

**IOP-17 Summary of Operations
4 February 2010, 0000 UTC – 6 February 2010 1200 UTC**

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1. Summary of storm evolution

The IOP-17 storm exhibited a complicated evolution. Low pressure first developed east of the Mexican Plateau and moved eastward over the northern Gulf of Mexico. The initial weak low pressure was associated with the eastward propagation of a wide trough over the western United States and Mexico. During the morning of 4 February, as the low propagated eastward, a wide shield of precipitation developed to its north over the southeastern United States. A weaker, dissipating precipitation region extended northwest across Kansas and Nebraska. The storm slowly intensified and split into two low centers, the first over the Tennessee River Valley and the second over the Florida Panhandle. The low over Florida quickly propagated northward along the East Coast and intensified, while the second center of low pressure propagated northward over Kentucky and also intensified. On 5 February, a wide shield of precipitation extended to the north of these low pressure centers, from the East Coast westward into Illinois and Missouri, with a strong surface pressure gradient and winds across the entire region covered by precipitation. Much of the precipitation within this region was snow, with two feet falling in Washington D.C., and 4-7 inches in the area of the ground deployment just southwest of Indianapolis. IN. Logistics associated with flight timing were complicated for this event because prior activities locked us into a daytime flight schedule. At Peoria, snow or freezing rain was predicted to begin very close to 1330 UTC, 5 February. The timing of the storm and its predicted precipitation over the aircraft base at Peoria the next day left the possibility that departure from Peoria on 5 February might not be possible unless we lifted off no later than 1330 UTC. To depart at 1330 UTC on 5 Feb., and stay within crew duty day limitations, we were also locked into a takeoff no earlier or later than 1330 UTC on 4 February (if we wanted to get two flights into the storm). We decided to attempt two flights, the first on 4 February at 1330 UTC and the second on 5 February at 1300 UTC, hoping to beat the onset of precipitation in Peoria. The ground equipment was placed in Indiana to coordinate with the second flight. The first flight sampled the cloud shield early, prior to the development of significant a strong low pressure center. Unfortunately, freezing precipitation developed over Peoria before 1330 UTC on 5 February, preventing takeoff of the second flight.

2. Locations of instrumentation platforms

MIPS Location:	39° 24' 16.40" N 86° 26' 07.19" W
MIPS time of operation	0320 UTC 5 Feb 10 to 1200 UTC 6 Feb 10
MAX Location:	-86.599788 39° 32' 34.78" N 86° 35' 59.24" W
MAX time of operation	1300 UTC 5 Feb 10 to 0200 UTC 6 Feb 10
MISS Location:	39°28'55.5"N, 86° 1'10"W
Profiler Time of Operation	0230 UTC 5 Feb 10 to 1700 UTC 06 Feb 10
UM Location:	Not used-sounding system inoperable
RF-09 Flight operations:	4 Feb 10 1341 to 2126 UTC

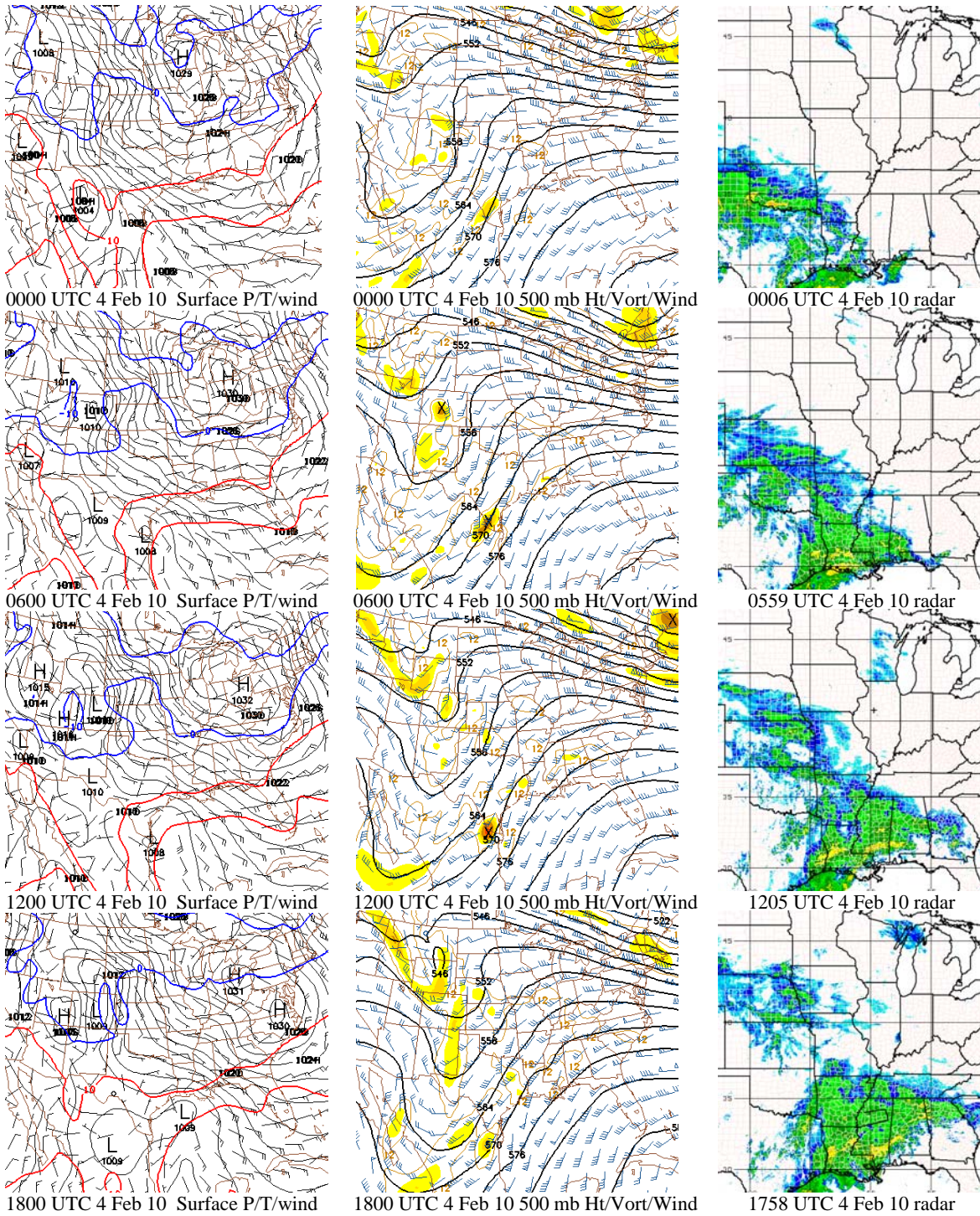


Figure 1: Evolution of the IOP-17 storm at the surface, 500 mb, and radar echoes from 0000 UTC 4 Feb 10 through 1800 UTC 4 Feb 10.

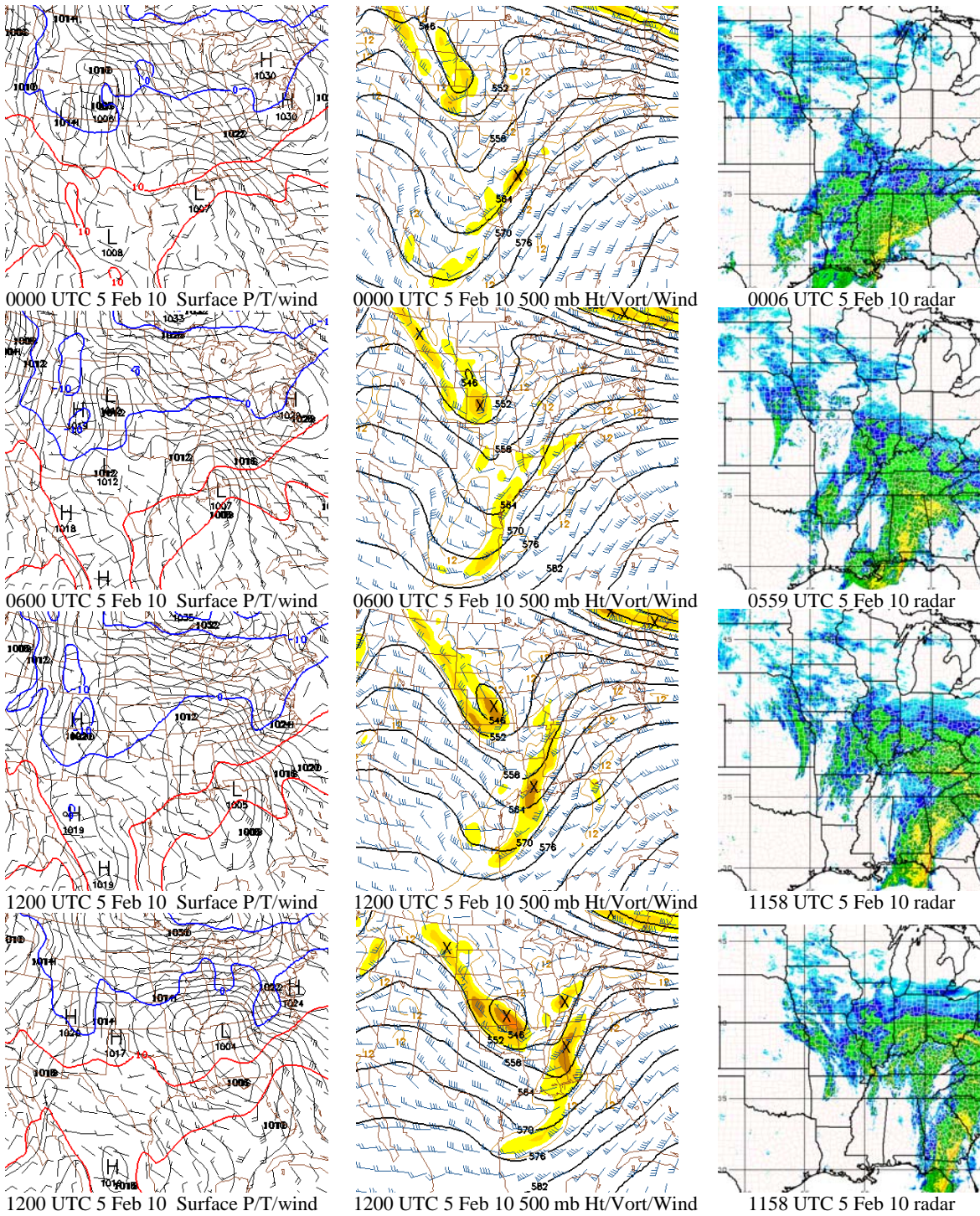


Figure 2: Evolution of the IOP-17 storm at the surface, 500 mb, and radar echoes from 0000 UTC 5 Feb 10 through 1800 UTC 5 Feb 10.

