

Case Example of the Utility of the GOES Aviation Fog Depth and Low Cloud Base and MODIS Fog Products by the NWS Albuquerque, NM Weather Forecast Office

Date of the Event: January 7, 2009

The Aviation forecaster at Albuquerque, NM (ABQ) used the GOES Fog Depth and Low Cloud Base products during their January 6 shift from 4pm-12am local time (2300 – 0700 UTC). Two airports in the ABQ county warning area (CWA) had fog in the vicinity as part of their terminal airport forecast (TAF) for the early morning hours of January 7 (See Table 1). The two TAF sites are Farmington (FMN) and Gallup (GUP) (See Figure 1) located to the northwest and west of Albuquerque respectively. These sites are surrounded by large data void areas.

When the 0000 UTC TAFs for these sites were being prepared, the forecaster on duty was unsure of the model guidance suggesting that this fog would occur by 0800 UTC at FMN and 0200 UTC at GUP as had been forecasted in the 1800 UTC issued TAF. The forecaster decided to remove the “VCFG” in the 0000 UTC issued TAF while lowering the cloud bases and visibility (See Table 2) in a “TEMPO” section from 1000-1400 UTC at both locations.

As the evening and early morning progressed the forecaster used the GOES Aviation Fog Depth and Low Cloud Base products along with the MODIS fog product (11-3.9um) to watch the progress of fog and low clouds. The concern was how quickly the areas of low ceilings and visibilities might spread toward the TAF sites. In general, semi-stationary fog and low stratus was seen in the GOES Fog Depth and Low Cloud Base products forming in the early morning hours along the western slopes of two mountain ranges in data void areas (See Figure 2). The fog to the east of FMN up to 0515 UTC had been decreasing in aerial coverage while remaining stationary. By using these fog products from GOES and MODIS the forecaster was able to gain confidence that the 0600 UTC TAFs issued at 0000 UTC were properly adjusted and that fog would likely not affect FMN until 1000 UTC or later.

Feedback included:

“Seeing where the lower clouds and fog were developing through the evening in the imagery made me much more confident if lower clouds and/or fog did occur, it wouldn’t be until 10Z or after, as remained forecasted in the 06Z TAF.”

For GUP the fog had remained to the southeast, but the GOES products indicated that it was becoming more continuous and larger in areal extent, while still fairly small in coverage overall. The MODIS fog product at 0521 UTC corroborated with GOES imagery and the product showed value at GUP by hinting at fog at this time (See Figure 3). Feedback from the forecaster indicated that they were beginning to adjust the GUP TAF to be issued at 0600 UTC to include the possibility (i.e. a “TEMPO” section) of fog conditions with 1 SM visibility from 0600 to 1000 UTC and lowering to 1/2SM visibility from 1000 to 1400 UTC (See Table 3). This adjustment to the TAF was partly based on what was being observed in the GOES and MODIS fog products, and in fact, these conditions began to occur a bit sooner than expected as a METAR special report of low visibility began to occur just before 0600 UTC.

According to the forecaster’s estimation, extra lead time to the 0600 UTC issued TAFs was provided through the examination of these products. Visibility at GUP varied from VFR to IFR during the 0600-1000 UTC period (See Table 4) with sparse fog indicated in the GOES products by 0915 UTC (See Figure 4). The MODIS fog product at this time showed a more continuous area of low clouds than the GOES products and higher cirrus clouds were possibly blocking the view of the low level features in the area of GUP. By 1115 UTC (See Figure 5) the areas of fog and low stratus are seen in the GOES products as becoming more continuous, but also remaining stationary and hence not affecting the FMN and GUP areas.

Other feedback from the forecaster included:

"We don't all that often or reliably see fog in our CWA so it was exciting to have an opportunity to use the new products. Thanks!"

This input supports the method of Service Oriented Architecture (SOA) that is being proposed for the next generation data server for the FAA and NWS. ABQ found value in these products while they do not often experience fog conditions. The climatology of each of these sites has a peak value in the occurrence of IFR visibility conditions of less than 10% at 1200 UTC, suggesting that a constant stream of this data to the local system could be a misuse of resources, but user-driven access is valuable and warranted.

