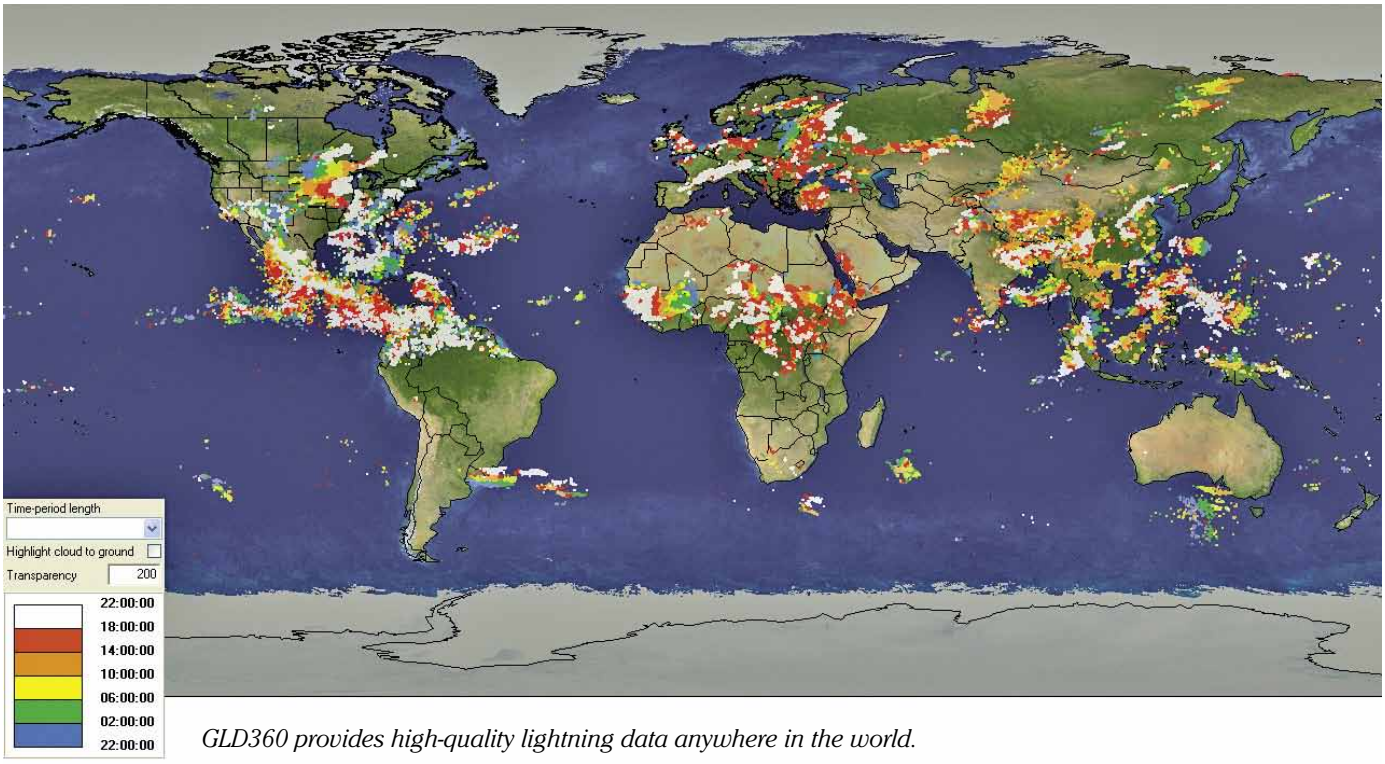
Unique Vaisala Global Lightning Dataset GLD360™

/ THE ONLY LIGHTNING DETECTION NETWORK CAPABLE OF DELIVERING SUCH HIGH-QUALITY DATA ANYWHERE IN THE WORLD

VAISALA



GLD360 provides high-quality lightning data anywhere in the world.

The Global Lightning Dataset GLD360 is the result of Vaisala's revolutionary world-wide sensor network. Proven, unique scientific advances in lightning waveform recognition at extreme distances, as well as in sensor sensitivity, allow the GLD360 network to produce unmatched, near-uniform high performance lightning detection on a global-scale. No other lightning detection network is capable of delivering such high-quality data anywhere in the world.

