

IOP-11 Summary of Operations
14 December 2009, 0000 UTC – 15 December 2009 0000 UTC

Author: Rauber

1. Summary of storm evolution

The IOP-11 cyclone formed east of the Rockies associated with a weak, low-amplitude shortwave (Fig. 1). Although the surface cyclone appeared moderately strong, the trough aloft was not deep and the system was starved for moisture. The cyclone propagated from eastern Colorado to central Lake Erie in the 24 hour period between 0000 UTC 14 Dec 09 and 0000 UTC 15 Dec 09 (Fig. 1). A single elongated band, and very weak companion bands developed within the deformation zone north of the cyclone. Because of the predicted narrowness of the precipitation distribution, its northern location, and inopportune position relative to WSR-88D sites, it was decided to not deploy the ground based systems. IOP-11 was therefore limited to the C-130, and the focus was on the bands over southeast Wisconsin.

2. Locations of instrumentation platforms

MIPS Location:	Not used
MAX Location:	Not used
MISS Location:	Not used
MO Location:	Not used
RF-05 Flight operations:	1322 UTC 12/14/09 to 2052 UTC 12/14/09

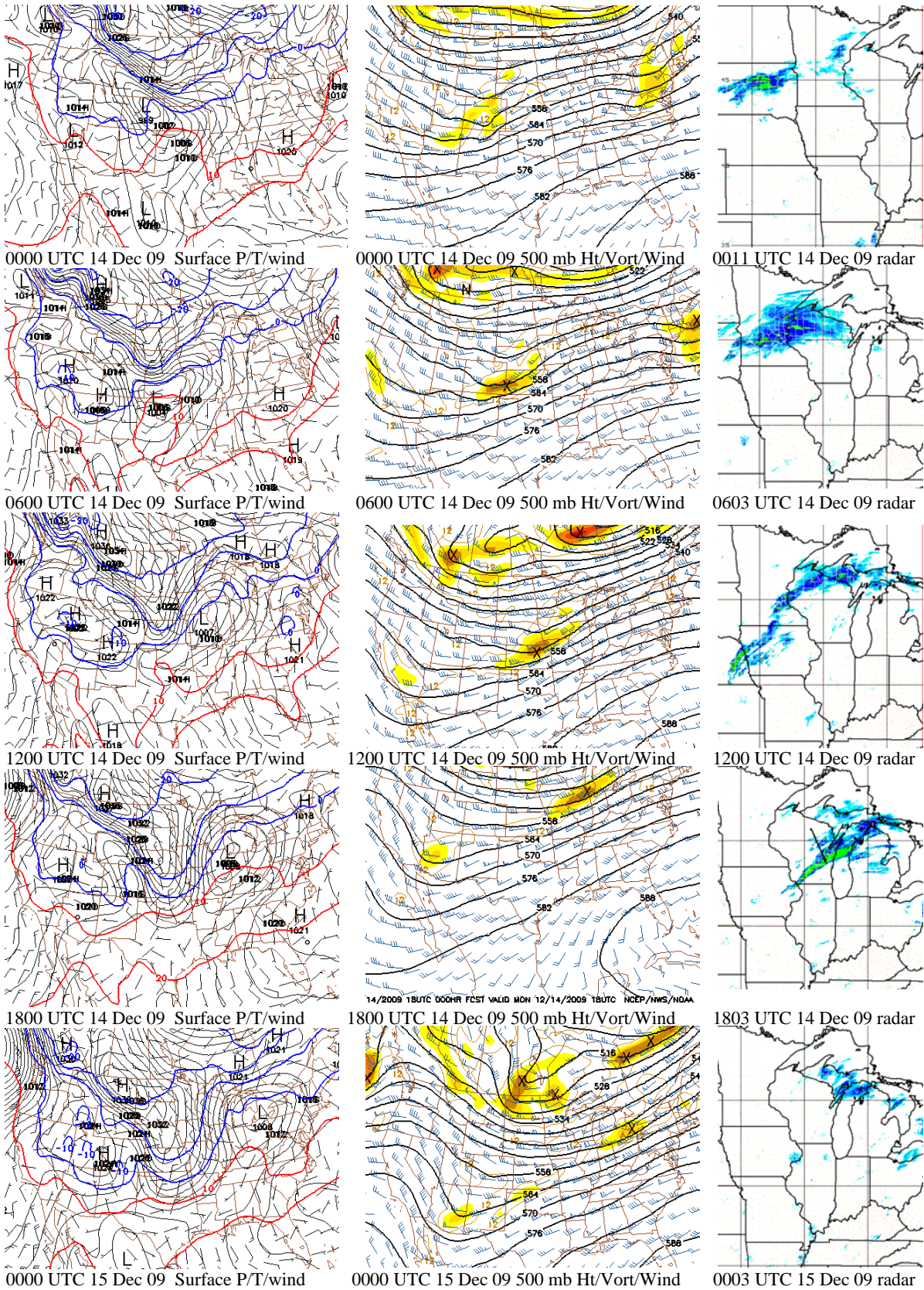
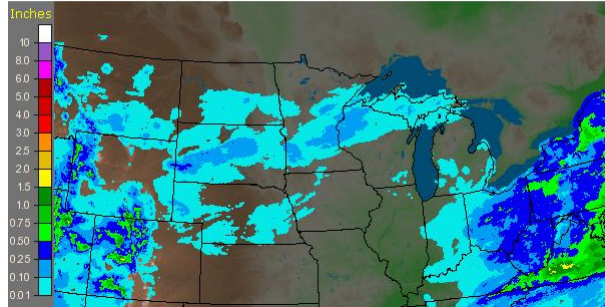