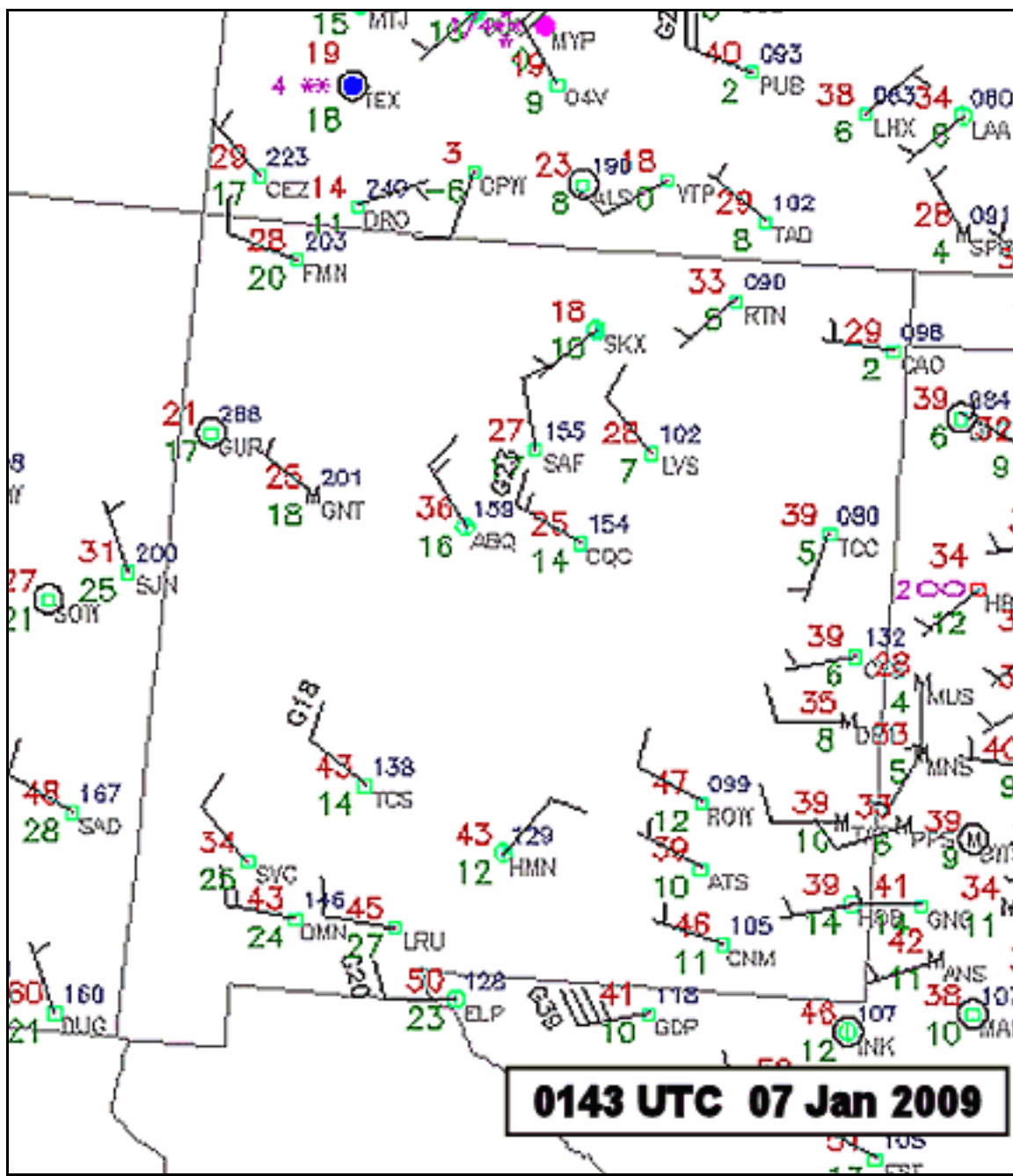


Figure 1 - Station model of METAR observations at 0143 UTC on January 7, 2009 centered on New Mexico. The airports at Farmington (FMN) and Gallup (GUP) to the northwest and west of Albuquerque (ABQ) respectively, are expected to have fog in the vicinity during the early morning hours.

