IOP-1 Summary of Operations
10 February 2009, 0800 UTC – 12 February 2009 0000 UTC

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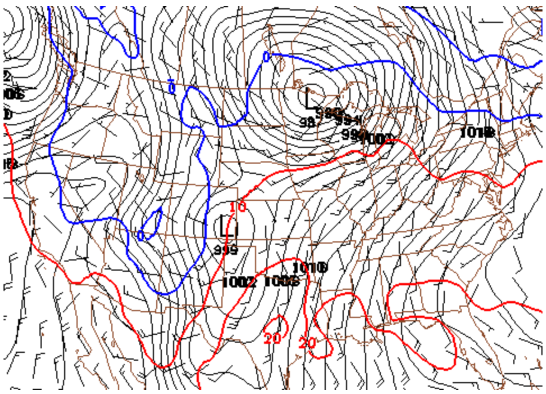
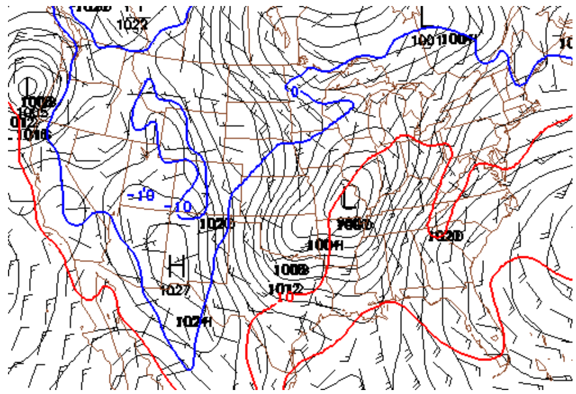
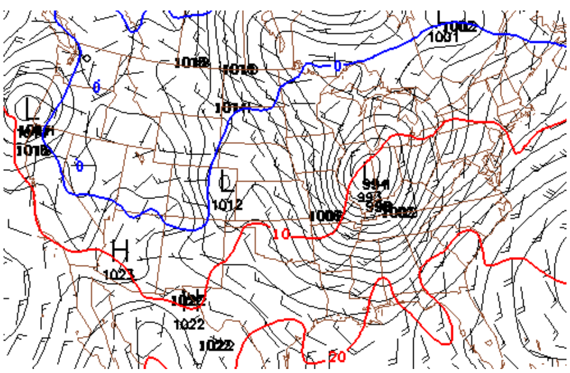
IOP-1 focused on a cyclone that developed in Southeast Colorado on 10 February at 1800 UTC, and tracked northeastward, with the central low pressure center passing over St. Louis, MO on Wednesday 11 February at 1200 UTC, Champaign, IL at 11 February 1800 UTC and Ft. Wayne IN at 12 February 0000 UTC. The cyclone had a large shield of warm frontal (WF) precipitation, a well defined dry slot (DS), and a large region of precipitation in the deformation zone (DZ) west of the dry slot. Relative to the cyclone, the site passed across the WF into the DS and then directly across the DZ. The forecast procedure for IOP-1 went quite well. The forecasters chose the best site and the correct deployment times.



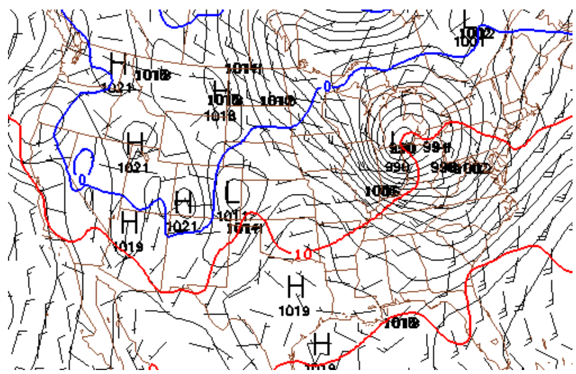
A. 10 Feb 09 1800 UTC Surf Pres/Temp



B. 11 Feb 09 1200 UTC Surf Press/Temp



C. 11 Feb 09 1800 UTC Surf Pres/Temp



D. 12 Feb 09 0000 UTC Surf Press/Temp

Figure 1A-D Evolution of surface cyclone during IOP-1 from 1800 UTC 10 Feb-0000 UTC 12 Feb 2009.

UAH departed Alabama at 10 February 1400 UTC. UI met the UAH team as they passed CMI. The MIPS, MAX, and UMR were deployed to the KLOT SSW site, arriving at the site at 11 February 0400 UTC. The UMR deployed to the Fairfield Inn site at 41° 29' 40.27'' N 88° 10' 6.08''W. The MIPS was initially deployed to the Channahon, IL site, but due to a malfunction of the MIPS generator, the MIPS was immediately redeployed to the MAX site at 41°17'31.50"N 88°13'33.50"W. No data was collected at Channahon, IL. Relative to KLOT, the MAX/MIPS site was 175 deg, 34.7 km.

