

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

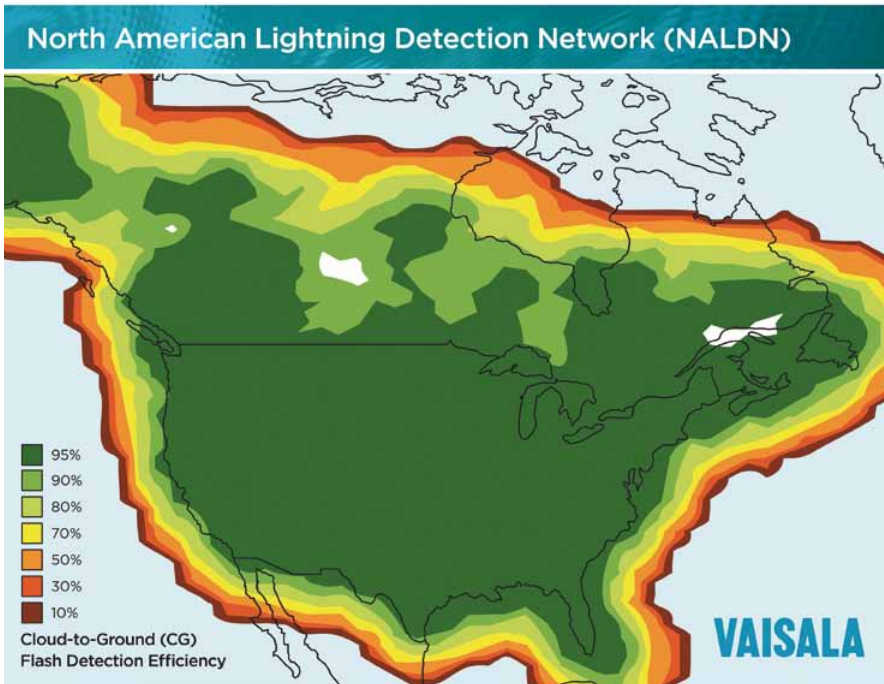
/ SCIENTIFIC ACCURACY. PROVEN RELIABILITY.



**VAISALA**

# Setting the Standard for Accuracy and Reliability.

Lightning information you can trust



**Vaisala's NLDN captures more lightning event parameters, assuring better precision and accuracy.**

The following advantages are observed:

- High stroke detection efficiency for all amplitude events.
- Absolute peak current measurements for all locations within the continental U.S.
- Excellent cloud versus cloud-to-ground classification.
- Precise location accuracy with confidence ellipses to fully quantify any stroke.

recording methods 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 calculate accurate lightning solutions. 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.

Over its 25-year history, 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 the most accurate and reliable large-scale lightning detection network in the world.

The NLDN provides:

- Thunderstorm detection efficiency in excess of 99 %
- Flash detection efficiency greater than 95 %
- Median location accuracy of 250 m or better
- Network uptimes nearing 99.99 %
- Data feed uptimes of better than 99.9 %
- Event timing precision of 1 microsecond RMS or less
- Accurate peak current measurements resulting from magnetic detection methods

NLDN sensors use both magnetic direction finding and time-of-arrival

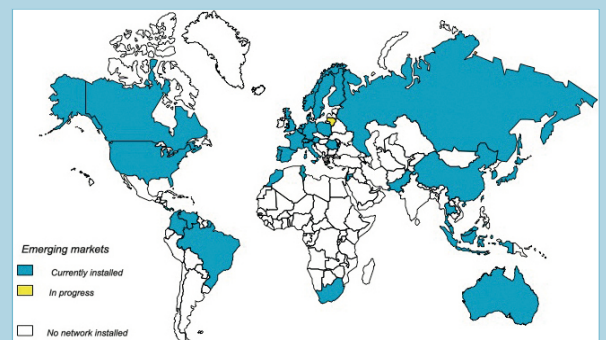
## Global leadership in lightning systems

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 U.S. National Lightning Detection Network (NLDN) is the leading lightning information system tracking cloud-to-ground lightning and survey level cloud 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 and individual lightning strike characteristics from the NLDN

to closely monitor thunderstorm development, strength, and paths. Electric power utilities, airports, telecommunications, and explosives handling operations rely on NLDN lightning data to identify which facilities are at risk. Since 1989, the NLDN has reported the more than 25 million cloud-to-ground lightning flashes that

occur every year. With the addition of strokes in 1995, the NLDN has created a comprehensive archive of lightning data used for statistical and forensic analysis. Usage of NLDN historical data has improved data models, engineering designs, claim verifications, and operational efficiency.