<p>FTUS80 KFMN 061742 RRC KFMN 061738Z 0618/0718 VRB05KT P6SM SCT015 BKN250 FM062100 27010KT P6SM BKN250 FM070300 36010KT P6SM SCT025 OVC050 FM070800 06010KT P6SM VCFG SCT001 BKN040</p>	<p>FTUS80 KGUP 061742 RRC KGUP 061738Z 0618/0718 24010KT P6SM VCFG SCT015 FM062100 24010KT P6SM SCT250 FM070200 24010KT P6SM VCFG SCT007 SCT040 FM070800 21010KT P6SM VCFG SCT001 FM071300 24010KT P6SM VCFG SCT001 SCT025</p>
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Table 1 - Terminal Airport Forecast (TAF) valid from 1800 UTC January 6 to 0800 UTC January 7 for Farmington (FMN) and Gallup (GUP) New Mexico issued at 1800 UTC. Notice "VCFG" in the early morning hours of both TAFs. This code represents fog in the vicinity is expected (highlighted in yellow with bold font).

<p>FTUS80 KFMN 062342 RRC KFMN 062340Z 0700/0724 27010KT P6SM BKN250 FM070300 VRB06KT P6SM SCT006 SCT250 TEMPO 0710/0714 09006KT 3SM BR OVC006 FM071500 VRB06KT P6SM SCT005 SCT040 FM071800 28012G18KT P6SM SCT050 SCT250</p>	<p>FTUS80 KGUP 062342 RRD KGUP 062340Z 0700/0724 25007KT P6SM SCT040 SCT250 FM070200 VRB06KT P6SM SCT012 SCT250 TEMPO 0710/0714 3SM BR OVC005 FM071500 VRB06KT P6SM SCT005 SCT025 SCT250 FM071900 25008KT P6SM SCT040 SCT250</p>
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Table 2 - Terminal Airport Forecast (TAF) valid from 0000 UTC January 7 to 0000 UTC January 8 for Farmington (FMN) and Gallup (GUP) New Mexico issued at 0000 UTC. Notice "VCFG" in the early morning hours of both TAFs has been removed from the prior TAF issued at 1800 UTC in Table 1 while the ceilings and visibilities have been lowered.

<p>FTUS80 KFMN 070542 RRD KFMN 070539Z 0706/0806 VRB06KT P6SM SCT006 SCT250 TEMPO 0710/0714 09006KT 3SM BR OVC006 FM071500 VRB06KT P6SM SCT005 SCT040 FM071800 28012G18KT P6SM SCT050 SCT250</p>	<p>FTUS80 KGUP 070542 RRE KGUP 070539Z 0706/0806 VRB06KT P6SM SCT012 SCT250 TEMPO 0706/0710 1SM BR OVC012 FM071000 VRB06KT 5SM BR SCT005 SCT250 TEMPO 0710/0714 1/2SM FZFG OVC005 FM071600 VRB06KT P6SM SCT005 SCT025 SCT250 FM071900 25013KT P6SM SCT040 SCT250</p>
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Table 3 - Terminal Airport Forecast (TAF) valid from 0600 UTC January 7 to 0600 UTC January 8 for Farmington (FMN) and Gallup (GUP) New Mexico issued at 0000 UTC. FMN forecast for fog and IFR conditions to occur after 1000 UTC remains GUP has been adjusted with an earlier arrival of IFR conditions down to 1SM visibility to occur during some part of the time period from 0600 to 1000 UTC and ½SM temporarily to occur from 1000 to 1400 UTC.

<p>KGUP 070953Z AUTO 00000KT 10SM CLR M16/M18 A3015 RMK AO2 SLP301 T11611178 KGUP 070853Z AUTO 00000KT 7SM CLR M14/M16 A3015 RMK AO2 SLP295 T11441161 53006 KGUP 070849Z AUTO 00000KT 2 1/2SM BR CLR M15/M17 A3014 RMK AO2 KGUP 070820Z AUTO 00000KT 5SM BR CLR M15/M17 A3013 RMK AO2 KGUP 070810Z AUTO 00000KT 1 3/4SM BR CLR M16/M18 A3013 RMK AO2 KGUP 070753Z AUTO 00000KT 10SM CLR M15/M17 A3012 RMK AO2 SLP286 T11501167</p>

Table 4 - METAR reports at Gallup, NM (KGUP) from ~0800 to ~1000 UTC. Visibility conditions varied widely while clear skies(CLR) remained. Fog was included in the GUP TAF as a temporary condition from 0600 to 1000 UTC (refer to Table 3)

