Triple LiDAR Event Data - University of Utah Part - Captured During the Fall Campaign

LID-UOU-FALL-TR

Author(s):	Regarding data questions contact:
Sebastian W. Hoch Mailing address: 135 S 1460 E, Room 819 William Browning Bldg, Salt Lake City, UT, USA, 84112 Tel./Fax.: 801-581-7094/ , E-mail and web: sebastian.hoch@utah.edu, https://faculty.utah.edu/u0546592-Sebastian_W._Hoch	Mailing address: Tel./Fax.: / E-mail and web: ,

1.0 Data Set Overview

1.1 Time period covered by the data

Day of event:

2012/10/07

1.2 Physical location (latitude, longitude, elevation)

40,094170, -113,238, 1337

1.3 Instrument type

LIDAR

1.4 Data provider

University of Utah

1.5 Web address references

http://www3.nd.edu/~dynamics/materhorn/

https://www.eol.ucar.edu/field_projects/materhorn-x

2.0 Instrument Description

Halo Photonics Streamline scanning Doppler wind LiDAR with 18m range gates measuring radial velocities along each ray.

2.1 Instrument website

http://halo-photonics.com/

http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

2.2 Table of specifications

Accuracy	Range	Frequency	Resolution
Consult the manufacturer specifications.	Consult the manufacturer specifications.	Consult the manufacturer specifications.	Consult the manufacturer specifications.

3.0 Data Collection and Processing

3.1 Description of data collection

Data collection, when available, was only conducted during intense observation periods (IOP).

3.2 Description of derived parameters and processing techniques used

Original data files are provided. For more details about derived parameters see: http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

3.3 Description of quality assurance and control procedures

This dataset was not subject to any quality control or processing it has been provided in its original form.

3.4 Data intercomparisons

4.0 Data Format

4.1 Data file structure

ASCII tab separated, the exact structure provided by the file description.

4.2 File naming convention

Several different file naming conventions are utilized for the different scanning strategies. However, all of the files are ASCII tab separated and follow a similar format with the file extension *.hpl or *.csm. The hpl have different file names include, but are not limited to Stare*, User*, VAD*, Wind_Profile*. The Stare* as the name indicates the LiDAR operates with the scanning head locked with both a fixed Azimuth and Elevation angle. The User* scans are user specified and are usually follow with a 1, 2, 3. These scans may be Range Height Indicator (RHI) scans, where a fixed Azimuth is used with a scanning elevation over time. Conversely these scans may also be Plan Position Indicator (PPI) scans, where the elevation is kept fixed and a range of azimuth values is scanned. A VAD* or Velocity Azimuth Display scan, where the elevation is kept constant and a 360 degree azimuth scan is performed allows for the three wind components of velocity to be mathematically computed from the radial velocity measurements. A Wind_Profile* where the elevation is set to 90 degrees sets the LiDAR to stare vertically. Finally, the LiDAR system has another method, Processed_Wind_Profile*, of computing vertical profiles of horizontal wind speed and direction, the format of these files will be described below. Additionally, a tab separated ASCII file is provided which gives additional information regarding the LiDAR system. The file includes the following columns: the data file name, the system time, the internal temperature, internal humidity, a 0 column, the input voltage and the data acquisition card temperature. The last column may not be present if the temperature is provided in the first column.

4.3 Data format

Varies.

4.4 Data layout

Each of the files has seventeen header lines describing the setup. The header describes the columns. The first row following the header provides the decimal hour, therefore the full time and date can be achieved by reading the Start time contained in the header. Also in the first line following the header is the Azimuth (degrees), followed by the Elevation (degrees). Following are rows corresponding to each 18m range gate for a single ray. The columns are the range gate number, the radial velocity (m/s), the signal to noise intensity (SNR + 1), Beta (m-1 sr-1). Following all the range gates for a given ray, the process begins again with the decimal hour line followed by the first range gate line and so on. The azimuth and elevations values which are provided next to the decimal hour may be used for plotting the different scanning methods. The Processed_Wind_Profile* files do not contain any header lines. These files provide the UTC time and date in the file name. The first line contains the number of data lines in the file. Following the first line of data there are three tab separated columns which are the height above ground level, the wind direction in degrees from north (0 north, 90 east, 180 south, 270 west), and finally the horizontal wind speed in m/s.

