A Demonstration of Vaisala's High Range Ceilometer

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Introduction

A demonstration of Vaisala's CL51 Ceilometer was conducted in November 2013 at the ARM Climate Research Facility Southern Great Plains (SGP) site to compare measurements of cloud height , boundary-layer height, and backscatter profile against the current ceilometer and micropulse lidar.

Motivation

- ARM utilizes Vaisala CL31 Ceilometers at all its sites to obtain measurements of cloud-base height, vertical visibility, and backscatter profile up to a maximum vertical range of 7.5 km
- Model CL51 designed to detect cirrus clouds to 13 km
- Support of Cirrus Clouds and Aerosol Properties (CCAP) field campaign at SGP
- Vaisala offered to conduct demonstration of CL51 during CCAP field campaign

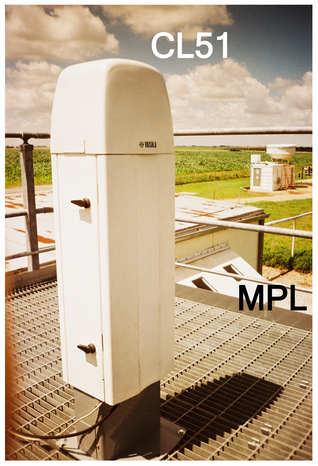
Objectives

- Evaluate CL51's high-range capabilities
- Compare measurements of CL51 with current CL31 Ceilometer and Micropulse Lidar (MPL)
- Examine microphysical properties of cirrus clouds and aerosols

Instrument Specifications

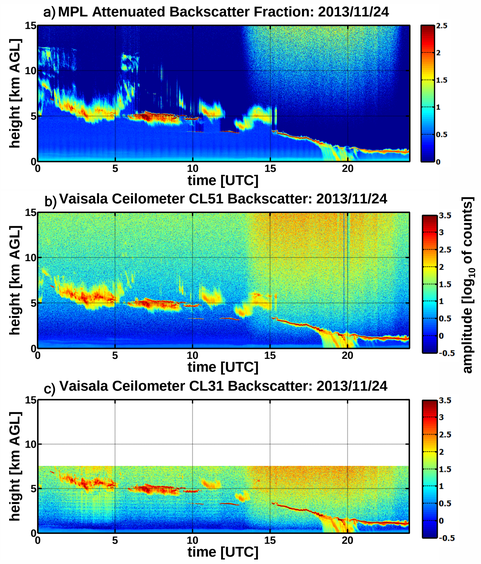
	Vaisala CL31	Vaisala CL51
Range	7.5 km	15 km
Resolution	5 m	10 m
Accuracy (solid target)	± 5 m	± 5 m
Measurement cycle	2 - 120 s	6 - 120 s
Laser	InGaAs pulsed diode	InGaAs pulsed diode
Wavelength	910 nm	910 nm
Size	34 x 33 x 119 cm	36 x 35 x 153 cm
Weight	31 kg	46 kg

CL51 Demonstration



- Ceilometer supplied by Vaisala
- Conducted at SGP Guest Instrument Facility during CCAP campaign
- Data collected 18 - 26 November 2013
- Cloud reporting range up to 13 km
- Backscatter profiling range up to 15 km
- Detects cirrus clouds without surpassing low and middle layer clouds

Backscatter Density Comparison



Aerosol backscatter profile measured by a) MPL, b) CL51 ceilometer, and c) CL31 ceilometer at SGP on 24 November 2013.

Summary

- CL51 provides six times greater signal-to-noise ratio than CL31
- Better detection of aerosol layers and boundary layer heights
- Improved data quality at both near and high range, including detection of cirrus clouds
- Good agreement with MPL to about 10 km
- Reduced ability to detect higher, thin cirrus may be due to intervening lower clouds

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Reference

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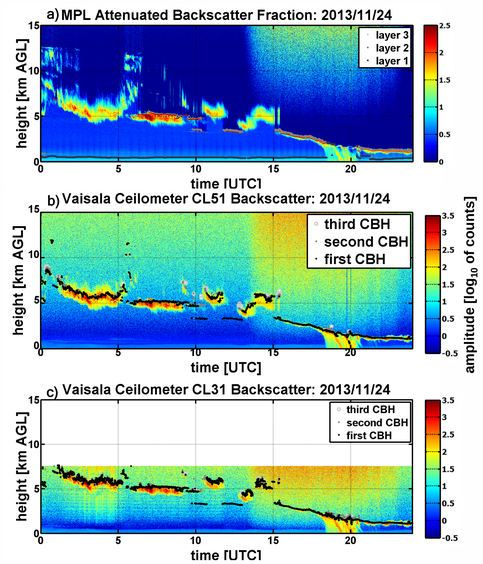
Cloud Height Comparison



Aerosol backscatter profile measured by a) MPL with boundary layer heights derived from CL51, b) CL51 ceilometer with cloud heights, and c) CL31 ceilometer with cloud heights at SGP on 24 November 2013.

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