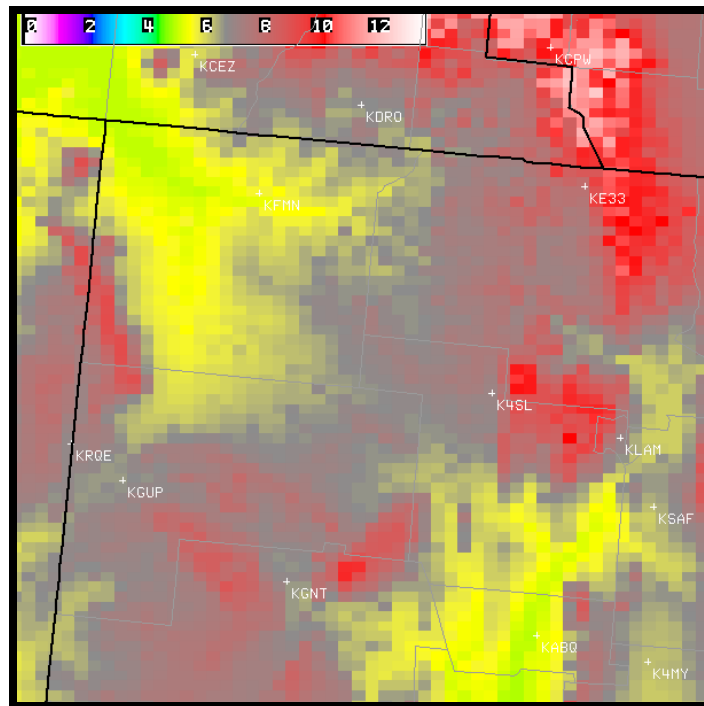
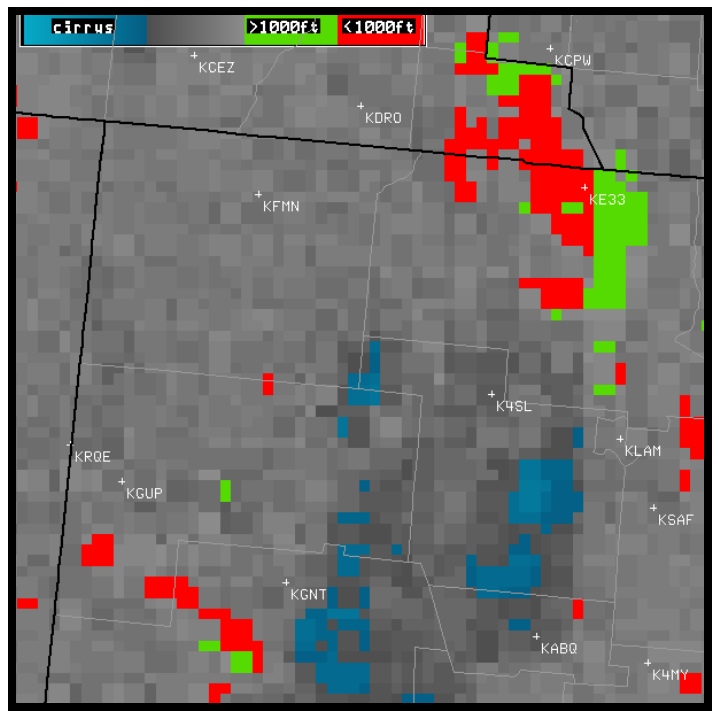
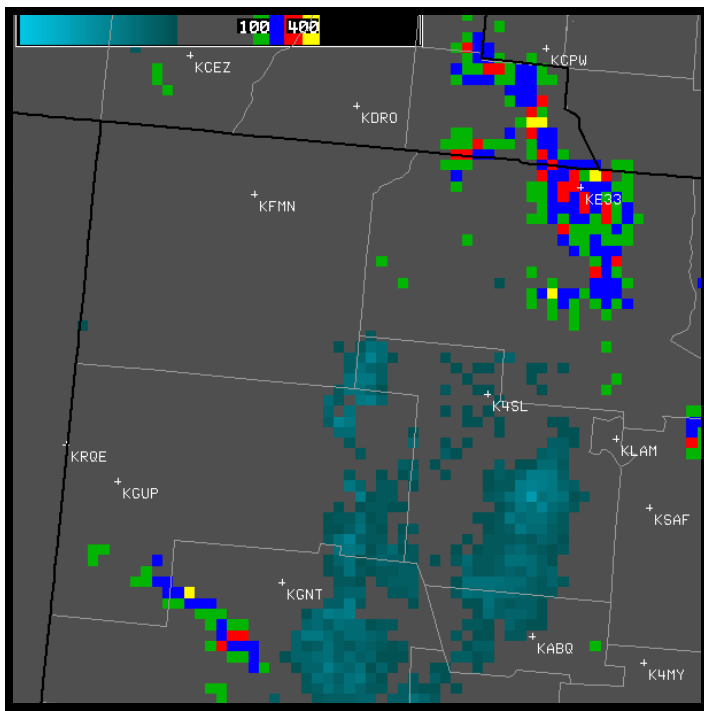


