CI Summary

IOP6: 7-8 June 2015

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Tonight's forecast is for potential nocturnal CI to occur in south-central Kansas between a stationary boundary and a cold front by 3-5 UTC. The LLJ will veer to SW throughout the night. There is less clear-air tonight and fewer aerosols for the lidars, probably because we're mostly in post-frontal cleaner air. It seems to be a marginal case for CI but the CI group is curious enough about it to have a mission.

The plan is to spread out the mobile radars and mobile PISAs to cover a broad spatial area. We're sending out seven mobile radars: NOXP, SR-1, SR-2, DOW 6, DOW 7 and DOW 8 and MAX. We'll also have the T-WOLF Doppler lidar. We have all four mobile PISAs: CLAMPS, SPARC, MISS and MIPS. We have one mobile sounding system. We have 2 NSSL mobile mesonets and 1 CSWR mobile mesonet. The mobile vehicles will drive on north-south roads crossing the wind shift boundary. Operations will be 9 pm – 3 am LT (2-8 UTC). Soundings from fixed and mobile systems will be launched at 10 pm and 1 am (3 and 6 UTC). The UWKA will fly a racetrack pattern across the boundaries with takeoff at 9 pm.

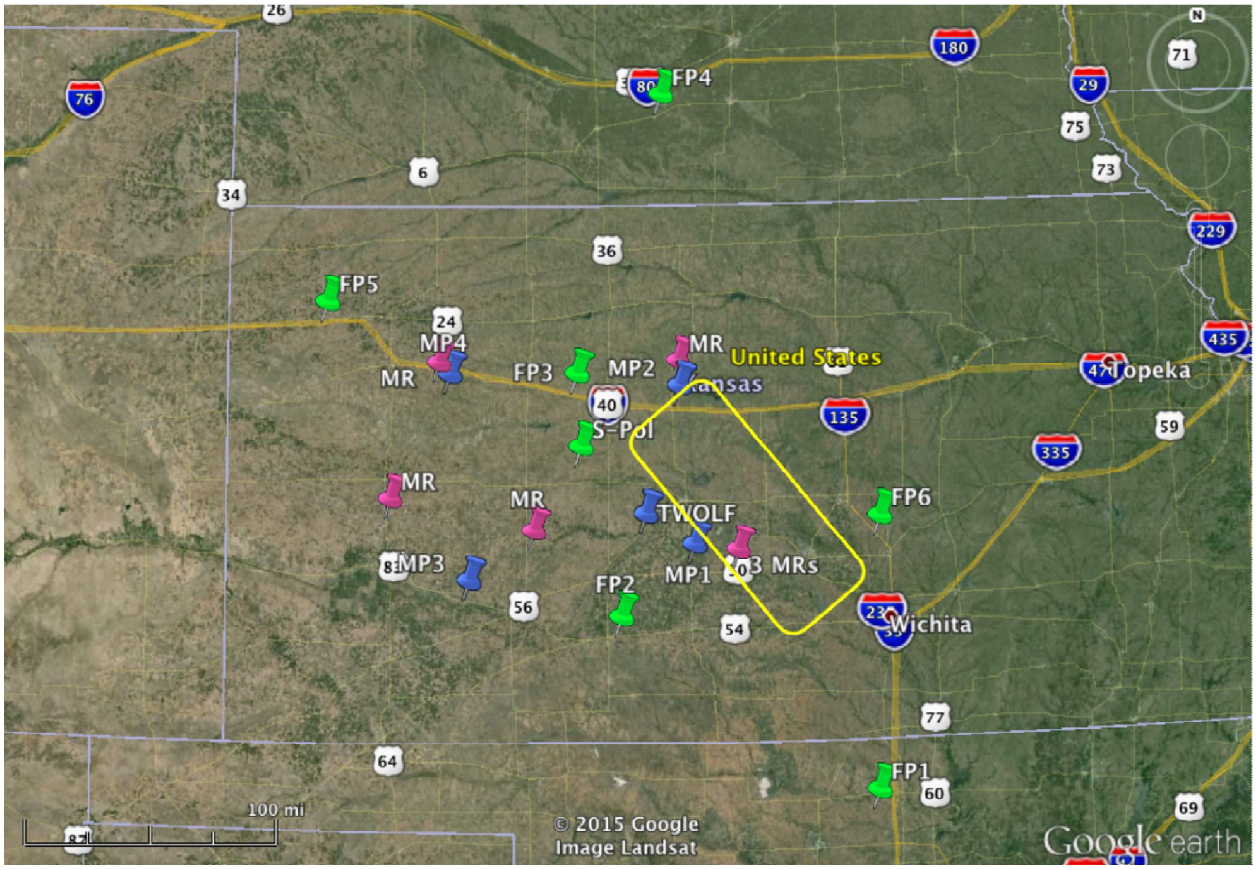

Fig. 1. Location of ground-based mobile assets for IOP6. MR= mobile radar; MRs= dense array of mobile radars for multiple-Doppler retrievals. Yellow rectangle is original UWKA flight track.

Most of the mobile radars are spread out over a broad area but we are also using a dense array of radars for multi-Doppler analyses in St John, KS. These radars are SR1, SR2 and NOXP (Fig. 1). The nowcasters gave a target location of Stafford County for CI which will be north of the cold front which is moving southward through the domain. Prior to sunset there is some CI along the eastern edge of the cold front (Fig. 2). The cold front extends SW to SE CO. The stationary boundary/wind shift line is to the south of the cold front, also running SW-NE through the domain.

