TITLE: Environment Canada Mobile Mesonet Data 2009-2010

AUTHOR:

Dr. David Sills
Severe Weather Scientist
Cloud Physics and Severe Weather Research Section
Environment Canada
4905 Dufferin Street
Toronto (Ontario) M3H 5T4
David.Sills@ec.gc.ca
905-833-3905 x235 Telephone
905-833-0398 Facsimile
Government of Canada
Website

1.0 DATA SET OVERVIEW:

These datasets include data collected by Environment Canada's Automated Mobile Meteorological Observation System (AMMOS) which formed part of the VORTEX2 mobile mesonet.

Data for the following cases were collected, archived, and quality controlled:

2009

12 May 2009 – thunderstorms with dry microbursts and a heat burst in near Childress, TX

13 May 2009 – pre-storm boundary sampling, back-building transient supercells near Clinton, OK

15 May 2009 – pre-storm boundary sampling, linear storms near Enid, OK

19 May 2009 – thunderstorms with dry microbursts near the NB/CO border

20 May 2009 – thunderstorms with transient supercell characteristics near Alliance, NB

22 May 2009 – thunderstorms with transient supercell characteristics near Newcastle, WY

23 May 2009 – thunderstorms near Ogallala, NB

2010

6 May 2010 – weak, elevated supercells near Wakeeny, KS
– sampled sharp boundary associated with triple point pre-storm

10 May 2010 – strong supercells and tornadoes in central OK
– sampled strong inflow into Seminole supercell

11 May 2010 – weak supercell with hail and possible tornado near Clinton, OK

12 May 2010 – supercells with at least one tornado near Clinton, OK
– good sampling of mesocyclone, region to rear of tornado

14 May 2010 – supercells with a strong tornado near Monahans, TX
– sampled initiation boundary

15 May 2010 – weak supercell with large hail near Artesia, NM

17 May 2010 – weak supercell with large hail near Artesia, NM

18 May 2010 – supercells with tornadoes near Dumas, TX
– good sampling of mesocyclones

19 May 2010 – supercells with tornadoes near Kingfisher, OK
– good sampling of mesocyclones

2.0 INSTRUMENT DESCRIPTION:

The AMMOS was mounted on a 2001 Jeep Cherokee, as shown in the photograph below, and operated by David Sills and Neil Taylor, both of Environment Canada.

AMMOS Instrumentation

RM Young 05103-10 wind monitor
- Speed. Range: 0-60 m/s with gust survival up to 100 m/s, accuracy ±3 m/s
- Direction. Range: 0-355 degrees, accuracy ±3°

Campbell Sci. HMP45C temperature (SlowT) / humidity probe
- Temperature. Range: -40°C to +60°C, accuracy ±0.2°C @ 20°C
- Humidity. Range: 0 -100%, accuracy ±2% @ 0-90%, ±3% @ 90-100%

Campbell Sci. 44212EC thermocouple (FastT)
- Range: -50°C to +50°C with accuracy ±0.1°C @ 25°C

Vaisala PTB210 pressure sensor + SPH10 static pressure head
- Range: 500 – 1100 hPa with accuracy ±0.15 hPa @ 20°C

Campbell Sci. CR1000-55 logger + housing

Campbell Sci. GPS16-HVS Garmin GPS receiver with antenna and mount kit

RM Young 32500 flux-gate compass and serial interface

J-tube housing for T/H measurements
- very well aspirated and with downward pointing exhaust to eliminate backflow problems

A lightning detection system was installed as well, but data were not logged.

3.0 DATA COLLECTION AND PROCESSING:

Sampling

Samples were taken every 1 s. All times were recorded in UTC.

Wind Parameters

The ‘uncorrected’ wind speed and wind direction (WindSpeedRaw, WindDirectionUncorrected) are those taken straight from the anemometer without correcting for vehicle orientation or speed. They are included in the archive so that wind corrections can be reprocessed if needed. They should not be used for analysis purposes.