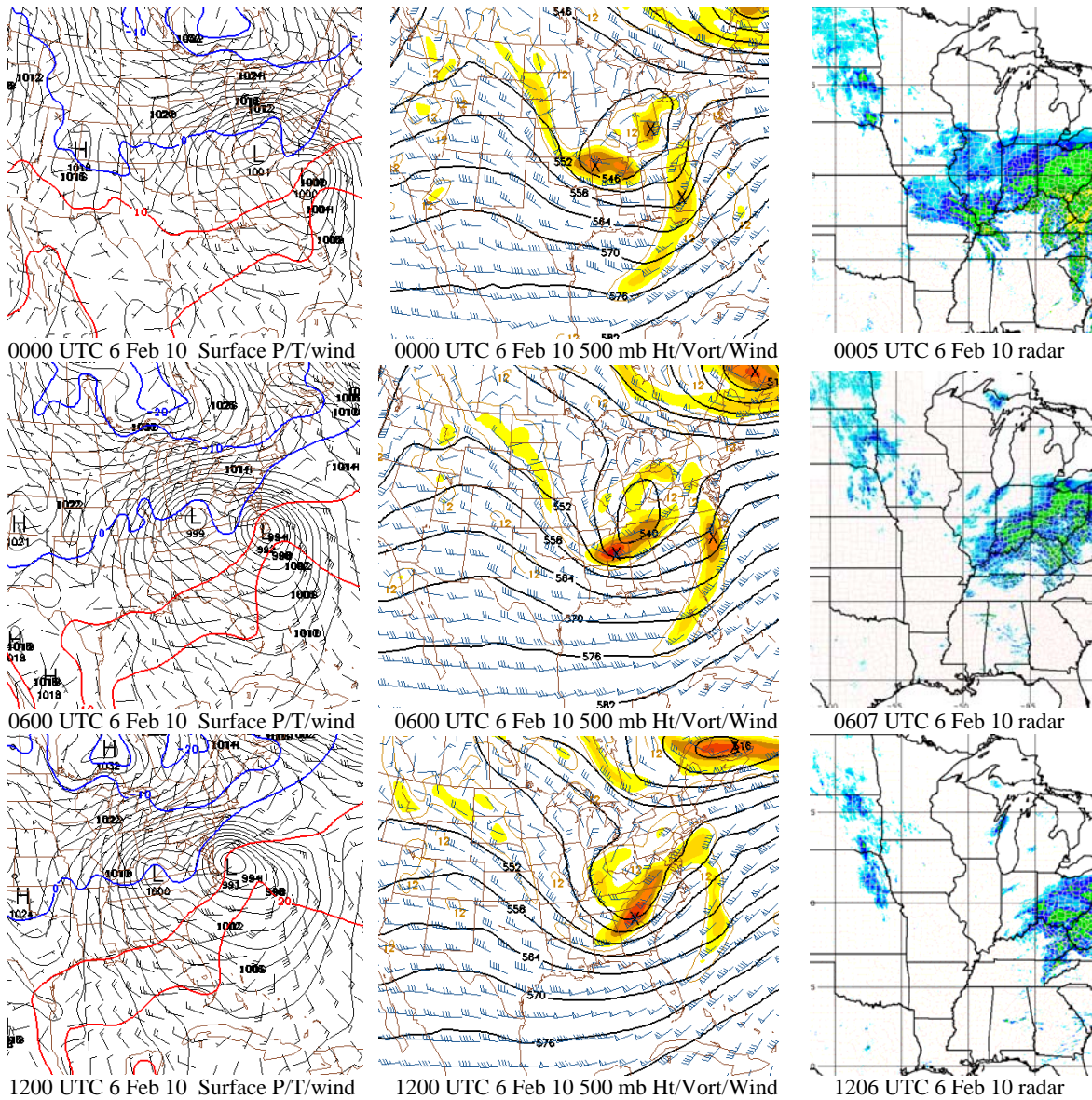
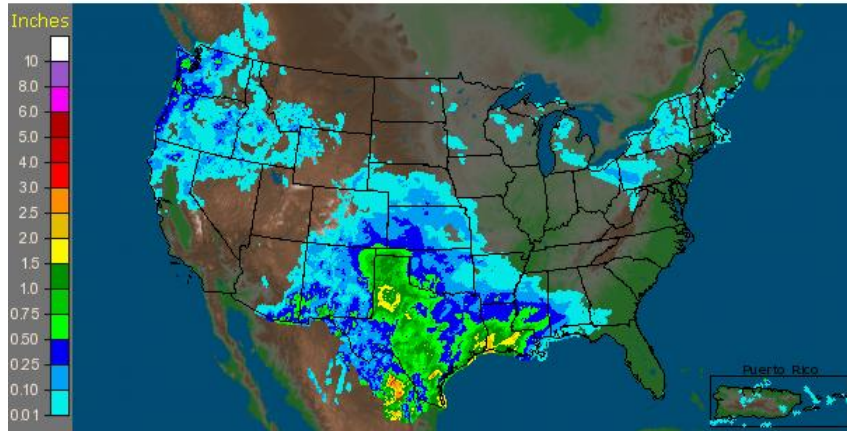


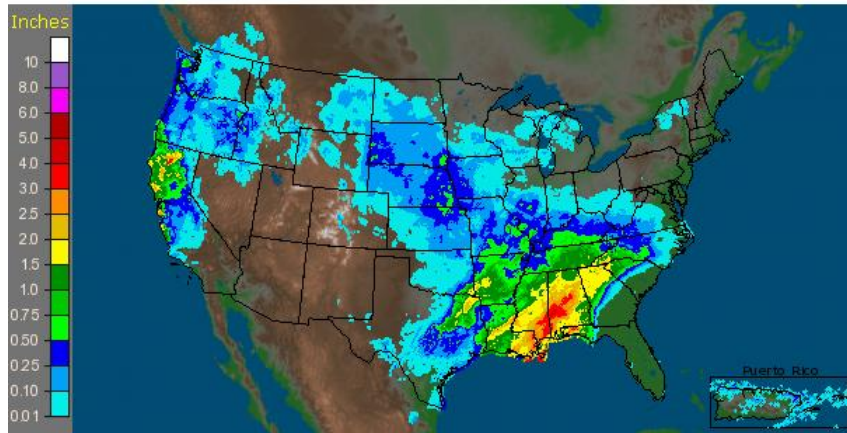
Figure 3: Evolution of the IOP-17 storm at the surface, 500 mb, and radar echoes from 0000 UTC 6 Feb 10 through 1200 UTC 6 Feb 10.

3. Precipitation over research area

CONUS + Puerto Rico: 2/4/2010 1-Day Observed Precipitation
Valid at 2/4/2010 1200 UTC- Created 2/6/10 11:31 UTC



CONUS + Puerto Rico: 2/5/2010 1-Day Observed Precipitation
Valid at 2/5/2010 1200 UTC- Created 2/7/10 11:31 UTC



CONUS + Puerto Rico: 2/6/2010 1-Day Observed Precipitation
Valid at 2/6/2010 1200 UTC- Created 2/8/10 11:31 UTC

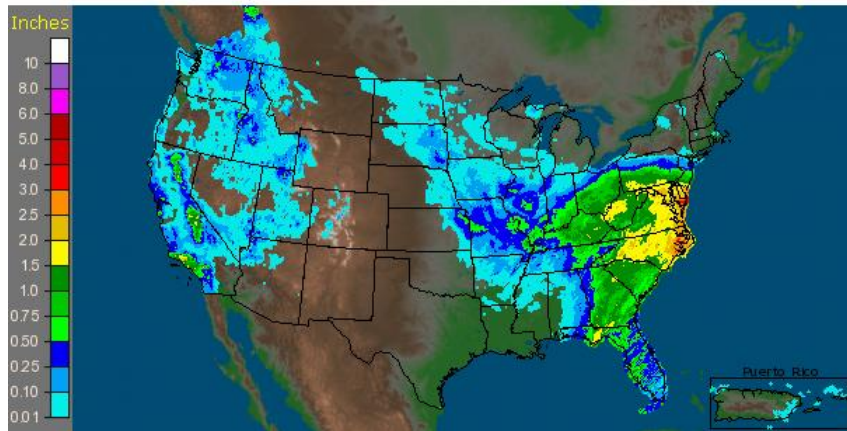
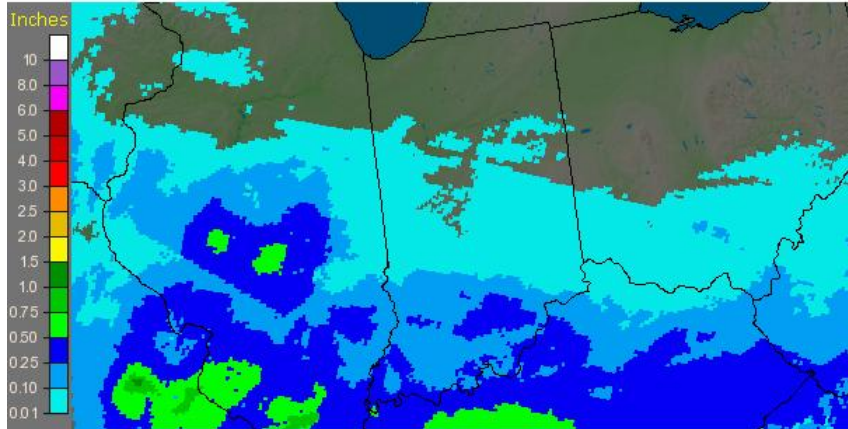


Fig. 4: 24 Hour precipitation ending at 1200 UTC 02/05/10, 1200 UTC 02/06/10, and 1200 UTC 02/07/2010 over the United States

Indiana: 2/5/2010 1-Day Observed Precipitation
Valid at 2/5/2010 1200 UTC- Created 2/7/10 11:32 UTC



Indiana: 2/6/2010 1-Day Observed Precipitation
Valid at 2/6/2010 1200 UTC- Created 2/8/10 11:32 UTC

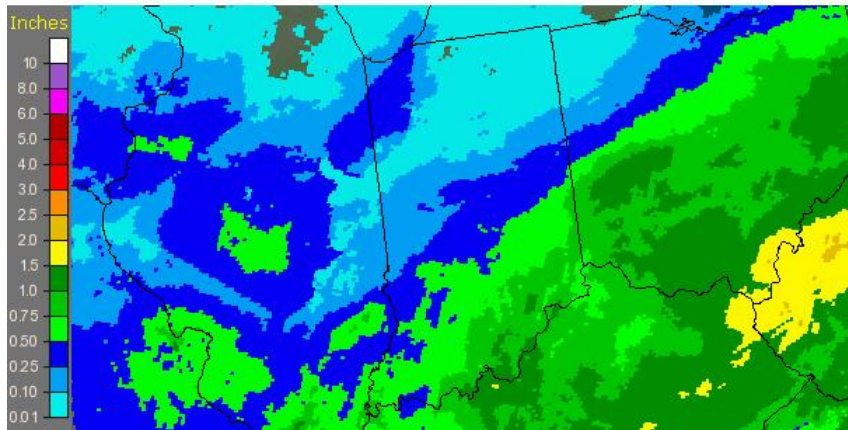


Fig. 5: 24 Hour precipitation ending at 1200 UTC 02/05/10, and 1200 UTC 02/06/10 over Indiana.