Figure 1: Evolution of the IOP-11 storm at the surface, 500 mb, and radar echoes from 0000 UTC 14 -15 Dec 09.

3. Precipitation over research area

North Central RFC Minneapolis, MN: 12/14/2009 1-Day Observed
Precipitation
Valid at 12/14/2009 1200 UTC- Created 12/16/09 11:33 UTC



North Central RFC Minneapolis, MN: 12/15/2009 1-Day Observed
Precipitation
Valid at 12/15/2009 1200 UTC- Created 12/17/09 11:33 UTC

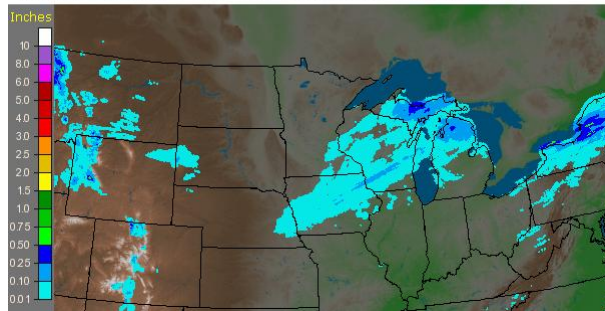


Fig. 2: 24 Hour precipitation ending at 1200 UTC 12/14/09, and 1200 UTC 12/15/09 over the northern Great Plains

Wisconsin: 12/15/2009 1-Day Observed Precipitation
Valid at 12/15/2009 1200 UTC- Created 12/17/09 11:32 UTC