## How the NLDN Works.



U.S. NLDN consists of more than 114 remote, ground-based lightning sensors.



Sensors instantly detect the electromagnetic signals created when lightning strikes the earth's surface.



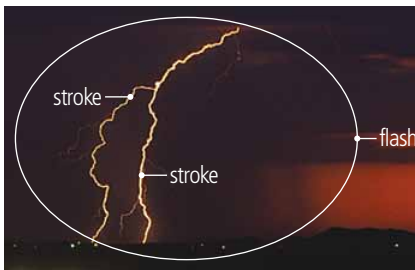
Sensors send raw data via satellite to the Network Control Center (NCC) in Tucson, Arizona.

Date/Time	Lat	Lon	kA
2003-08-26 11:03:58.480	39.1551	-77.4376	-3.071
2003-08-26 11:05:39.021	39.1204	-77.3562	-3.478
2003-08-26 11:07:05.583	39.1209	-77.3709	-5.106
2003-08-26 11:16:21.953	39.1906	-77.376	-5.9505
2003-08-26 11:18:19.382	39.1609	-77.2416	-10.0455
2003-08-26 11:21:35.033	39.2202	-77.2089	-5.7905
2003-08-26 11:21:51.516	39.1622	-77.2964	13.988
2003-08-26 11:21:51.550	39.1643	-77.2978	-18.7405
2003-08-26 11:21:51.847	39.1727	-77.2497	-9.4165
2003-08-26 11:21:51.894	39.1614	-77.2922	-14.023
2003-08-26 11:21:51.894	39.1638	-77.2953	-21.386
2003-08-26 11:23:01.415	39.2005	-77.1651	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 11:26:29.846	38.124	-77.2623	-9.2315
2003-08-26 11:26:30.056	39.1643	-77.3152	-8.4315
2003-08-26 11:28:00.571	39.1613	-77.2861	-10.889
2003-08-26 11:28:00.538	39.1263	-77.1947	13.3015
2003-08-26 11:28:54.780	39.1356	-77.2145	-10.989

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



Lightning information is sent to users across the country.



## Accurate and scientific lightning flash and stroke reporting

NLDN flash data provides time, location, polarity, amplitude and multiplicity of each cloud-to-ground lightning flash. However, there can be up to 20 return strokes that make up a flash and these strokes often strike the earth in different locations up to several kilometers apart. NLDN stroke data provides time, location, polarity, amplitude and confidence information of these strokes, providing the very detailed data needed for in-depth lightning analysis and lightning incident investigations. Flash data is most often used for general trending of lightning events; stroke data is critical for understanding specific incidents.

## Over 20 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.

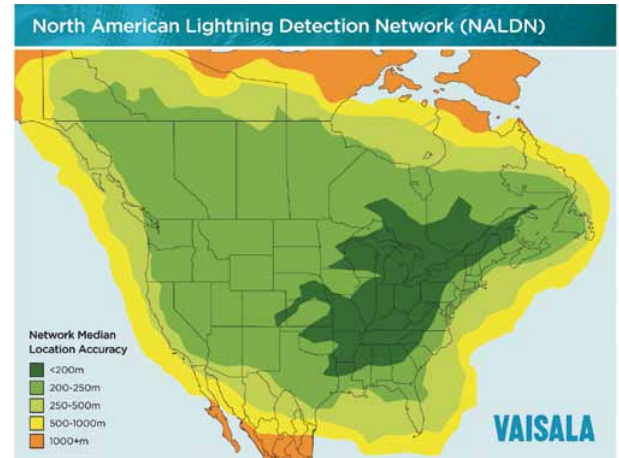
Live lightning tracking to save lives and protect property.