Operations started at the MIPS/MAX site at 0900 UTC +/- 1 h. The MAX was up during the entire precipitation event, from 11 February 0800 UTC to 12 February 0000 UTC. Three scan types were used for the MAX during the event: VAD volume scans (elevations close to that of VCP 11), RHI scans (nominally normal to precipitation bands, in the sector 280°-330°), and vertically-pointing (moments only before 1900 UTC, time series thereafter to the end of the event). The 915 MHz profiler ran continuously through the event, as did other operating instruments (see below for instrument problems).

The WF rain shield moved over the site from north to south, with rain falling at the site from about 0800 UTC (Fig. 2) through about 1330 UTC (Fig. 3). At approximately 0840 UTC, a sharp mesoscale gravity wave was detected at the site with a 4 mb pressure fluctuation. The wave was clearly evident at the base of the descending precipitation shield in the 915 MhZ profiler W-field (Fig. 4) and to a lesser extent in the SNR field (Fig. 5).

At ~1330 UTC, the DS moved over the site and precipitation ceased. The site remained very close to the eastern edge of the precipitation shield of the DZ for several hours (Figs. 6, 7) as precipitation streamed northeastward just west of the site. During this time, MAX scans were restricted to VADs and RHIs to the NW toward the DZ. During this time, the DZ exhibited significant banding, with bands spaced ~ every 20 km. The bands had tops that extended nominally up to 6-7 km, about 1-2 km above the background stratiform rain. During the time the site was in the DS, the precipitation in the DZ developed and the echo shield wrapped southwestward.