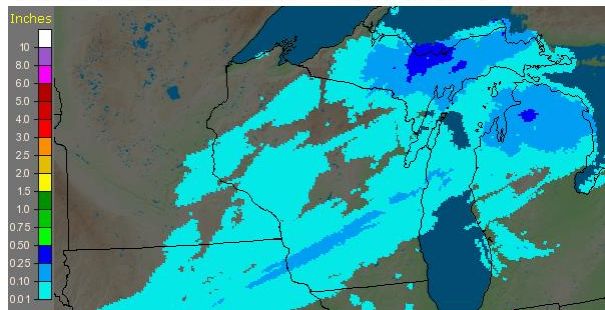


Fig. 3: 24 Hour precipitation ending at 1200 UTC 12/15/09, over Wisconsin

4. Flight Summary

C-130 Flight RF-05

The C-130 departed Peoria at 1333 UTC and flew direct to Dropsonde track position H10. Successful dropsondes were then dropped along track H at the positions H10-H1. As the C-130 progressed along the dropsondes track, it passed at the 6.6 km (22 Kft, -31C) level through the tops of the primary band at 1430 to 1440 UTC. The aircraft was about 1.5 km below the highest tops. There was no turbulence within the band at the flight altitude. North of the band, the clouds tops descended to about 2.5 km, and finally disappeared altogether around 1513 UTC near the north end of the dropsonde track. At 1511 UTC, the C-130 entered an elevated cloud layer with tops near 7 km and bases that ranged from 4-6 km. It remained in this layer during the turn at H1 and southward until 1550 UTC. The flight within the upper level cloud was along the north end of the H dropsonde track, and then southward first to RZN in Northwest Wisconsin and then to MSN (Madison, WI.). During the transit, we moved out of the high cloud at 1557 UTC, and back over the shallow cloud (tops 2 km) at 1553 UTC. These layers overlapped briefly. The entire leg southward was flown at 6.6 km (22 Kft). The aircraft cross the primary band between 1638 and 1648 UTC. Cloud tops in the band approached 8 km and the WCR data suggested turrets at the tops, although no turbulence was noted in the cockpit.

The aircraft reached MSN at 1654 UTC and turned NE to BJB to position for a N-S leg between BJB and RHI at 18Kft. The band was crossed between 1705 and 1720 UTC at an altitude of 5 km (18 Kft). Again tops extended to 8 km and no turbulence was noted. The aircraft reached RHI and turned southeastward back to BJB at 15 kft (4.5 km) at 1732 UTC, arriving at 1805 UTC while still in the southern part of the band. The C-130 then descended out the south side of the band, turned, and reentered the band heading toward MNM at 3.9 km (13 Kft). The band was crossed between 1815 and 1831 UTC. Again, no turbulence was experienced, and the WCR data indicated cloud tops to 8 km with turrets visible with higher reflectivity streamers.

The aircraft arrived at MNM at 1838 UTC, turned and descended to 11 Kft (3.2 km) crossing the band between 1849 and 1905 UTC while flying toward BJB. After arriving at BJB at 1906 UTC, the decision was made to stay on the same track and return to MNM at 15Kft (4.5 km). After the turn, the C-130 was still ascending as it entered the south side of the band, but leveled off in time before crossing the tallest turrets. The aircraft arrived at MNM at 1934 UTC, turned and ascended to 18Kft. At that point, the band had exited Wisconsin, and flight time limitations dictated that we head back to Peoria.

Summarizing, the aircraft made a number of passes across a single major band in southeast Wisconsin at altitudes ranging from 22Kft (6.6 km) to 11 Kft (3.2 km). The band had turrets reaching 8 km, but no turbulence was evident during band passage.