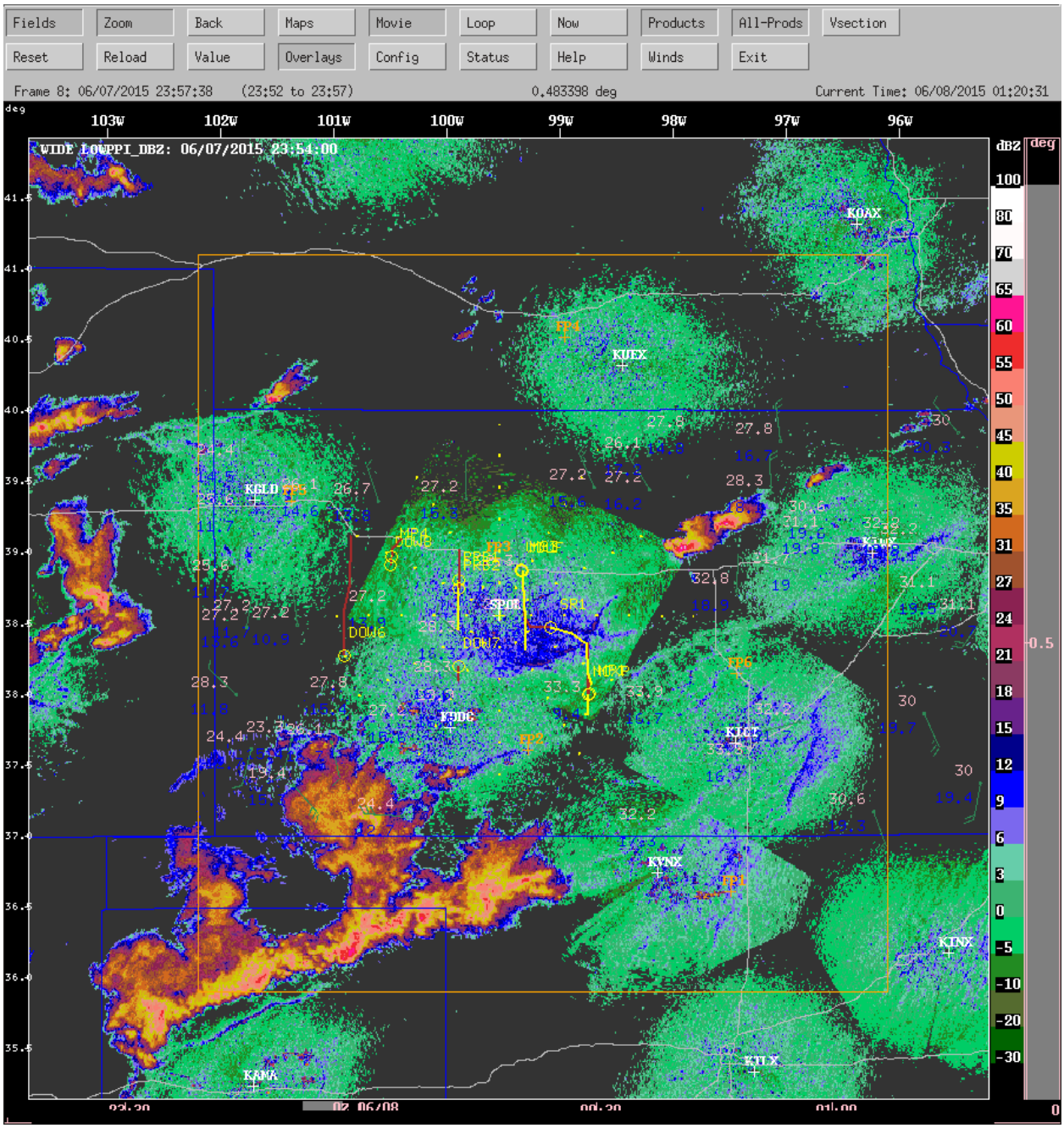

Fig. 2. 2354 UTC radar mosaic.

UWKA took off at 9 pm (0201 UTC) to do a 30-min racetrack pattern across the boundary at 8000 ft MSL to identify boundaries or convergence regions. It's possible they'll do a sawtooth pattern as well.

Outflow boundaries and cold front and stationary boundary are merging. There is a bit of new initiation associated with intersecting cold front, stationary boundary just east of FP6-Hesston (Fig. 3).

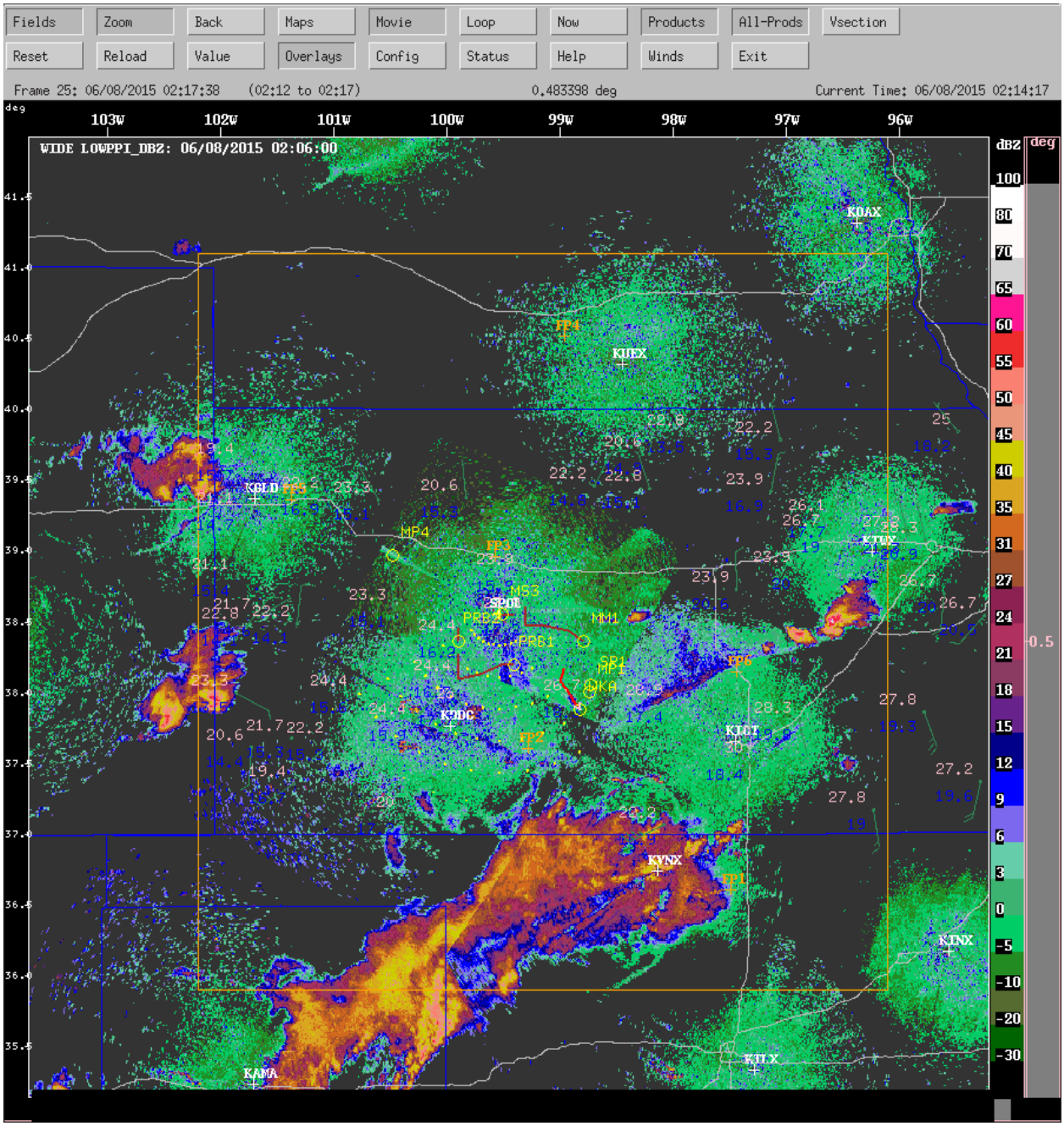

Fig. 3. 0206 radar mosaic.

0236 UTC (936 pm): UWKA is doing a NW-SE racetrack pattern across boundary. They saw a cloud band and 5 m/s updrafts. They will drop to 6000 ft for their next racetrack pattern.

At 0236 UTC, there is some new initiation along the NE edge of the old QLC south of Wichita NEXRAD. This is in advance of the gust front from the system.