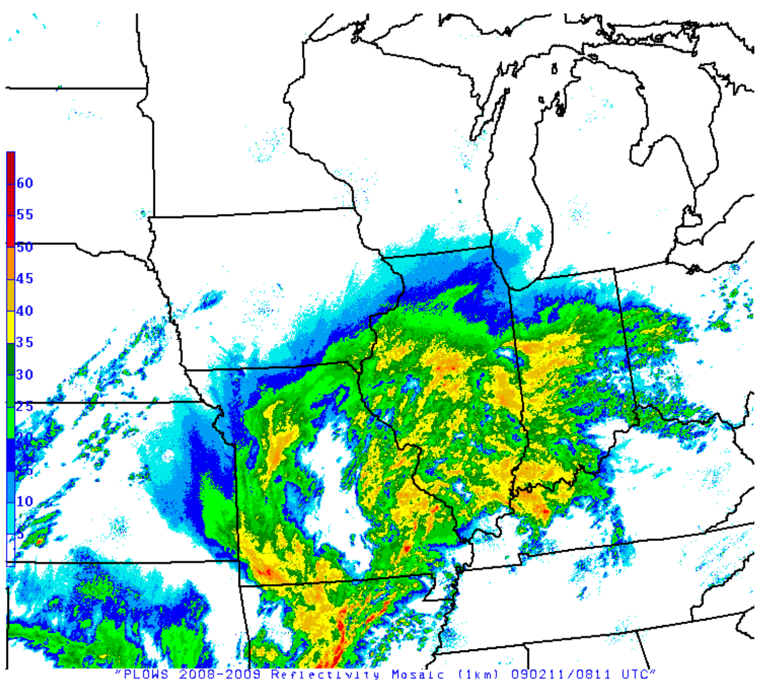


Figure 2: Composite reflectivity from WSR-88D radars at 0811 UTC

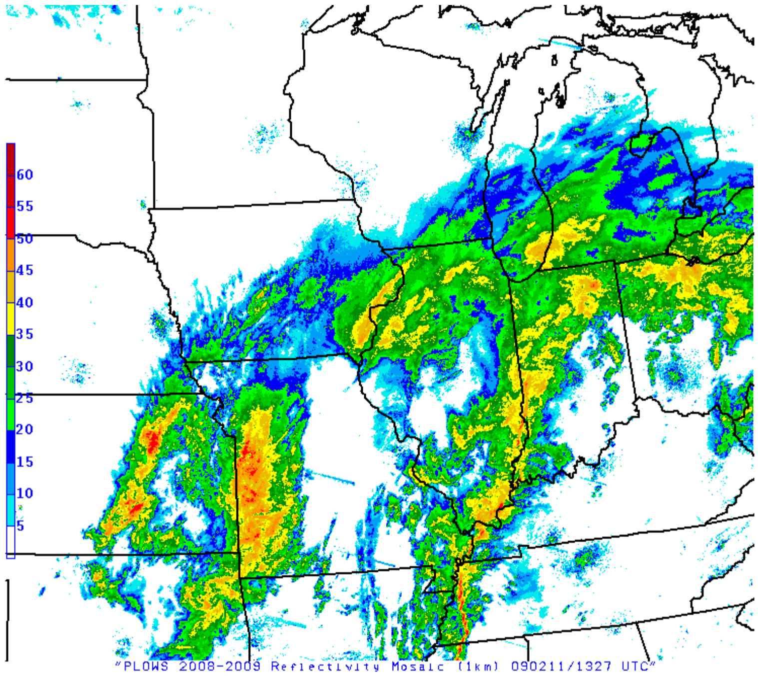


Figure 3: Composite reflectivity from WSR-88D radars at 1327 UTC

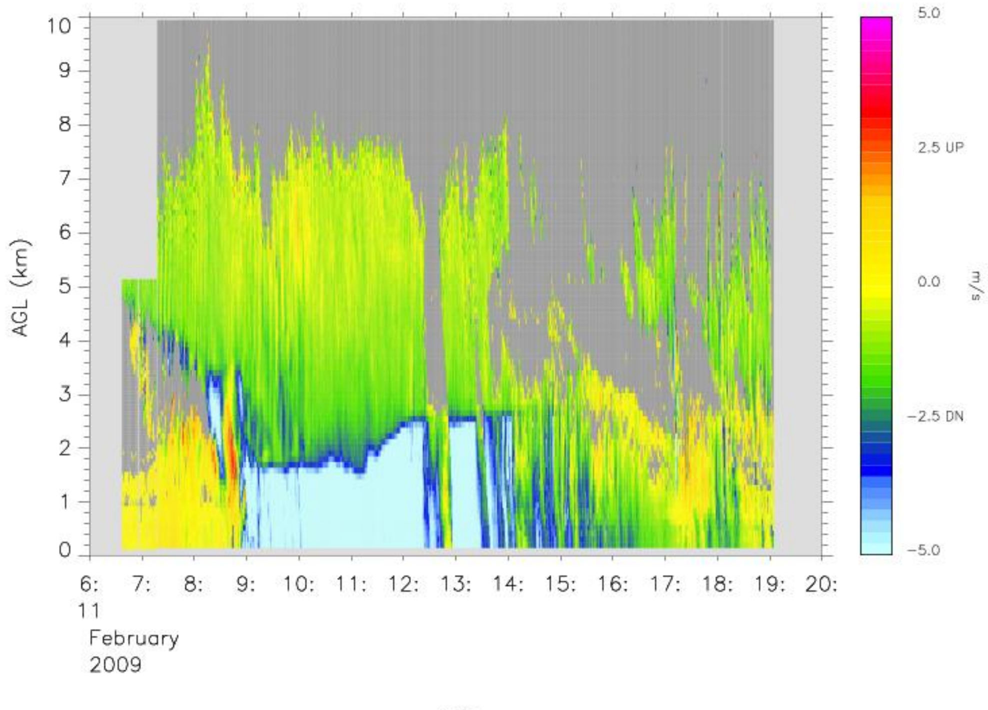


Figure 4: W-field from 0600-2000 UTC 11 Feb 09. Wave is at 0840 UTC.