C-130 Flight RF-05 Flight track

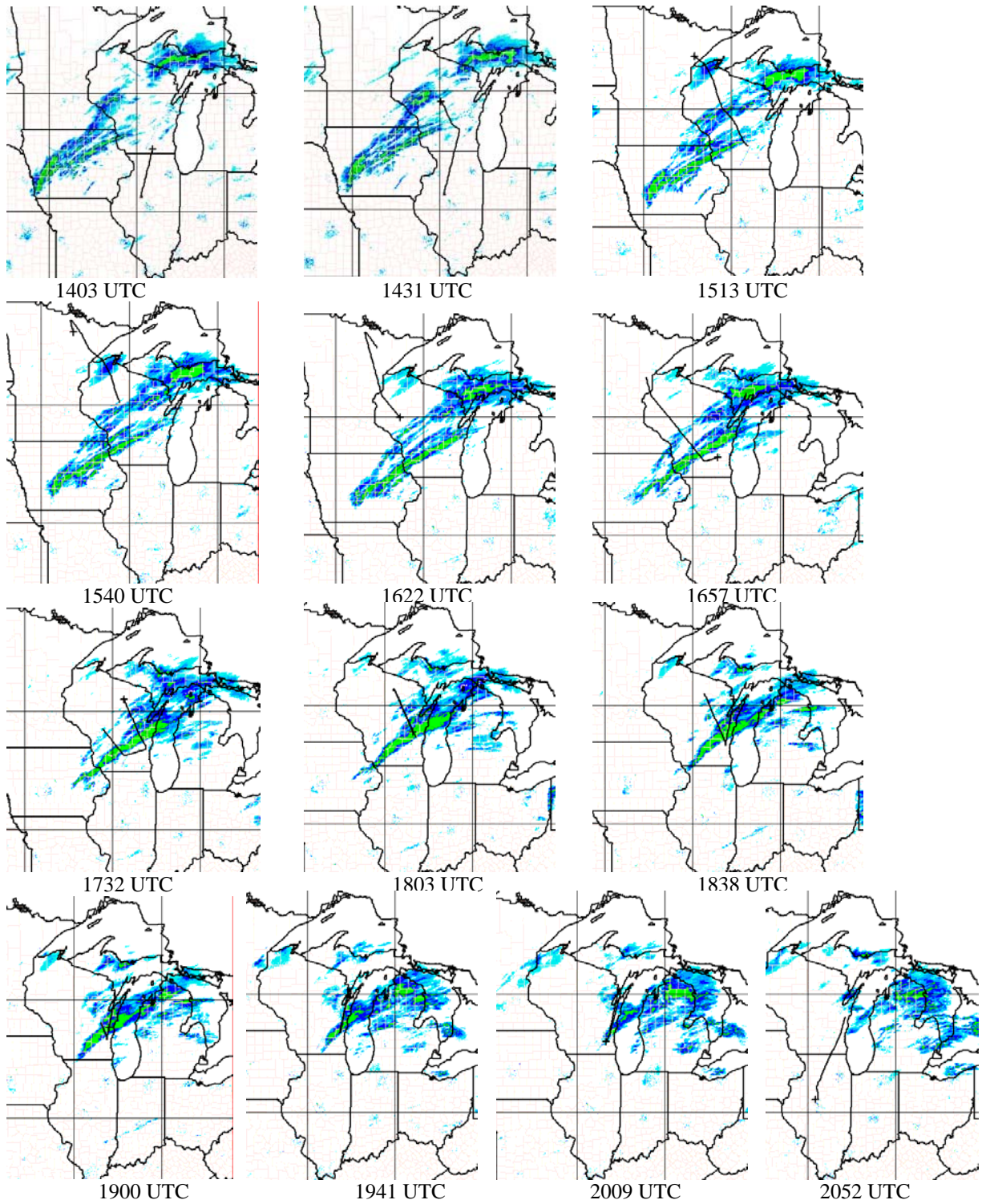


Figure 4: C-130 flight track overlaid on radar composites from 1403 UTC 14 Dec 09 through 2052 UTC 14 Dec 09. Times shown are the times of the radar composites. The flight track for the period just before the composite is shown.