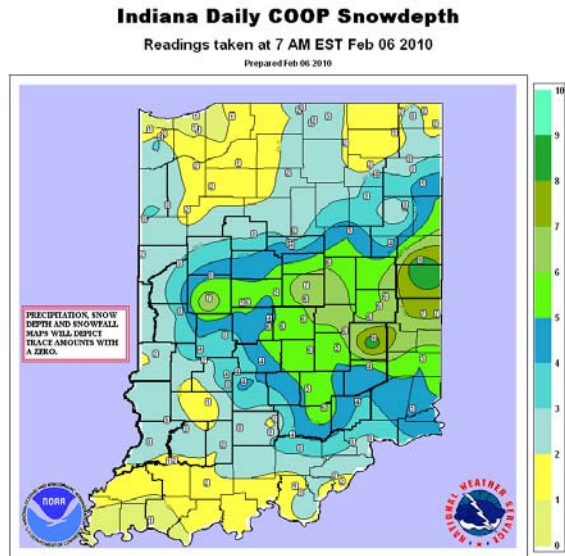
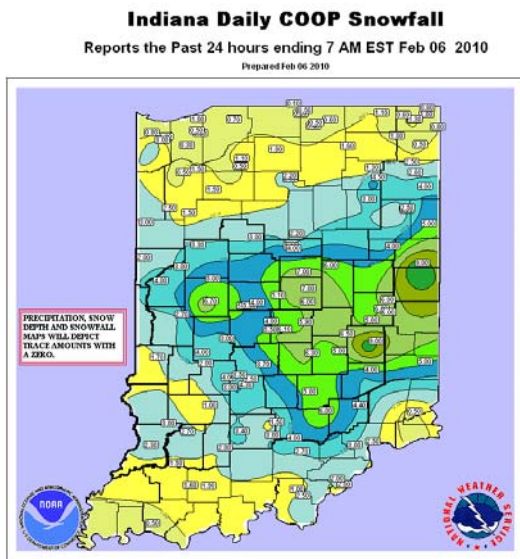


Fig. 6: one day and storm total snowfall in Indiana for the IOP-17 cyclone

Storm total snowfall reported by news organization

These totals are preliminary. Indianapolis got six inches by Saturday morning. On Friday, 5.3 inches fell in Indianapolis, breaking a 1908 record of 3.6 inches for that day.

Alexandria: 8.5
Atlanta: 7
Avon: 5.8
Bedford: 2
Brownsburg: 6
Columbus: 3.5
Crawfordsville: 4
Economy: 12
Fishers: 6
Fountain City: 9
Frankfort: 8
Franklin: 6.5
Indianapolis: 6

Jamestown: 5.5
Kokomo: 4
Lafayette: 5
Marion: 6
Muncie: 9.5
New Whiteland: 8.5
Noblesville: 7
Portland: 5
Rushville: 6.5
Seymour: 6
Spencer: 4
Parts of Wayne County: 10

Snowfall reports received at NWS in Indianapolis:

SNOW REPORTS LISTED BY AMOUNT

INCHES	LOCATION	ST COUNTY	TIME
9.50	5 N MUNCIE	IN DELAWARE	0225 AM
9.00	RUSHVILLE	IN RUSH	0730 AM
9.00	3 SSE RIDGEVILLE	IN RANDOLPH	0700 AM
8.50	NEW WHITELAND	IN JOHNSON	0708 AM
8.50	2 S ALEXANDRIA	IN MADISON	1125 PM
8.40	MCCORDSVILLE	IN HANCOCK	0826 AM
8.00	STRAUGHN	IN HENRY	1029 PM
7.50	6 S INDIANAPOLIS	IN MARION	0800 AM
7.00	NOBLESVILLE	IN HAMILTON	0746 AM
7.00	4 N INDIANAPOLIS	IN MARION	0700 AM
7.00	4 WNW ATLANTA	IN TIPTON	0530 AM
6.70	6 SE CRAWFORDSVILLE	IN MONTGOMERY	0700 AM
6.50	4 N ZIONSVILLE	IN BOONE	0800 AM
6.50	MORRISTOWN	IN SHELBY	0700 AM
6.10	6 SSW SPEEDWAY	IN MARION	0700 AM
6.00	SEYMOUR	IN JACKSON	0715 AM
6.00	4 SSE NEW CASTLE	IN HENRY	0700 AM
6.00	2 SW NEW CASTLE	IN HENRY	0700 AM
6.00	FRANKFORT	IN CLINTON	1003 PM
5.70	1 NNW AVON	IN HENDRICKS	0700 AM
5.00	8 WSW COLUMBUS	IN BARTHOLOMEW	0700 AM
5.00	LAFAYETTE	IN TIPPECANOE	1003 PM
4.60	2 S LAFAYETTE	IN TIPPECANOE	0700 AM
4.40	1 ENE BROOKLYN	IN MORGAN	0820 AM
4.40	2 NE NORTH VERNON	IN JENNINGS	0730 AM
4.30	6 WNW BLOOMINGTON	IN MONROE	0800 AM
4.00	4 WNW PERRYSVILLE	IN VERMILLION	0900 AM
4.00	4 SW REELSVILLE	IN PUTNAM	0800 AM
4.00	SPENCER	IN BROWN	0700 AM
4.00	1 WNW COVINGTON	IN FOUNTAIN	0700 AM
4.00	4 SW KOKOMO	IN HOWARD	0515 AM
3.40	WILLIAMS	IN LAWRENCE	0700 AM
3.00	FREELANDVILLE	IN KNOX	0700 AM
3.00	FLORA	IN CARROLL	0700 AM
2.70	MARSHALL	IN PARKE	0700 AM
2.00	1 SW PENCE	IN WARREN	0905 AM
2.00	8 S SHOALS	IN MARTIN	0700 AM
1.90	5 WNW GRAYSVILLE	IN SULLIVAN	0700 AM
1.70	TERRE HAUTE	IN VIGO	0920 AM

4. Flight Summary

Flight RF-09 focused on the cloud shield north of the weak low pressure center over the Southeast United States. This cloud shield was best characterized as warm frontal rather than the wrap around region of a well developed low. The warm front was evident across the Gulf Coast states. Forcing for this shield of precipitation was weak, and the clouds appeared mostly stratiform on the WCR during the flight. Because of the icing experienced in the previous storm, we took a more cautious approach to the flight track, orienting the flight legs parallel, rather than normal, to the developing dry slot over the Gulf. This essentially made the legs parallel rather than perpendicular to reflectivity enhancements that might be bands. Later in the flight we did run perpendicular legs, but not as far as the dry slot. Because of the warm temperatures in this storm, we were unable to descend very far to obtain microphysical profiles. The flight legs were limited to higher elevations.

C-130 Flight RF-07 Flight track

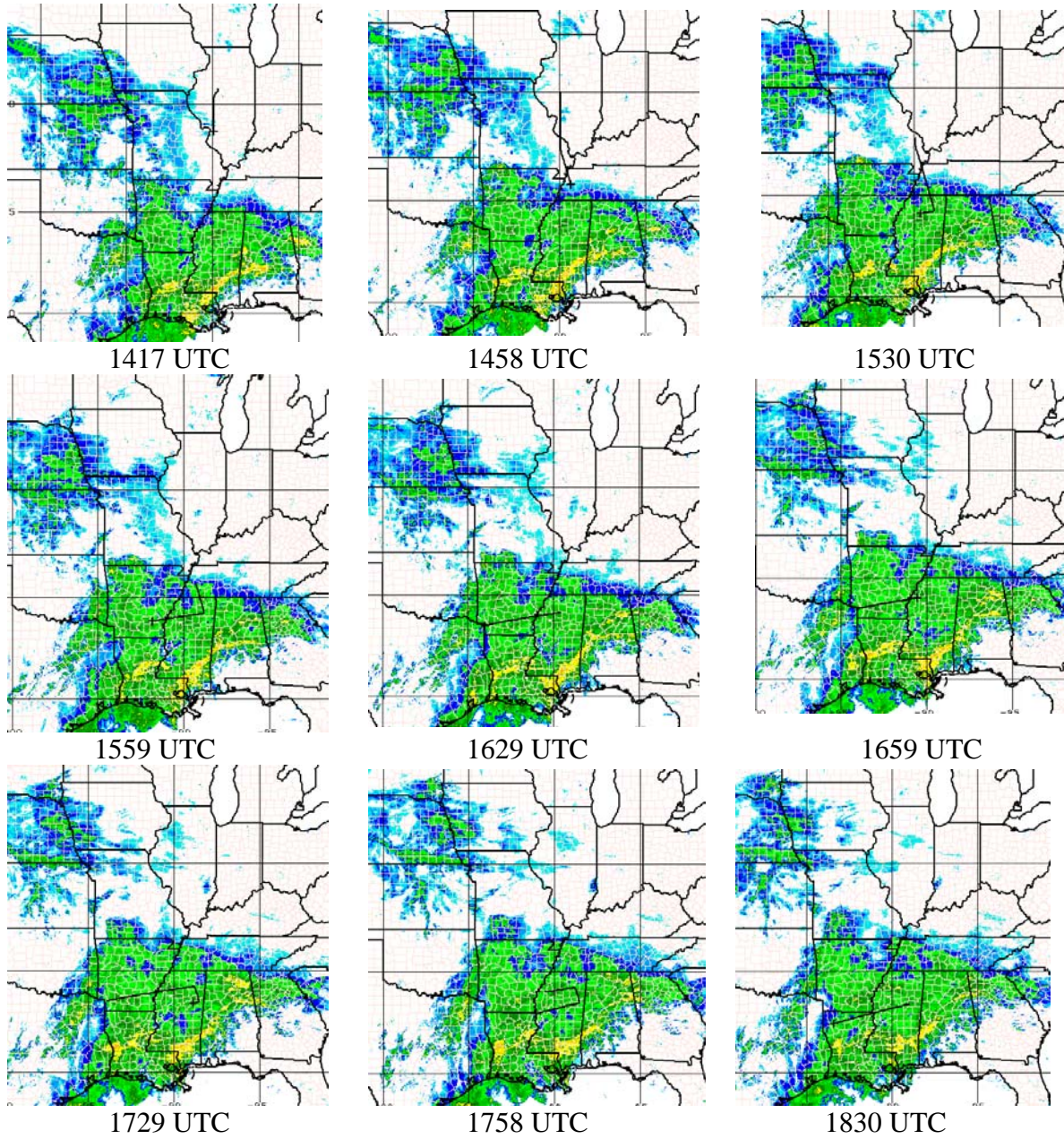


Figure 7: C-130 flight track overlaid on radar composites from 1400 UTC 4 Feb 10 through 1830 UTC 4 Feb 10. Times shown are the times of the radar composites. The flight track for the period just before the composite is shown.

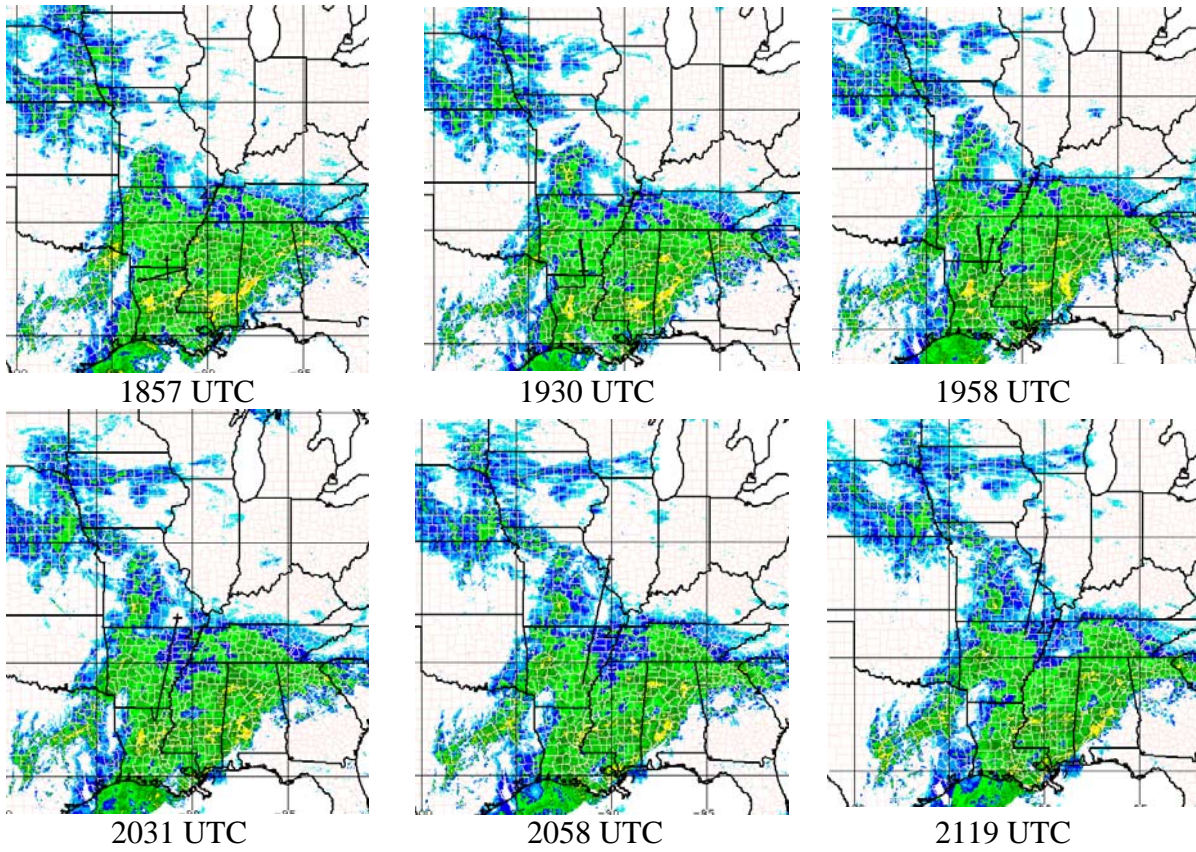


Figure 8: C-130 flight track overlaid on radar composites from 1900 UTC 4 Feb 10 through 2130 UTC 4 Feb 10. Times shown are the times of the radar composites. The flight track for the period just before the composite is shown.