The wind observations to use for analysis purposes are the ‘GPS corrected’ wind speed and direction (WindSpeedGPSCorrected, WindDirectionGPSCorrected). This is true for periods where the vehicle was in motion and for periods when the vehicle was stopped.

Temperature and Moisture Parameters

Two temperatures are recorded, one from the HMP45C instrument (TemperatureHMP45) and one from the 44212 instrument (Temperature44212). The HMP45C temperature is measured within the protective membrane that contains the humidity sensor, so the response time is slow. Therefore, this is known as the ‘slow’ temperature. It should not be used on its own but should be combined with the HMP45C relative humidity (RelHumidityHMP45) to calculate a dew point temperature (DewPointHMP45).

Since the protective membrane allows water molecules to pass quasi-freely through it, the dew point temperature is safely assumed to be the same on both side of the membrane. Therefore, there are two volumes of air – one inside the membrane and one outside – each with their own temperature and relative humidity, but both having the same dew point temperature (i.e., DewPointHMP45).

Since the dew point of the air outside of the membrane is known, it can be combined with the ‘fast’ temperature from the 44212 instrument outside of the membrane (Temperature44212) to obtain a relative humidity of air outside the membrane (RelHumidity44212HMP45).

From there, mixing ratio can be calculated using the ‘slow’ temperature and relative humidity from the HMP45C, or using the ‘fast’ temperature and derived relative humidity. The latter is used for the data in the archive (MixingRatio).

Potential temperature calculations use the ‘fast’ temperature, and the equivalent and virtual potential temperature calculations also use the derived relative humidity. The resulting potential temperatures (Theta, ThetaE, ThetaV) are recorded in the archive.

Quality Control

For the archived parameters, each data sample is followed by an associated data quality flag. The following flags are used (following the NARSTO flagging protocol):

V0 – valid datum
V2 – valid datum modified by quality controller
M1 – missing datum
M2 – datum invalidated by the quality controller
M3 – wind datum invalidated due to significant vehicle acceleration / deceleration

V0 and V2 data can be used without reservations. M2 and M3 data have been invalidated and should not be used without the consent of the data originator.

M2 data have been invalidated for a variety of reasons, including:

- a malfunctioning instrument
- poor GPS reception
- wind processing errors
- poor quality sampling location

M3 data were invalidated when the vehicle either changed speed by more than 2 km/h in 1 sec or changed orientation by more than 20 degrees in 1 sec. Such sudden changes often resulted in wind processing errors.

4.0 DATA FORMAT:

All files are saved as comma delimited ASCII files with a .dat extension.

Parameters (with units) included in data sets:

Logger Time Variables

Year(YY), Month(MM), Day(DD), Hour(hh), Min(mm), Sec(ss)

Other Quality Control Flagged Parameters (with units)

GPSTime(HHMMSS), GPSLongitudedec(Decimal Degrees), GPSLatitudedec(Decimal Degrees), GPSAltitude(m), GPSSpeedKPH(km/h), GPSSatellites(#), GPSDirectionTrue(degrees true), GPSDirectionMagnetic(degrees), CompassHeading(degrees), WindSpeedRaw(m/s), WindDirectionUncorrected(degrees), WindSpeedGPSCorrected(m/s), WindDirectionGPSCorrected(degrees true), TemperatureHMP45(C), RelHumidityHMP45(%), Temperature44212(C), DewPointHMP45(C), RelHumidity44212HMP45(%), BaroPressure(hPa), MixingRatio(g/kg), Theta(K), ThetaE(K), ThetaV(K)

5.0 DATA REMARKS:

There are no known data quality issues aside from those flagged.

The data files can be viewed using any text editor.

2009 and 2010 data have been uploaded to the data catalogue.

Related photographs and some dash-cam video are also available - contact David.Sills@ec.gc.ca.

6.0 REFERENCES:

None.

Last updated 21 Dec 2011