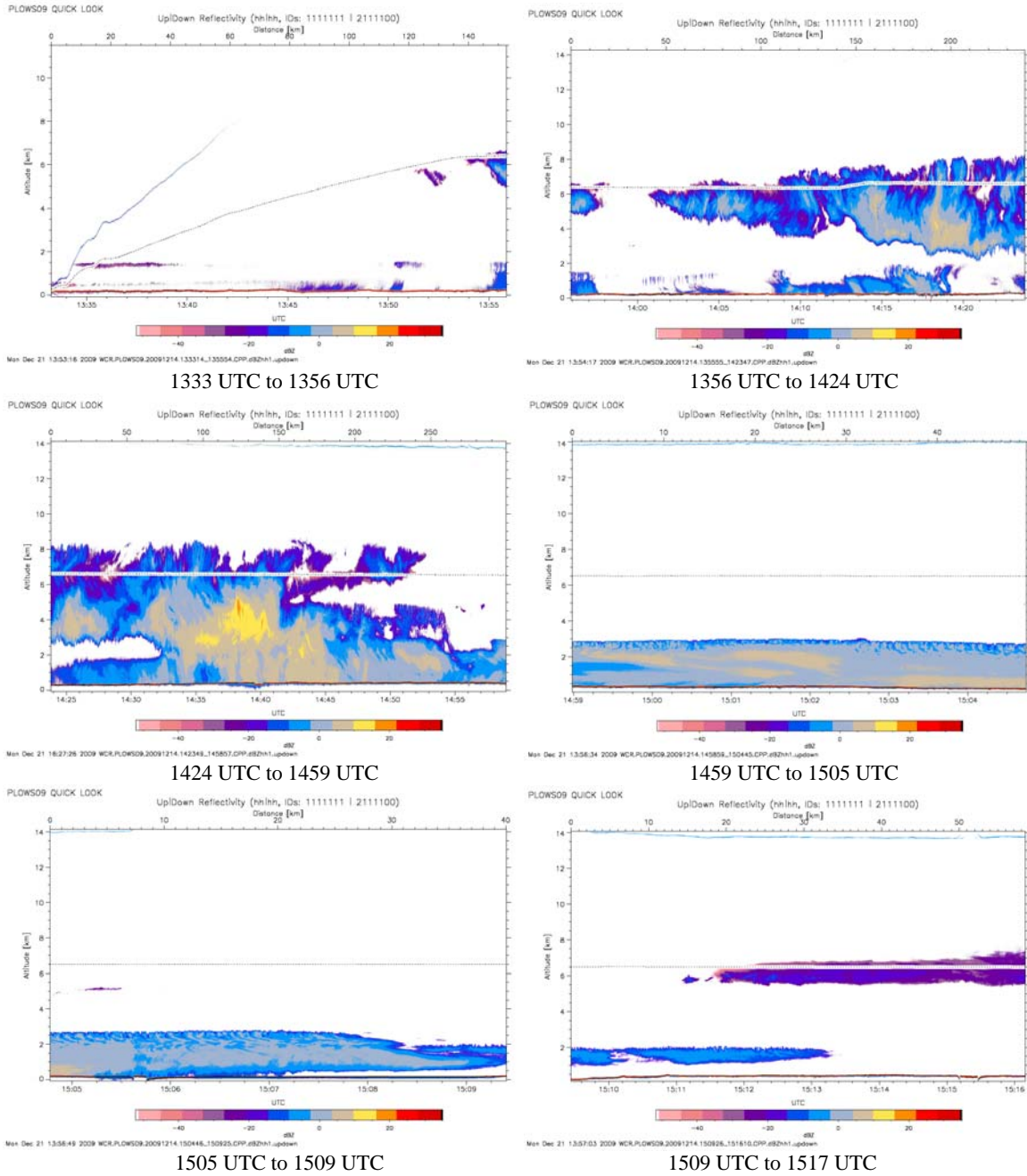
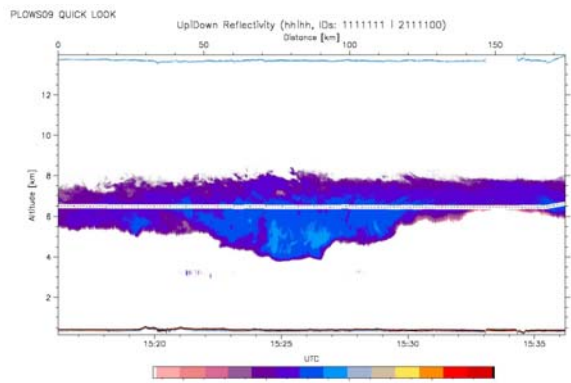
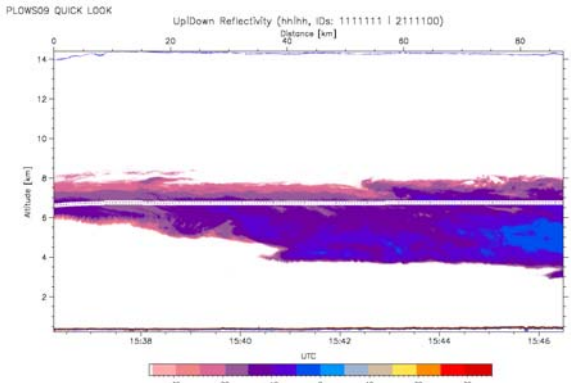