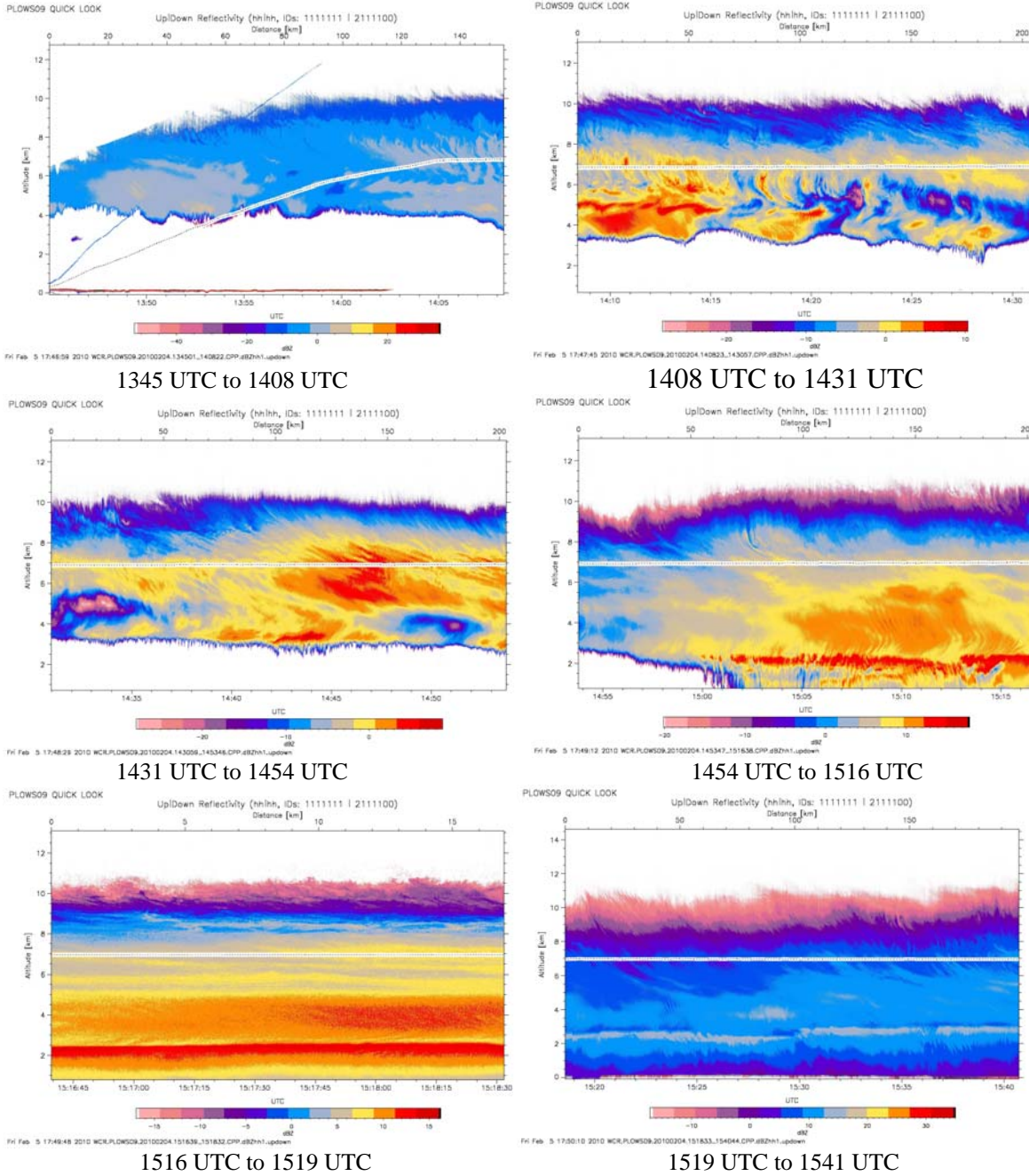


Fig. 9: Wyoming Cloud Radar Quicklook of radar reflectivity between 1345 UTC 4 Feb 10 and 1541 UTC 4 Feb 10.

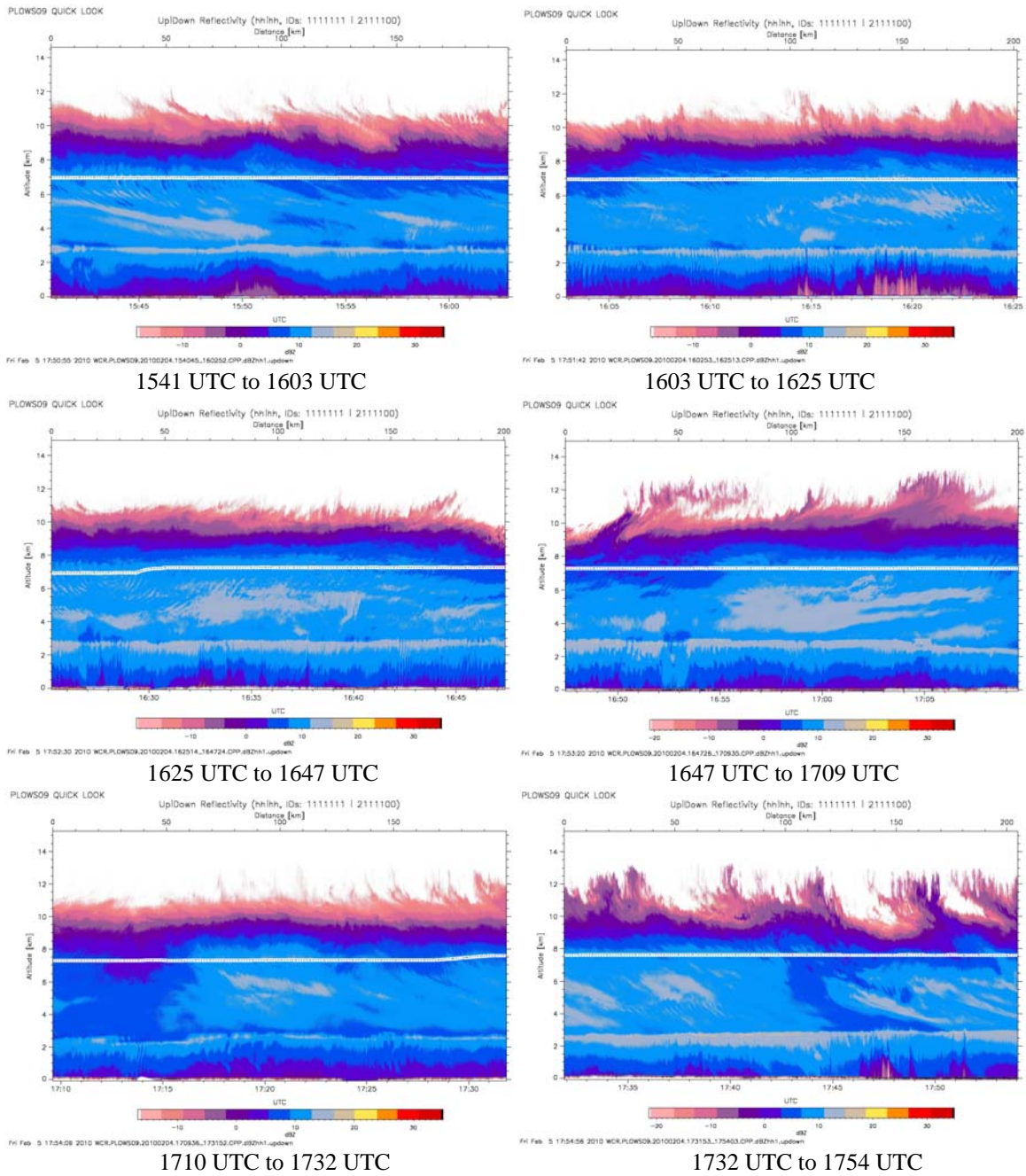


Fig. 10: Wyoming Cloud Radar Quicklook of radar reflectivity between 1541 UTC 4 Feb 10 and 1754 UTC 4 Feb 10.

