

A Review of IFR Conditions

Central Indiana, 30 November 2008

12-22Z

Logan Johnson

Summary

On the morning of November 30, 2008, a surface low pressure system tracked up through the southeastern United States and into south Central Indiana. During the afternoon hours, the low slowly moved northward directly over central Indiana, before exiting the state into lower Michigan by the evening. The system brought mixed wintry precipitation, beginning as snow and sleet, and eventually changing to rain as warmer air rushed northward with the low's passage.

As the low crossed Central Indiana, IFR conditions developed at all TAF sites in Central Indiana. The event was a mix of reduced ceiling heights below 1000 feet, and visibilities of less than 3 miles, with both sometimes simultaneously occurring. Conditions did briefly fall to LIFR at times with visibility below 1 mile, and conditions fell to VLIFR at IND where visibility fell to 1/4SM and VV001 Ceiling conditions. Conditions were IFR or worse for between 6 and 12 hours.

MOS will be examined to see how well the event was forecast by traditional numerical guidance. Finally, a brief analysis of forecast and observed weather conditions will help to analyze the physical causes of the IFR conditions.

Surface Observations

Red Colors Indicate IFR or lower conditions

KBMG

12Z 13003KT 6SM -RA BR BKN004 OVC012 01/00
13Z 00000KT 6SM -RA BR BKN004 OVC010 01/01
14Z 15004KT 2 1/2SM BR OVC004 02/01
15Z 17003KT 1 1/2SM BR OVC002 02/01
16Z 22007KT 3SM BR OVC002 03/02
17Z 25007KT 5SM BR OVC006 03/02
18Z 24009KT 5SM BR OVC008 03/02
19Z 26005KT 7SM OVC008 03/01
20Z 24008KT 7SM OVC006 03/01

21Z 24009KT 10SM SCT010 OVC015 02/00

KIND

12Z 10006KT 3SM -SNPL BR BKN009 OVC013 01/M01
13Z 10005KT 2 1/2SM -SN BR OVC007 01/00
14Z 12004KT 3SM BR OVC005 01/00
15Z 00000KT 2 1/2SM BR OVC003 01/01
16Z 19005KT 3/4SM BR OVC003 02/01
17Z 22004KT 1SM -DZ BR OVC001 02/02
18Z 24008KT 3SM BR OVC003 03/02
19Z 26007KT 5SM BR OVC005 03/02
20Z 22008KT 6SM BR OVC012 03/01
21Z 23010KT 6SM -RA BR BKN008 OVC016 02/01
22Z 23008KT 6SM BR BKN008 OVC015 02/01
23Z 24012KT 10SM OVC008 02/00
00Z 24011KT 10SM OVC010 02/M01
01Z 24010KT 10SM OVC021 01/M02

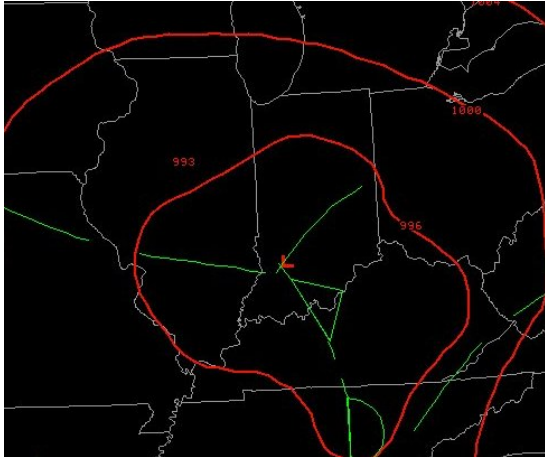
KHUF

12Z 00000KT 2SM -SN BR OVC013 01/M01
13Z 00000KT 2SM BR BKN005 OVC012 01/M01
14Z 00000KT 2SM BR BKN003 OVC008 01/M01
15Z 00000KT 3SM BR OVC003 01/M01
16Z 24007KT 2SM BR OVC005 02/01
17Z 24008KT 4SM BR BKN005 OVC010 02/01
18Z 24008KT 4SM BR OVC005 02/00
19Z 24007KT 10SM SCT009 BKN013 OVC021 03/00
20Z 25007KT 10SM BKN011 OVC018 02/M01

KLAF

12Z 07008KT 2 1/2SM -SN BR BKN006 OVC010 00/M02
13Z 08007KT 1 1/4SM -SN BR OVC006 00/M02
14Z 09007KT 3SM BR OVC006 01/M02
15Z 09006KT 3SM BR OVC006 01/M02
16Z 09006KT 3SM BR OVC006 01/M02
17Z 10004KT 3SM BR OVC006 01/M01
18Z 00000KT 1 1/2SM BR OVC004 01/M01
19Z 00000KT 3/4SM BR OVC004 01/M01
20Z 25005KT 1/4SM FG VV001 01/M01
21Z 23006KT 3/4SM BR OVC001 01/M01
22Z 24006KT 2SM BR OVC005 01/M01
23Z 23005KT 6SM BR SCT007 SCT011 OVC016 01/M01

