4 June 2012 West Texas DC3 case

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Overview:

This dataset includes data over the region of interest from three platforms in support of a DC3 study of charge polarity including:

1) West Texas Mesonet (mesonet.csv)
2) West Texas Lightning Mapping Array (WTLMA) (LYLOUT_YYMMDD_HHMMSS_0600.dat.flash.h5 files)
3) Weather Research and Forecasting ensemble output subset over region (YYMMDD_HHMMSS_memNN.nc).

Region of interest: Lat: 32° – 35° Lon: -104° – -99°

The time period covered includes 2012/06/04 12:00:00 UTC to 2012/06/05 03:50:00 UTC

- Mesonet observations from 1500 UTC to 0100 UTC surrounding the time period of storm initiation
- WTLMA from 1800 UTC from 0300 UTC covering the period of storm activity
- WRF ensemble files at 1200 UTC and 0000 UTC for observation comparison and hourly 1800 UTC-2100 UTC output for convective environments. Additionally accumulated rainfall totals from ensemble members are provided at 1800 and 1900 UTC in *rainnc.nc files

West Texas Mesonet Observations:

The West Texas Mesonet Observations during the period of interest are provided in a .csv file by time with headers of observation type. The lat/lon of each observation is listed in the file. Observations are provided at 5 minute intervals including relative humidity (%) and temperature (C) at 1.5 m height, gust speed, scalar wind speed, vector wind speed and standard deviation (m/s) and direction and standard deviation (degrees) at 10 m height. Wind speed is also provided at a 2 m height and temperature at 2 m and 9 m. Also provided are dew point temperature (C), sea level pressure (hPa), station pressure (hPa), equivalent potential temperature (K), 10-m u- and v-component winds (m/s).

The West Texas Mesonet is supported by Texas Tech University and the National Wind Institute. Details on the measurement platforms and current information can be found at http://www.depts.ttu.edu/nwi/research/facilities/wtm/index.php. Scripts used for reading the raw data to create the included csv and for plotting the data can be found at https://github.com/vbalderdash/wtx_mesonet

WTLMA Observations:

Files include VHF sources and flash groups at ten minute intervals.
WTLMA array is centered at 33.606968, -101.822625, 984.00

Sampling frequency: 80 μs

More information on the network and current data can be found at: http://pogo.tosm.ttu.edu/about/

Network operation and specifications:

> Thomas, R. J., P. R. Krehbiel, W. Rison, S. J. Hunyady, W. P. Winn, T. Hamlin, and J. Harlin(2004), Accuracy of the Lightning Mapping Array, J. Geophys. Res., 109, D14207, doi:10.1029/2004JD004549.
>
> Chmielewski, V. C., and E. C. Bruning (2016), Lightning Mapping Array flash detection performance with variable receiver thresholds, J. Geophys. Res. Atmos., 121, 8600–8614, doi:10.1002/2016JD025159.

Flash clustering:

> Fuchs, B. R., E. C. Bruning, S. A. Rutledge, L. D. Carey, P. R. Krehbiel, and W. Rison (2016), Climatological analyses of LMA data with an open-source lightning flash-clustering algorithm, J. Geophys. Res. Atmos., 121, 8625–8648, doi: 10.1002/2015JD024663.

File format:
- H5 files with 'events' (VHF sources) and grouped 'flashes'
- Each event has lat/lon/alt/time (UTC), assigned charge where negative (positive) values refer to positive (negative) leaders traveling into negative (positive) charge, reduced chi-squared for quality control, flash ID number if event belongs to a grouped flash (single points will each have a unique number), station mask which codes the stations contributing (see the "header" metadata attached to the events table for the station mask bit order), source power (dBW) and number of stations contributing
- Each flash has an associated center point, duration, area, initiation location and number of events (sources) within the flash

WRF V3.5.1 Ensemble files:

NetCDF format files containing model output from 50 member ensemble parsed down to standard meteorological variables and mixing ratios over the region of interest

Model Setup:
- 4 km grid spacing, 38-eta levels
- Parameters used in simulation:
  - Thompson microphysics
  - RRTM longwave radiation
  - Dudhia shortwave radiation
  - MM5 Monin-Obukhov surface later
  - Unified Noah land-surface model
  - YSU planetary boundary layer scheme
  - No cumulus parameterization
- Data assimilated every 6 hours from 0600 UTC on 2 June to 0600 UTC on 4 June using the DART (Data Assimilation Research Testbed) ensemble adjustment Kalman filter technique
  - Meteorological Terminal Aviation Routine

  - Mesonet
  - Marine
  - Cloud Track Winds
  - Aircraft Communications Addressing and Reporting System
  - Rawinsonde Observations
- Forecast period began at 0600 UTC 4 June 2012

Output files:
- Include cloud water, ice, graupel, rain, snow and vapor mixing ratios (g/kg), estimated 10 cm reflectivity values (dBZ), temperature (K), potential temperature 'p temperature' (K), pressure (hPa), dew point (C), Geopotential height (m), and u-, v-, w- component winds (m/s) at given lat/lon grid points
- rainnc files contain accumulated rainfall up to the listed time (mm)

More information
The real-time Texas Tech WRF and ensemble this was directly modeled after can be found at http://www.atmo.ttu.edu/bancell/real_time_WRF/TTUWRF-about.html

Ancell, B.C., E. Kashawlic, and J.L. Schroeder, 2015: Evaluation of Wind Forecasts and Observation Impacts from Variational and Ensemble Data Assimilation for Wind Energy Applications. Mon. Wea. Rev., 143, 3230–3245, https://doi.org/10.1175/MWR-D-15-0001.1