PARAFOG: Pre-FOG alert tool based on ceilometer measurements

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MOTIVATION FOR THIS STUDY

Air traffic at busy airports can be significantly disrupted because low visibility due to fog makes it unsafe to take off, land and taxi on the ground. In this poster we show how automatic profiling Lidar ceilometer measurements (CL31/CL51) on most airports, can be used to provide pre-fog alert information, and hence help airport weather forecasters to better predict those low visibility conditions. This research was carried out prior to a field campaign at Paris CDG airport (France).

Ref: Haeffelin, M., Laffineur, Q., Bravo-Aranda, J.-A., Drouin, M.-A., Casquero-Vera, J.-A., Dupont, J.-C., and De Backer, H.: Radiation fog formation alerts using attenuated backscatter power from automatic Lidars and ceilometers, Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-182, in review, 2016.

PHYSICAL PRINCIPLE

β_{att} (attenuated backscatter) profiles can be used to track progressive hygroscopic growth of fog condensation nuclei
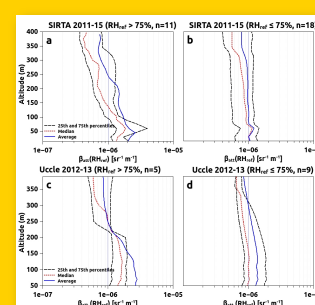
β_{att} vs VIS

β_{att} vs RH
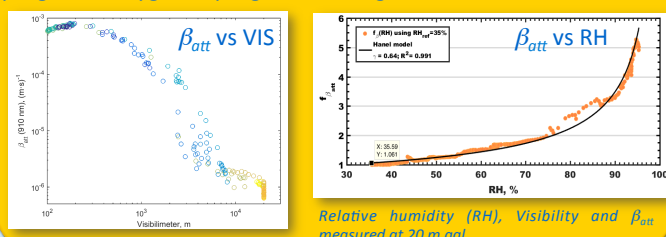
Relative humidity (RH), Visibility and β_{att} measured at 20 m agl

METHODOLOGY

Reference β_{att} profiles are found in dry (RH) conditions

- RH<75% β_{att} profiles show well mixed conditions and little attenuation
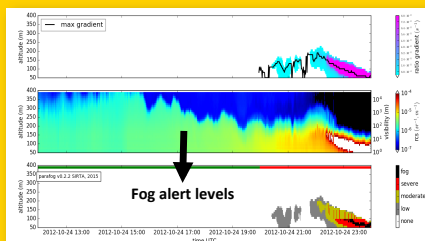- RH>75% β_{att} profiles show attenuation due to scattering by moist aerosols

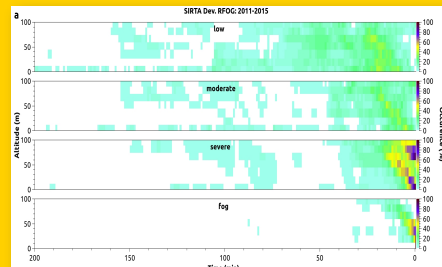## FOG ALERT LEVELS

Temporal gradient of β_{att}/β_{Ref} ratio

Altitude of maximum gradient

Alert levels defined based on ratio gradient and β_{att} thresholds

Fog alert levels

FOG ALERT OCCURRENCE

Frequency of occurrence of each alert level (low-, moderate-, severe-, and fog-level alerts) for each altitude agl and each time before fog occurrence time.
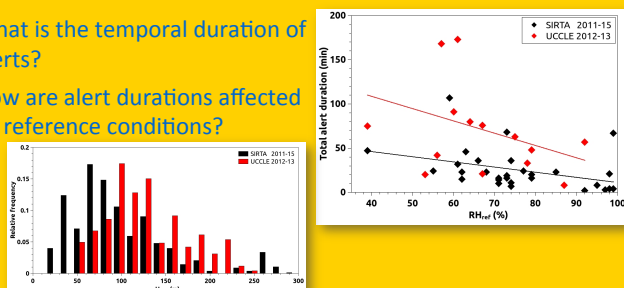
For each height / time interval, the sum of occurrences of all alert levels = 100% (incl. no alert).

FOG ALERT STATISTICS

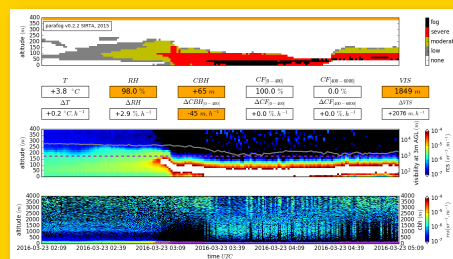What is the temporal duration of alerts?

How are alert durations affected by reference conditions?

At what altitude do alerts occur?

REALTIME FOG ALERTS AT CDG AIRPORT

CL31, RH and VIS measurements at CDG airport are analyzed in realtime (5 min) by PARAFOG

CONCLUSIONS

Pre-fog alert occurrences and durations depend on the cooling processes leading to supersaturated conditions, and on the reference conditions that can be found.