Synoptic Scale Analysis 12Z



At 12Z on 30 November, the surface low had tracked into southwestern Indiana and was located near Knox and Daviess Counties in our Forecast Area. Surface obs at 12Z:

BMG 12Z 13003KT 6SM -RA BR BKN004 OVC012 01/00

IND 12Z 10006KT 3SM -SNPL BR BKN009 OVC013 01/M01

HUF 12Z 00000KT 2SM -SN BR OVC013 01/M01

LAF 12Z 07008KT 2 1/2SM -SN BR BKN006 OVC010 00/M02

Observations at this time are consistent with a nearby surface low pressure. While all sites were still north of the low, it was close enough that warm air was intruding in the low levels and beginning to cause a changeover of precipitation. All sites were just above freezing except LAF which was far enough north of the low to remain in an ENE surface wind direction.

15Z



BMG 15Z 17003KT 1 1/2SM BR OVC002 02/01
IND 15Z 00000KT 2 1/2SM BR OVC003 01/01
HUF 15Z 00000KT 3SM BR OVC003 01/M01
LAF 15Z 09006KT 3SM BR OVC006 01/M02

The surface low continued to lift north. It was located somewhere in the immediate vicinity of Putnam County Indiana. Observations were consistent with this, as IND and HUF had calm winds and LIFR conditions. All sites had risen above freezing at this point, with LAF remaining in an easterly wind regime. BMG had just entered the true warm sector south of the low and the temperature was rising.

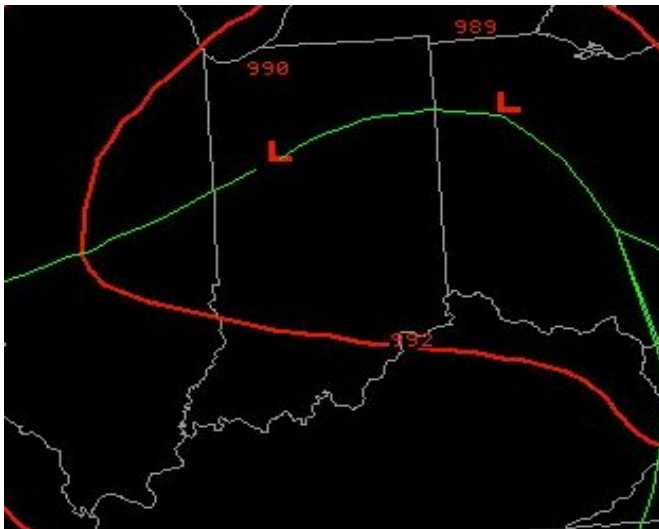
18Z



BMG 18Z 24009KT 5SM BR OVC008 03/02
IND 18Z 24008KT 3SM BR OVC003 03/02
HUF 18Z 24008KT 4SM BR OVC005 02/00
LAF 18Z 00000KT 1 1/2SM BR OVC004 01/M01

The surface low had pushed to near LAF by 18Z. From the wind fields, it is evident that the warm sector had pushed through all sites but LAF at this time. Visibilities had improved in the warmer temperatures and dew points, both of which had climbed to above freezing in the southwest winds.

21Z



BMG 21Z 24009KT 10SM SCT010 OVC015 02/00
IND 21Z 23010KT 6SM -RA BR BKN008 OVC016 02/01
HUF 21Z 26008KT 9SM OVC010 02/M01
LAF 21Z 23006KT 3/4SM BR OVC001 01/M01

By 21Z the low had moved only a little farther north and remained across far north central Indiana. Winds were southwest at all sites, but at HUF the winds were turning more westerly. Conditions remained IFR at IND and LIFR at LAF, but had improved at HUF and BMG. LAF, with its close proximity to the low had the worst conditions.

Brief Synopsis of Synoptic Conditions and WHY?

Through an analysis of observations and surface maps, it is evident that the worst conditions were co-incident with the presence of the surface low pressure. The question is then, why?

There seems to be two factors involved in this particular case, preconditioning and then the presence of the surface low.

Preconditioning was achieved through the light precipitation that fell across the area during the morning hours. As temperatures began below freezing, the ground was quite cold and precipitation fell as snow and sleet. Then warmer air moved in as the low pushed north. The atmosphere was now saturated, and then the advection of warm and moist air over a cold ground occurred. These were preconditioning factors that primed the atmosphere.

As the low moved overhead, surface winds dropped to calm very rapidly. Then the action of mixing the atmosphere ceased, and fog formation became effective. Thus the preconditioned atmosphere reacted to the presence of calm winds and allowed for both ceilings and fog to form.