Meteorologists in both public and private sectors use real-time NLDN data to closely monitor thunderstorm development, strength, and paths for issuing severe weather warnings. Lightning is a fast and accurate indicator of severe weather and can also help identify hazardous weather where other observations can be weak, 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:

- 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 Lightning Tracking Software, LTS2005, maps NLDN data and provides warnings and all clears in audible, visual, and e-mail formats for warning areas of any size or shape.



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:** reposition field crews to respond to approaching storm threats. Statistical analysis of lightning data supports engineering, planning and performance enhancement
- **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
- **Hazardous materials handling:** warn personnel working near explosives and flammable materials to evacuate
- **Forestry:** dispatch fire fighting 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

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 flashes and 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.

# 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. Meteorologists, 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.

## How to access real-time NLDN lightning information

Vaisala's NLDN lightning information is available to customers through various lightning mapping systems and Internet lightning information services.

Historic lightning information is available via:

- CD or traditional Internet protocols and used with Vaisala Fault Analysis and Lightning Location System (FALLS)
- Custom lightning reports, such as Vaisala FaultFinder® or Vaisala Facility Site Analysis (FSA), prepared by Vaisala's trained lightning data analysts
- Online lightning verification reports, such as Vaisala STRIKEnet. Lightning data is also available for regions beyond the continental U.S., including Canada, Europe, and oceanic areas.

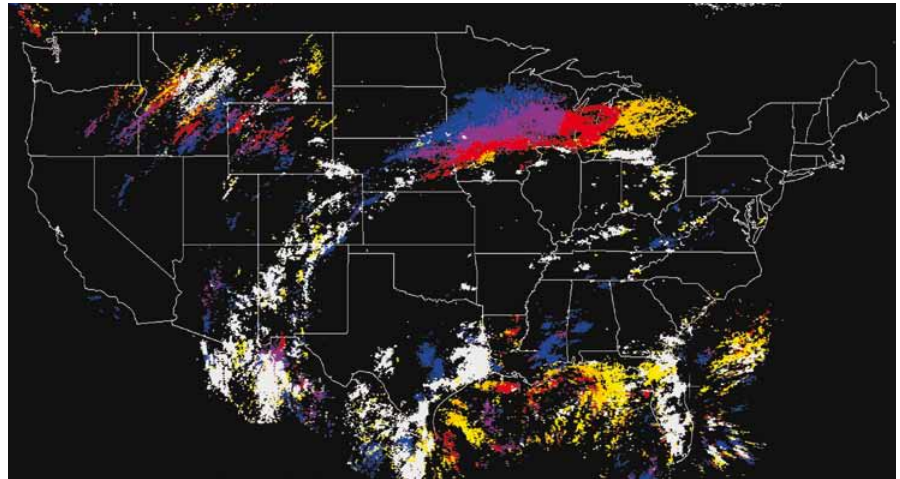
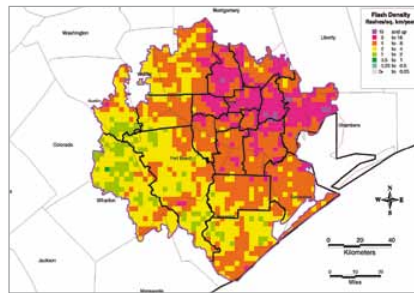


Image shows 24 hours of lightning data from Vaisala's U.S. National Lightning Detection Network



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



Vaisala STRIKEnet® online analysis uses NLDN historic data to pinpoint lightning activity relative to suspected lightning damage.

2000

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

2003

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

2005

- 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™ (TLP™) algorithm operating in NLDN® yields 200 meter or better location accuracy with patented terrain and propagation corrections.

2011

- Network fully upgraded to latest technology with LS7001 and TLS200 sensors for improved location accuracy and detection efficiency.



## 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 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 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 [www.vaisala.com/thunderstorm](http://www.vaisala.com/thunderstorm)

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