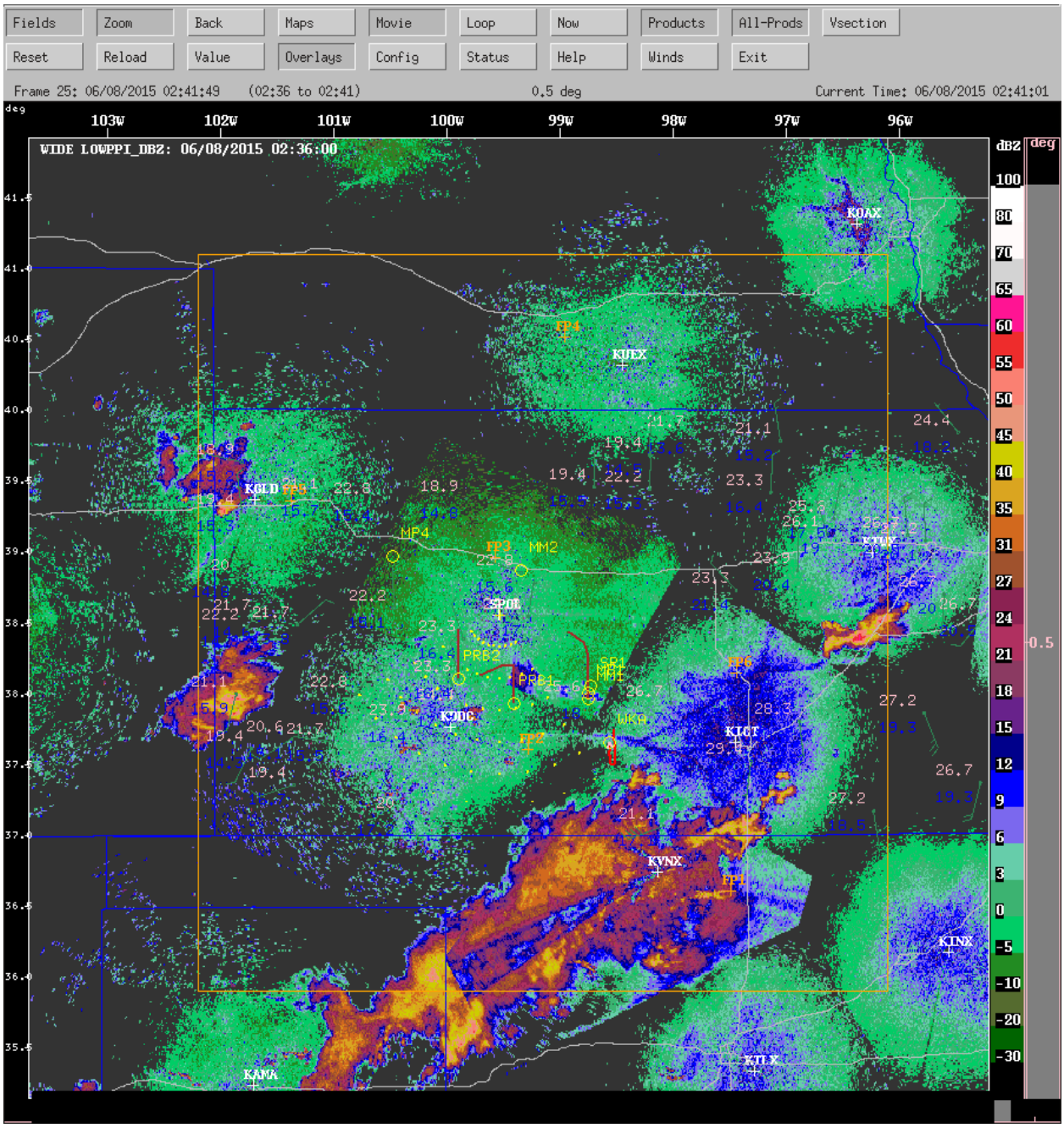

Fig. 4. 0236 UTC radar mosaic.

UWKA was close to a new cell (~40 dBZ) forming. They will move further west.

At 0312 UTC there is a bore and UWKA will fly over it (Fig. 5).

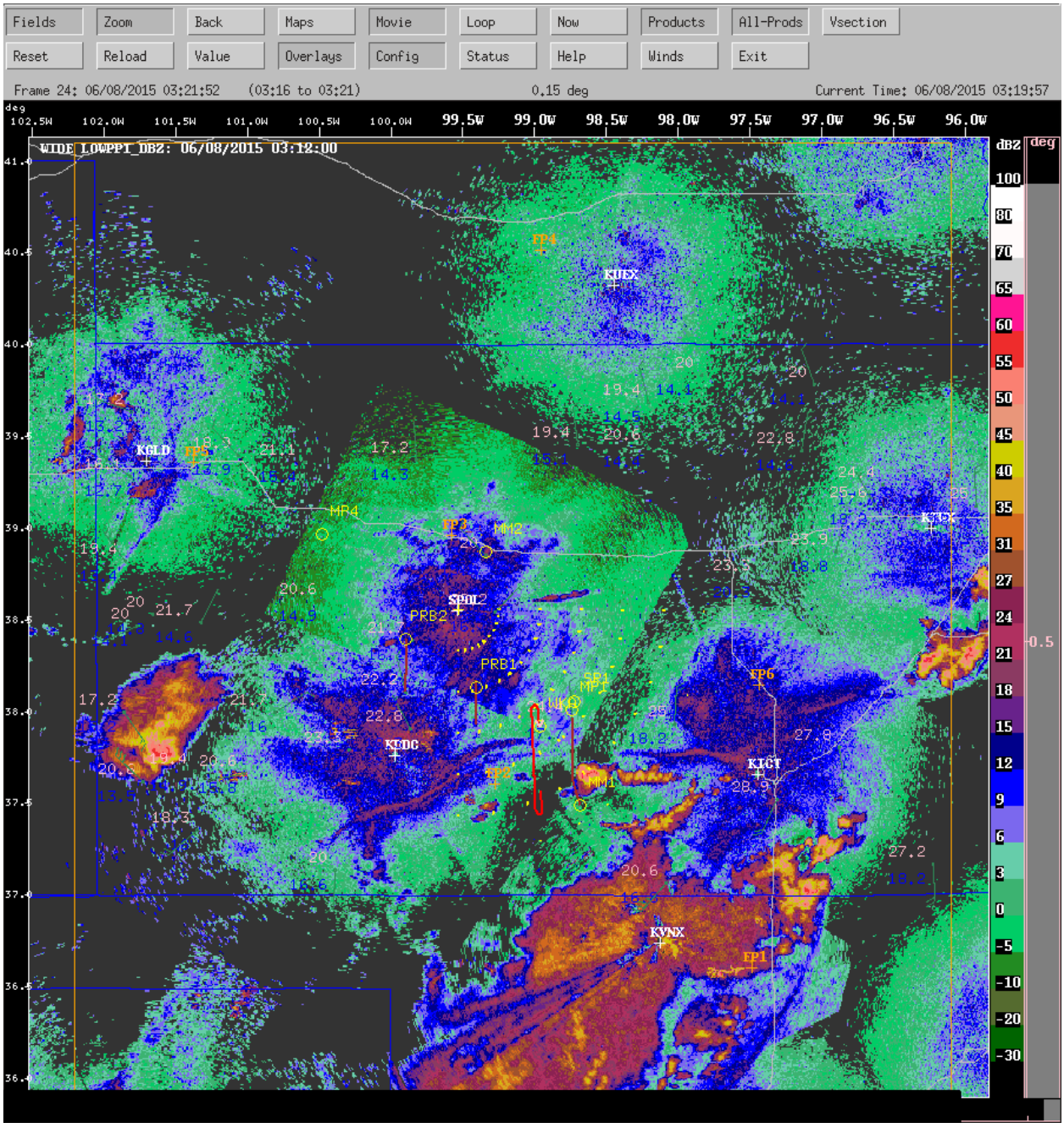

Fig. 5. 0312 UTC radar mosaic.

