

LIGHTNING DIFFERENTIATED

Precise lightning data can make a big difference for key operators in the aviation, energy and insurance sectors



Thunderstorms and lightning strikes not only put lives at risk but impact weather-dependent industries by causing damage and disrupting operations. Highly precise lightning data provides an accurate overview of the prevailing thunderstorm situation, offering precise information about the estimated time of arrival (ETA) and departure (ETD) of thunderstorm cells, which in turn provides a helpful indication about other severe weather conditions such as hail, heavy rain and strong winds. This data helps to avoid damage, improve operational efficiency and mitigate risk, saving a lot of money.

LINET AND NOWCAST

Lightning research and safety specialist nowcast operates a lightning-detection system that facilitates the precise detection of lightning strikes. The system stems from intense and extensive research carried out at test sites in Munich, Germany.

The lightning-detection system has been successfully installed across the globe under the Lightning Detection Network (LINET) brand name. LINET is demonstrably one of the most precise lightning detection systems in the world and boasts cutting-edge technological features such as 3D lightning localization, which can measure the height of cloud lightning.

NOWCASTING AND CELL STORM TRACKING

From the moment a thunderstorm evolves, cell tracking and nowcasting provide an accurate picture of its development. Cell tracking groups single lightning strikes into thunderstorm cells, which are then tracked

by nowcasting to determine the expected speed and direction of the storm.

The fastest nowcasting algorithm available is rTNT – real-time tracking and nowcasting – which computes all lightning strikes in real time. Within minutes of the first strike, rTNT calculates the thunderstorm movement and provides a 60-minute preview. The resulting geographic polygons are displayed in nowcast's web application, LINET view, or integrated via SFTP or streaming as an XML feed into most GIS applications.

In the pursuit of establishing the most efficient, reliable and actionable lightning safety system on the market, nowcast has conducted cutting-edge research into combining the LINET system with locally installed electrostatic field mills. The results have been very positive and will define future lightning safety projects.

FIELD MILLS

Electrostatic field mills are used to detect local thunderstorm cells above or close to an area of interest such as an airport, mine or sports venue. Through the measurement of electric field strength and variation, the potential for lightning risk can be estimated.

When a field mill detects voltage less than 100V/m for a 'fair field' weather situation, we can safely assume that there is no chance of a lightning flash in the vicinity. As the voltage increases, so does the chance of a lightning flash. However, it is not a simple case of setting a defined voltage limit or threshold and accordingly activate an action sequence, as is currently the standard procedure with field mills. Multiple variables from numerous data sources plus a robust algorithm are

required to forecast a developing thunderstorm properly.

With a standalone field mill system, it is only possible to predict the probability of a lightning flash occurring in the next few minutes, not the actual position of the strike. This is vital information for keeping the area of interest safe but does not offer much efficiency gain. The greatest efficiency gains are realized when a field mill system is used as a basis for an 'all clear – area safe' process. To maximize these gains the field mill system needs to be complemented with a precision lightning detection network. The combined data from both systems needs to be processed in real time with a complex algorithm, with actionable data made available via an online solution.

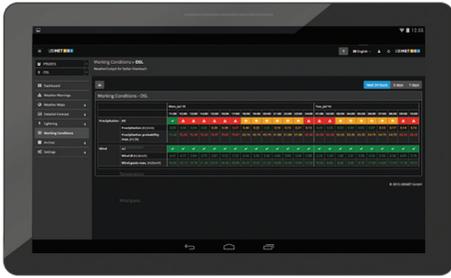
DOES PRECISE LIGHTNING DATA MAKE A DIFFERENCE?

Airports strive to keep downtime during thunderstorm and lightning activity to an absolute minimum. By warning about an impending storm and precisely determining when a thunderstorm has passed, nowcast helps airports keep downtime as short as possible and as long as absolutely necessary.

