaultFinder<sup>®</sup> or Vaisala Facility Site Analysis (FSA), prepared by Vaisala's trained lightning data analysts
- Online lightning verification reports, such as Vaisala STRIKEnet (now provided by CoreLogic/Weather Fusion).

*Outside the U.S., Vaisala also provides lightning data anywhere in the world through its global network GLD360. Contact us for additional information about GLD360 data services.*

2003

- Second major upgrade completed with installation of next generation sensors.

2006

- Survey level cloud detection capability available.

2010

- Complete communications upgrade to new VSAT technology for higher bandwidth capabilities and speed. Latency improved to 15 seconds or less. Total Lightning Processor<sup>™</sup> (TLP<sup>™</sup>) algorithm operating in NLDN<sup>®</sup> yields 200 meter or better location accuracy with patented terrain and propagation corrections.

2011

- Network fully upgraded to latest technology with LS7001 sensors for improved location accuracy and detection efficiency.

2013

- Complete network upgrade to use the newest LS7002 sensors and the latest central processor, for excellent cloud flash detection efficiency of 50-60%, cloud-to-ground flash detection efficiency of 95% or higher, and improved classification accuracy of 80-90%.



## About Vaisala

Vaisala offers a comprehensive range of products that provide the measurement data necessary for forecasting the weather, protecting the environment and improving the safety of air ground operations, and road traffic. In industrial settings Vaisala products help to enhance the efficiency of manufacturing processes and improve the working environment, as well as reduce adverse impacts on the environment.

Vaisala's origins date back to the 1930s when Professor Vilho Väisälä, Vaisala's founder and long-time managing director, invented some of the operating principles of the radiosonde for upper air observations.

The parent company, headquartered in Vantaa, Finland, is listed on the Helsinki Exchanges (HEX).

Vaisala has offices and business operations in the United States, Canada, the United Kingdom, Sweden, France, Germany, China, Malaysia, Japan, Brazil, and Australia.

For more about Vaisala, visit [www.vaisala.com](http://www.vaisala.com)

## About Vaisala Thunderstorm

One of Vaisala's recognized areas of expertise is lightning. Vaisala Thunderstorm is the lightning-specialty business unit within the Vaisala Group. Lightning-sensitive operations around the world rely on our lightning warning, tracking, mapping and analysis systems and services to save lives, protect property and reduce economic losses caused by lightning.

For more on Vaisala Thunderstorm, please visit [vaisala.com/thunderstorm](http://vaisala.com/thunderstorm).

*“The National Lightning Detection Network (and Vaisala’s GLD360) ensures the NWS core mission of protection of life and property. It also positively impacts NWS numerical weather prediction (NWP) models and is used for issuing watches and warnings for convective storms.”*

*- National Weather Service, USA*

# VAISALA

For more information, visit [vaisala.com/thunderstorm](http://vaisala.com/thunderstorm) or contact us at [sales@vaisala.com](mailto:sales@vaisala.com)

Ref. B210412EN-E ©Vaisala 2015

This material is subject to copyright protection, with all copyrights retained by Vaisala and its individual partners. All rights reserved. Any logos and/or product names are trademarks of Vaisala or its individual partners. The reproduction, transfer, distribution or storage of information contained in this brochure in any form without the prior written consent of Vaisala is strictly prohibited. All specifications — technical included — are subject to change without notice.

