

SPIFFY 2016 README

Data sets contained in this campaign:

	Start Date	Stop Date	Contact
CSU SPiFFY CIMS	2016-02-03	2016-10-29	Name: Delphine Farmer Email: delphine.farmer@colostate.edu Phone: 970-491-0624
CSU SPiFFY Trace Gases	2016-07-15	2016-10-04	Name: Delphine Farmer Email: delphine.farmer@colostate.edu Phone: 970-491-0624
CSU SPiFFY Met	2016-08-10	2016-09-30	Name: Delphine Farmer Email: delphine.farmer@colostate.edu Phone: 970-491-0624
SPIFFY 2016 PSD	2016-07-27	2016-11-02	Name: John Ortega Email: ortega@ucar.edu Phone: (303) 497-1428
Met_data_2016_Feb	2016-02-06	2016-02-28	Name: John Ortega Email: ortega@ucar.edu Phone: (303) 497-1428
Particle Exchange Velocity	2016-02-03	2016-11-05	Name: Erin Boedicker Email: Erin.Boedicker@colostate.ed
Particle Flux	2016-02-03	2016-11-05	Name: Erin Boedicker Email: Erin.Boedicker@colostate.edu

CSU SPiFFY CIMS – ICARTT Header

47, 1001  
 Delphine Farmer  
 Colorado State University  
 Acetate HR-TOF-CIMS  
 SPiFFY  
 1, 1  
 2016, 10, 07, 2017, 08, 29  
 0  
 UTCTime\_Start  
 14  
 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1  
 -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999  
 Formic\_conc\_sd  
 Formic\_conc  
 Propanoic\_conc\_sd

Propanoic\_conc  
Methacrylic\_conc\_sd  
Methacrylic\_conc  
Butyric\_conc\_sd  
Butyric\_conc  
Valeric\_conc\_sd  
Valeric\_conc  
Heptanoic\_conc\_sd  
Heptanoic\_conc  
UTCTime\_Stop  
UTCTime\_Midpoint

1

One minute mixing ratios were averaged from 5 Hz mixing ratios. The standard deviation of those averages is included as the uncertainty. The limit of detection was calculated for a calibration period during which all species' limits of detection at 1 min

18

PI\_CONTACT\_INFO: Chemistry MC 1872, 200 W. Lake St., Fort Collins, CO 80523

PLATFORM: MEFO Chemistry Tower

LOCATION: Manitou Experimental Forest Observatory

ASSOCIATED\_DATA: N/A

INSTRUMENT\_INFO: N/A

DATA\_INFO: ppt (parts per trillion by volume)

UNCERTAINTY: +/- standard deviation "\_sd"

ULOD\_FLAG: -7777

ULOD\_VALUE: N/A

LLOD\_FLAG: -8888

LLOD\_VALUE: Formic 3.4 ppt, Propanoic 0.89 ppt, Methacrylic 0.23 ppt, Butyric 0.45 ppt, Valeric 0.36 ppt, Heptanoic 0.42 ppt calculated from 2016.10.14-04:45AM calibration

DM\_CONTACT\_INFO: Data Manager: Dr. Delphine Farmer, Delphine.Farmer@colostate.edu; AND Ryan Fulgham, sfulgham@rams.colostate.edu

PROJECT\_INFO: SPiFFY\_Fall2016\_2016.10.07-2016.10.29

STIPULATIONS\_ON\_USE: Use of these data require prior ok from PI.

OTHER\_COMMENTS: Inlet was at 30 m above ground level, instruments were housed in trailer at base of tower.

REVISION: 0

R0: final data

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## CSU SPiFFY Trace Gases – ICARTT Header

37, 1001

Delphine Farmer

Colorado State University, Department of Chemistry

2B Technologies (model 202) O3, TEI (model 42i-TL) NOx, Teledyne (model T100U) SO2

Manitou, Summer 2016

1, 1

2016, 07, 15, 2017, 01, 12

60

datetime\_1min\_MDT, seconds\_past\_midnight

4

1, 1, 1, 1

-9999, -9999, -9999, -9999

O3\_ppbv, ppbv

NO\_ppbv, ppbv

NO2\_ppbv, ppbv

SO2\_ppbv, ppbv

1

1 min merge of O3, Nox, and SO2 trace gas measurements

18

PI\_CONTACT\_INFO: delphine.farmer@colostate.edu

PLATFORM: Instruments located in a trailer at the base of the MEFO tower, inlet positioned ~10 m a.g.l.

