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CFACT
NCAR/EOL ISS Ceilometer Products Data Report

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Web References

CFACT Homepage: https://www.eol.ucar.edu/field_projects/cfact
CFACT Field Catalog: https://catalog.eol.ucar.edu/cfact
ISS Operations during CFACT: https://www.eol.ucar.edu/content/iss-operations-cfact
ISS Homepage: https://www.eol.ucar.edu/observing_facilities/iss

Citations

If these data are used for research resulting in publications or presentations, please acknowledge EOL and NSF by including the following citations, as appropriate:

The ISS Platform

UCAR/NCAR - Earth Observing Laboratory. (1997). NCAR Integrated Sounding System (ISS). UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.5065/D6348HF9

Ceilometer C51 Data Set

NCAR/EOL ISS Team. 2022. CFACT: NCAR/EOL ISS Ceilometer CL51 Data Products. Version 1.0. UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.26023/X1ZN-4F8P-TM0B.

Ceilometer C61 Data Set

NCAR/EOL ISS Team. 2022. CFACT: NCAR/EOL ISS Ceilometer CL61 Products. Version 1.0. UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.26023/AC7Y-XXTF-80G.

Acknowledgement

Users of EOL data are expected to add the following acknowledgement to all of their publications, reports and conference papers that use those data:

"We would like to acknowledge operational, technical and scientific support provided by NCAR's Earth Observing Laboratory, sponsored by the National Science Foundation."

Overview

NCAR/EOL operated the Integrated Sounding Systems (ISS) in the Heber Valley in Utah for the Cold Fog Amongst Complex Terrain (CFACT) winter time fog study. ISS operated two ceilometers: Vaisala CL51 at the North Pivot field site and CL61 at Deer Creek.

Time period:	06 Jan - 24 Feb 2022
Location:	Heber Valley, Utah, USA

Site Description

CL51 instrument was operated at the North Pivot site along with other ISS equipment such as a radar wind profiler, surface meteorological sensors and web cameras.

Latitude:	40.48813°N
Longitude:	111.43302°W
Elevation:	1700m

CL61 instrument was operated near the Deer Creek Sounding site at the ISS radiosonde station:

Latitude:	40.48913°N
Longitude:	111.46990°W
Elevation:	1659.24 m

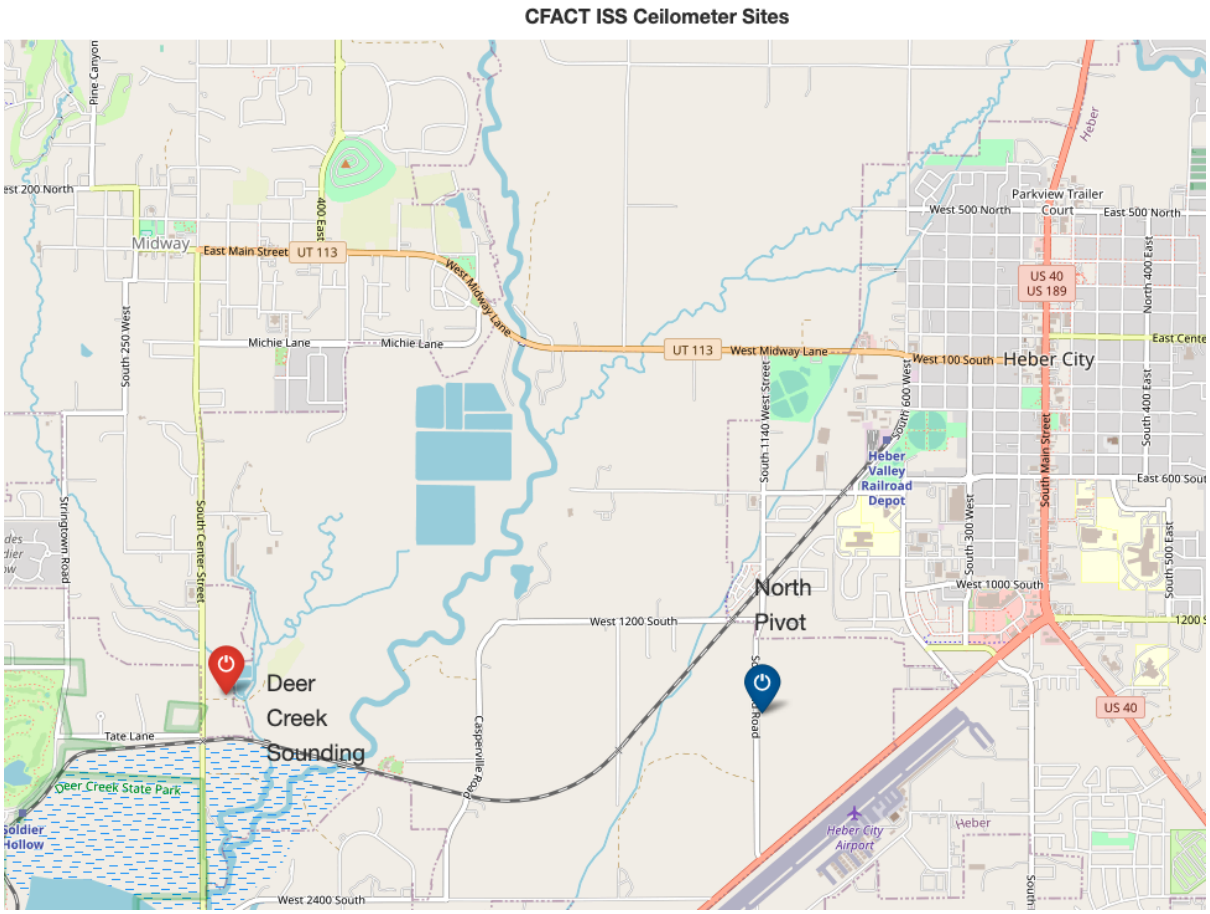

Figure 1. ISS ceilometer locations at the ISS1 North Pivot site (CL51) and the Deer Creek sounding site (CL61).

The ISS ceilometers at CFACT. The CL51 ceilometer was mounted on the front of the ISS1 trailer at the North Pivot site (left photo). The CL61 ceilometer was on the ground adjacent to the sounding trailer and met tower at the Deer Creek sounding site (right photo)..

Instrument Description

Vaisala Ceilometer CL51

Vaisala Ceilometer CL51 is a commercial instrument designed to measure high-range cirrus cloud heights without surpassing the low and middle layer clouds, or vertical visibility in harsh conditions.

Instrument Fact Sheet:
https://www.vaisala.com/sites/default/files/documents/CL51-Datasheet-B210861EN.pdf

Vaisala Ceilometer CL61

Vaisala Ceilometer CL61 is a commercial instrument designed to measure high-range cirrus cloud heights without surpassing the low and middle layer clouds, or vertical visibility in harsh conditions. In addition to basic ceilometer reporting, the CL61 offers depolarization measurement that enables differentiation between solid, liquid, or mixed-phase clouds and precipitation. The CL61 is approximately 5 times more sensitive than the CL51.

Instrument Fact Sheet:
https://www.vaisala.com/sites/default/files/documents/WEA-MET-WhitePaper-CL61-Applications-B212377EN-B.pdf

Data Set Description

Vaisala Ceilometer CL51

Data set Name: NCAR/EOL ISS Ceilometer CL51 Products
Data format:
(1) netCDF3 in the format -
L3_DEFAULT_06610_YYYYMMDD0000_1_360_1_3120_10_30_4000_3_0_1_500_1000_4000_60.nc
(2) raw DAT files - arrives as a single tar file.

Data file frequency: Daily files for netCDFs; 6 hour files for DAT files.
Data version: v1.0
Data status: final
Data access: public
Resolution: Each daily file contains an array size of 5400, ~ 3.75 min time resolution.

Vaisala Ceilometer CL61

Data set Name: NCAR/EOL ISS Ceilometer CL61 Products
Data format: netCDF3; iss_cl61_YYYYMMDD_HHMMSS.nc
Data file frequency: every 5 minutes
Data version: v1.0
Data status: final
Data access: public
Resolution: 5 seconds

Data Collection and Processing

Data was stored directly to disk drives at the ISS base trailers and transmitted to servers at EOL for local storage and added back-up.

CL51 data processing was performed by Boundary Layer View 2.0 Software (BL-VIEW) proprietary to Vaisala. BL-View generates an online visual representation of the mixing layer height (MLH). BL-View also uses an all-weather algorithm that takes into account possible precipitation and cloud events. The ceilometer and communication status is permanently displayed on the main screen so that possible operational warnings and alarms can be investigated. Link to Vaisala BL-View Data Sheet. The global attribute for the netCDF and hdf version

```
// global attributes:
           :_NCProperties =
"version=1|netcdflibversion=4.4.1-rc2|hdf5libversion=1.8.17" ;
```

Raw CL-View ascii formatted data are also downloadable as a single tar file containing raw DAT files.