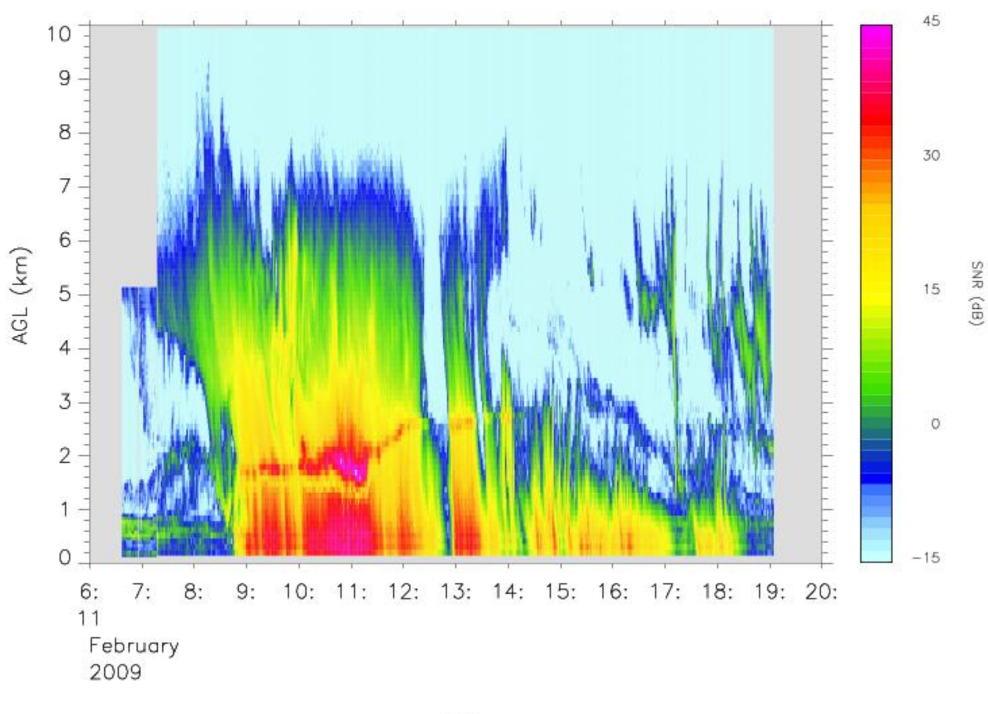


Figure 5: SNR field from 0600-2000 UTC 11 Feb 09

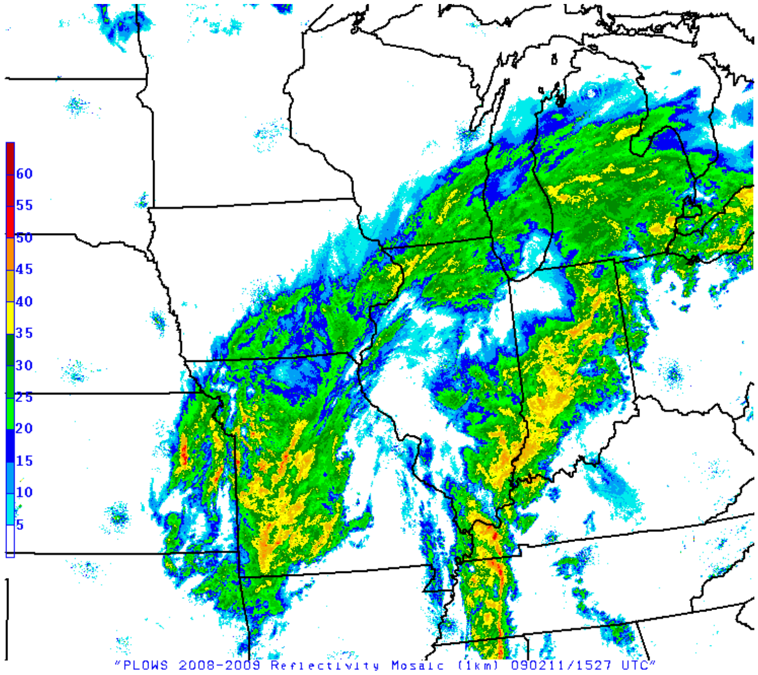


Figure 6: Composite reflectivity from WSR-88D radars at 1527 UTC

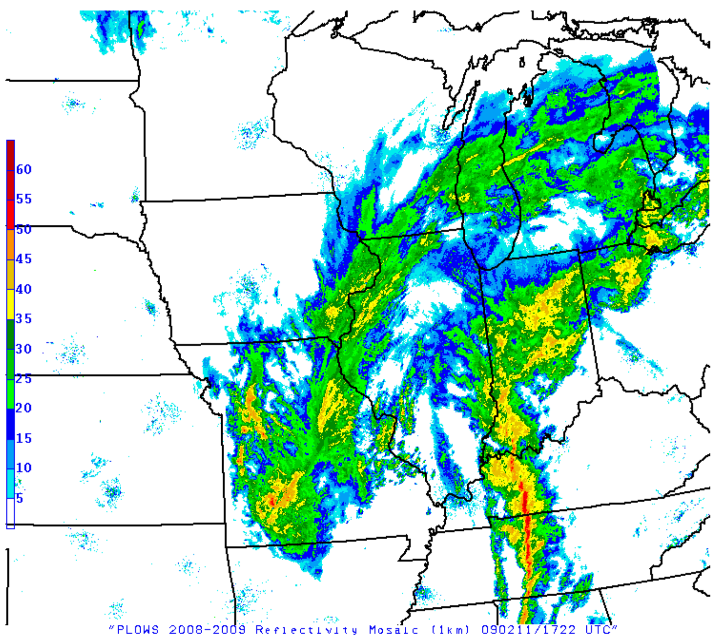


Figure 7: Composite reflectivity from WSR-88D radars at 1722 UTC

At ~1900 UTC (Fig. 8), the DZ started progressing eastward over the site. Steady rain, sometimes heavy, and strong winds were present during this period. Several bands passed over the site, the most notable at the western edge of the dry slot where vertical