LOCATION: Manitou Experimental Forrest (MEFO), Woodland Park, Colorado

ASSOCIATED\_DATA: N/A

INSTRUMENT\_INFO: Commercial analyzers for NOx (TEI, model 42i-TL), O3 (2B Technologies, model 202), SO2 (Teledyne, model 100 EU)

DATA\_INFO: All are in ppbv.

UNCERTAINTY: +/- 5% for O3, +/- 5% for SO2, +/- 5% for NO, +/- 8% for NO2

ULOD\_FLAG: -7777

ULOD\_VALUE: N/A

LLOD\_FLAG: -8888

LLOD\_VALUE: 50 pptv for NOx and SO2 according to manufacturer specifications for commercial analyzers; 3 ppbv for O3

DM\_CONTACT\_INFO: Data Manager: Ilana Pollack, ipollack@rams.colostate.edu

PROJECT\_INFO: Project Info: Manitou Measurements from 15 Jul - 15 Aug, 2016

STIPULATIONS\_ON\_USE: Use of these data require prior ok from PI.

OTHER\_COMMENTS: N/A

REVISION: 0

R0: Final Data.

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## CSU SPiFFY Met README

Manitou Experimental Forest Observatory  
Summer/Fall 2016  
Met data from Chemistry Tower  
John Ortega, NCAR, Atmospheric Chemistry Observations and Modeling

Meteorological data was taken at 1 Hz from 4 levels on the chemistry tower: 1.8m (level 1), 7.0m, 14.1m, and 27.8m (level 4). Data archived here is averaged every 5 minutes. The data file for each day should have exactly 288 lines -1 line for each 5 minute period. The columns in the text files are the following:

1. Time (Matlab day) January 1, 2016 = 736330
2. Time (decimial day of year; July 7 = 189 in 2016 (188 for non leap years)).
3. Temperature in deg C
4. % Relative humidity
5. Pressure in mb (1 mb = 1 hPa)
6. Wind speed in m/s
7. Wind direction in degrees (north = 0, west = 270, etc.).

Wind directions were broken down into their sine and cosine components prior to averaging.

Missing data is listed at -8888.

The met data on level 4 is oriented 30 degrees east of north, so the wind direction data has 30 degrees subtracted from it in the final data. This has been taken into account in all of the data files, but not in the plots (jpeg files: "WS\_2016XXXX.jpg" where XXXX is the day and month (e.g. 0809 = August 9 or 1030 = October 30)).

Wind speed for all 4 levels: "WS\_2016XXXX.jpg"  
Wind direction for all 4 levels: "WD\_2016XXXX.jpg"  
Temperature for all for levels: "Temp\_2016XXXX.jpg"  
Relative humidity for all 4 levels: "RH\_2016XXXX.jpg"

The following data files are available in tab-delimited text:

5 minute data for single day: "MET\_levelX\_2016YYYY.txt where X is the level 1-4 and YYYY is the month and day as described above.

5 minute data for the July 7-August 20: "MET\_levelX\_July7\_Aug20.txt" wher X is the level 1-4.

The time stamp in columns 1 and 2 are the middle (2:30) of each 5 minute period.