GLD360 provides ≥70% cloud-to-ground flash detection efficiency with a median cloud-to-ground stroke location accuracy of 2-5 km. To ensure the GLD360 network meets these stringent, high performance specifications, continuous validation studies are performed in North America, South America, and Europe. Vaisala operationally monitors the performance of the network to maintain a high quality dataset. Vaisala also continues to pursue and implement enhancements to ensure the network maintains its place as the performance leader in global lightning detection.

Accurate and Efficient Lightning Detection is Vital

Accurate lightning detection and warning systems are needed in various environments to save lives, to improve outdoor-related operations (e.g. special events, infrastructure maintenance), and to help mitigate property damages or equipment failures. GLD360 provides an effective way of producing cloud-to-ground lightning warnings that help customers meet the appropriate balance of safety and operational efficiency. GLD360 can provide data to lightning-sensitive facilities around the world, such as airports, energy sector infrastructure, mining facilities, maritime assets, military bases, and sports arenas. GLD360 also enables lightning data feeds anywhere in the world to meteorological institutions, insurance companies, and other organizations that incorporate thunderstorm data into their daily operations.

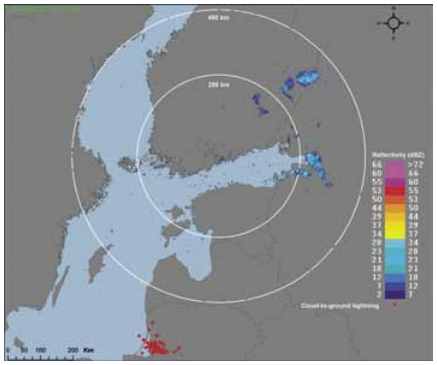
Primary Needs for Lightning Detection at Meteorological Services

- Thunderstorm identification and tracking
- Severe weather forecasting
- Radar proxy in areas of poor weather radar coverage
- Hurricane & typhoon warnings
- Flood warning systems
- Meteorological & hydrological modelling
- Weather forecast verification
- Climate research

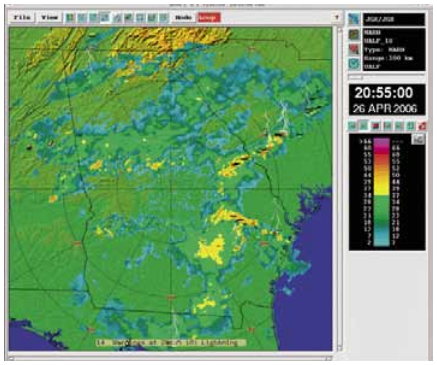
GLD360 provides meteorologists with a valuable dataset to improve weather forecasting and nowcasting in their respective regions anywhere in the world. Continuous thunderstorm identification and tracking not only improves thunderstorm nowcasts, but also nowcasts of precipitation, severe weather, turbulence, high seas and tropical cyclone intensity.

GLD360 data becomes especially useful in regions where weather radar coverage is limited. GLD360 data gives much earlier warnings of thunderstorms approaching areas of interest as it's possible to merge the lightning data with weather radar information. The upper picture on the right shows an example of weather radar image in Finland merged with GLD360 data. In this case the GLD360 data gave a 2-hour lead time before the storm was detected by the weather radar.

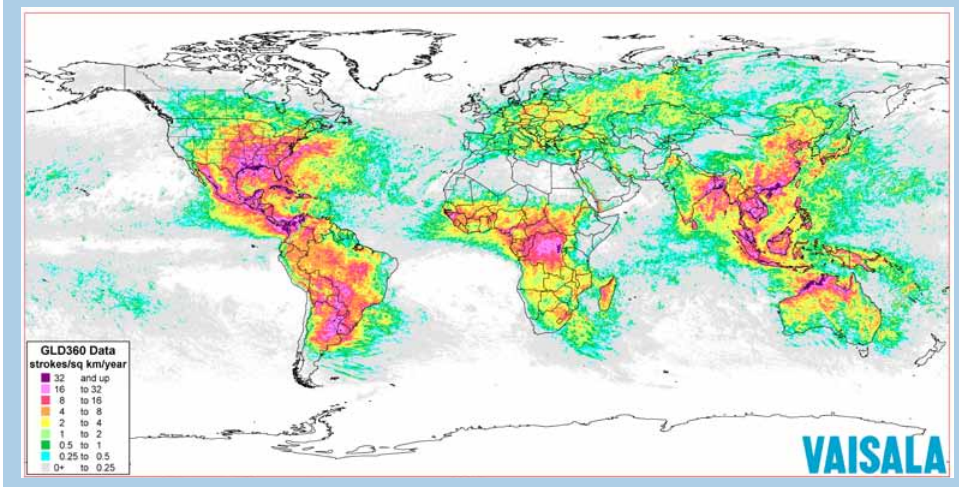
GLD360 data also provides interesting possibilities for climate research in the future as it offers homogenous lightning data around the entire globe.