4.5 List of parameters with units, sampling intervals, frequency, range

Consult individual file headers, additionally see file description provided above, or http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

4.6 Data version number and date

raw, v1.0, October 2016

4.7 Description of flags, codes used in the data, and definitions

4.8 Data sample

```
Sample dataset is not suitable for display in this document.
```

5.0 Data Remarks

5.1 PI's assessment of the data

5.2 Missing data periods

5.3 Software compatibility

6.0 References

[1] http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

[2] Fernando, H. J. S., E. R. Pardyjak, S. Di Sabatino, F. K. Chow, S. F. J. DeWekker, S. W. Hoch, J. Hacker, J. C. Pace, T. Pratt, Z. Pu, J. W. Steenburgh, C. D. Whiteman, Y. Wang, D. Zajic, B. Balsley, R. Dimitrova, G. D. Emmitt, C. W. Higgins, J. C. R. Hunt, J. G. Knievel, D. Lawrence, Y. Liu, D. F. Nadeau, E. Kit, B. W. Blomquist, P. Conry, R. S. Coppersmith, E. Creegan, M. Felton, A. Grachev, N. Gunawardena, C. Hang, C. M. Hocut, G. Huynh, M. E. Jeglum, D. Jensen, V. Kulandaivelu , M. Lehner, L. S. Leo, D. Liberzon, J. D. Massey, K. McEnerney, S. Pal, T. Price, M. Sghiatti, Z. Silver, M. Thompson, H. Zhang, T. Zsedrovits, 2015: The MATERHORN – Unraveling the Intricacies of Mountain Weather, BAMS, doi: http://dx.doi.org/10.1175/BAMS-D-13-00131.1.

Triple LiDAR Event Data - University of Notre Dame Part - Captured During the Fall Campaign

LID-UND-FALL-TR

Author(s):	Regarding data questions contact:
Harindra Joseph S. Fernando Mailing address: 156 Fitzpatrick Hall of Engineering, Notre Dame, IN, USA, 46556 Tel./Fax.: 574-631-9346/ 574-631-9236, E-mail and web: Fernando.10@nd.edu, http://ceees.nd.edu/profiles/hfernando	Laura S. Leo / Zachariah Silver Mailing address: 156 Fitzpatrick Hall of Engineering, Notre Dame, IN, USA, 46556 Tel./Fax.: 574-631-8419/574-631-9236 E-mail and web: LauraSandra.Leo.13@nd.edu / zsilver@nd.edu, https://engineering.nd.edu/profiles/lleo / https://engineering.nd.edu/profiles/zsilver

1.0 Data Set Overview

1.1 Time period covered by the data

Day of event:

2012/10/07

1.2 Physical location (latitude, longitude, elevation)

40,097200, -113,23759, 1327

1.3 Instrument type

LIDAR

1.4 Data provider

University of Notre Dame

1.5 Web address references

http://www3.nd.edu/~dynamics/materhorn/

https://www.eol.ucar.edu/field_projects/materhorn-x

2.0 Instrument Description

Halo Photonics Streamline scanning Doppler wind LiDAR with 18m range gates measuring radial velocities along each ray.

2.1 Instrument website

http://halo-photonics.com/

http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

2.2 Table of specifications

Accuracy	Range	Frequency	Resolution
Consult the manufacturer specifications.	Consult the manufacturer specifications.	Consult the manufacturer specifications.	Consult the manufacturer specifications.

3.0 Data Collection and Processing

3.1 Description of data collection

Data collection, when available, was only conducted during intense observation periods (IOP).

3.2 Description of derived parameters and processing techniques used

Original data files are provided. For more details about derived parameters see: http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

3.3 Description of quality assurance and control procedures

This dataset was not subject to any quality control or processing it has been provided in its original form.

3.4 Data intercomparisons

4.0 Data Format

4.1 Data file structure

ASCII tab separated, the exact structure provided by the file description.

4.2 File naming convention

Several different file naming conventions are utilized for the different scanning strategies. However, all of the files are ASCII tab separated and follow a similar format with the file extension *.hpl or *.csm. The hpl have different file names include, but are not limited to Stare*, User*, VAD*, Wind_Profile*. The Stare* as the name indicates the LiDAR operates with the scanning head locked with both a fixed Azimuth and Elevation angle. The User* scans are user specified and are usually follow with a 1, 2, 3. These scans may be Range Height Indicator (RHI) scans, where a fixed Azimuth is used with a scanning elevation over time. Conversely these scans may also be Plan Position Indicator (PPI) scans, where the elevation is kept fixed and a range of azimuth values is scanned. A VAD* or Velocity Azimuth Display scan, where the elevation is kept constant and a 360 degree azimuth scan is performed allows for the three wind components of velocity to be mathematically computed from the radial velocity measurements. A Wind_Profile* where the elevation is set to 90 degrees sets the LiDAR to stare vertically. Finally, the LiDAR system has another method, Processed_Wind_Profile*, of computing vertical profiles of horizontal wind speed and direction, the format of these files will be described below. Additionally, a tab separated ASCII file is provided which gives additional information regarding the LiDAR system. The file includes the following columns: the data file name, the system time, the internal temperature, internal humidity, a 0 column, the input voltage and the data acquisition card temperature. The last column may not be present if the temperature is provided in the first column.