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## SPIFFY 2016 PSD

NCAR-ACOM PSD (particle size distribution) instrument

John Ortega  
January 19, 2017

The NCAR Particle Size Distribution (PSD) instrument is the super-position of two Scanning Mobility Particle Sizers (SMPS). The same sample flow of ambient air is ionized with a Po210 charger, and then sent to both a nano-SMPS and a regular SMPS at flow rates of 1.5 and 1 L/min respectively. Sheath air and high voltage to the DMA is supplied using an NCAR-built blower box that continuously scans the voltage from 0 to ~ 8000V and back from 8000 V to 0 completing a cycle every 280 seconds followed by 20 seconds idle time. A new cycle is started every 300 seconds starting at midnight and every 5 minutes after that resulting in 288 up/down scans per day. The mono-disperse particles exiting the 2 DMAs are counted by TSI 3025 (nsmmps) and a TSI 3760 (rsmmps) condensation particle counters (CPC). The nsmmps counts particles with mobility diameters between ~4nm and ~80 nm, and the rsmmps counts particles with mobility diameters between ~40nm and 300 nm. The overlap region between the two distributions is merged during post processing. Only singly charged particles are considered. The raw data is inverted using a 1st principles technique where the raw counts are converted in to  $dN/d\log D_p$  using the Fuch's charging efficiency, DMA penetration efficiency, diffusion losses, CPC counting efficiency and DMA transfer function. This summarized in Stolzenburg and McMurry (Aerosol Science and Technology, 42: 421-432, 2008).

The inlet for the instrument is ~3 meters above ground level at the Manitou Experimental Forest Observatory (near Woodland Park, CO). It consists of a 3/8" copper tube protected against rain and large particles and insects and brought through a port into one of the climate-controlled trailers at the site. Instrument control and data storage is done using a Labview code and the data inversion is done in a subsequent steps using a series of Matlab scripts.

The data is saved in MS Excel worksheets, which can easily be read in by any standard data analysis program. The first two rows are  $D_p$  in nm and  $d\log D_p$  respectively. The first column is dime of day (in decimal day; 0.25 = 6am), and subsequent columns are  $dN/d\log D_p$  for each  $D_p$  listed in the first row followed by integrated particle number counts ( $N$  in  $\text{cm}^{-3}$ ), Particle surface area in  $\text{um}^2/\text{cm}^3$ , volume in  $\text{um}^3/\text{cm}^3$  and mass in  $\text{ug}/\text{m}^3$ . Time is Mountain standard time.

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## Met\_data\_2016\_Feb

### Manitou Experimental Forest Observatory

Met data from Chemistry Tower

John Ortega, NCAR, Atmospheric Chemistry Observations and Modeling

Meteorological data was taken at 1 Hz from 4 levels on the chemistry tower: 1.8m (level 1), 7.0m, 14.1m, and 27.8m (level 4).

Data archived here is averaged every 5 minutes. The data file for each day should have exactly 288 lines -1 line for each 5 minute period. The columns are the following:

1. Time (Matlab day)
2. Time (decimial day of year; July 7 = 189 (for leap year 2016))
3. Temperature in deg C
4. % Relative humidity
5. Pressure in mb (1 mb = 1 hPa)
6. Wind speed in m/s

7. Wind direction in degrees (north = 0, west = 270, etc.).

Wind directions were broken down into their sine and cosine components prior to averaging.

Missing data is listed at -8888.

The met data on level 4 is oriented 30 degrees east of north, so the wind direction data has 30 degrees subtracted from it in the final data. This has been taken into account in all of the data files, but not in the plots (jpeg files: "WS\_YYYYMMDD.jpg" where YYYY is the year and MMDD is the month and day).

The following plots are made for each day  
Wind speed for all 4 levels: "WS\_20150XXX.jpg"  
Wind direction for all 4 levels: "WD\_20150XXX.jpg"  
Temperature for all for levels: "Temp\_20150XXX.jpg"  
Relative humidity for all 4 levels: "RH\_20150XXX.jpg"

The following data files are available in tab-delimited text:  
5 minute data for single day: "MET\_levelX\_YYYYMMDD.txt" where X is the level 1-4 and MMDD is the month and day.

The time stamp in columns 1 and 2 are the middle (2:30) of each 5 minute period.