An example of the weather radar image in Finland merged with GLD360 data



Integrated real time lightning data from a weather radar and Vaisala's lightning network in U.S.



Stroke Density Map - 20 km grid **2012** **GLD360 data**

One year global lightning event density map using GLD360 cloud-to-ground stroke and cloud flash data from 1 July 2011 through 30 June 2012. The color legend is located in the lower left corner of the image showing lightning event density values in units of events per square kilometer per year. Pink represents the highest lightning event density values and gray represents the lowest lightning event density values.

Primary Needs for Lightning Detection at Airports

- Present weather thunderstorm reporting
- Low level wind shear watches
- Cloud to ground lightning warnings for outdoor personnel
- Avoiding thunderstorm hazards and lightning strikes to airplanes in the terminal approach area

Vaisala's Airport Lightning Information System (ALIS) service helps customers make well-informed decisions that optimize safety and efficiency at airports anywhere in the world.

ALIS is a hosted service powered by Vaisala's unique GLD360™ dataset. For airport professionals, Vaisala ALIS provides an instant web access to an advanced lightning display with clear alarm areas and messages, usable with only minimal training.

Fully compliant with the International Civil Aviation Organization (ICAO) requirements, Vaisala ALIS issues present weather thunderstorm alerts for Meteorological Observers when lightning is within 5 nmi (9 km) or 10 nmi (19 km). To protect outdoor ground operations personnel, ALIS issues cloud-to-ground lightning warnings based on customer-selected warning criteria. In addition, ALIS issues low-level wind shear watches for Air Traffic Controllers to improve situational awareness when lightning occurs within 30 km of an airport. Air traffic controllers can also use the ALIS web-based display to help pilots avoid flying through hazardous thunderstorms in the terminal approach area and avoid severe turbulence, wind shear, hail, and natural/airplane triggered lightning strikes to airplanes.

Primary Needs for Lightning Detection in Defense Environments

- Lightning warnings and advisories to ensure safety

- Lightning detection data for validation and verification of weather forecasts

The primary use of lightning data amongst defense customers is for resource protection and safety. This encompasses both safety of personnel as well as equipment and ground or flight operations. GLD360 offers the unique capability to provide lightning hazard situational awareness practically anywhere on the globe where defense forces may be operating. Lightning warnings and advisories are critical to ensuring the safety of troops and equipment. Inherently dangerous activities, such as aircraft refueling, munitions handling, etc., further elevate the importance of timely and accurate lightning data. The need for a global source of lightning warnings is especially true when those operations are taking place in austere areas where precision lightning data from local networks may not be available.

Another application where lightning data is valuable is for validation and verification of operational weather forecasts. This is especially important when the forecasters are not co-located with the personnel and operations that they're supporting. In these instances, GLD360 data can be the eyes to alert forecasters to impending impact weather and can also help with developing improved forecast techniques to handle diverse weather phenomenon in new operating locations.

Primary Needs for Lightning Detection in the Energy Sector

- Electricity transmission asset monitoring
- Wind turbine monitoring and field service safety
- Engineering and protection investment planning

The energy industry uses real-time, accurate lightning data to pre-position field maintenance crews, monitor transmission and generation assets, and protect human lives. GLD360 provides uniform global lightning coverage to ensure that even the most remote of locations can be effectively monitored. Electricity transmission system operators are in position to respond to lightning-caused outages, which helps to keep the lights on for their customers. Additionally, archived GLD360 data is used to support engineering planning analysis to target necessary protection investments and improve long-term grid stability.

