Vaisala’s new Airport Lightning Information System (ALIS): Using Vaisala’s GLD360™ to improve cloud-to-ground lightning warnings, present weather reporting, and low level windshear situational awareness at airports anywhere in the world

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Table of contents

- Brief GLD360 and ALIS introduction
- Low level windshear
- Present weather reporting
- Cloud-to-ground lightning warnings
Lightning power spectrum and Vaisala detection technology

Cloud-to-ground (CG) and Cloud (CL) lightning is detected in the very low frequency (VLF) band.

GLD360 CG and CL detection
GLD360 lightning geo-location
Validation results:
CG flash DE = ≥60%
CG stroke LA = 2.5 km

Validation results:
CG flash DE = ≥70%
CG stroke LA = 1.0 km

Validation results:
CG flash DE = 98%
CG stroke LA = 1.0 km

GLD360 global performance map

GLD360 & NALDN Combined Detection Efficiency Map, 2012
GLD360 annual global lightning density map
July 2011 through June 2012
Identifying and tracking a large thunderstorm complex producing significant straight-line wind damage
29-30 June 2012

Vaisala NLDN

Vaisala GLD360
Vaisala ALIS
Login screen
Vaisala ALIS web-based display example
Lightning color-coded by time (wide area view)
## Table of contents

- Brief GLD360 and ALIS introduction
- **Low level windshear**
- Present weather reporting
- Cloud-to-ground lightning warnings
Gust front shelf cloud and debris from strong winds field
Gust front outflow from a line of thunderstorms
National Academy of Sciences study performed for the FAA in 1983

FIGURE 6  Squall Line Thunderstorm Outflow (schematic). (Source: Goff, 1980).
Low level windshear watch

- ALIS issues a low level windshear watch whenever lightning is detected within 30 km of the airport

"Lightning has been detected within 30 km of the airport. A low level windshear watch has been issued for the airport due to the possibility of thunderstorm-induced straight-line winds (gust fronts and outflows) moving through the airport."
Table of contents

- Brief GLD360 and ALIS introduction
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- Present weather reporting
- Cloud-to-ground lightning warnings
Thunderstorm reporting

- ICAO Annex 3 titled states that “the following present weather phenomena shall be identified, as a minimum: precipitation and freezing precipitation, ..., thunderstorms (including thunderstorms in the vicinity).”
  - Thunderstorms (at the airport) are defined as being within 5 nm (9 km) of an airport
  - Thunderstorms in the vicinity of the airport are defined as being between 5 and 10 nm (9 and 19 km) of an airport
Example of thunderstorm at the airport
# Table of contents

- Brief GLD360 and ALIS introduction
- Low level windshear
- Present weather reporting
- **Cloud-to-ground lightning warnings**
Cloud-to-ground lightning warning methodology

Lightning detection network tracks lightning as it approaches the airport
Airport lightning warning study comparing Vaisala NLDN precision network with GLD360

NLDN stroke+cloud data; May 5, 2011 - Aug 31, 2011

GLD360 reprocessed data; May 5, 2011 - Aug 31, 2011

Stroke Density strokes/cm² km, 10 km grid
16 and up
8 to 16
4 to 8
2 to 4
1 to 2
0.5 to 1
0.25 to 0.5
0.1 to 0.25
0.05 to 0.1
0.01 to 0.05
0.005 to 0.01
0.001 to 0.005
0

NLDN

GLD360
Probability of detection (POD2)
12 airports’ lightning compared with thunderstorms

Lightning at 12 U.S. airports
- NLDN
- GLD360

Severe thunderstorm warnings¹
- Non-organized
- Pulse
- Linear
- Supercell

Tornado warnings²
- No SPC watch
- SPC severe thunderstorm watch
- SPC tornado watch

¹National Weather Service (NWS) forecaster-enhanced warnings for three 2007 tornado outbreaks, Guillot et al.
²National Weather Service (NWS) forecaster-enhanced warnings for 2003-2007 severe thunderstorms, Keene et al.
Summary of ALIS features

- GLD360 data subscription with an area defined by a 500 km radius from the airport

- Web-based lightning display with lightning events color-coded by time to assist with thunderstorm tracking

- Alarm radii at 5 nm (9 km) and 10 nm (19 km) to assist weather observers with "TS" and "VCTS" present weather reporting

- Alarm radii at 30 km used to issue low windshear watches for Air Traffic Controllers

- Customer-configurable alarm radius distance to issue cloud-to-ground lightning warnings to protect outdoor airport workers