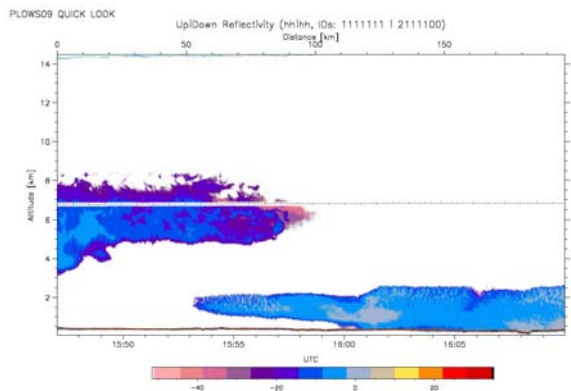
Fig. 5: Wyoming Cloud Radar Quicklook of radar reflectivity between 1333 UTC 14 Dec 09 and 1517 UTC 14 Dec 09.



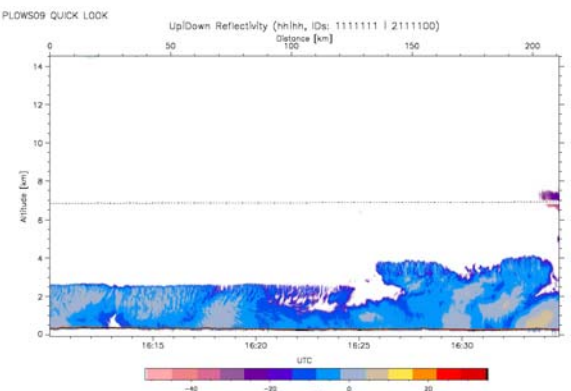
1517 UTC to 1536 UTC



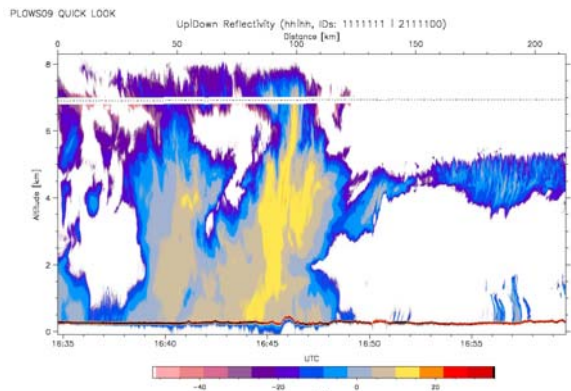
1536 UTC to 1546 UTC



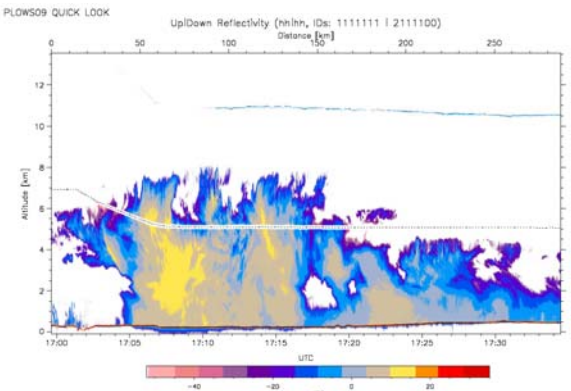
1546 UTC to 1610 UTC



1610 UTC to 1634 UTC



1635 UTC to 1659 UTC



1700 to 1734 UTC

Fig. 7: Wyoming Cloud Radar Quicklook of radar reflectivity between 1517 UTC 14 Dec 09 and 1734 UTC 14 Dec 09.