The solution's unique lightning safety concept combines data from three systems to provide airports with a superior decision-making platform, providing full situational awareness. This includes identifying the exact time a thunderstorm will arrive at an airport; registering all lightning activity in the vicinity of an airport and providing a clear indication when the first lightning strike will hit; measuring all electromagnetic activity directly above the airport and identifying the precise moment

Lightning detection

Lightning data is recorded and visualized in the Weather Cockpit using the traffic light system



for the 'all clear'; using a big-data algorithm to indicate the perfect moment to stop and resume operations; and providing easy, intuitive and scientifically empirical visualization using the traffic light system.

Determining when it is safe to resume presents the greatest opportunity to maximize efficiency. There are various processes currently used to determine when it is safe to resume activities. The best practice thus far has been the countdown method, which involves using a highly accurate lightning detection network to record every lightning flash within a designated boundary. A countdown timer is activated and reset each time a flash is detected. Once the countdown timer reaches zero, the area is deemed safe and outdoor activities can resume.

There are no set safety thunderstorm standards; boundary sizes and countdown periods vary from industry to industry and from institution to institution. An example of a guideline safety standard can be noted in the aviation industry. The industry often uses an inner core boundary of 5 nautical miles (9.3km), an intermediate boundary of 8 nautical miles (14.8km) and an outer boundary of 13.5 nautical miles (25km). This method is effective in improving safety, but depending on the timers, can come at the cost of operational efficiency. Data is visualized in the system's 'Weather Cockpit' using the traffic light system, providing sound weather-based decision support for safer and more efficient airport operation.

SAVE 96 MINUTES

This combined approach was the basis of the nowcast research into a number of thunderstorm events at an international airport during 2017. The airport employed the LINET countdown system to optimize its thunderstorm stoppage procedures. The system was considered highly successful and helped to keep disruptions to a minimum. However, the question was raised whether stoppages could be reduced even further by combining a field mill with LINET. Upon reviewing the data, it was discovered

Key user benefits

Benefits of nowcast lightning data:

- Automated, reliable and transparent decision-making procedure
- Based on highly precise, real-time lightning data
- Visualized using the traffic light system

For airports:

- 50-70% reduction of ground-handling downtime
- Save money and maximize capacity
- Increased airport safety
- Redundant safety concept with combination of lightning and field mill data

For insurance businesses:

- Highly precise lightning alerts
- Reliable digital claims verification based on accurate lightning data
- Appropriate premium calculation with historical weather data

For the energy sector:

- Prevent power outages
- Optimize maintenance operations
- Ensure grid stability

that during those select events, a conservative total of 96 minutes could have been saved.

INSURANCE APPLICATIONS

According to insurance firm Munich RE, natural catastrophes caused claims amounting to US\$160bn in 2018. Precise lightning data is vital in helping insurance customers better protect themselves and their property. On average, more than 50% of severe weather warnings may be attributed to thunderstorms. In this regard, lightning detection and the quality of lightning data also plays a major part in issuing timely alerts.

The quality of lightning data also matters for swift digital claim verification. With the Claims Information System (CIS), Ubimet offers insurance companies location-specific weather information regarding lightning, storms, hail and rain for the recent past.

The online portal enables queries based on addresses and time periods. The results are displayed as an unequivocal yes/no answer to determine whether, for example, a claim is justified because lightning has really struck and caused damage. In addition, historical hail analysis also helps better define appropriate premiums for certain regions based on historical weather data including highly precise lightning data.

PREVENTING POWER OUTAGES

Lightning is a common cause of power outages due to it hitting electrical equipment or striking a tree that may fall onto a power line. By monitoring thunderstorm and lightning activity, grid stability may be safeguarded and power outages prevented as appropriate measures are implemented.

By visualizing approaching thunderstorms, as well as lightning activity using the traffic light system, grid operators can better prepare for severe weather events and plan maintenance activity to optimize grid operations.

OUTCOME

The nowcast method provides a highly accurate, technology-based decision-support system for multiple industries, including aviation, energy and insurance businesses. The combination of the LINET lightning detection system with electrostatic field mills provides a basis for decision making and the highest safety level for thunderstorm management. Ultimately the system offers maximum efficiency when managing a thunderstorm situation as all parameters are taken into consideration. ■