4.3 Data format

Varies.

4.4 Data layout

Each of the files has seventeen header lines describing the setup. The header describes the columns. The first row following the header provides the decimal hour, therefore the full time and date can be achieved by reading the Start time contained in the header. Also in the first line following the header is the Azimuth (degrees), followed by the Elevation (degrees). Following are rows corresponding to each 18m range gate for a single ray. The columns are the range gate number, the radial velocity (m/s), the signal to noise intensity (dB), Beta (m-1 sr-1). Following all the range gates for a given ray, the process begins again with the decimal hour line followed by the first range gate line and so on. The azimuth and elevations values which are provided next to the decimal hour may be used for plotting the different scanning methods. The Processed_Wind_Profile* files do not contain any header lines. These files provide the UTC time and date in the file name. The first line contains the number of data lines in the file. Following the first line of data there are three tab separated columns which are the height above ground level, the wind direction in degrees from north (0 north, 90 east, 180 south, 270 west), and finally the horizontal wind speed in m/s.

4.5 List of parameters with units, sampling intervals, frequency, range

Consult individual file headers, additionally see file description provided above, or http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

4.6 Data version number and date

raw, v1.0, October 2016

4.7 Description of flags, codes used in the data, and definitions

4.8 Data sample

```
Sample dataset is not suitable for display in this document.
```

5.0 Data Remarks

5.1 PI's assessment of the data

CSM Data -

10/07

LiDAR Triangle Scan towards UU

166 gates, 18m gate length

AZ = 196, EL = 0 -90

10/10

Tower mode with ARL

AZ = 315, EL = 0 -90

Files ending with 011029 - 211845

166 gates, 18m gate length

Tower mode with ARL

Files ending with 211845 - 221845

62 gates, 48m gate length

LiDAR Triangle Scan towards UU

Files ending with 222659 - 235659

62 gates, 48m gate length

AZ = 196, EL = 0 -90

10/11

LiDAR Triangle Scan towards UU

62 gates, 48m gate length

AZ = 196, EL = 0 -90

10/14

166 gates, 18m gate length

AZ = 285, EL = 0 - 180

10/16

AZ = 315, EL = 0 - 90

62 gates, 48m gate length

5.2 Missing data periods

5.3 Software compatibility

6.0 References

[1] http://www.inscc.utah.edu/~hoch/METCRAX2.0/HALO_INFO/StreamLine%20v4.pdf

[2] http://remotesensing.spiedigitallibrary.org/article.aspx?articleid=2521574

[3] Fernando, H. J. S., E. R. Pardyjak, S. Di Sabatino, F. K. Chow, S. F. J. DeWekker, S. W. Hoch, J. Hacker, J. C. Pace, T. Pratt, Z. Pu, J. W. Steenburgh, C. D. Whiteman, Y. Wang, D. Zajic, B. Balsley, R. Dimitrova, G. D. Emmitt, C. W. Higgins, J. C. R. Hunt, J. G. Knievel, D. Lawrence, Y. Liu, D. F. Nadeau, E. Kit, B. W. Blomquist, P. Conry, R. S. Coppersmith, E. Creegan, M. Felton, A. Grachev, N. Gunawardena, C. Hang, C. M. Hocut, G. Huynh, M. E. Jeglum, D. Jensen, V. Kulandaivelu , M. Lehner, L. S. Leo, D. Liberzon, J. D. Massey, K. McEnerney, S. Pal, T. Price, M. Sghiatti, Z. Silver, M. Thompson, H. Zhang, T. Zsedrovits, 2015: The MATERHORN – Unraveling the Intricacies of Mountain Weather, BAMS, doi: http://dx.doi.org/10.1175/BAMS-D-13-00131.1.

Triple LiDAR Event Data - Army Research Lab Part - Captured During the Fall Campaign

LID-ARL-FALL-TR

Author(s):	Regarding data questions contact:
Yansen Wang Mailing address: 2800 Powder Mill Road, Adelphi, MD, USA, 20783-1138 Tel./Fax.: 301-394-1310/ , E-mail and web: yansen.wang.civ@mail.mil, https://www.arl.army.mil/www/default.cfm?page=43	Melvin Felton / Edward Creegan Mailing address: Tel./Fax.: 301-394-2618 / 575-678-4684/ E-mail and web: melvin.a.felton.civ@mail.mil / edward.d.creegan.civ@mail.mil, https://www.arl.army.mil/www/default.cfm?page=45

1.0 Data Set Overview

1.1 Time period covered by the data

Day of event:

2012/10/07

1.2 Physical location (latitude, longitude, elevation)

40,095630, -113,2422, 1349,0481028199999

1.3 Instrument type

LIDAR

1.4 Data provider

Army Research Lab

1.5 Web address references

http://www3.nd.edu/~dynamics/materhorn/

https://www.eol.ucar.edu/field_projects/materhorn-x

2.0 Instrument Description

Leosphere scanning Doppler wind LiDAR with 50m range gates measuring radial velocities along each ray.