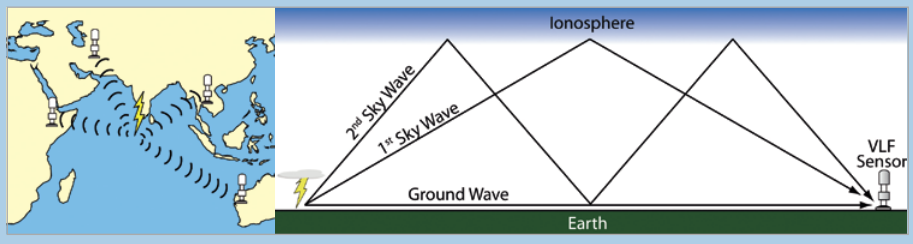
Wind farm operators are using GLD360 data to identify wind turbines that need to be inspected for possible lightning damage, whether they are operating at far distances offshore or countries away from their control center. Field service teams can be notified in advance to return to ground when working at nacelle heights on wind turbines. GLD360 lightning data is also a valuable proxy for high winds and waves that could disrupt vessel and helicopter access to and from wind farms (on the ground or offshore). It is no surprise that energy customers are finding value in GLD360 to improve operational efficiency and safety.

Primary Needs for Lightning Detection in Maritime

- Early lightning warnings to ensure smooth operations and safety of personnel on offshore oil and gas platforms

- Early lightning warnings to ensure uninterrupted and safe helideck operations to offshore oil & gas platforms
- Lightning detection in assuring smooth ports operations and maritime traffic

Oceanic lightning detection is needed to issue early warnings to offshore oil and gas platforms of an approaching thunderstorm. Early thunderstorm warnings enable preventive actions to minimize operational downtime and increase safety on oil platforms and in helideck operations. GLD360 provides uniform global lightning coverage to ensure that even the most remote locations can be effectively monitored. GLD360 lightning data complements other weather observations in weather critical maritime environments like high winds and waves that could disrupt vessel and helicopter access to offshore oil and gas platforms.



A network of sensors operating in the Very Low Frequency (VLF) band and measuring horizontal magnetic field of radio impulses generated by return strokes and large cloud pulses produce GLD360 data.

GLD360 Data Generated with a Few Sensors But High Detection Efficiency

The data is generated by a network of sensors operating in the Very Low Frequency (VLF) band. Each sensor measures the horizontal magnetic field of radio impulses generated by individual lightning return strokes and large cloud pulses. The recorded radio impulses are compared to a locally stored waveform bank, which contains a collection of lightning waveforms indexed by distance and propagation profile. This comparison helps the sensor to identify the most reliably repetitive feature of the waveform, which improves the arrival time accuracy and therefore the location accuracy of the network.

This comparison is also used to identify the polarity of each event.

Arrival time and arrival angle measurements from each sensor are sent back to a central processor, which then aggregates data from all reporting sensors to make a determination of the event's time and location using an optimization routine that minimizes the squared error of all time and angle measurements. The inclusion of arrival angle, which is determined using magnetic direction finding, improves the detection efficiency by reducing the number of sensors that need to report each event. The peak VLF field value is also reported by each sensor and used together with an empirical propagation model to estimate peak current magnitude for ground strokes.

Lightning Information and Reports Easily via Client-based Application

Customers requiring near real time access to global lightning, and those needing to archive lightning events for further review will benefit from a client based application as part of their lightning display system. LTS2005 provides the ability to distinguish between cloud, cloud to ground, positive and negative polarity strikes, as well as the capacity for an unlimited number of alarms restricted by customer defined areas. LTS2005 can generate videos of approaching storms, and can create reports of lightning for any 24 hour period.

Benefits

- The data is available anywhere in the world, even scarcely populated areas
- In some regions of the world, this dataset may provide the only cost-effective way to produce high quality convective precipitation and severe weather nowcasts.
- No capital investment is needed to enable accurate lightning detection anywhere in the world
- Easy access to the data with minimal lead time
- The data quality is proven by stringent and continuous validation by Vaisala scientists and engineers

