MISS Wind Profiler Data for PLOWS Feb-Mar 2009

This readme discusses wind profiler data collected with the NCAR/EOL MISS system for the PLOWS program.

MISS is the Mobile Integrated Sounding System and consists of a heavy 20-foot trailer towed around by a large pick-up truck. The primary instruments on MISS for PLOWS were the UHF wind profiler and a radiosonde balloon-borne sounding system known as GAUS (GPS Advanced Upper-Air Sounding System). There also was a surface weather sensor. The site locations are listed below. MISS was powered from a generator so operation was not continuous during PLOWS.

The MISS wind profiler is a standard Radian (now Vaisala) LAP-3000 915-MHz boundary layer radar. The radar detects scattering from precipitation and from clear-air refractivity gradients (such as those due to turbulence and inversions). The strength of the scattering (reflectivity) and thus ability to measure wind is a complicated function of temperature, humidity, turbulence, precipitation, and the presence of unwanted signals (radio interference, clutter echoes from trees, power lines, birds, etc). Typically for PLOWS the altitude range was from about 200 meters up to around 1 – 2 km in clear-air, and up to around 4 km during precipitation.

The profiler uses the standard DBS (Doppler Beam Swinging) technique to measure winds. Raw Doppler spectra data were recorded every 30 seconds as the radar antenna was steered along five beam directions. Winds were calculated from spectral moments averaged over 30 minutes. The raw spectra and moments were saved so it is possible to reprocess the data for shorter (or longer) periods, however wind estimates at periods shorter than ten minutes may have significant errors due to inhomogeneities in the wind and the widely separated sampling volumes in the oblique beams.

The raw data on these systems is the standard NOAA/AL and Vaisala / Radian POP4 spectral data. This data was later reprocessed using the NCAR/RAL NIMA (NCAR Improved Moments Algorithm) which uses image processing and fuzzy logic techniques to analyze the spectral data and separate atmospheric echoes from unwanted signals such as radio interference and clutter. We generally find that NIMA processed wind measurements agree with radiosonde soundings to better than 1.5 m/s (standard deviation). NIMA also enables us to recover weak or noisy data, for example typically extending the range 100 to 300 meters. More information on NIMA is at http://www.ral.ucar.edu/technology/profiler/

The accompanying data files are of two types, wind measurements (files with extension ".winds_LO.nc"), and spectral moments data (extension "mom.nc"). Files nima.20090308.winds_LO.nc and nima.20090308.mom.nc are for March 8th, 2009. The winds data are generally at 30-minute intervals. The moments data are the zeroth, first, and second moments of signals from each 30-second dwell of the steered beam. These moments are the signal strength (here SNR or Signal to Noise Ratio which can be used to estimate reflectivity), Doppler shift (from which the winds are derived), and

spectral width (can be used to estimate turbulence with lots of caveats). We generally recommend that only experienced profiler users analyze the moment data.

The data files are in netCDF format. This is an advanced binary format with data self-descriptors widely used in the atmospheric research community. It was devised by UCAR/Unidata and is described further on their web site http://www.unidata.ucar.edu/content/software/netcdf/

The data is arranged in time, height coordinates. For winds (in the *.winds_LO.nc files) use variables wspd and wdir (wdir follows the meteorological convention, ie: the direction the wind comes from, measured clockwise in degrees from north). There is a confidence variable (eg, wind_conf), which describes the degree of confidence (0-1) that the NIMA algorithm places in the derived data. These variables have the same dimension as the wind data. Use only those data points for which corresponding confidence level exceeds the threshold confidence level. Usually we use a threshold confidence level of 0.5.

Other data files for the profiler are available on request. These include the raw POP spectral files, NIMA reprocessed spectral files (netCDF format), raw POP winds (ascii and netCDF), and raw POP moments (netCDF).

MISS plots, logs and other information can be accessed from the EOL project page: http://www.eol.ucar.edu/deployment/field-deployments/field-projects/plows/plows

Please contact Bill Brown (wbrown at ucar.edu or phone 303-497-8774) for more information.

MISS Sites:

Feb 23, 15 UT – Feb 24, 22 UT
Champaign Airport, IL
40° 2' 30" N, 88° 16' 5" W, 230 m
Tests

Feb 26, 18 UT - Feb 27, 01 UT
Tomah, WI
44° 1' 18" N, 90° 29' 36" W, 300 m
IOP 3

Feb 28, 20 UT – Mar 1, 21 UT
Champaign Airport, IL
40° 2' 24" N, 88° 16' 10" W, 230 m
Tests

Mar 7, 22 UT – Mar 9, 21 UT
Walcott, IA

41° 37' 6" N, 90° 47' 5" W, 245 m
IOP 4