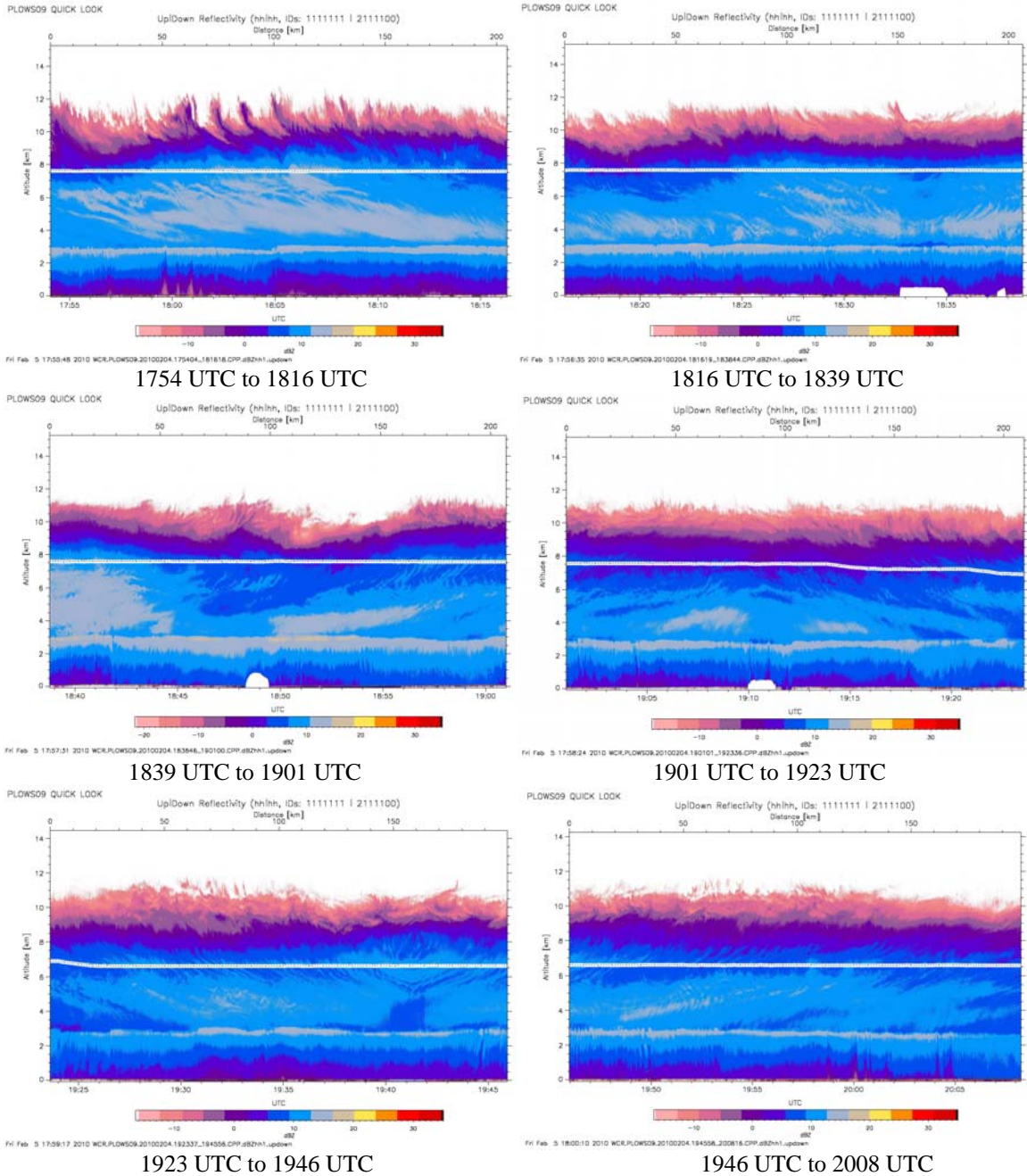
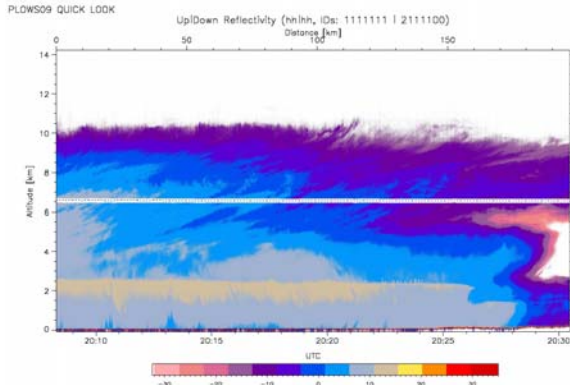
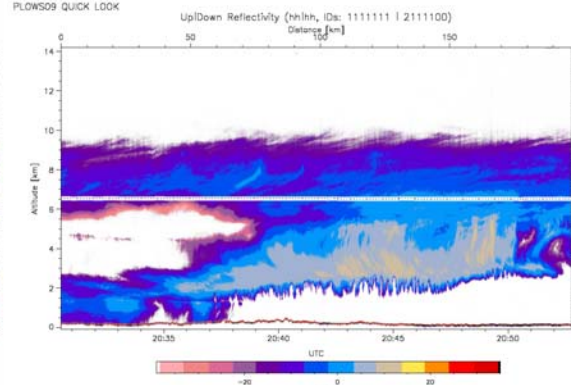


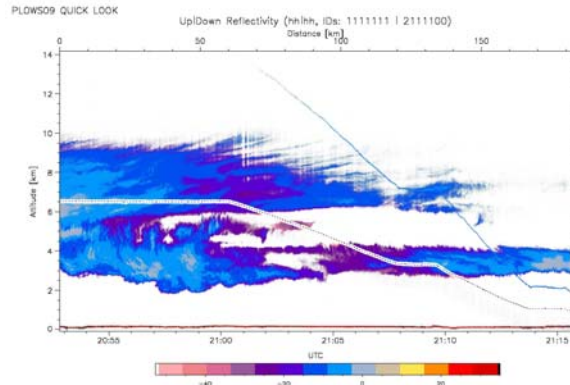
Fig. 11: Wyoming Cloud Radar Quicklook of radar reflectivity between 1754 UTC 4 Feb 10 and 2008 UTC 4 Feb 10.



2008 UTC to 2031 UTC



2031 UTC to 2053 UTC



2053 UTC to 2115 UTC

Fig. 12: Wyoming Cloud Radar Quicklook of radar reflectivity between 2008 UTC 4 Feb 10 and 2115 UTC 4 Feb 10.

5. MIPS operations: The MIPS was located in Martinsville, which is in the White River Valley. As a result of the low elevation relative to the plains above the valley, the precipitation at the MIPS site, because of melting, was wetter and the total snowfall much less. A local minimum of 2 inches of slush was on the ground at the end of the IOP. The heavy wet snow led to significant attenuation problems for the XPR as it accumulated on the top surface of the radar. The radar had to be swept often to keep up the signal strength. All other instruments operated without any problems.

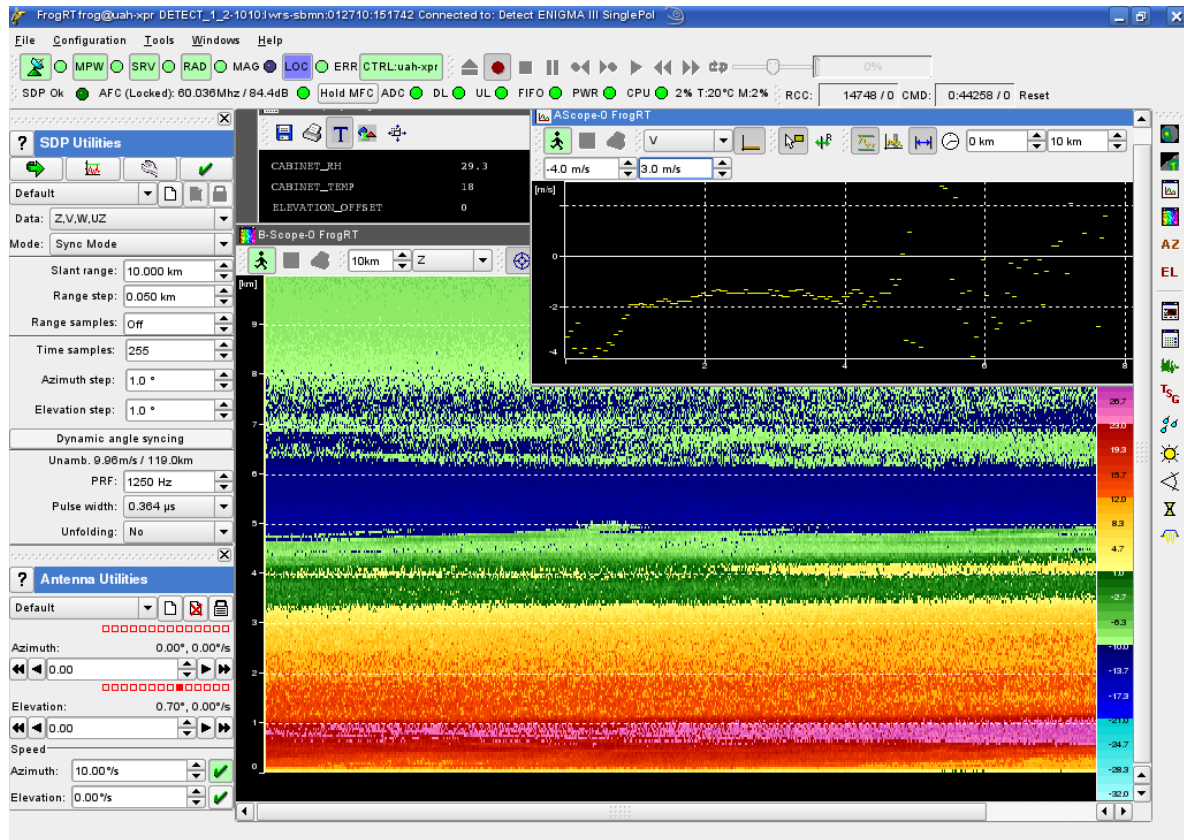


Fig. 13: Example of 90 sec. segment of XPR radar reflectivity showing two distinct layers

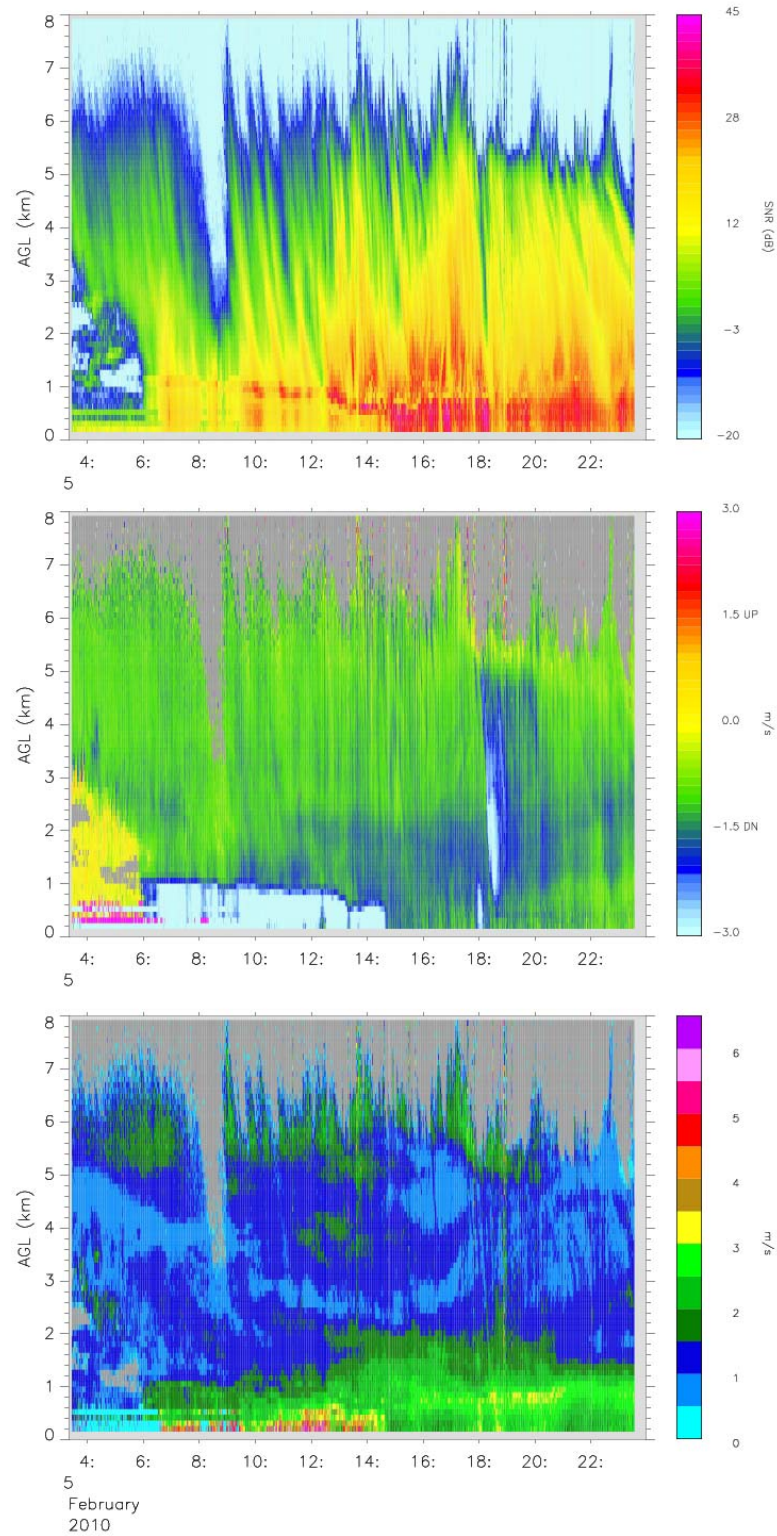


Figure 14: MIPS 915 MHz Profiler SNR, vertical velocity and spectral width for the period of operation 0300 UTC 5 Feb 10 through 0000 UTC 6 Feb 10