The bore is initiating new convection at 0340 ~100 km south of S-Pol (Fig. 6). The UWKA will do traverses normal to the bore. TWOLF will do RHIs normal to the bore. So this will become a bore IOP. Just kidding.

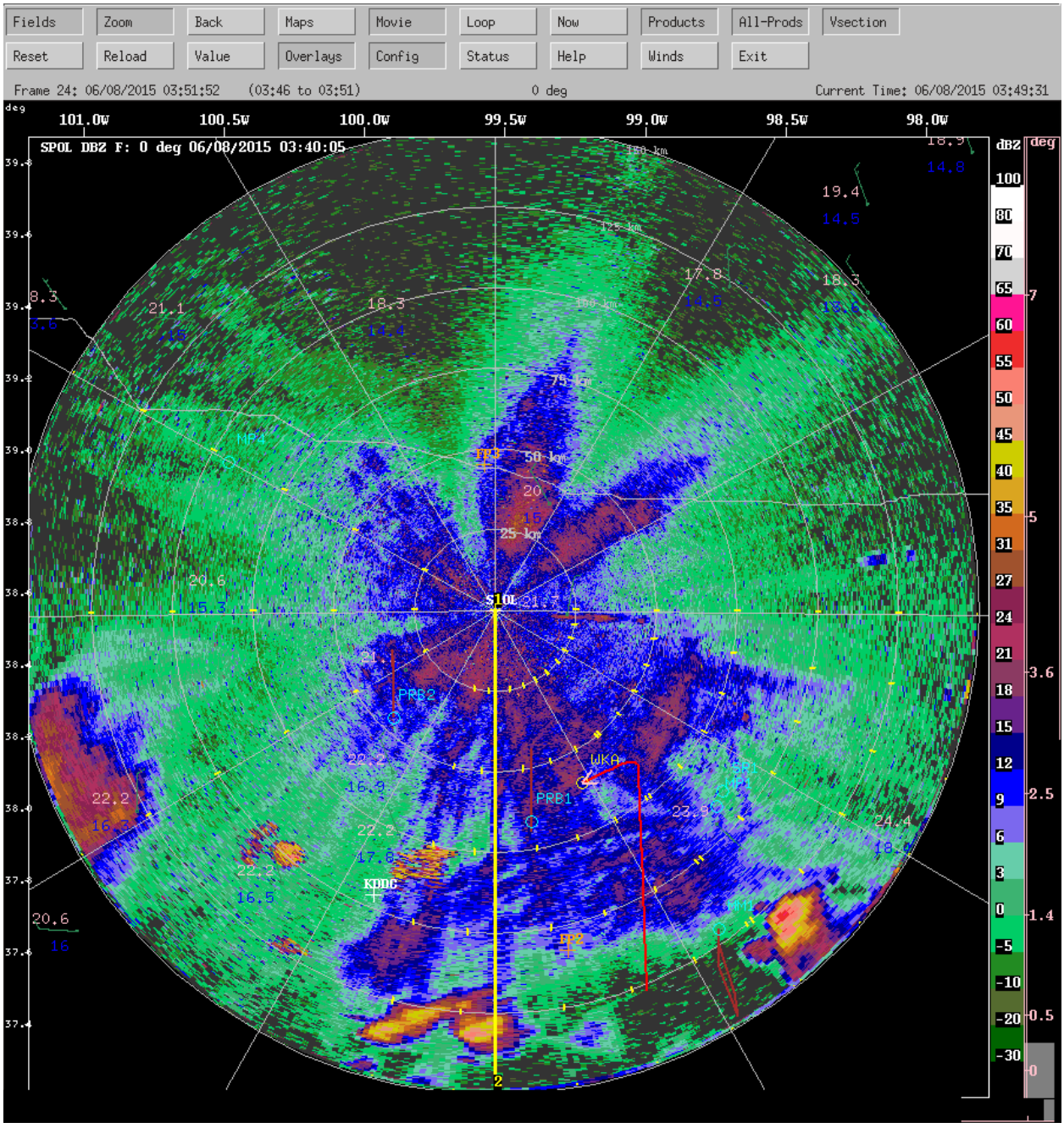

Fig. 6. S-Pol radar reflectivity at 0340 UTC.

Wichita had two boundaries collide and then zipper up initiate.

0412 UTC (1112 LT) Different wave structure orientation in S-Pol north of the bore. One MM will go east-west to cross over it.

Bore passed MP3 at Cimarron. Doppler lidar showed some signature in both the cloud layer and in the low-level vertical motion field (Figs. 6,7). The following data image is from 0330-0454 UTC.