Figure 2 – GOES Aviation Fog Depth (upper left) and Low Cloud Base (upper right) at 0515 UTC on January 7, 2009 for the northwest area of the Albuquerque, NM County Warning Area. Farmington (KFMN) and Gallup (KGUP) are TAF sites. Fog and low stratus is seen in these products to the west of higher elevation areas seen in the topography image from AWIPS (lower center, shaded in thousands of feet).

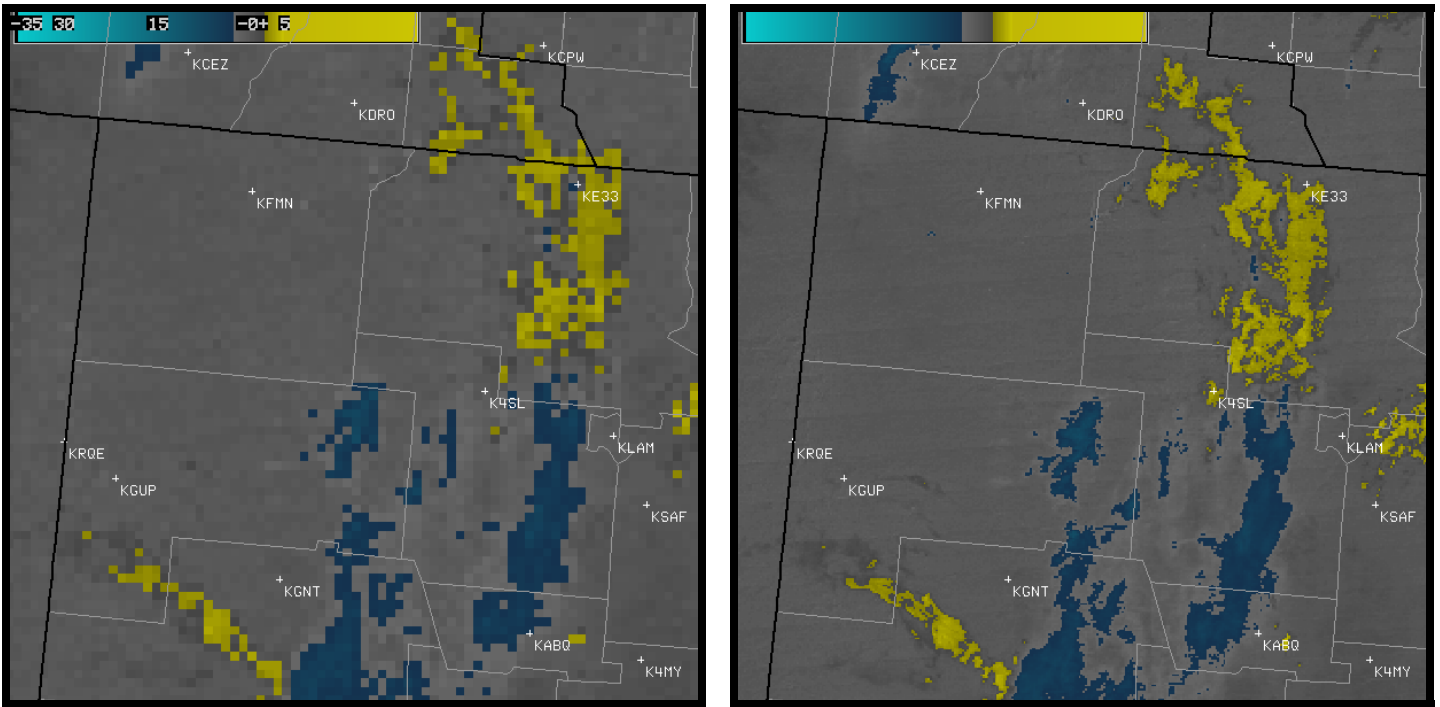


Figure 3 – Same as Figure 2 except for the MODIS fog (11um-3.9um) product at 0521 UTC. MODIS fog product imagery indicates fog/low stratus in locations similar to the GOES Aviation products. The 4km MODIS fog (left) was available for the event, but the 1km imagery (right) is shown as an example of the greater detail that can be seen in the variable elevation areas. Notice that some darker grey shading is near the KGUP TAF site even though the bulk of the indicated fog (in yellow) is to the southeast.