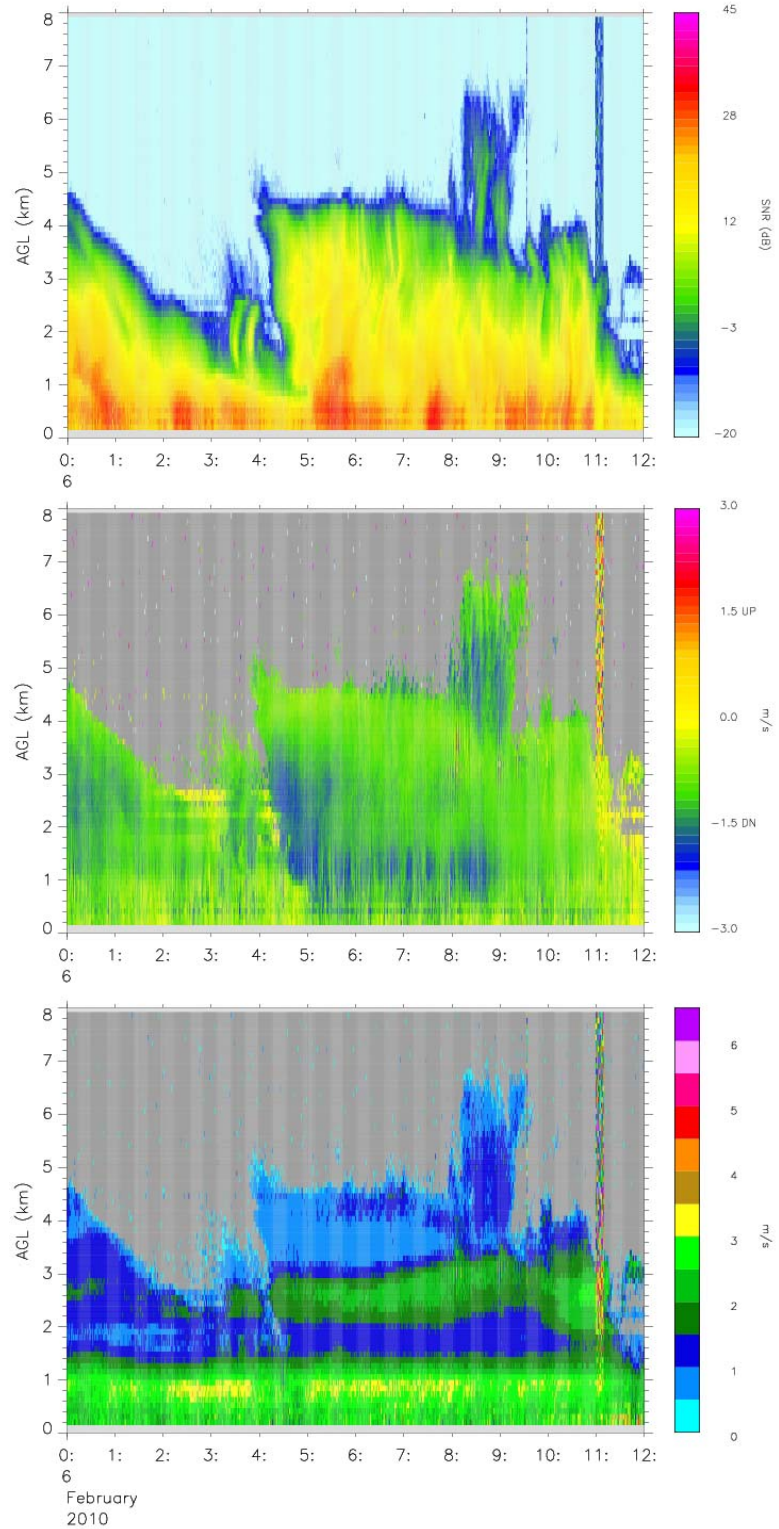
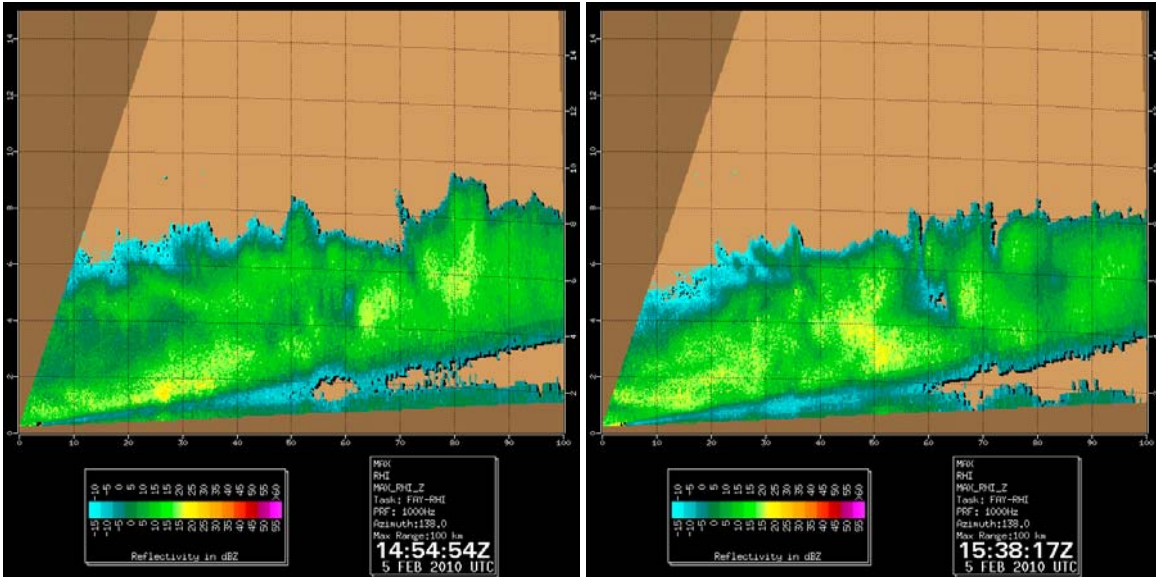


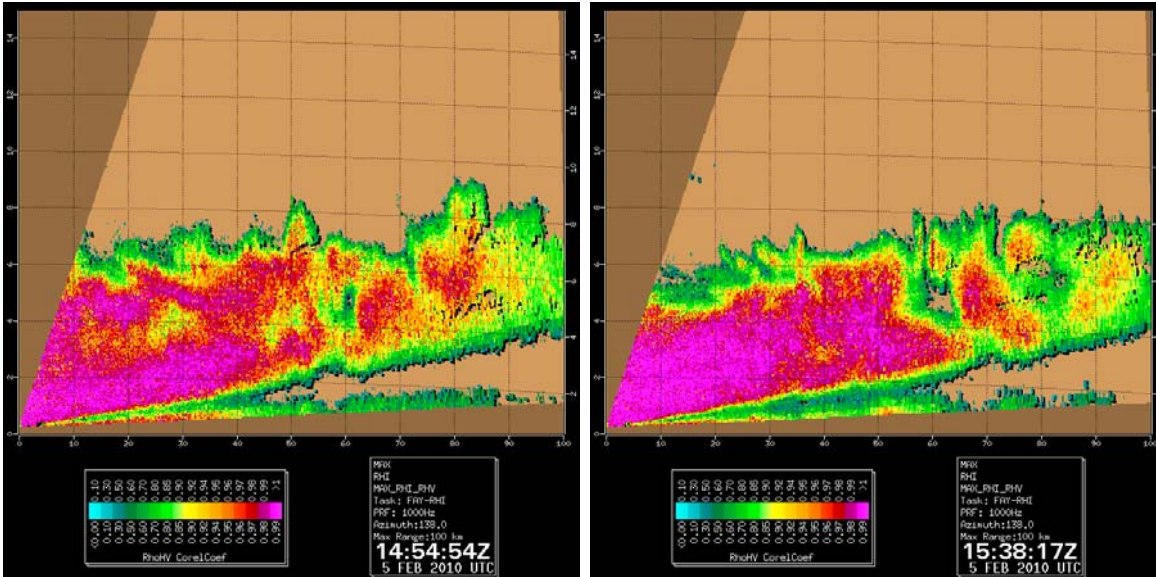
Figure 15: MIPS 915 MHz Profiler SNR, vertical velocity and spectral width for the period of operation 0000 UTC 6 Feb 10 through 1200 UTC 6 Feb 10

6. MAX operations: The MAX was located on the plains above the river valley and experienced similar snowfall amounts to those characterized by the local observations on the figures and tables in Sec. 3. The MAX operated without any problems.



MAX RHI Reflectivity showing bands at 1454 UTC

MAX RHI Reflectivity showing bands at 1538 UTC



MAX Correlation coefficient showing bands at 1454 UTC

MAX Correlation coefficient showing bands at 1538 UTC

Fig. 16: MAX Radar RHIs of radar reflectivity and the Correlation Coefficient at 1454 and 1538 UTC 5 Feb 10.

7. MISS 915 MHz Profiler

The MISS operated MISS at the Super-8 Hotel, Franklin, IN. No problems occurred during operations.

