

Plains Elevated Convection at Night (PECAN) Oklahoma Mesonet Data Set

1.0 Contacts

NCAR/EOL:

Scot Loehrer

loehrer@ucar.edu

Oklahoma Climatological Survey:

Chris Fiebrich

chris@mesonet.org

2.0 Dataset Overview

This data set contains the 5-minute resolution observations from the 36 Oklahoma Mesonet stations located within the PECAN domain (Fig. 1) for the period 1 June – 17 July 2015. Also included are the 1-minute observations for 9 and 10 July 2015. These data were collected, quality controlled, and archived by the Oklahoma Climatological Survey at the University of Oklahoma.

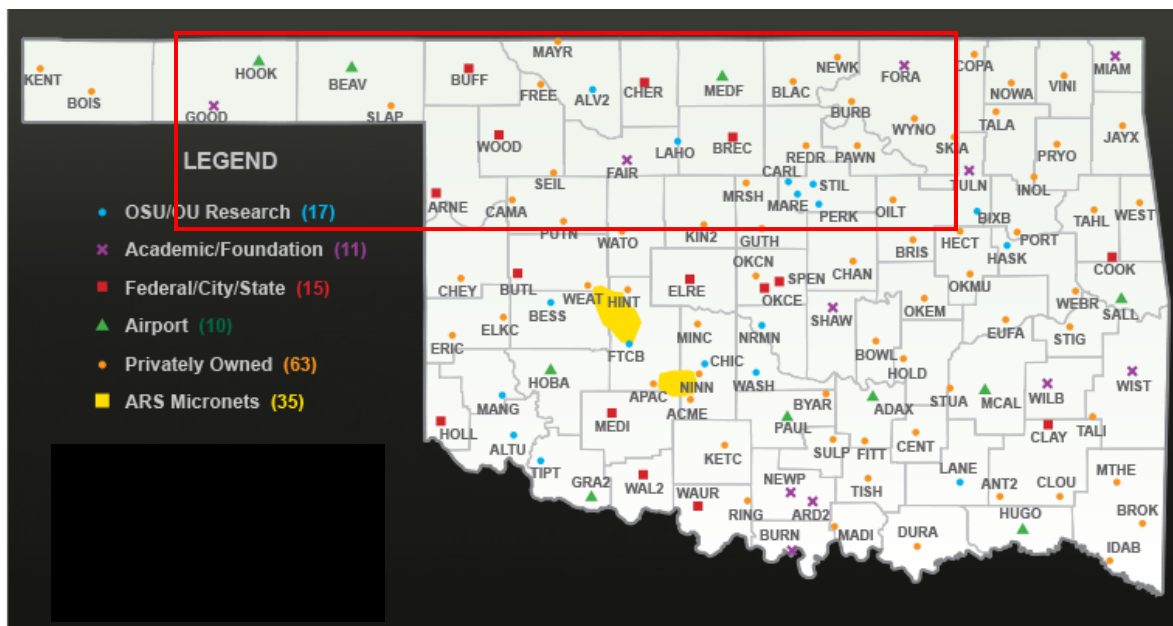


Figure 1. Map of Oklahoma Mesonet locations (only those in the red box are included in this data set).

3.0 Project Overview

Plains Elevated Convection At Night (PECAN) was a multi-agency project designed to advance the understanding of continental, nocturnal, warm-season precipitation. It focused on nocturnal convection in conditions over the central United States plains states with a stable boundary layer (SBL), a nocturnal low-level jet and the largest convective available potential energy located above the SBL. Three aircraft (University of Wyoming King Air, NOAA P-3, and NASA DC-8) as well as a large array of fixed and mobile ground instrumentation were deployed out of Kansas from 1 June to 15 July 2015.

4.0 File Format Description

4.1 Five Minute Data Format

The five minute resolution Oklahoma Mesonet (OKMeso) data are in the columnar ASCII Mesonet Time Series (MTS) format. Each file contains the data for one station for the UTC day. For this data set all 36 MTS files for a day have been tarred into a single file using the naming convention:

OKMeso_5min_yyyymmdd.tar.gz

Where yyyymmdd is the UTC year, month, and day

The individual MTS station files contained within the tar files follow the naming convention:

yyymmddSSSS.mts

where SSSS is the station identifier

The MTS header consists of 3 lines:

- 1) Copyright information
- 2) Number of variables in the file and the base date and time of the data in the file
- 3) Variable IDs for each data column

The MTS data columns are as follows:

Name	ID	Unit	Description
Station ID	STID		Station ID

Station Number	STNM		Station Number
Time	TIME	minutes after base time	Minutes after base time (typically 0000 UTC)
Relative Humidity	RELH	percent	5-minute averaged relative humidity at 1.5m.
Air Temperature	TAIR	degrees Celsius	5-minute averaged air temperature at 1.5m.
Wind Speed	WSPD	meters per second	5-minute averaged wind speed at 10m.
Wind Vector	WVEC	meters per second	5-minute averaged wind velocity (speed and direction accounted for) at 10m.
Wind Direction	WDIR	degrees	5-minute averaged wind direction at 10m.
Wind Direction Standard Deviation	WDSD	degrees	Standard deviation of wind direction during the 5-minute interval.
Wind Speed Standard Deviation	WSSD	meters per second	Standard deviation of wind speed during the 5-minute interval.
Maximum Wind Speed	WMAX	meters per second	Highest 3-second wind speed at 10m sample.
Precipitation	RAIN	millimeters	Liquid precipitation accumulation since 0000 UTC. Frozen precipitation cannot be recorded until it melts; therefore, precipitation from snow may not be recorded until several days after the snow event.
Station Atmospheric Pressure	PRES	millibars	5-minute averaged atmospheric pressure.
Solar Radiation	SRAD	watts per square	5-minute averaged downwelling global solar radiation.

		meter	
Air Temperature at 9m	TA9M	degrees Celsius	5-minute averaged air temperature at 9m
2m Wind Speed	WS2M	meters per second	5-minute averaged wind speed at 2m
Temperature Under Native Vegetation at 10cm	TS10	degrees Celsius	15-minute averaged temperature under native vegetation at 10cm.
Temperature Under Bare Soil at 10cm	TB10	degrees Celsius	15-minute averaged temperature under bare soil at 10cm.
Temperature Under Native Vegetation at 5cm	TS05	degrees Celsius	15-minute averaged temperature under native vegetation at 5cm.
Temperature Under Bare Soil at 5cm	TB05	degrees Celsius	15-minute averaged temperature under bare soil at 5cm. This variable is only available prior to December 1, 2013.
Temperature Under Native Vegetation at 25cm	TS25	degrees Celsius	15-minute averaged temperature under native vegetation at 25cm. This variable is only available after and including December 1, 2013.
Temperature Under Native Vegetation at 30cm	TS30	degrees Celsius	15-minute averaged temperature under native vegetation at 30cm. This variable is only available prior to December 1, 2013.
Temperature Under Native Vegetation at 60cm	TS60	degrees Celsius	15-minute averaged temperature under native vegetation at 60cm. This variable is only available after and including December 1, 2013.
Soil Moisture Calibrated Delta-T at 5cm	TR05	degrees Celsius	Calibrated change in temperature of soil over time after a heat pulse is introduced. Used to calculate soil water potential, fractional water index, or volumetric water.

Soil Moisture Calibrated Delta- T at 25cm	TR25	degrees Celsius	Calibrated change in temperature of soil over time after a heat pulse is introduced. Used to calculate soil water potential, fractional water index, or volumetric water.
Soil Moisture Calibrated Delta- T at 60cm	TR60	degrees Celsius	Calibrated change in temperature of soil over time after a heat pulse is introduced. Used to calculate soil water potential, fractional water index, or volumetric water.

The missing data values used in the MTS files are as follows:

Value	Description
-999	Data flagged as bad by quality assurance routines.
-998	Sensor not installed.
-997	Cannot compute value due to missing calibration coefficient(s).
-996	Station did not report (missing).
-995	Data not reported on this time interval (e.g., soil temperature only reports every 15 minutes and is not available at 25 minutes after the hour).
-994	Value too wide to fit in column.

The five minute data have had the coefficients and quality assurance flags already applied by the Oklahoma Mesonet.

4.2 One Minute Data Format

The one minute data were only collected for the periods of:

2200 UTC 8 July to 1400 UTC 9 July

2200 UTC 9 July to 1200 UTC 10 July

These were days the primary PECAN operations were located in the Texas panhandle region.

The one minute resolution OKMeso data are in the comma-separated ASCII MES01 format. Each file contains the data for one station for the

UTC day. For this data set all 36 MTS files for a day have been tarred into a single file using the naming convention:

OKMeso_1min_yyyymmdd.tar.gz

Where yyyymmdd is the UTC year, month, and day

The individual station files contained within the tar files follow the naming convention:

yyymmddSSSS.mes01

where SSSS is the station identifier

The MES01 data parameters are as follows:

- 1) Station ID
- 2) Tables (MES01N or MES01Nhere)
- 3) "UTC DateTime"
- 4) Record number
- 5) Relative Humidity (%)
- 6) 1.5m Air Temperature (C)
- 7) Solar Radiation (W/m^2)
- 8) Primary Rain Gauge (hundredths of an inch)
- 9) Secondary Rain Gauge (hundredths of an inch)
- 10) Station Pressure (mb -700)
- 11) Minimum 12-second sample station pressure (mb - 700)
- 12) Maximum 12-second sample station pressure (mb - 700)
- 13) 10m Wind Speed (m/s)
- 14) 10m Wind Direction (deg)
- 15) 9m Air Temperature (C; see note 1)
- 16) 2m Wind Speed (m/s)
- 17) 10m Maximum Wind Speed (m/s)
- 18) 1.5m Unaspirated Air Temperature (C)
- 19) Station Battery Voltage (V)
- 20) Minimum Battery Voltage Sample (V)
- 21) Maximum Battery Voltage Sample (V)

Note 1: When the Tables parameters is MES01M the 9m air temperature uses a bare bead thermistor. When the Tables parameter is MES01N the 9m air temperature uses a platinum resistance thermometer.

The missing value in the one minute (MES01) files is +/- 7999.

The one minute data have NOT had coefficients applied by the Oklahoma Mesonet. Solar radiation is the only variable that needs coefficients.

The one minute data have also NOT had the quality assurance flags applied by the Oklahoma Mesonet.

5.0 Instrumentation

Parameter	Sensor Used	Accuracy
TAIR	Thermometrics Air Temperature	+/- 0.5C
TA9M	Thermometrics Air Temperature	See Note 1
WSPD	RM Young Wind Monitor	+/- 0.3m/s
WDIR	RM Young Wind Monitor	+/-3 degrees
WS2M	RM Young Wind Sentry	
PRES	Vaisala Barometer	+/-0.4mb (TAIR -30 to 50C)
RAIN	Met One Tipping Bucket	+/- 5% (at 0-5cm/hr)
RELH	Vaisala HMP45C	+/-3% (for 10-98)
SRAD	Li-Cor Pyranometer	+/-5%
TR05/TR25/TR60	Campbell Scientific 229-L	
TB10/TS05/TS10/TS25/TS60	Thermocouple Sensor	+/-0.5C

NOTE 1 – TA9M uses an un aspirated radiation shield, resulting in a warm bias on calm, sunny days and its accuracy is dependent on the wind speed:

- +/- 0.5C when WS > 6m/s
- +/- 1.0C when WS 3-6m/s
- +/- 1.5C when WS 2-3m/s
- +/- 3.0C when WS 1-2m/s

TAIR is housed in an aspirated radiation shield which continuously draws ambient air over the sensor while protecting it from solar radiation.

6.0 Data Quality Control Procedures

These data were processed and quality controlled by the Oklahoma Mesonet using the methods described in Fiebrich et. al. (2010) and McPherson, et al. (2007).

The file pecan_data_quality_analysis.xlsx contains a data quality summary prepared by the Oklahoma Mesonet. It includes the following:

- The “trouble tickets” tab lists all trouble ticket information affecting the sites in this PECAN data set.
- The “quality flags” tab lists all manual data flags that were applied to the five minute (MTS) data files. These flags will need to be manually applied to the raw one minute (MES01) files.
 - “G” indicates data were deemed good via manual review by a QA meteorologist despite failing automated QA checks.
 - “1” indicates suspect data (a problem was found with the sensor/site, but QA could not identify a problem with the data)
 - “2” indicates data are erroneous and should not be used.
- Data coincident with technicians at a site have already been marked as missing in the five minute (MTS) data files. There were no technician visits during the one minute data periods.
- The “solar radiation coefficients” tab contains the solar radiation coefficients (already applied to the five minute (MTS) data, but not the one minute (MES01) data by the Oklahoma Mesonet).
 - The calibrated solar radiation =
raw solar radiation *80/coefficient

NCAR/EOL has not conducted any additional processing or quality control on these data.

7.0 References

Fiebrich, C. A., C. R. Morgan, A. G. McCombs, P. K. Hall, Jr., and R. A. McPherson, 2010: Quality assurance procedures for mesoscale meteorological data. *J. Atmos. Oceanic Technol.*, **27**, 1565-1582.

McPherson, R. A., C. A. Fiebrich, K. C. Crawford, R. L. Elliott, J. R. Kilby, D. L. Grimsley, J. E. Martinez, J. B. Basara, B. G. Illston, D. A. Morris, K. A. Kloesel, S. J. Stadler, A. D. Melvin, A.J. Sutherland, and H. Shrivastava, 2007: Statewide Monitoring of the Mesoscale Environment: A Technical Update on the Oklahoma Mesonet. *J. Atmos. Oceanic Technol.*, **24**, 301-321.