

Aviation Verification Brief

August 11, 2009: Dense Fog at Logan Airport

Joe DelliCarpini, Science and Operations Officer

NOAA/NWS Boston, MA



1. Introduction

Conditions were significantly under forecast at Logan International Airport in Boston (BOS) on August 11, 2009 as a fog bank over the coastal waters moved onshore. This resulted in a significant reduction of Airport Arrival Rates (AAR) at BOS during the evening “push,” which caused an estimated 20 to 25 flight diversions and substantial delays.

The BOS T-WITI score for August 11 was 169. This is above the normalized impact score of 100, which indicates a “normal” weather impact day in the NAS.

A backdoor cold front pushed south along the east coast of Massachusetts during the morning of August 11 and stalled near Cape Cod at 18 UTC (Figure 1). A weak low pressure center had formed along the front off the coast of Rhode Island, and helped to maintain an east wind at BOS during the afternoon. This persistent onshore flow resulted in the formation of a fog bank well offshore, which headed toward the coast by mid afternoon.

Forecasters were aware of the fog bank on satellite imagery. The office received a report from a pilot boat off the coast of Braintree, MA just after 20 UTC, which indicated the fog bank was very shallow. The nearest METAR from Beverly, MA (KBVY) indicated a visibility of 10SM and a ceiling of 500 feet. It was expected that the fog bank would remain just offshore through at least 22 UTC, with the possibility of IFR ceilings and visibilities thereafter. However, confidence was not high enough to prompt an amendment of the TAF.

An informal review of WFO Boston operations indicated three factors that may have played a role in the under forecasting of this event. First, forecasters were closely monitoring the potential for severe thunderstorms across interior southern New England, which may have diverted attention away from the offshore fog bank. Second, it was also around the time of the afternoon shift change. Finally, the lack of real-time observations (aside from the pilot boat and KBVY) may have led to an underestimation of how poor conditions actually were.