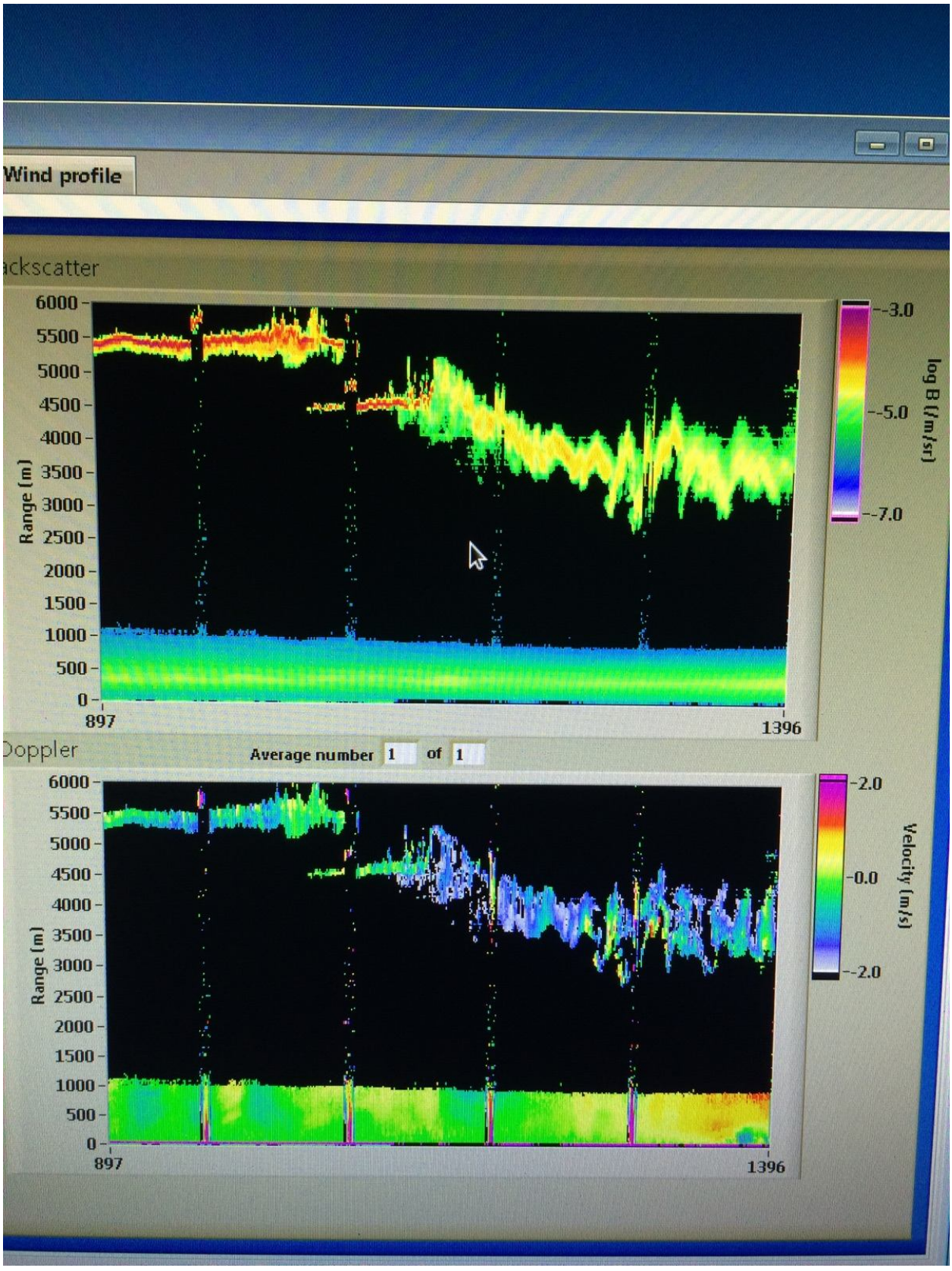

Fig. 6. Doppler lidar in Cimarron with MP3 (SPARC) from 0330-0454 UTC.

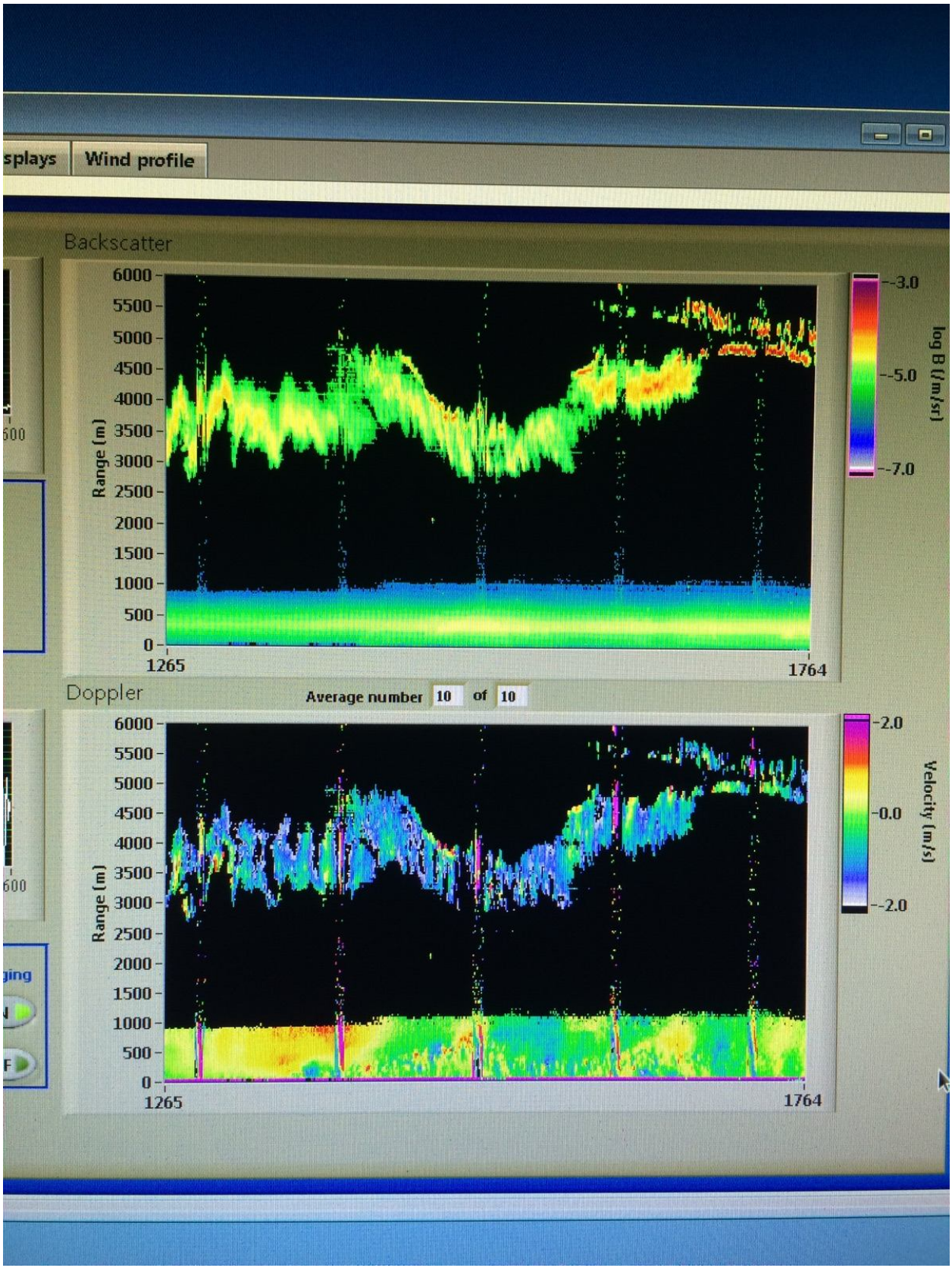

Fig. 7. Doppler lidar in Cimarron with MP3 (SPARC) from 0430-0600 UTC.

New cell forming for no apparent reason at 0430 UTC (1130 LT) 125 km NNW of S-Pol (Fig. 8). It does not last long.