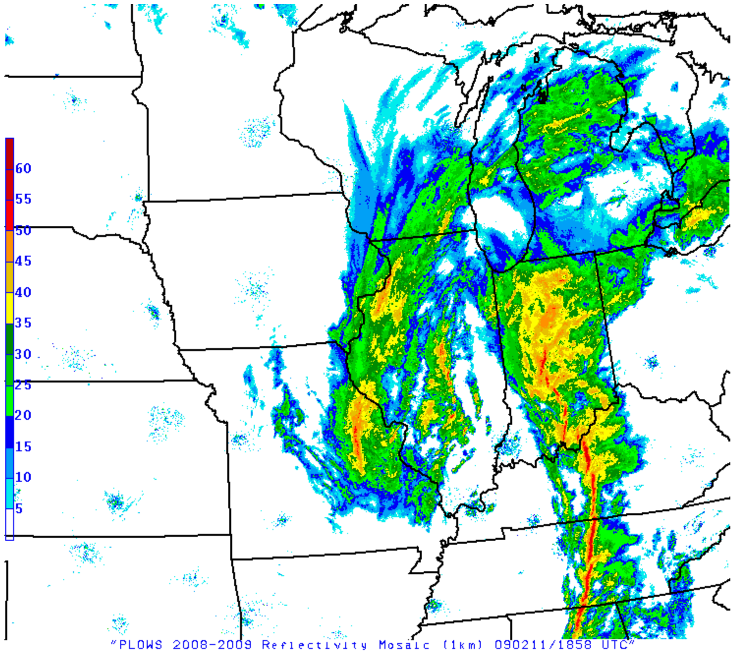


Figure 8: Composite reflectivity from WSR-88D radars at 1858 UTC

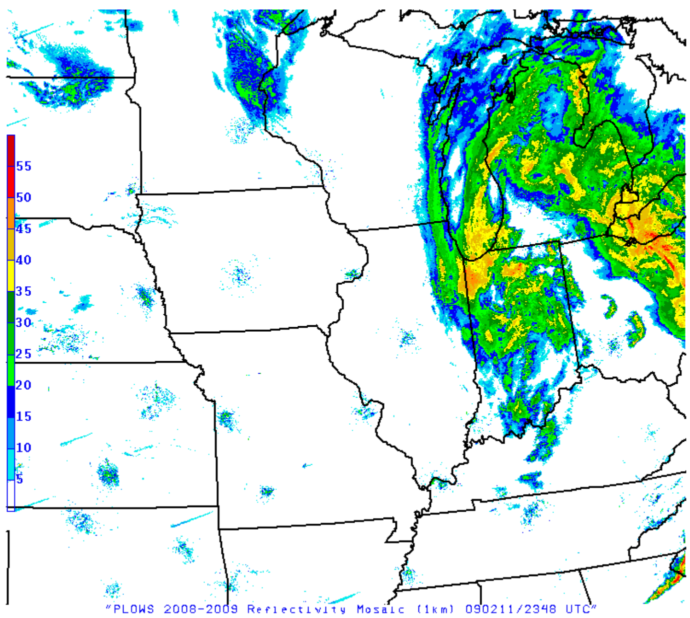


Figure 9: Composite reflectivity from WSR-88D radars at 2348 UTC

velocities exceeding 4 m/s were estimated and a distinct updraft/downdraft couplet was obvious in the 915 data. The DZ passed across the site in 5 hours (Fig. 9). During this time, the MAX was placed in time series mode, with pauses for RHIs every 15 minutes and VADs every 30 minutes. Bands were noted during the passage of the DZ over the site. A very narrow 400 km band was present at the back edge of the precipitation shield.

Although it lost some of its character as it passed over the site, it was still notable on the KLOT 88D.

The profiler record for the entire event appear below as Figs 10-13.