CL61 data processing software is developed by Vaisala or third parties. The CL61 reports measurements in NetCDF format using CF-1.8 conventions. Refer to the global metadata attributes below:

```
// global attributes:
           :_NCProperties =
"version=1|netcdflibversion=4.4.1.1|hdf5libversion=1.8.18" ;
           :title = "CL61-D, Profiling Ceilometer, rev A" ;
           :conventions = "CF-1.8" ;
           :history = "1.0.0-rc1" ;
           :featureType = "profile" ;
           :unit = "m" ;
           :temporal span of this file in minutes = 5. ;
           :time between consecutive profiles in seconds = 5 ;
```

Ceilometer CL51 Data Remarks

The CL51 ceilometer functioned as expected. No large gaps, spikes, anomalous data were observed or reported by the BL-View software. Comparisons with the CL61 which operated nearby showed similar overlapping back-scatter properties in height and time. The BL-View algorithm reports cloud heights (to the base of the clouds), backscatter, and “boundary layer” heights, identified from gradients in the backscatter profile. Caution should be exercised in interpreting this data as the actual planetary boundary layer, however comparisons with soundings do indicate that these layers do frequently coincide with potential temperature inversions and other significant levels in the atmosphere.

- Click here to access online daily plots
- Click here to access 4 hour averaged daily plots
- Click here to access the interactive Field Catalog for daily and 4 hour averaged plots

Ceilometer CL61 Data Remarks

The CL61 ceilometer data is not currently processed by BL-View, so cloud and boundary layer data are not available. The CL61 data does include a depolarization channel which enables some determination of the nature of the particles the scattering occurred from. An example of CL61 measurements from IOP 9 is shown in Figure 2. Cloud base can be seen to be rising from 1.5 km early in the period to about 2.5 km later. Some kind of precipitation is falling from the cloud and the depolarization measurements can be used to identify this precipitation. Backscatter from spherical particles such as water cloud droplets, mist, fog and drizzle is not generally polarized so the depolarization ratio from these particles is close to zero. Rain, dust, smoke, snow, ice pellets, and graupel are non-spherical and thus have increasingly polarized backscatter (see Figure 3). The depolarization ratios in Figure 2 indicate that initially drizzle (or perhaps freezing drizzle) was falling, which later turned to snow.