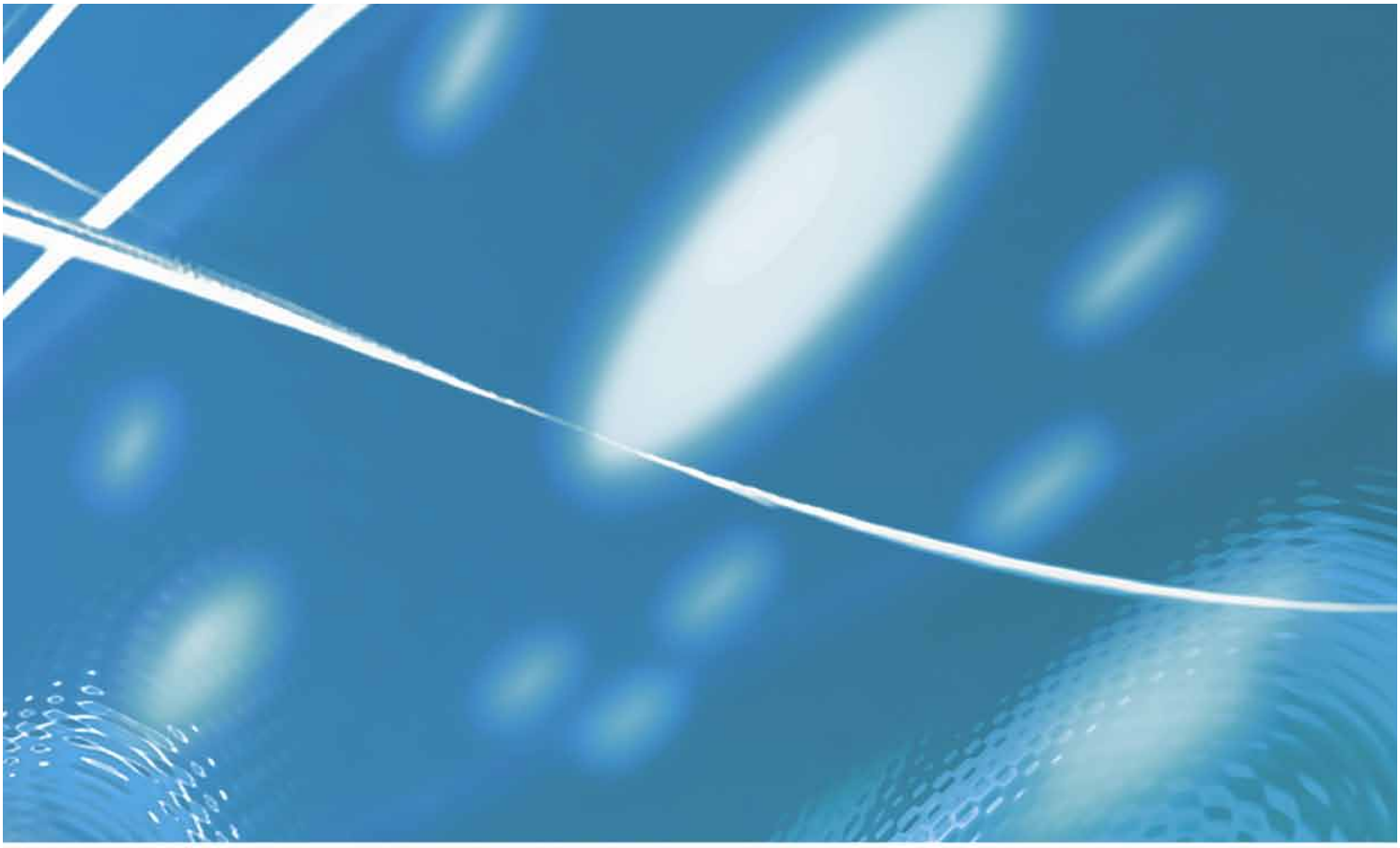
Features

- ≥97% detection of all thunderstorms producing at least three lightning flashes
- ≥70% cloud-to-ground flash detection efficiency
- ≥5% cloud flash detection efficiency
- 2-5 km median cloud-to-ground stroke location accuracy
- Triplicated archive of all global events detected since 1 May 2011
- Duplicated central processing servers
- 24/7 monitoring for quality assurance by Vaisala experts

Experience Counts

In lightning detection, Vaisala leads the industry with over 40 years of experience. As of 2013, we have delivered 90 precision lightning detection networks in over 45 countries around the world. And Vaisala remains decades ahead of the competition.

The United States National Lightning Detection Network (NLDN) has been built, owned and operated by Vaisala since 1989. The NLDN is the most validated and referenced lightning detection network in the world with over 1,000 scientific references.



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Scan the code to see the lightning activity around the globe