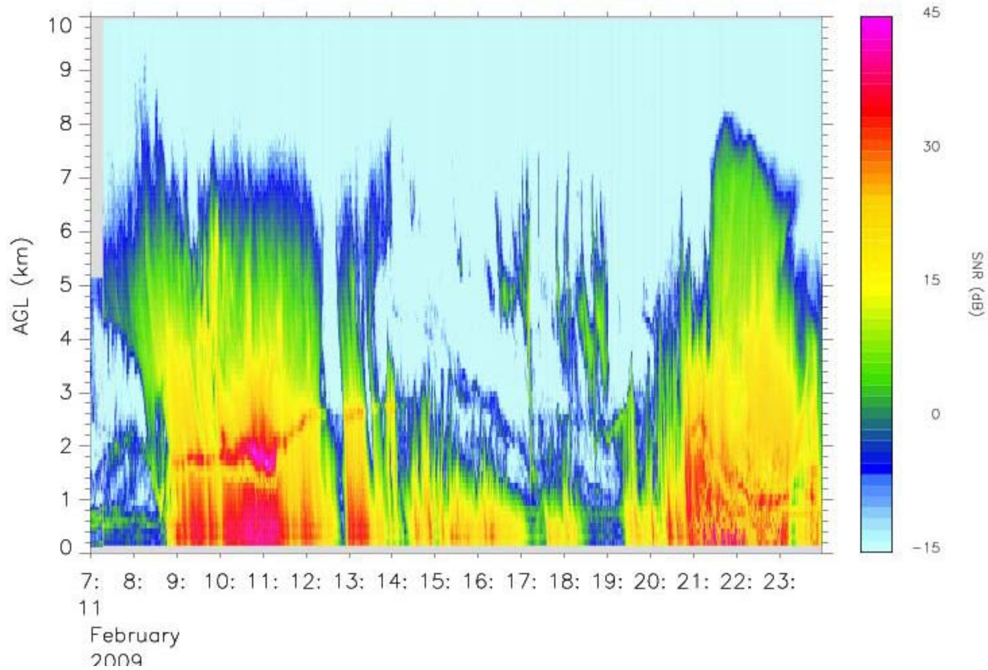


Figure 10 SNR from 0700 11 Feb 09-0000 12 Feb 09 from the 915 MhZ profiler

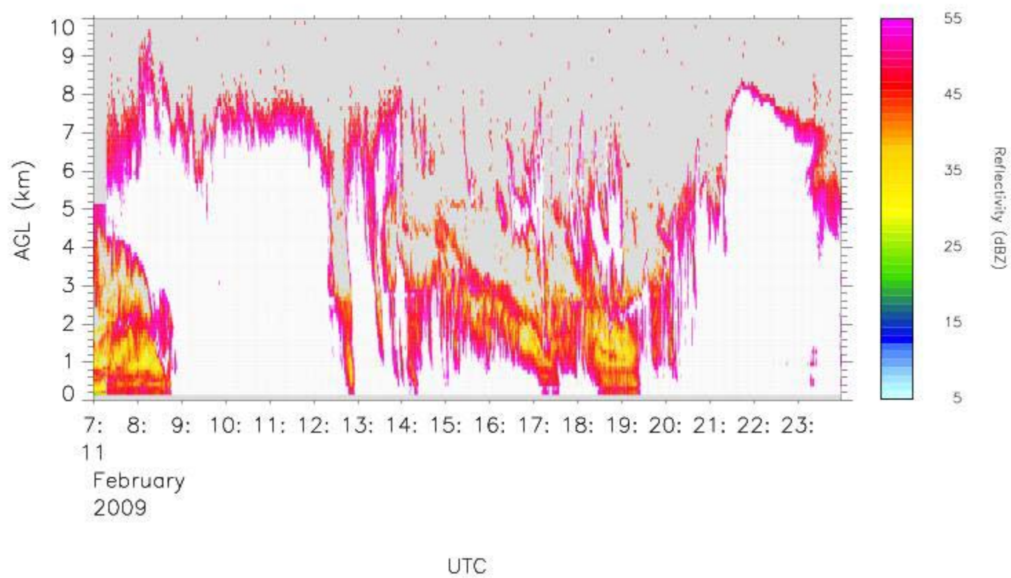


Figure 11 Reflectivity from 0700 11 Feb 09-0000 12 Feb 09 from the 915 MhZ profiler

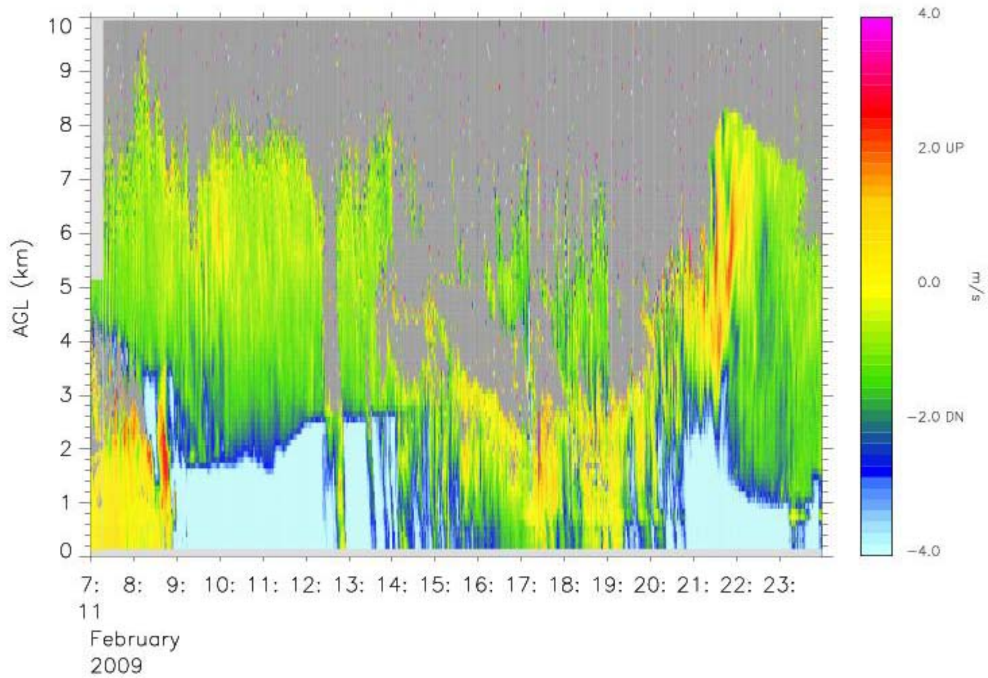


Figure 12: W-field from 0700 11 Feb 09 – 0000 12 Feb 09 from the 915 Mhz profiler