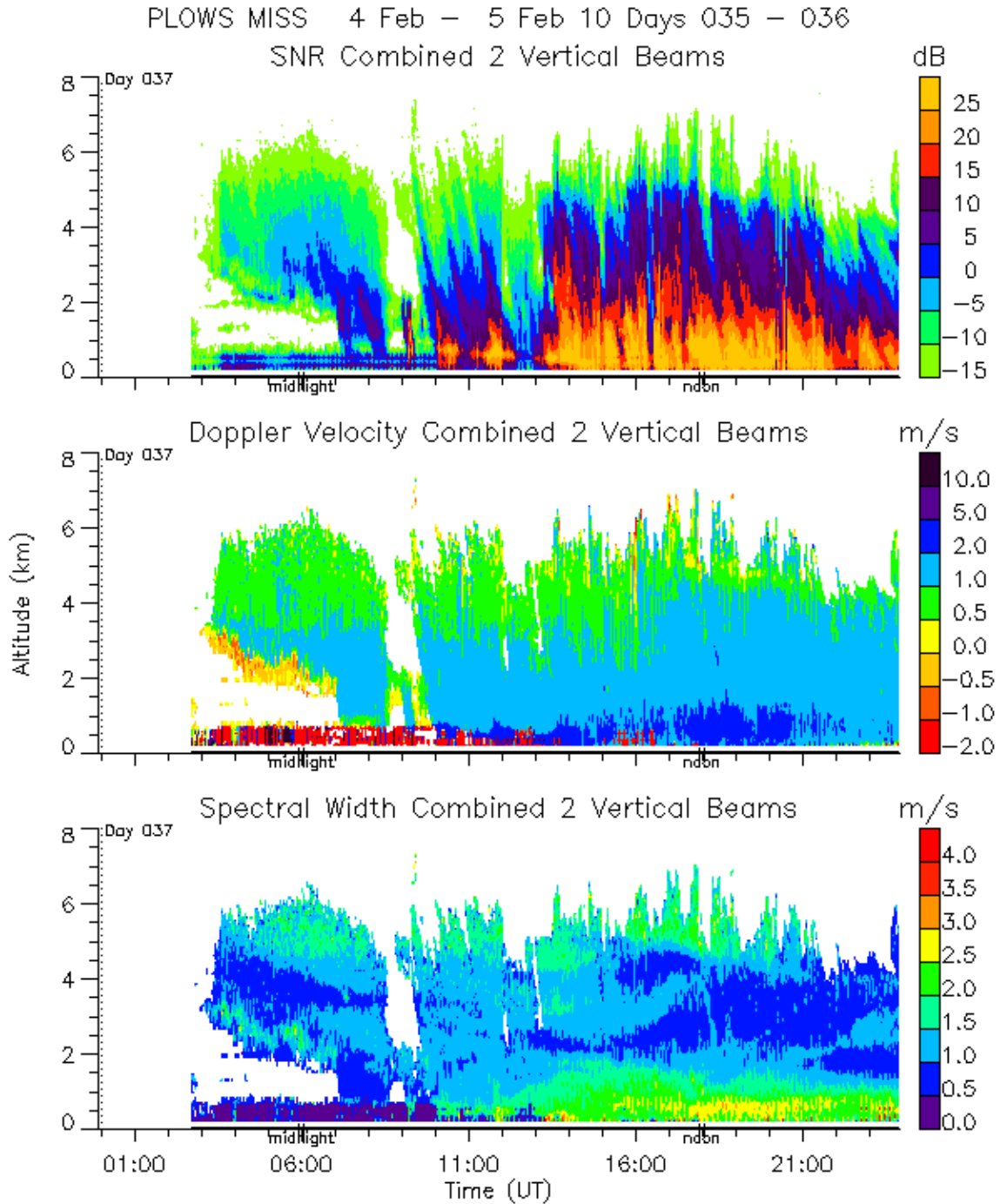


Figure 17: MISS 915 MHz Profiler SNR, vertical velocity and spectral width for the period of operation 0000 UTC 5 Feb 10 through 0000 UTC 6 Feb 10

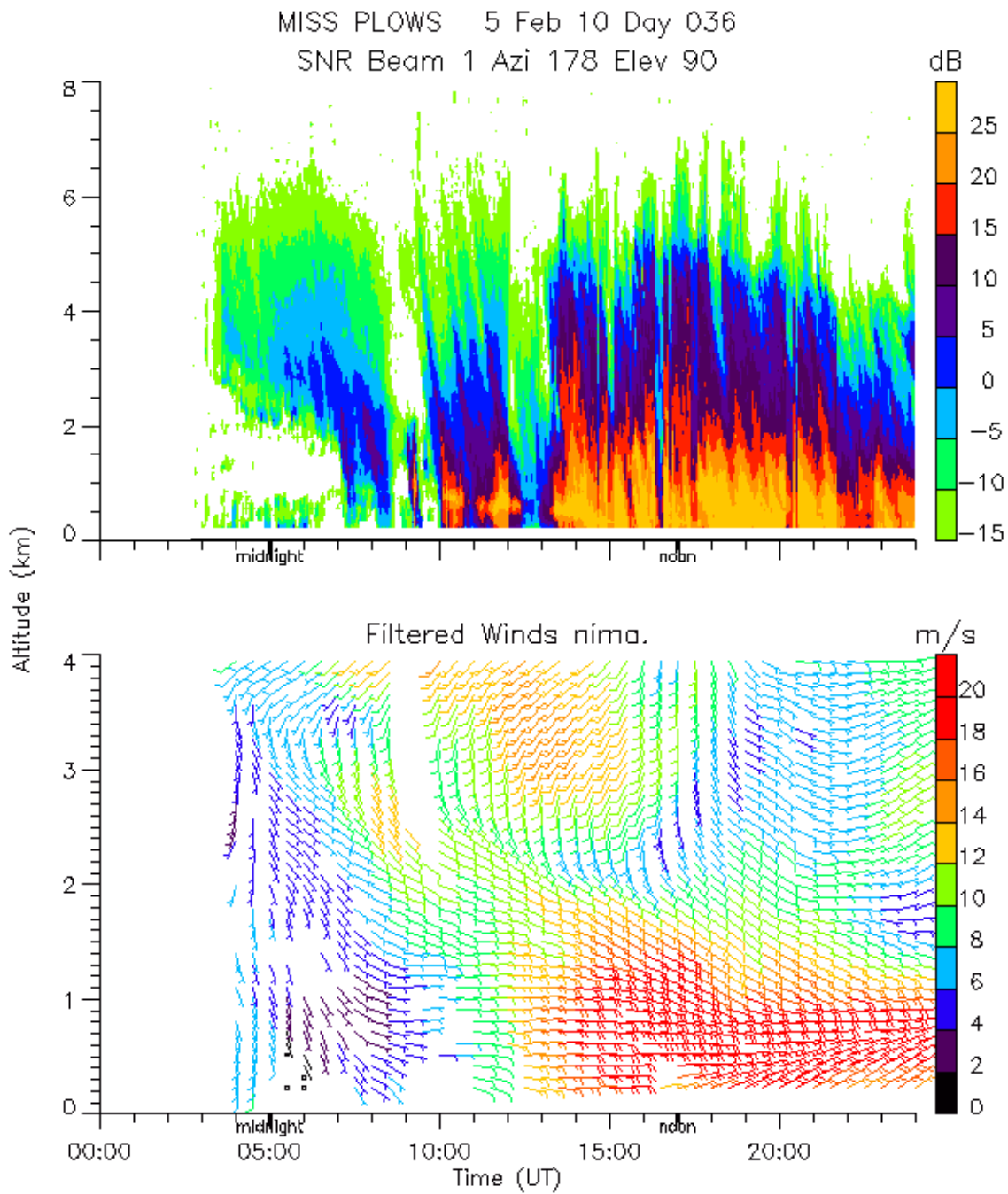


Figure 18: MISS 915 MHz Profiler SNR and Winds or the period of operation 0000 UTC 5 Feb 10 through 0000 UTC 6 Feb 10

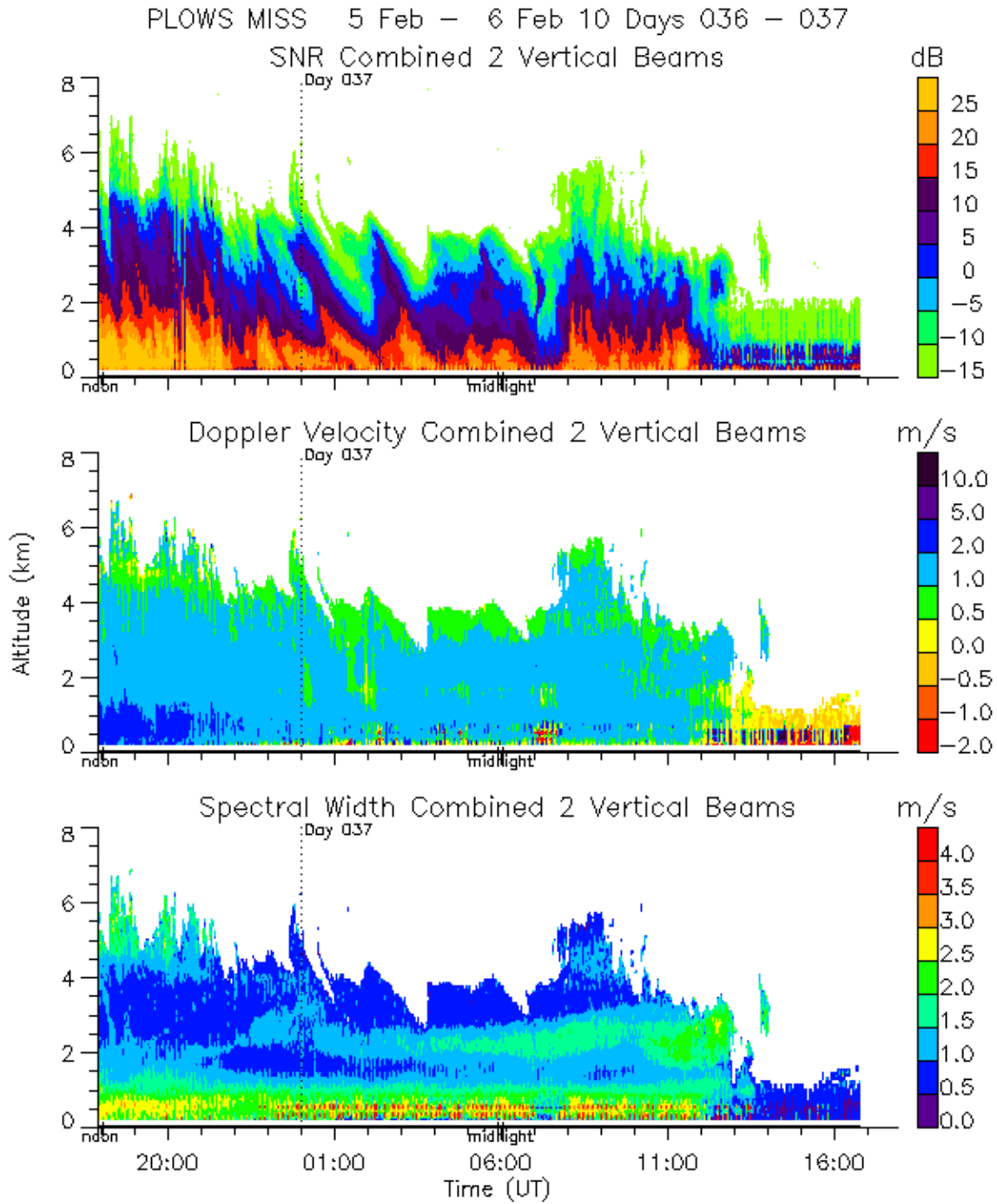


Figure 19: MISS 915 MHz Profiler SNR, vertical velocity and spectral width for the period of operation 0000 UTC 1800 5 Feb 10 through 1700 UTC 6 Feb 10