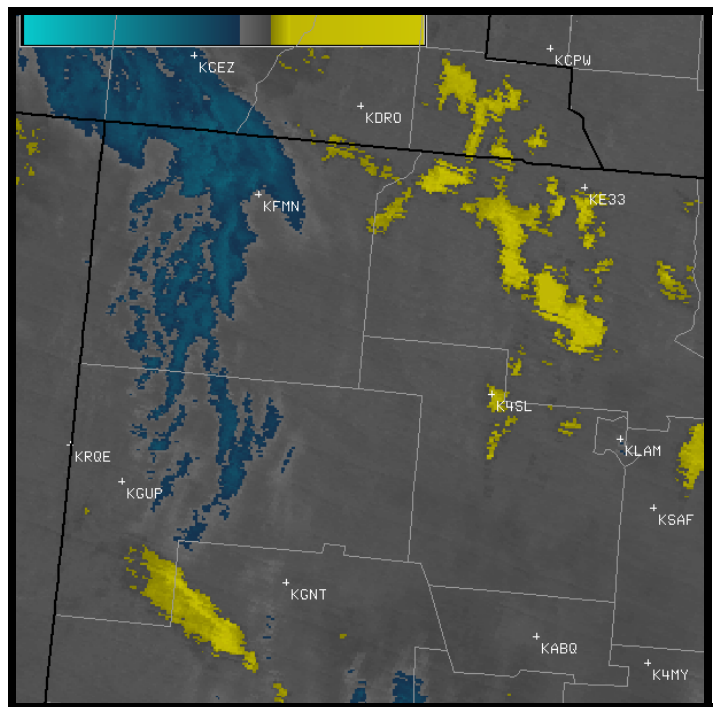
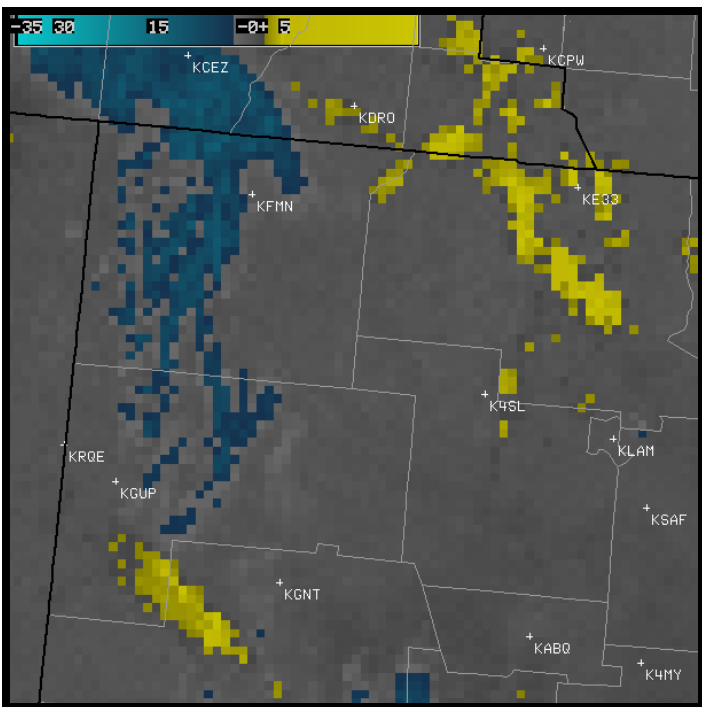