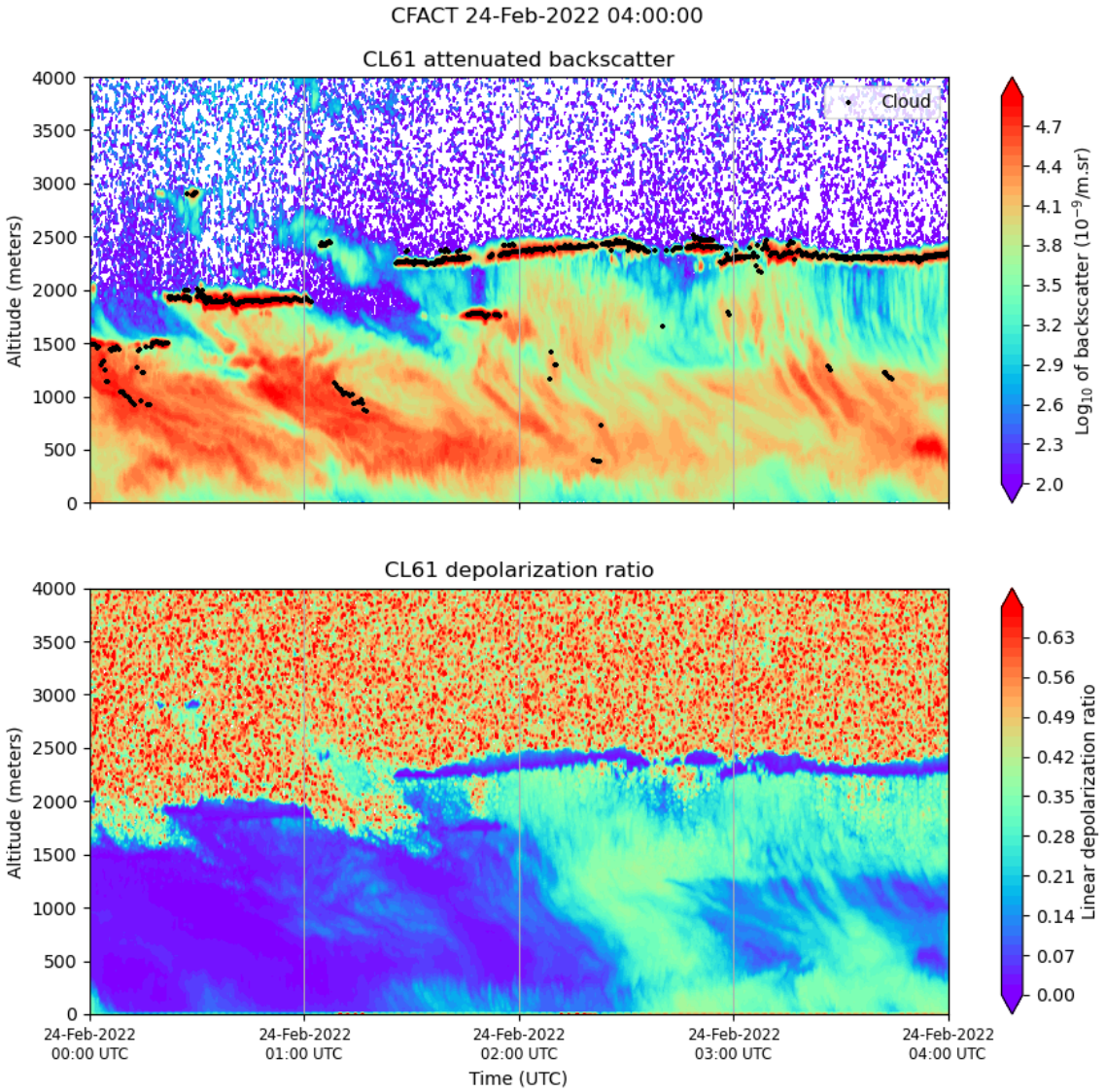

Figure 2: ISS CL61 measurements for a 4-hour period during IOP 9.

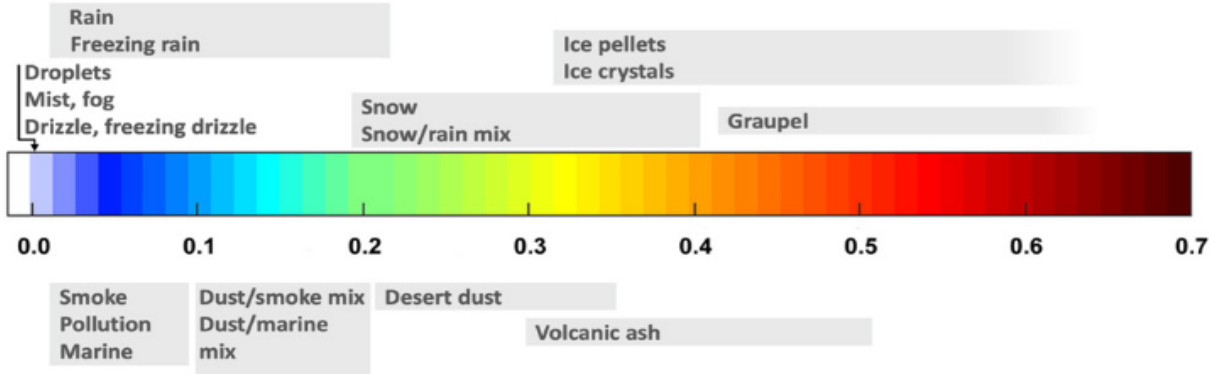

Figure 3: Typical depolarization ratios for a variety of atmospheric scattering conditions. Note that the color scale differs slightly to that in Figure 2. (Vaisala CL61 whitepaper).

During IOP01 (2022 Jan 11 - 12) there is a data gap from 11 Jan 20:41:55 - 12 Jan 15:32:36 due to incorrect time stamps. Correcting the time stamps for this time period cannot be determined with reasonable accuracy and confidence.

Otherwise, the ceilometer functioned as expected. Qualitative comparisons with the CL51 which operated nearby showed similar overlapping back-scatter properties in height and time.

- Daily plots for the entire CFACT campaign can be previewed in the CL61 data set landing page.
- Click here to access online daily plots (plots available only after 20220202)
- Click here to access 4 hour averaged daily plots (plots available only after 20220201)

Intensive Operating Periods (IOPS)

IOP1 - Ephemeral fog - Tues/Wed Jan 11-12 2022

IOP2 - Ephemeral fog - Sun/Mon Jan 16-17 2022

IOP3 - Ephemeral fog - Wed/Thurs Jan 19-20 2022

IOP4 - Ice-crystal - Thurs/Fri Feb 3-4 2022

IOP5 - Moisture surge - Wed/Thurs Feb 9-10 2022

IOP6 - Quiescent - Sat/Sun Feb 12-13 2022

IOP7 - Thurs/Fri Feb 17-18 2022

IOP8 - Fri/Sat Feb 18-19 2022

IOP9 - Wed/Thurs Feb 23-24 2022