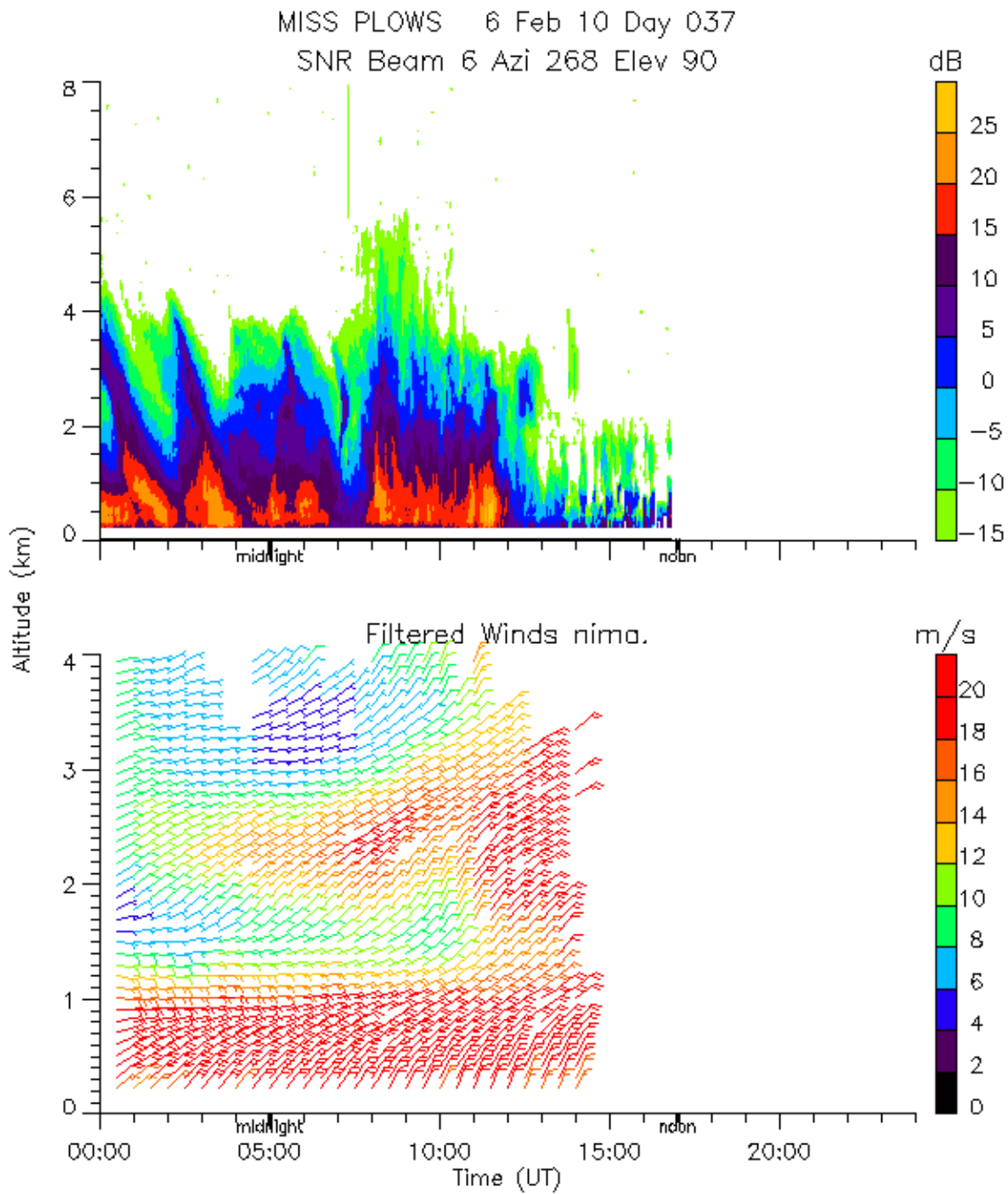


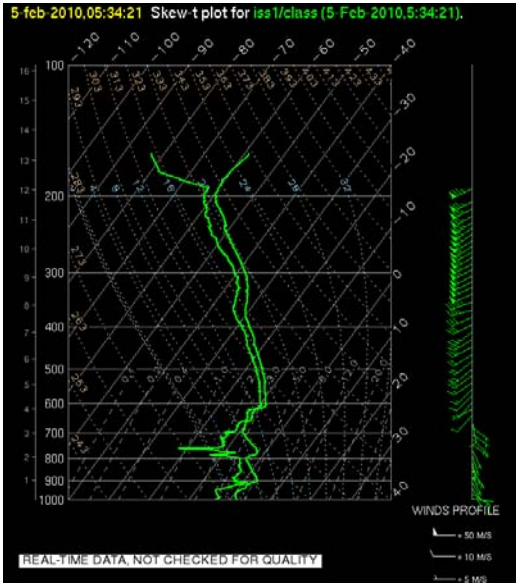
Figure 20: MISS 915 MHz Profiler SNR and Winds
or the period of operation 0000 UTC 6 Feb 10 through 1400 UTC 6 Feb 10

8. Rawinsondes

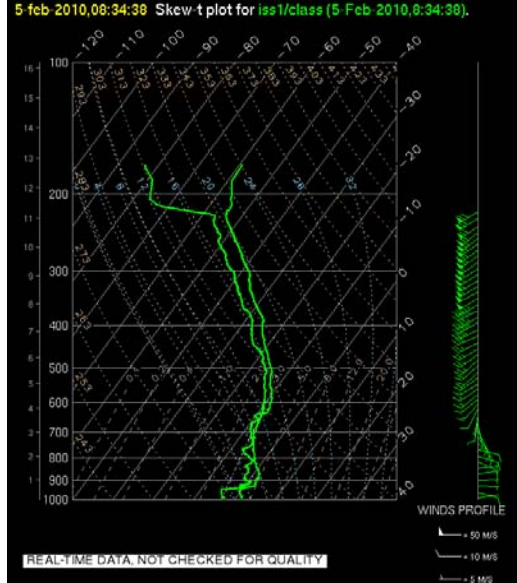
Rawinsondes were launched at the MISS site in Franklin, IL on a 3 hourly schedule. The following soundings were launched

DATE	Launch	Nominal Date and time		Status
2010 02 05	0534 UTC	2010 02 05	0600 UTC	Good
2010 02 05	0834 UTC	2010 02 05	0900 UTC	Good
2010 02 05	1126 UTC	2010 02 05	1200 UTC	Good
2010 02 05	1430 UTC	2010 02 05	1500 UTC	Failed
2010 02 05	1727 UTC	2010 02 05	1800 UTC	Good
2010 02 05	2040 UTC	2010 02 05	2100 UTC	Good
2010 02 05	2333 UTC	2010 02 06	0000 UTC	Good
2010 02 06	0228 UTC	2010 02 05	0600 UTC	Good
2010 02 06	0526 UTC	2010 02 05	0600 UTC	Good

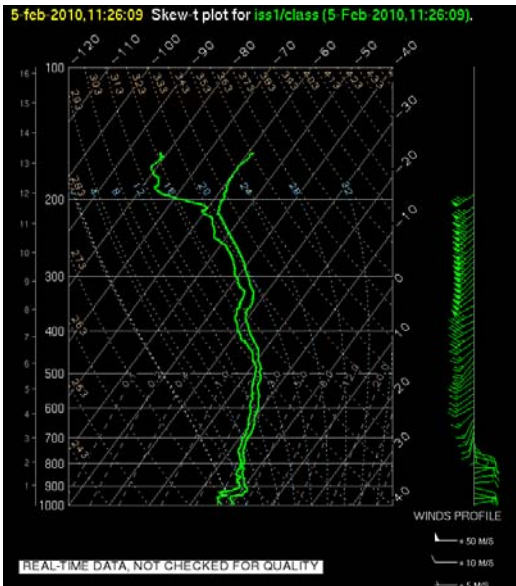
Rawinsondes were not launched by Missouri during this IOP because of an equipment failure.



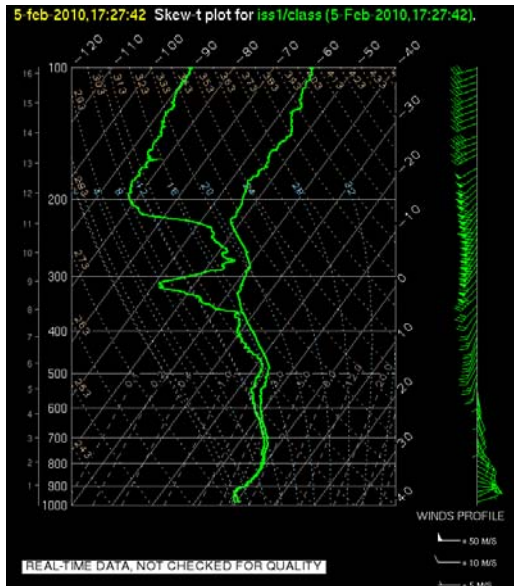
MISS Sounding 0600 UTC 05 Feb 10



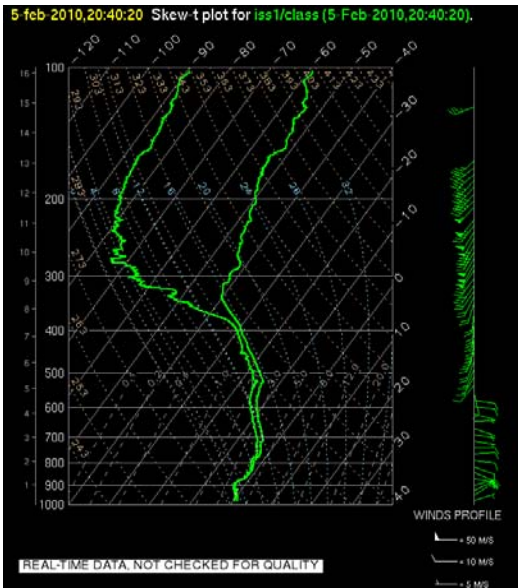
MISS Sounding 0900 UTC 05 Feb 10



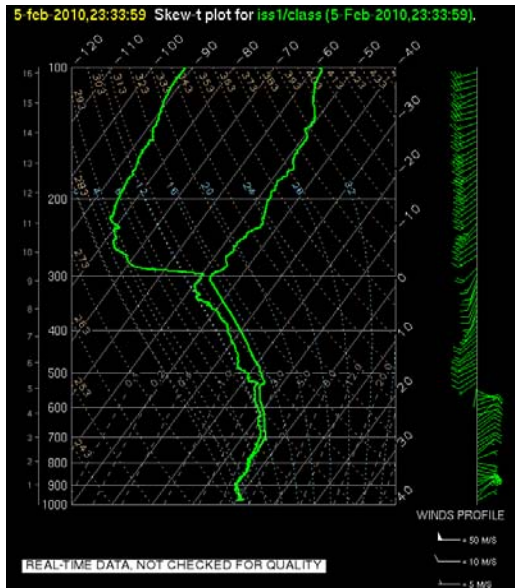
MISS Sounding 1200 UTC 05 Feb 10



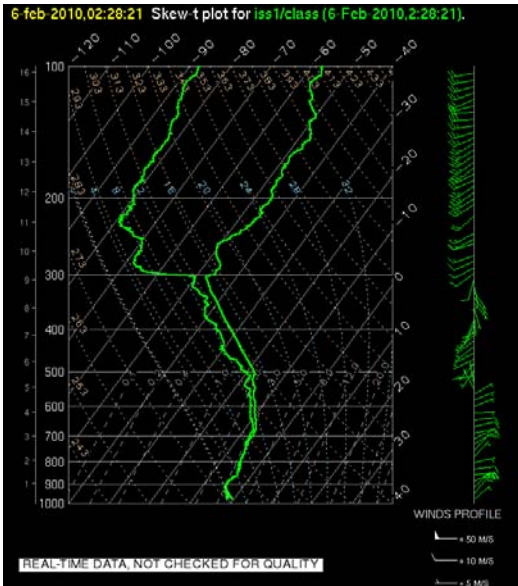
MISS Sounding 1800 UTC 05 Feb 10



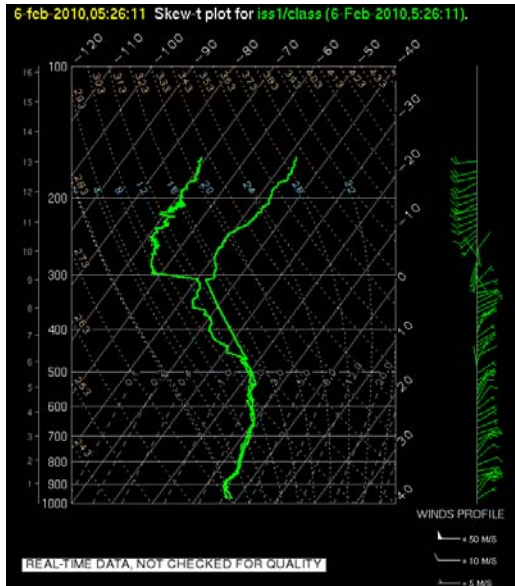
MISS Sounding 2100 UTC 05 Feb 10



MISS Sounding 0000 UTC 06 Feb 10



MISS Sounding 0300 UTC 05 Feb 10



MISS Sounding 0600 UTC 06 Feb 10