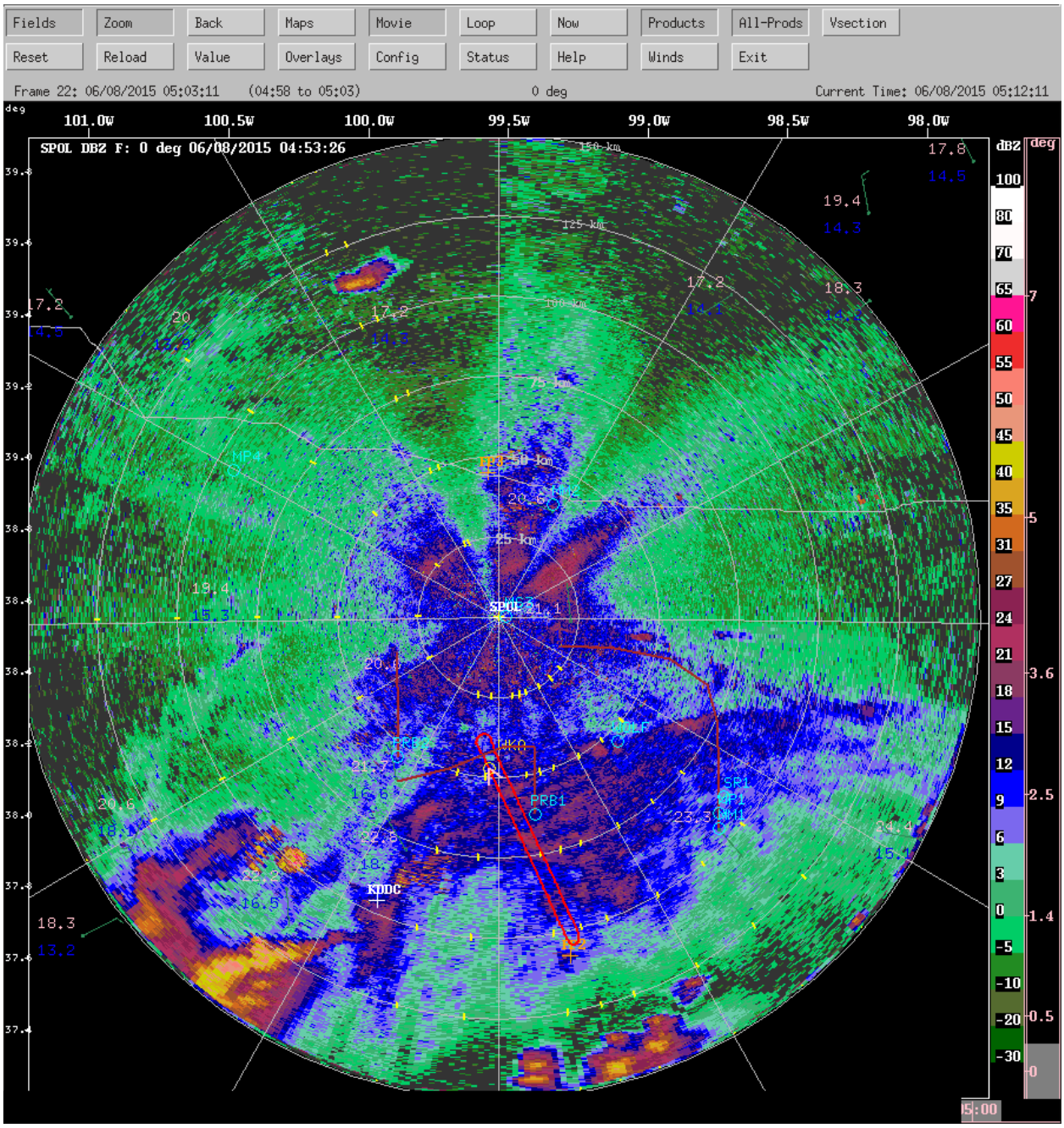

Fig. 8. 0453 UTC S-Pol reflectivity.

CI continues behind and on the eastern edge of the bore (Fig. 9).

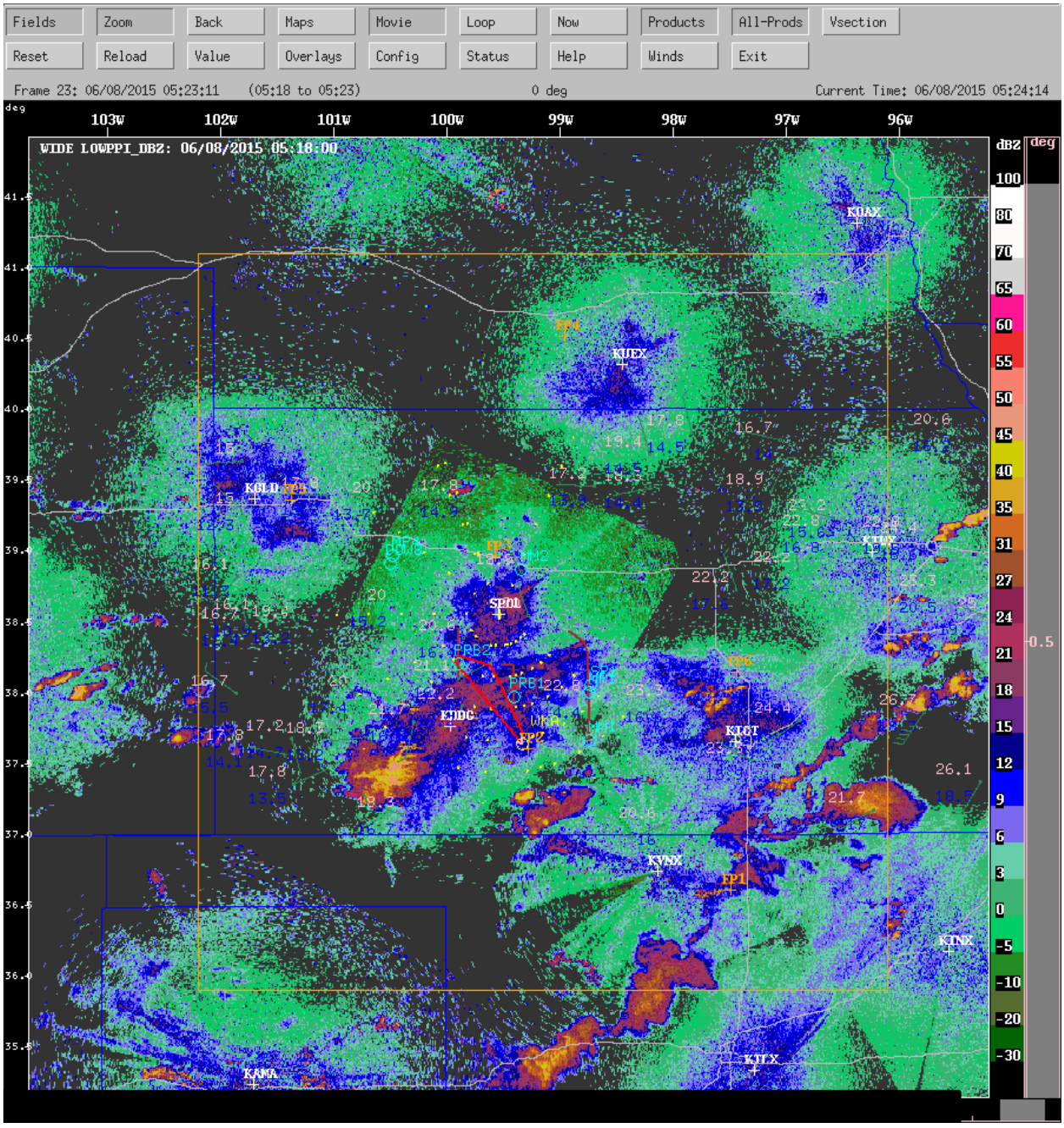

Fig. 9. 0518 UTC radar mosaic.

Mobile mesonet observed a 8 mb pressure rise driving south across bore. And then CI formed over that location.