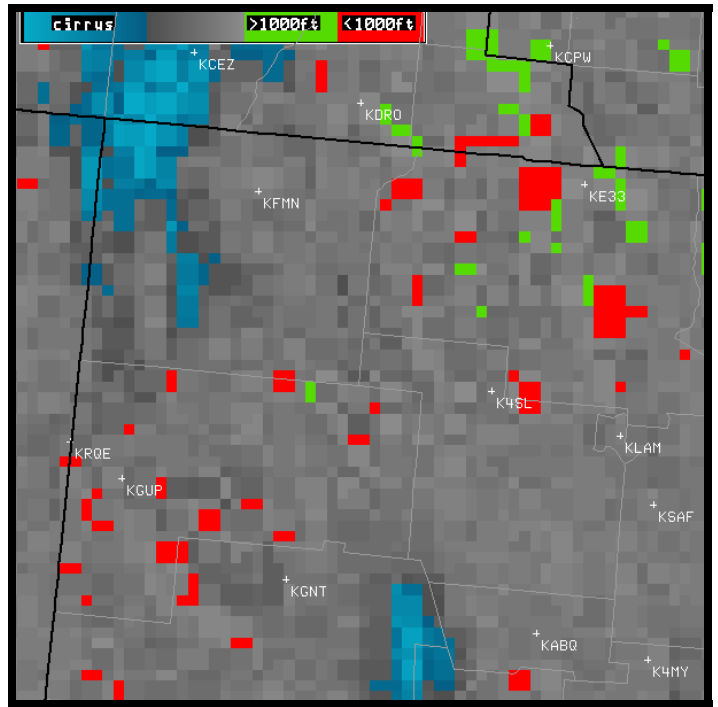
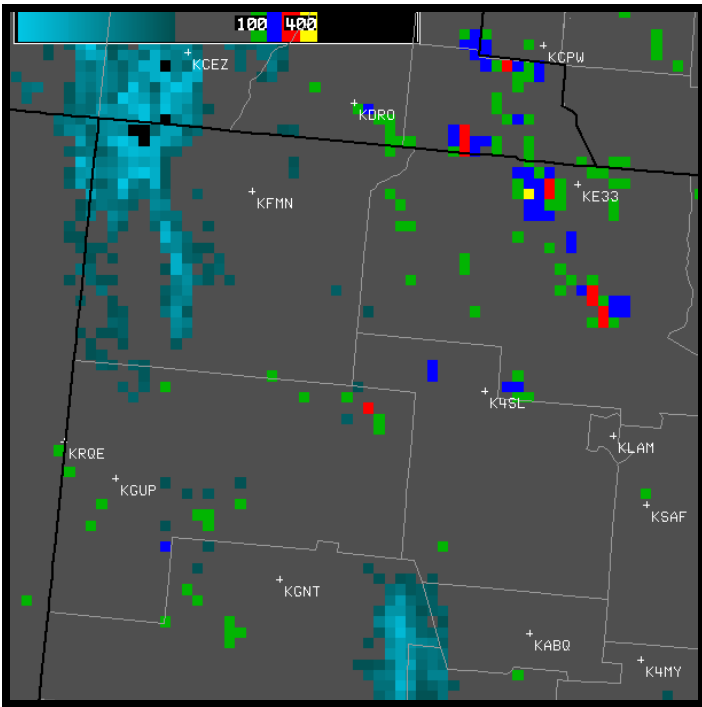