The COMET DLAC course mentions specifically in the section on synoptic fog formation: Slow moving, non-intensifying lows or open waves with a flat orientation to the isobars. Forms fog in a broad zone north of the warm front and near the weak low center.

This captures the situation here. While there was no well-defined warm front, there was a northward surge of warm and moist air. Fog formed north of that, and then near the weak low pressure center. The low pressure was slow moving (almost 12 hours to go from the Ohio River to Michigan), and was not intensifying, in fact if anything it may have been slowly filling.

MOS

A review of guidance shows that in general, guidance captured the lowered ceilings fairly well, but did not capture the very low visibility.

One point worth noting is that the better set of MOS guidance came at 12Z on the 29th of November, a full 24 hours before the event. Subsequent 00Z runs that night were not as pessimistic with conditions, and 12Z runs that morning were very bad. Here is a sample:

```
KIND    ETA MOS GUIDANCE    11/29/2008  1200 UTC  
DT /NOV  29/NOV  30                /DEC  1                /DEC  2
```

HR	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	06	12
N/X							35				42				31				38		26
TMP	46	49	43	39	39	38	37	36	40	41	38	36	35	34	33	35	35	35	32	30	27
DPT	24	23	24	26	29	31	32	32	33	34	33	32	31	30	29	31	32	31	28	27	24
CLD	BK	BK	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	CL
WDR	11	11	08	09	09	07	06	06	06	23	27	26	25	25	26	28	28	28	27	25	20
WSP	06	06	06	07	07	07	06	06	05	05	07	08	10	10	08	15	19	15	10	08	06
CIG	8	8	8	7	7	6	6	2	3	3	3	4	4	3	3	3	4	4	4	6	8
VIS	7	7	7	7	7	7	7	3	3	3	5	5	4	4	4	5	3	5	5	7	7
OBV	N	N	N	N	N	N	N	BR	BR	HZ	BR	BR	BR	BR	BR	BR	BR	BR	N	N	N

The MET guidance from 12Z on 29 November was indicating a period of category 2 ceilings towards 12Z on the 30th. This would correspond to a forecast ceiling height of between 200-400 feet. This was then shown to improve to a category 3, ceiling heights of 500-900 feet for the rest of the day through 00z. For visibility, the model indicated a category 3 for six hours in the morning, which would be a visibility of 1 to <2 Miles.

Thus, the 12Z MET MOS guidance would have, in general, captured the situation very well. Ceilings were in the range, and visibility was too, but it was at times much lower than category 3.

By 12Z on the 30th, the MOS was much less accurate.

KIND	ETA		MOS GUIDANCE										11/30/2008 1200 UTC																			
DT	/NOV	30/DEC	1										/DEC 2										/DEC 3									
HR	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	06	12											
N/X							31					36				23				38	33											
TMP	41	40	38	37	36	34	33	34	34	33	30	28	27	26	24	29	35	37	33	37	36											
DPT	36	35	34	32	31	30	30	31	30	29	27	23	21	20	19	21	23	23	24	28	29											
CLD	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	BK	BK	FW	CL	SC	BK	OV											
WDR	22	23	24	25	25	24	24	26	28	28	27	27	27	25	24	23	22	21	18	19	19											
WSP	10	09	07	08	11	11	10	14	19	16	12	12	10	08	07	10	12	12	10	16	14											
CIG	4	4	4	4	4	4	3	3	4	3	4	5	6	6	8	8	8	8	8	8	7											
VIS	5	7	7	5	5	4	4	3	3	4	5	7	7	7	7	7	7	7	7	7	7											
OBV	HZ	N	N	HZ	N	BR	BR	BR	BR	BR	BR	N	N	N	N	N	N	N	N	N	N											

Now the model was indicating just ceilings of MVFR (10-19 hundred feet), and visibility was forecast to be nearly unlimited. This was a very bad forecast for an ongoing event.

Summary

This was a case in which there was a combination of preconditioning factors and then the presence of a weak, slow moving surface low. In this case, MOS guidance from 24 hours ahead of the event was pretty good. However, MOS

guidance became progressively worse as time went on and the event approached. This may have been because the model forecast of the low pressure track was inaccurate, and thus the model did not expect the surface low to drift right over the TAF sites. Indeed, a look at the MOS wind predictions shows that the models expected a southwest wind of 5-10kts all afternoon rather than the near calm winds that were experienced.

A forecaster would have had to expect that the model forecast of the low track was bad, and then recognize the preconditions of light precip, warm air advection over cold ground, and then a close proximity of a weak, slow moving, and filling surface low pressure. This would have been an extremely difficult event to predict with any good accuracy in the face of very bad MOS guidance.