The 10 pm sounding from FP6 showed that if there is lifting to overcome the negative area below 3 km, there can be CI. Bores have been shown to lift air 1-3 km and indeed CI occurred almost directly over FP6 (Fig. 10). It will be interesting to see the profiling data from FP6.

0549 UTC (1249) UWKA is heading home. They got data on pretty much the complete evolution of the bore and some CI associated with it.

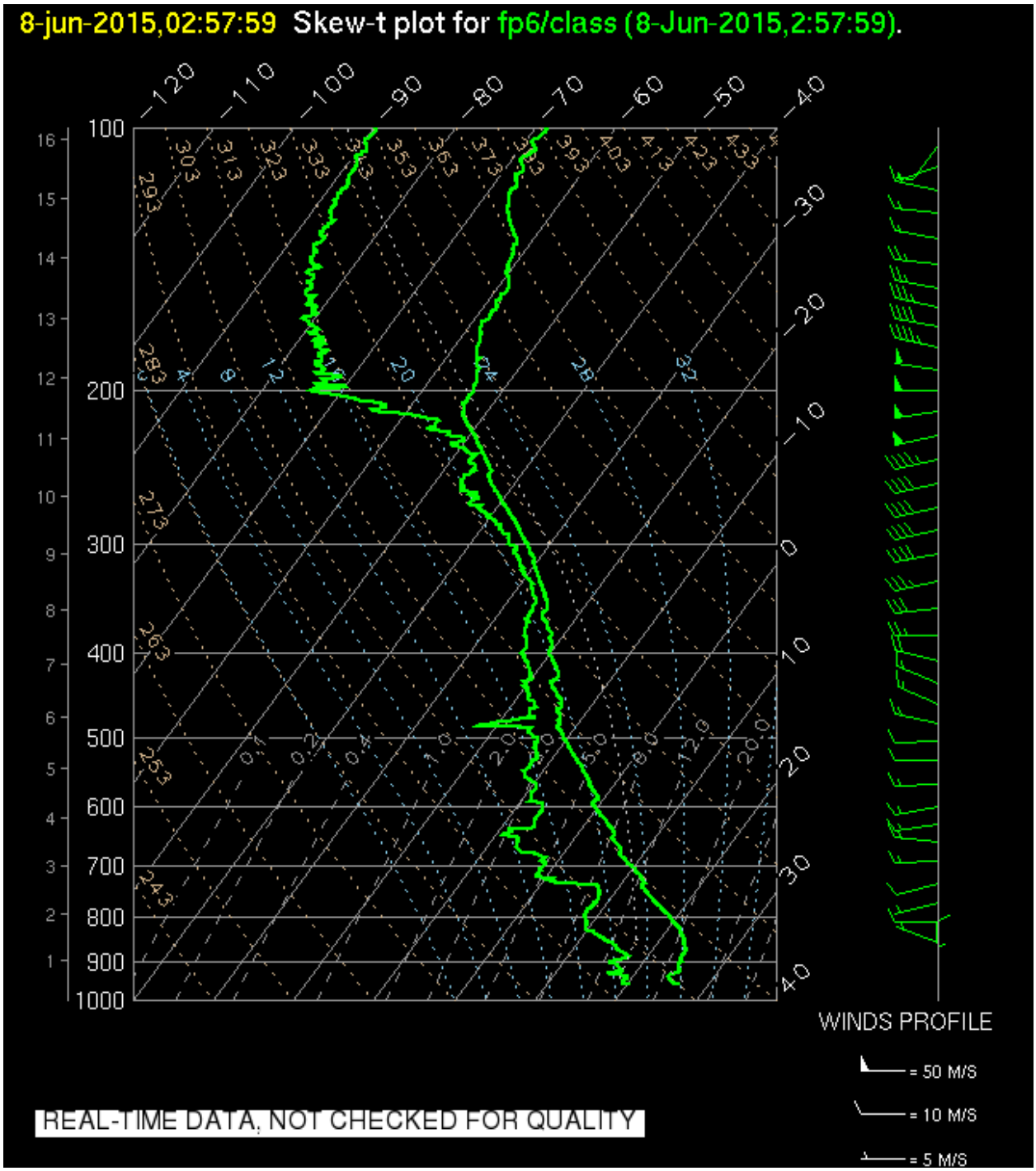

Fig. 10. 0257 UTC sounding from FP6-Hesston.

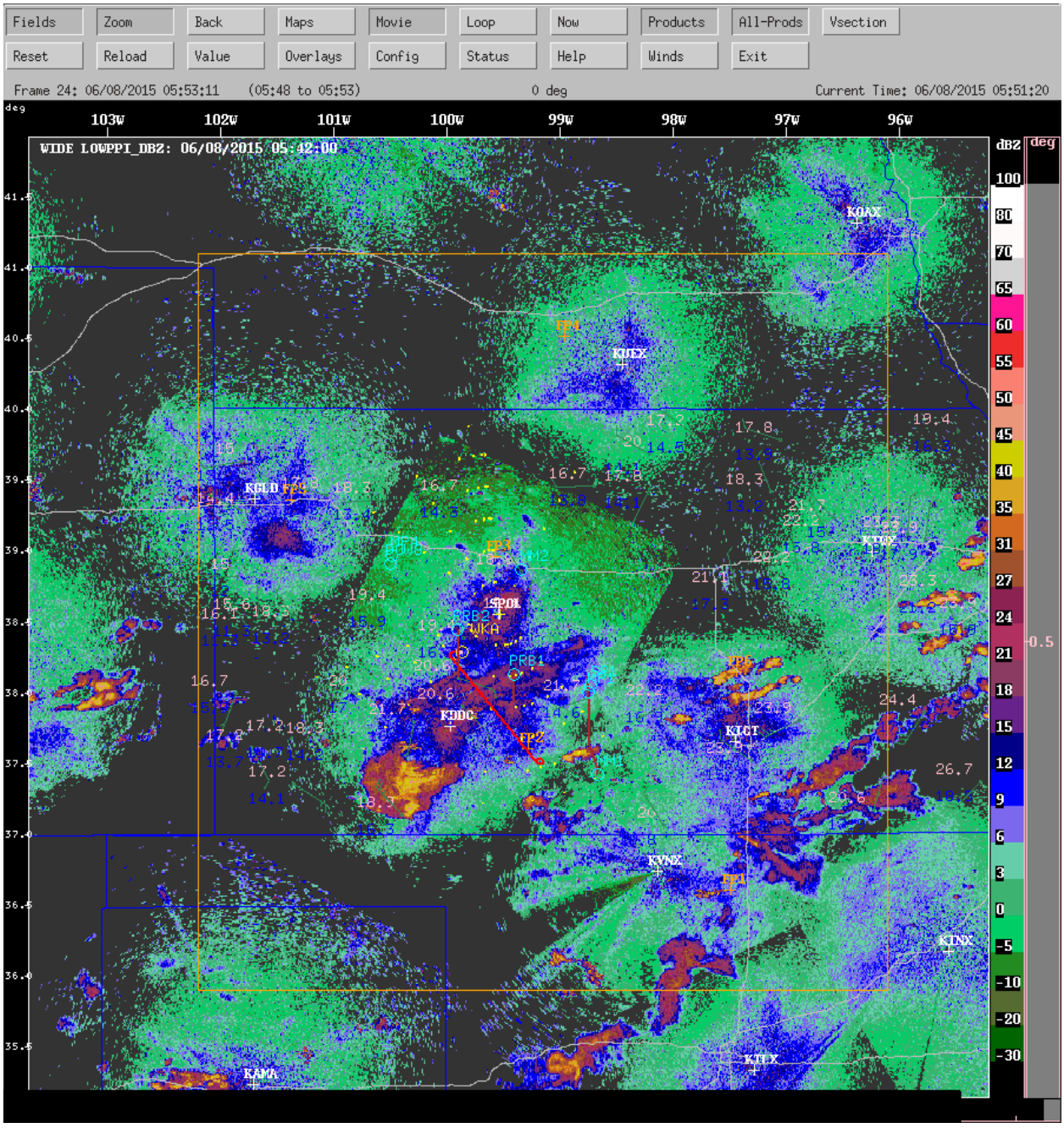

Fig. 11. 0542 UTC radar mosaic.