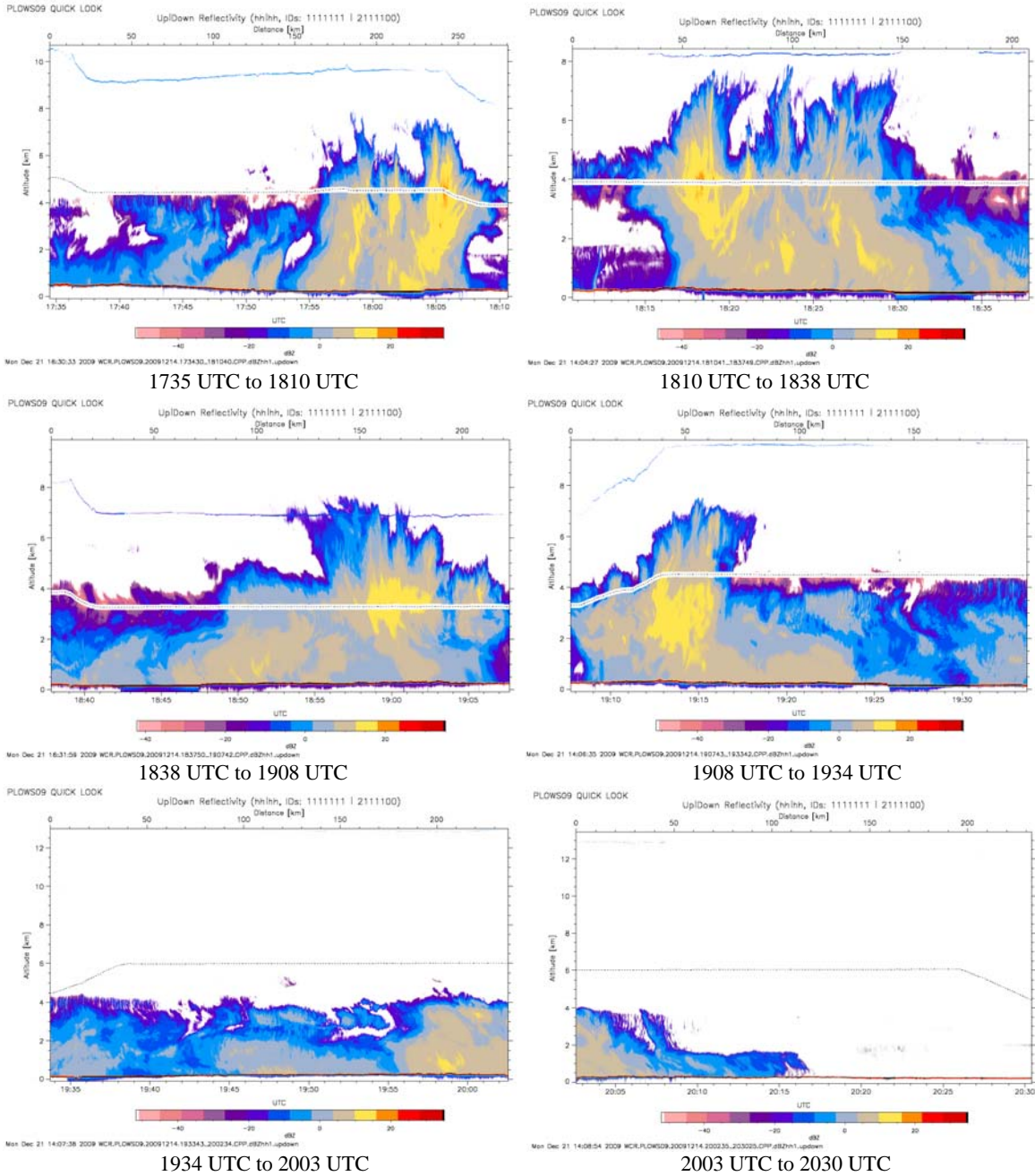


Fig. 8: Wyoming Cloud Radar Quicklook of radar reflectivity between 1735 UTC 14 Dec 09 and 2030 UTC 14 Dec 09.