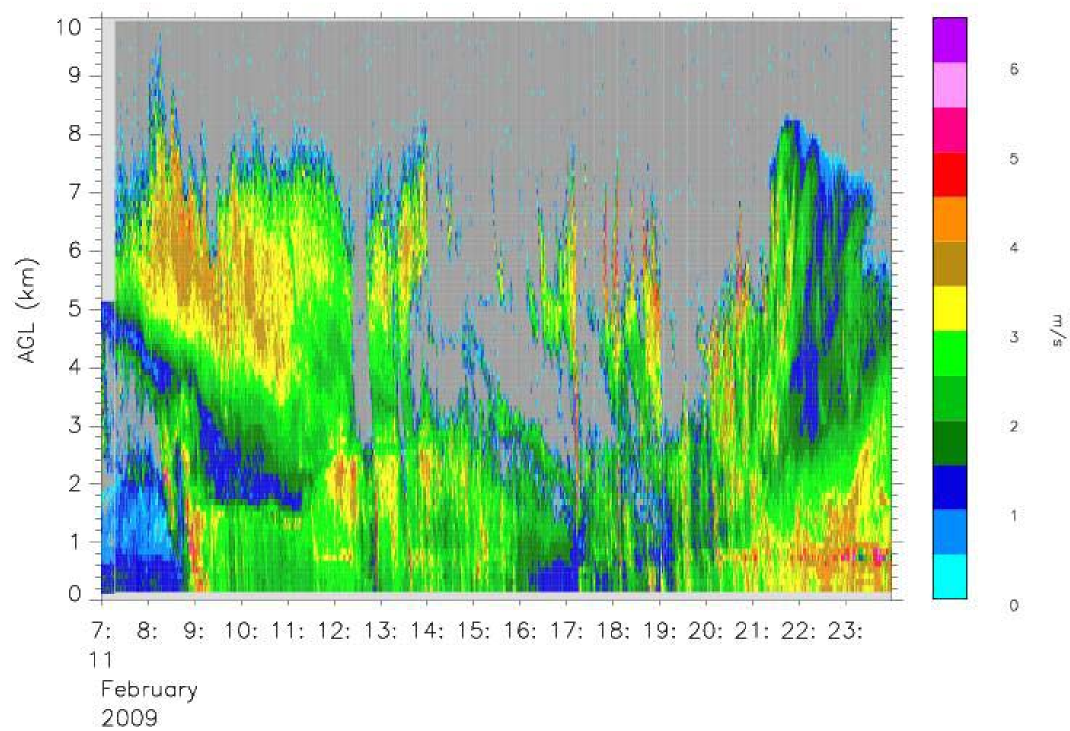


Figure 13: Spectral Width field from 0700 11 Feb 09 – 0000 12 Feb 09 from the 915 MhZ profiler

KEY ISSUES

1) Collocation of the MIPS/MAX was very useful since the MIPS X-band system was not yet available. It was decided that the MAX/MIPS co-location will be utilized in the forthcoming IOPs in the 2008-09 winter.

2) Blocking by hotel buildings caused loss of data during some UMR launches. Freezing of water just above the melting level also led to balloons breaking prematurely around the 700 mb level terminating some launches.

3) Setup was complicated at night for the collocated MIPS/MAX due to mud and the narrow road.

4) Teardown of the systems will be difficult in more wintery conditions due to the strong winds and freezing temperatures at the back edge of the system.

INSTRUMENTATION PROBLEMS

MIPS: The MIPS power source was the MAX 10 kW generator. One of the plugs was a GFI circuit, which tripped frequently, so it could not be used. This limited the power to one 30 A, 120 V line. This limitation precluded use of the ceilometer. The 915 MHz profiler and surface met instruments operated continuously during the event. The 915 data appear to be excellent, and ground clutter was very minor. There were some problems with the MPR, with data gaps of about 1 h during two time periods. The Parsivel also had dropouts due to some minor computer problems. Turbulence associated with the trailers may have affected the data collection. The hotplate experienced more frequent drop outs from COM problems.

MAX: Since this was a rain event, and the melting layer was near 1 km, attenuation limited the maximum range to 60-70 km at times, and reflectivity will need to be adjusted to account for attenuation, particularly at long range.