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## Particle Exchange Velocity

45, 1001  
Delphine Farmer  
Colorado State University  
Ultra-High Sensitivity Aerosol Spectrometer  
Seasonal Particles in Forests Flux study (SPiFFY)  
1, 1  
2016, 04, 16, 2022, 05, 24  
1800  
DateTimeLocal\_Start, seconds\_past\_midnight, Local Time (Mountain Daylight Time)  
12  
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1  
-9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999  
DateTimeLocal\_End, seconds\_past\_midnight, Local Time (Mountain Daylight Time)  
Vex\_93\_67\_nm, cms-1, Total Vex for particles 84.38-102.96nm  
Vex\_114\_285\_nm, cms-1, Total Vex for particles 102.96-125.61nm  
Vex\_139\_435\_nm, cms-1, Total Vex for particles 125.61-153.26nm  
Vex\_164\_96\_nm, cms-1, Total Vex for particles 153.26-176.66nm  
Vex\_190\_15\_nm, cms-1, Total Vex for particles 176.66-203.64nm  
Vex\_245\_015\_nm, cms-1, Total Vex for particles 203.64-286.39nm  
Vex\_344\_58\_nm, cms-1, Total Vex for particles 286.39-402.77nm  
Vex\_454\_18\_nm, cms-1, Total Vex for particles 402.77-505.59nm  
Vex\_608\_32\_nm, cms-1, Total Vex for particles 505.59-711.05nm  
Vex\_855\_525\_nm, cms-1, Total Vex for particles 711.05-1000nm  
Vex\_Total, cms-1, Total Vex over entire size range  
1

Size dependent particle exchange velocity (Vex) is presented in 30 minute periods, these were calculated from 10 Hz particle data and sonic data. The exchange

velocities (Vex) follow the sign convention that negative is downward and positive is upward movement. The midpoint of the size range is included in the column headers. This data was quality control filtered based on 30% stationarity bounds, friction velocity less than 0.14 m/s, and precipitation events have been removed.

18  
PI\_CONTACT\_INFO: Chemistry MC 1872, 200 W. Lake St., Fort Collins, CO 80523  
PLATFORM: MEFO Chemistry Tower  
LOCATION: Manitou Experimental Forest, Colorado, USA (39.1006°N, 105.0942°W).  
ASSOCIATED\_DATA: N/A  
INSTRUMENT\_INFO: N/A  
DATA\_INFO: Units are cm s-1  
UNCERTAINTY: Contact PI  
ULOD\_FLAG: -7777  
ULOD\_VALUE: N/A  
LLOD\_FLAG: -8888  
LLOD\_VALUE: Contact PI  
DM\_CONTACT\_INFO: Dr. Delphine Farmer, Delphine.Farmer@colostate.edu; AND Erin Boedicker  
PROJECT\_INFO: SPiFFY\_Winter2016\_2016.02.03-2016.02.28,  
SPiFFY\_Spring2016\_2016.04.16-2016.05.14, SPiFFY\_Summer2016\_2016.07.14-2016.08.11,  
SPiFFY\_Fall2016\_2016.09.25-2016.11.03  
STIPULATIONS\_ON\_USE: Use of these data require prior ok from PI.  
OTHER\_COMMENTS: Inlet was at 30 m above ground level, instruments were housed in trailer at base of tower.  
REVISION: R0  
R0: Final Data  
DateTimeLocal\_Start, DateTimeLocal\_End, Vex\_93\_67\_nm, Vex\_114\_285\_nm,  
Vex\_139\_435\_nm, Vex\_164\_96\_nm, Vex\_190\_15\_nm, Vex\_245\_015\_nm, Vex\_344\_58\_nm,  
Vex\_454\_18\_nm, Vex\_608\_32\_nm, Vex\_855\_525\_nm, Vex\_Total