2.1 Instrument website

http://www.leosphere.com/en/

2.2 Table of specifications

Accuracy	Range	Frequency	Resolution
Consult the manufacturer specifications.	Consult the manufacturer specifications.	Consult the manufacturer specifications.	Consult the manufacturer specifications.

3.0 Data Collection and Processing

3.1 Description of data collection

Data collection, when available, was only conducted during intense observation periods (IOP).

3.2 Description of derived parameters and processing techniques used

Original data files are provided.

3.3 Description of quality assurance and control procedures

This dataset was not subject to any quality control or processing it has been provided in its original form.

3.4 Data intercomparisons

4.0 Data Format

4.1 Data file structure

ASCII tab separated, the exact structure provided by the file description.

4.2 File naming convention

The Leosphere 100s saves individual *.jpg images of each scan as well as an ASCII tab separated data file with the extension *.rtd. The file names show the start date and time of the scan. Additionally, there are two other files called Config_AP.ini and Scenario.ini for each individual grouping of scans.

4.3 Data format

Varies.

4.4 Data layout

The Leosphere 100s saves individual *.jpg images of each scan as well as an ASCII tab separated data file with the extension *.rtd. The first line of the header indicates how many header lines are contained within the file. The header explains details regarding the setup of the system. Following the individual descriptions, the last header line contains the column headers. Each line, or row, in the data file following the header corresponds to the data for a given ray. Each column corresponds to all of the variables along the ray. The first few columns of each ray include the Timestamp or date, GPS UTC (ddmmyyhhmmss.ss), Int Temp (°C), Ext Temp (°C), Pressure (hPa), Rel Humidity (%), Azimuth Angle (°), Elevation Angle (°). The Azimuth and Elevation angles provided for each ray indicate they type of scan that is performed. Following these columns, each range gate, every 50m, beginning at 100m contains the following columns: Radial Wind Speed (m/s), Radial Wind Speed Dispersion (m/s), Carrier To Noise Ratio (dB), Wind Speed (m/s), Wind Direction (°), X-Wind (m/s), Y-Wind (m/s), Z-Wind (m/s). Columns which do not have data are populated with NaN values. The key values are the Radial Wind Speed and the Carrier To Noise Ratio. Additionally, there are two other files called Config_AP.ini and Scenario.ini for each individual grouping of scans. The Config_AP.ini is an ASCII file that defines all the configurations parameters and is self explanatory. The Scenario.ini file is again an ASCII file that tabulates the type of scan, the azimuth and elevation angles.

4.5 List of parameters with units, sampling intervals, frequency, range

Consult individual file headers, additionally see file description provided above.

4.6 Data version number and date

raw, v1.0, October 2016

4.7 Description of flags, codes used in the data, and definitions

4.8 Data sample

```
Sample dataset is not suitable for display in this document.
```

5.0 Data Remarks

5.1 PI's assessment of the data

5.2 Missing data periods

5.3 Software compatibility

6.0 References

[1] Fernando, H. J. S., E. R. Pardyjak, S. Di Sabatino, F. K. Chow, S. F. J. DeWekker, S. W. Hoch, J. Hacker, J. C. Pace, T. Pratt, Z. Pu, J. W. Steenburgh, C. D. Whiteman, Y. Wang, D. Zajic, B. Balsley, R. Dimitrova, G. D. Emmitt, C. W. Higgins, J. C. R. Hunt, J. G. Knievel, D. Lawrence, Y. Liu, D. F. Nadeau, E. Kit, B. W. Blomquist, P. Conry, R. S. Coppersmith, E. Creegan, M. Felton, A. Grachev, N. Gunawardena, C. Hang, C. M. Hocut, G. Huynh, M. E. Jeglum, D. Jensen, V. Kulandaivelu , M. Lehner, L. S. Leo, D. Liberzon, J. D. Massey, K. McEnerney, S. Pal, T. Price, M. Sghiatti, Z. Silver, M. Thompson, H. Zhang, T. Zsedrovits, 2015: The MATERHORN – Unraveling the Intricacies of Mountain Weather, BAMS, doi: http://dx.doi.org/10.1175/BAMS-D-13-00131.1.