Amazing bores, propagating northward and southward, initiating convection as they go (Fig. 12).

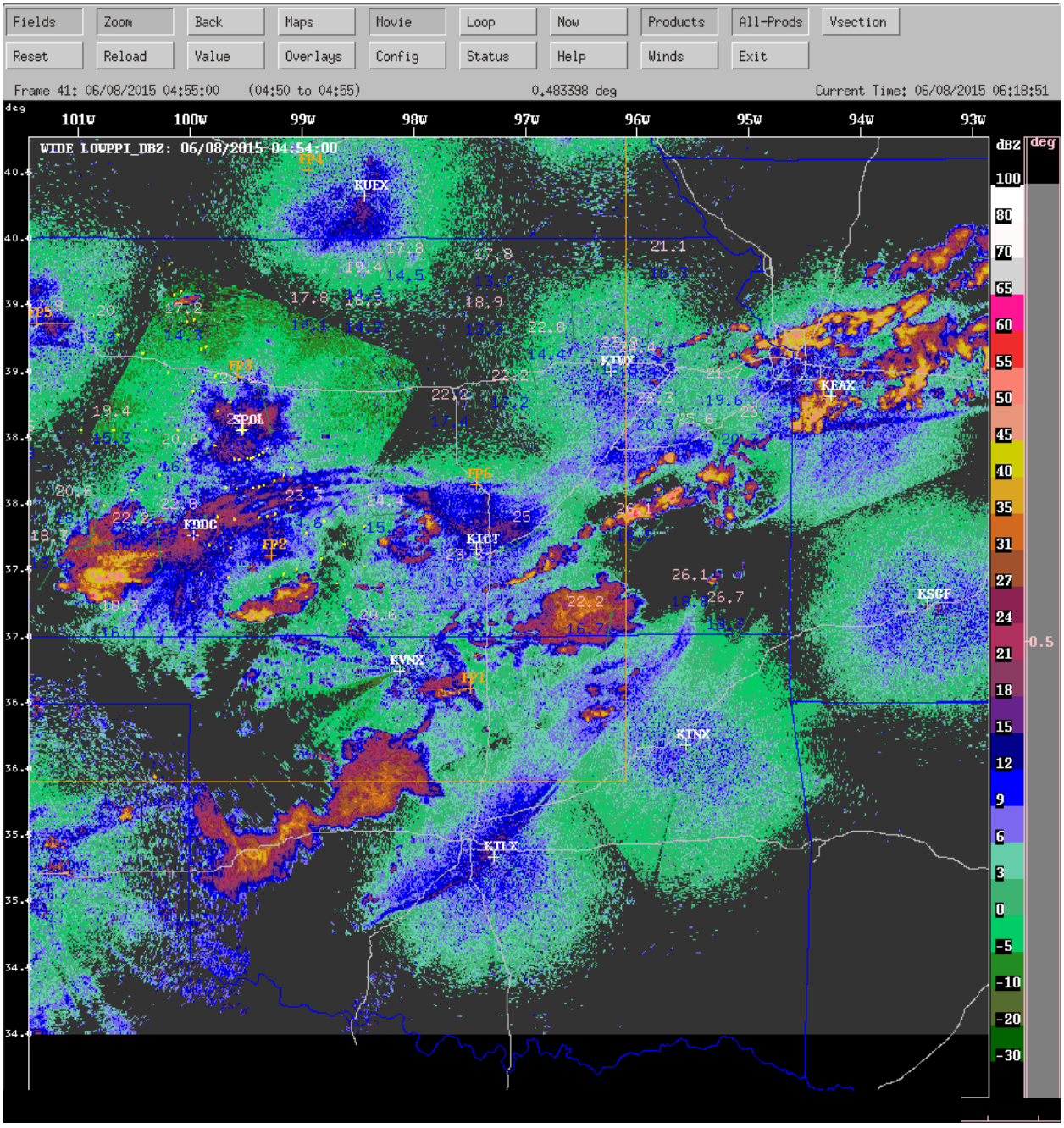

Fig. 12. 0454 UTC radar mosaic.

Bore input from Kevin Haghi (OU)

Bore Aspect

A prolific night for bores: from Colorado to Ohio, bores evolved from convective outflows. The first noticeable bore occurred just before 3Z and was visible with the Dodge City NEXRAD clear air reflectivity. Around the same time, Wichita and Oklahoma City NEXRAD demonstrated reflectivity fine-lines moving away from the perimeter of a linear MCS extending SW to NE along the Texas panhandle,

Oklahoma and into southern Kansas. Along the northern portion of the MCS, a fine-line evolved into an undular bore, moving towards the north into the S-Pol lobe. It was noticeable on S-Pol for multiple hours. From the same MCS, an extremely long-lived undular bore moved towards the east from I-35 in Oklahoma towards Tulsa. It persisted past operations that ended at 630Z. Currently at 9Z it is still ongoing, moving into Arkansas and initiating convection

The NEXRAD network and S-Pol were at times displaying multiple undular bores overlapping one another. One undular pattern in particular passed through the S-Pol and Dodge City NEXRAD coming from the ESE. It's origin is unknown, yet it appeared to sustain itself for an extended period. It also may have interacted with the undular bore moving from the south associated with the main MCS.

Outside of the PECAN domain, there were bores developing from weak convective outflows in the SE portion of Colorado. Extending along the cold front was active elevated convection. From Oklahoma through Missouri, into Indiana and Ohio, multiple long-lived extensive atmospheric bores were pushing S or SE. Atmospheric bores were also noticeable near Amarillo.

A reason for such a prolific night appears to be a very well defined surface stable layer and a present cold front. Soundings in Oklahoma, Missouri, Indiana and Ohio all demonstrate reasonably deep but strong thermal inversions. With a strong inversion, wave ducting only require a small amount of curvature in the winds. It is not unreasonable to believe the synoptic-scale LLJ extending along the cold front provided the curvature necessary for favorable Scorer parameter vertical profiles and thus wave ducts. Behind the cold front, the cold air itself provided the stable boundary and favorable curvature synoptic-scale backing winds with height.

We ended ops at 0630 UTC (130 am LT).