Figure 4 - GOES Aviation Fog Depth (upper left) and Low Cloud Base (upper right) at 0915 UTC on January 7, 2009 for the northwest area of the Albuquerque, NM County Warning Area. MODIS fog product (11um-3.9um) at 0934 UTC at 4km (lower left) and 1km (lower right) resolutions for the same area. Areas of fog in GOES products have become thin and sparse compared to 0515 UTC (figure 3). However MODIS fog products provide more continuity and more detail in the 1km image, especially in higher terrain areas to the east of Farmington (KFMM)

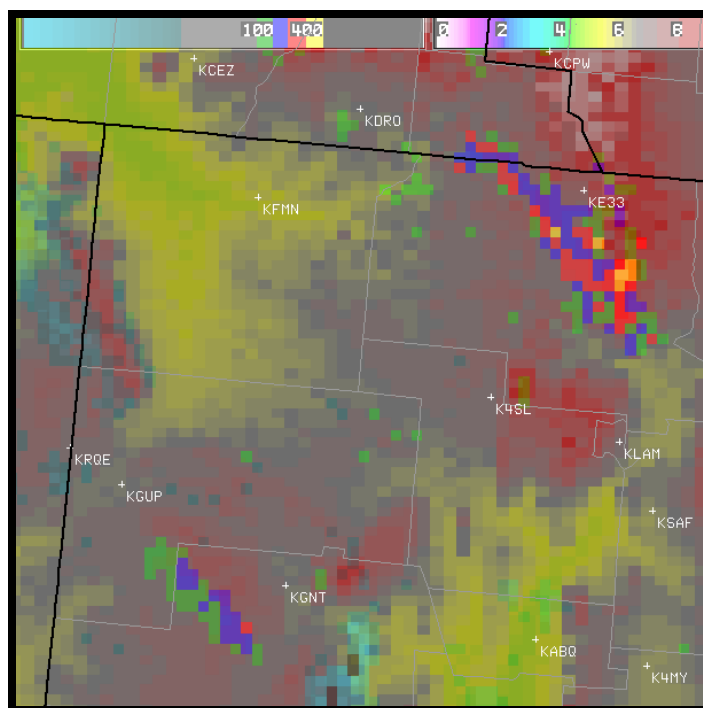
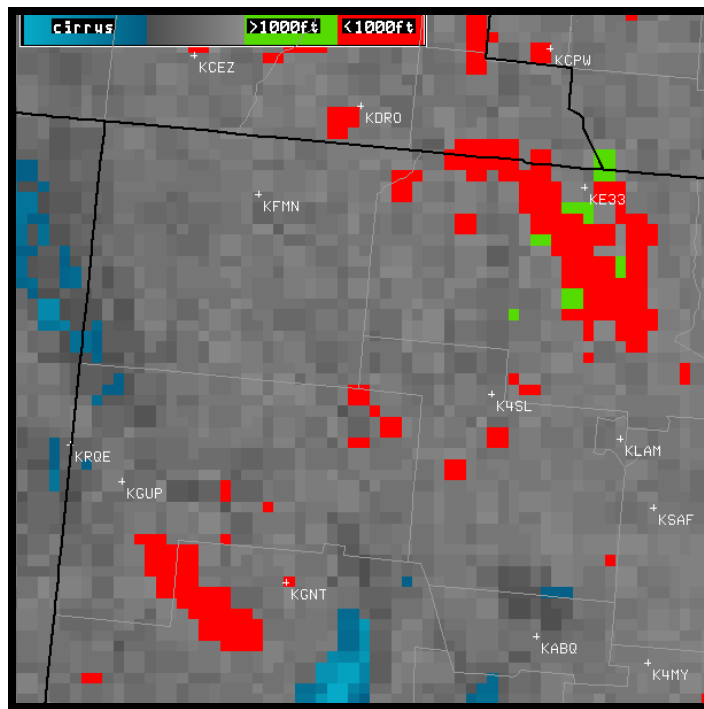
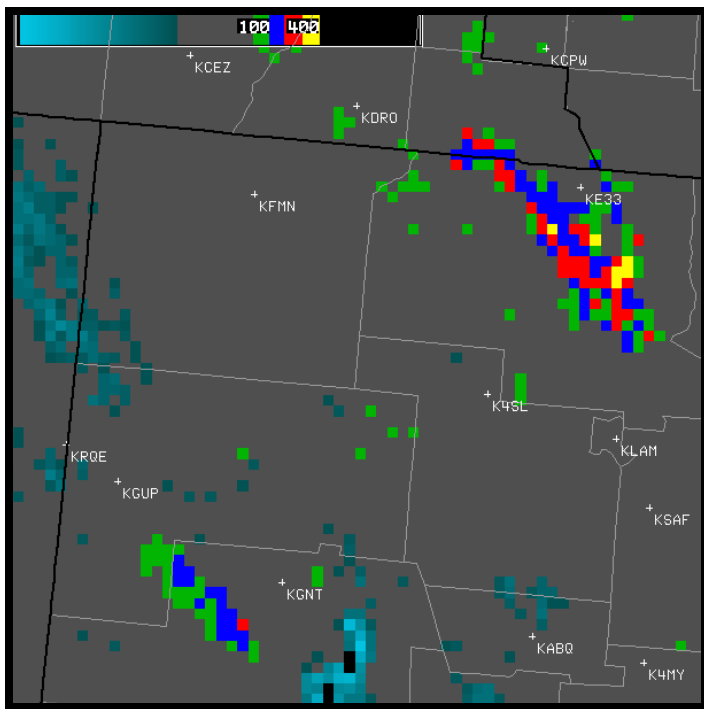


Figure 5 - GOES Aviation Fog Depth (upper left) and Low Cloud Base (upper right) at 1115 UTC on January 7, 2009 for the northwest area of the Albuquerque, NM County Warning Area. The fog depth is also shown overlaid on the AWIPS topography image. Notice that the areas of fog are in similar locations as they were at 0515 UTC (See Figure 1) and even earlier.