UM:

We need to reevaluate the sites to minimize blockage in the future. This may require a somewhat more remote hotel site.

ACTION ITEMS

UAH

Change hotplate location from van roof to surface, repair the MIPS generator, solve the problem with the serial to Ethernet converter (hot plate), repair the pump for the fuel tank on the generator trailer. Need voltage meter.

1. Fix mips generator (HSV)

2. Fix max transfer pump
3. Ck ceilometer (CMI)
4. Replace battery in mIPS van
5. Acquire two cards with serial ports (will fix the hotplate problem)
6. Change GFI plug on MAX generator
7. Image generation during deployments
8. Change oil in pedestal
9. Wire the magnetic compass on MAX
10. File the hole in disdrometer tripod
11. Static pressure head on MIPS (get from M3V)
12. Purchase another terabyte disk for data transfer
13. Data backup from IOP1
14. Need to check all sites to verify suffient area for MIPS, MAX and two vehicles. MAX is 30 ft long, MIPS is 50 ft; power trailer is 20 ft

UI

Need to evaluate new sounding sites closer to MAX/MIPS location
Need to identify workspace in CMI to repair equipment on MAX/MIPS trailers

UM

Need to contact InterMet technicians about several items:

1. Above ~200 mb, the laptop gives a "Buffer overrun" message and then terminates the software session. This may be related to a message that we see on starting up the software, that the IMetOS software is already running. Is there a PID file that needs to be killed somewhere in Windows?
2. GMT times stored in several of the raw data files continue to be off by an hour.
3. When converting to TTAA TTBB format, an anomalously warm level (+10C) is consistently generated at the 414-mb level.

UM radiosonde flights

<u>Launch History</u> - 11 launches, labeled A-K

A	-	05:37 a.m. CST	(terminated 684 mb)*
B	-	06:20 a.m. CST	(terminated 164 mb)
C	-	07:33 a.m. CST	(terminated 200 mb)
D	-	09:20 a.m. CST	(terminated 121 mb)
E	-	11:22 a.m. CST	(terminated 117 mb)
F	-	01:18 p.m. CST	(terminated 141 mb)
G	-	02:45 p.m. CST	(terminated 711 mb)*
H	-	03:09 p.m. CST	(terminated 731 mb)*

I	-	04:20 p.m. CST	(terminated 135 mb)**
J	-	05:52 p.m. CST	(terminated 145 mb)
K	-	07:15 p.m. CST	(terminated 146 mb)

* Terminated low / early.

** Temperatures were very erratic through ~400 mb level, then became smoother and more typical for that layer. Thermal probe ***may*** have been touched during launch phase.

<u>Some notes:</u>

- ***Initial*** latitude, longitude, and elevation from the UIUC surveys of the Marriott Inn/Hampton Inn in Joliet were as follows:
  - Latitude: 41.4945 N
  - Longitude: 88.1683 W
  - Elevation: 590' (determined from 1993 USGS topo map). This converts to 179.2 m MSL. GPS determination of the base station elevation (after GEOID correction) regularly came in at ~179.8 m.
- Times noted here were recorded as a matter of careful observation. We had noted previously that the GMT times stored in all of the files were off by an hour. These have been corrected in the data files, although the raw files have been retained as well. However, the files appended with a ".RTX" extension have the time straight from the laptop system which was/is correct, and needs no correction.
- Flight B - Heights may need to be adjusted. "Differential corrections" may not have been turned off in time. Still ,the heights seem to be just fine (buddy check and comparison with ILX).
- After flight B, "Differential Corrections" were turned off, and latitude, longitude, and elevation were fixed.
- Flight I – Did we have a bad temperature sensor or did the balloon encounter the bright band? Sensor may have been touched during launch.
- Several later flights (F, G, H, I ????) may have had a slightly elevated surface temperature. Davis weather station mounted to the Chevy Cobalt was parked just southeast of the parent vehicle (the cargo van w/the radiosonde system). Engine heat and opening and closing of cab door may have elevated the temperature by ~1C or so. We switched to the sling psychrometer for Flights J and K; problem solved.
- Flight G – balloon burst early, 1-2 minutes into flight.
- Flight H – vanished several minutes into flight. Signal simply dropped out. No sign of trouble. Datastream just stopped.

Lessons learned:

- Need to have a clear line of sight between radiosonde and ground station antenna.
- Sonde often takes 2-3 minutes to "see" entire GPS satellite constellation. Be patient.
- Sondes seem to respond poorly to heavy rain (signal attenuation?).
- Improvements for future flights
    - Improve horizon visibility (leave the exact hotel site).
    - Find a better way to improve line of sight between sondes and antenna *AND* keep the sonde ~dry.