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## Particle Flux

44, 1001

Delphine Farmer  
Colorado State University  
Ultra-High Sensitivity Aerosol Spectrometer  
Seasonal Particles in Forests Flux study (SPiFFY)  
1, 1  
2016, 04, 16, 2022, 05, 24  
1800  
DateTimeLocal\_Start, seconds\_past\_midnight, Local Time (Mountain Daylight Time)  
11  
1, 1, 1, 1, 1, 1, 1, 1, 1, 1  
-9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999, -9999  
DateTimeLocal\_End, seconds\_past\_midnight, Local Time (Mountain Daylight Time)  
Flux\_93\_67\_nm, #cm-2s-1, Total flux for particles 84.38-102.96nm  
Flux\_114\_285\_nm, #cm-2s-1, Total flux for particles 102.96-125.61nm  
Flux\_139\_435\_nm, #cm-2s-1, Total flux for particles 125.61-153.26nm  
Flux\_164\_96\_nm, #cm-2s-1, Total flux for particles 153.26 - 176.66 nm  
Flux\_190\_15\_nm, #cm-2s-1, Total flux for particles 176.66-203.64nm  
Flux\_245\_015\_nm, #cm-2s-1, Total flux for particles 203.64-286.39nm  
Flux\_344\_58\_nm, #cm-2s-1, Total flux for particles 286.39-402.77nm  
Flux\_454\_18\_nm, #cm-2s-1, Total flux for particles 402.77-505.59nm  
Flux\_608\_32\_nm, #cm-2s-1, Total flux for particles 505.59-711.05nm  
Flux\_855\_525\_nm, #cm-2s-1, Total flux for particles 711.05-1000nm  
Flux\_Total, #cm-2s-1, Total flux over entire size range  
1

Size dependent particle number flux is presented in 30 minute periods, these were calculated from 10 Hz particle data and sonic data. The midpoint of the size range is included in the column headers. This data was quality control filtered based on 30% stationarity bounds, friction velocity less than 0.14 m/s, and precipitation events have been removed.

18

PI\_CONTACT\_INFO: Chemistry MC 1872, 200 W. Lake St., Fort Collins, CO 80523

PLATFORM: MEFO Chemistry Tower

LOCATION: Manitou Experimental Forest, Colorado, USA (39.1006°N, 105.0942°W).

ASSOCIATED\_DATA: N/A

INSTRUMENT\_INFO: N/A

DATA\_INFO: Units are # cm<sup>-2</sup> s<sup>-1</sup>

UNCERTAINTY: From instrument noise for the 2016 winter, spring, summer, and fall was 20, 30, 30, and 20 # cm<sup>-2</sup> s<sup>-1</sup>. From counting for the 2016 winter, spring, summer, and fall was 800, 2000, 2000, and 1000 # cm<sup>-2</sup> s<sup>-1</sup>. From covariance calculation the 2016 winter, spring, summer, and fall was 30, 80, 70, and 60 # cm<sup>-2</sup> s<sup>-1</sup>.

ULOD\_FLAG: -7777

ULOD\_VALUE: N/A

LLOD\_FLAG: -8888

LLOD\_VALUE: The limit of detection was calculated for the total flux to be 8, 40, 70, and 60 # cm<sup>-2</sup> s<sup>-1</sup> for the 2016 winter, spring, summer, and fall

DM\_CONTACT\_INFO: Dr. Delphine Farmer, Delphine.Farmer@colostate.edu; AND Erin Boedicker

PROJECT\_INFO: SPiFFY\_Winter2016\_2016.02.03-2016.02.28,

SPiFFY\_Spring2016\_2016.04.16-2016.05.14, SPiFFY\_Summer2016\_2016.07.14-2016.08.11,

SPiFFY\_Fall2016\_2016.09.25-2016.11.03

STIPULATIONS\_ON\_USE: Use of these data require prior ok from PI.

OTHER\_COMMENTS: Inlet was at 30 m above ground level, instruments were housed in trailer at base of tower.

REVISION: R0

R0: Final Data

DateTimeLocal\_Start, DateTimeLocal\_End, Flux\_93\_67\_nm, Flux\_114\_285\_nm,

Flux\_139\_435\_nm, Flux\_164\_96\_nm, Flux\_190\_15\_nm, Flux\_245\_015\_nm, Flux\_344\_58\_nm,

Flux\_454\_18\_nm, Flux\_608\_32\_nm, Flux\_855\_525\_nm, Flux\_Total