▼ Plymouth State Weather Center ▼

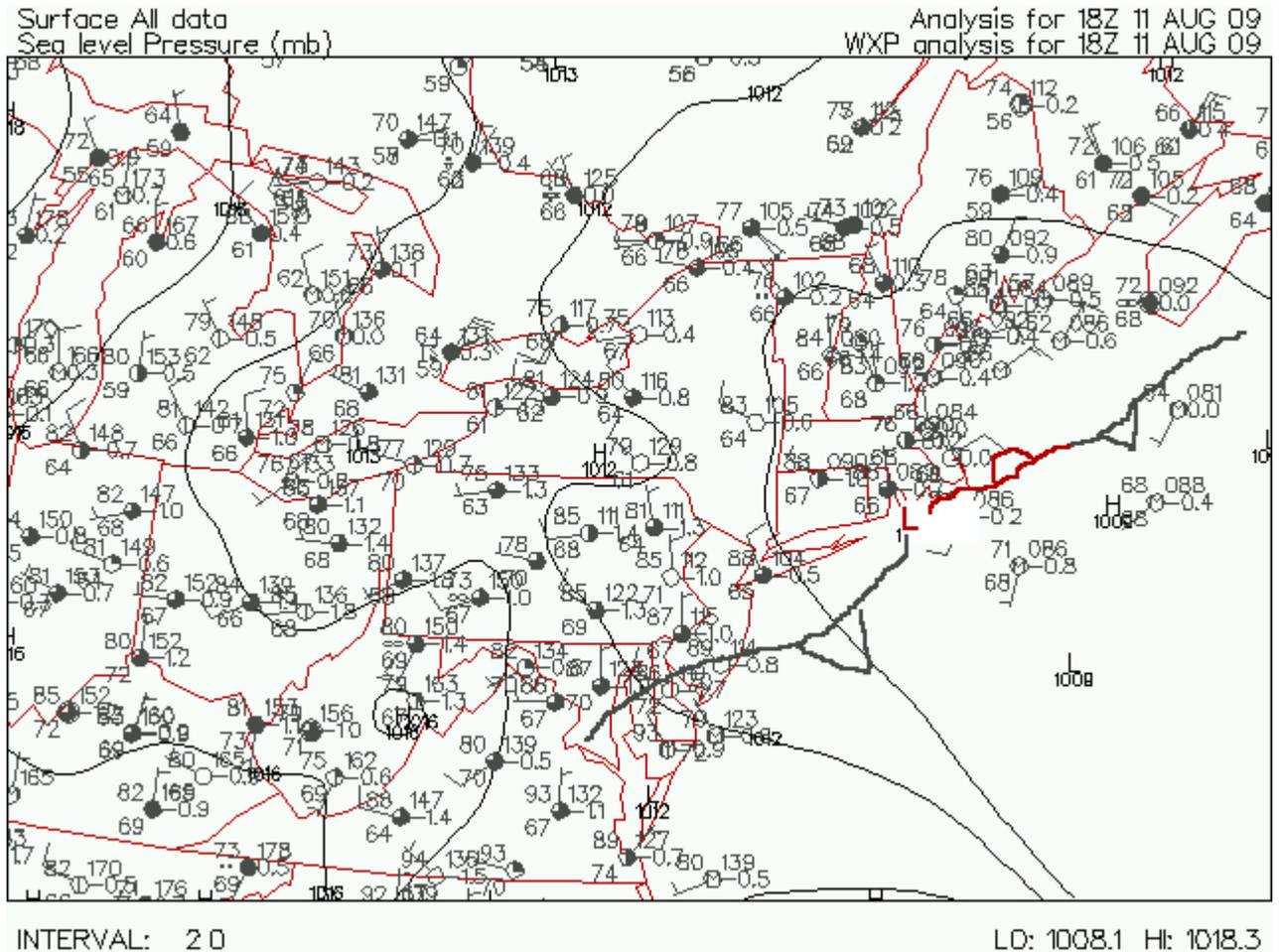


Figure 1. Surface analysis from 18 UTC Aug 11, 2009
(Courtesy of Plymouth State Weather Center)

2. Verification and Impact

T-WITI verification is shown in Figure 2. Note that Delta values, indicative of a significant difference between hourly METARs and 4-hour look ahead TAFs, are greatest between 20 UTC and 23 UTC. Negative values indicate an under forecast of conditions.

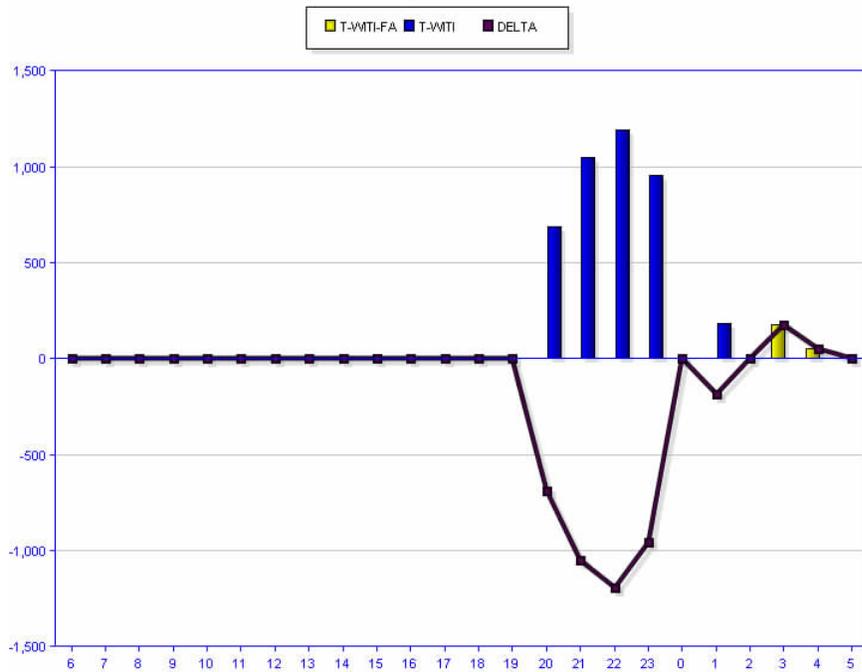


Figure 2. T-WITI score for BOS, August 11, 2009

A closer examination of hourly METARs and 4-hour look ahead TAFs is shown in Figure 3. LIFR conditions associated with the fog bank were not forecast at BOS during the 4-hour look ahead period. TAFs during that time indicated VFR conditions.

METAR Based							Departure Rates				Arrival Rates				4hr Lookahead Based						
Hour	Wind Speed	Wind Gusts	Wind Direction	Ceilings	Visibility	Significant Weather	Scheduled	Actual	Scheduled	Actual	Hour	Wind Speed	Wind Gusts	Wind Direction	Ceilings	Visibility	Significant Weather				
6Z	0	0	0	722 (UNL)	10	none	0	0	0	1	6Z	10	0	270	722 (UNL)	10	none				
7Z	5	0	200	180	10	none	0	0	0	0	7Z	10	0	270	722 (UNL)	10	none				
8Z	4	0	300	180	10	none	0	0	0	1	8Z	10	0	270	722 (UNL)	10	none				
9Z	5	0	310	140	10	none	7	8	4	5	9Z	6	0	280	100	10	none				
10Z	7	0	280	70	10	none	37	37	6	11	10Z	6	0	320	25	5	BR				
11Z	6	0	280	722 (UNL)	10	none	36	35	29	21	11Z	6	0	320	25	5	BR				
12Z	3	0	60	65	9	none	46	34	26	23	12Z	6	0	320	25	5	BR				
13Z	8	0	140	722 (UNL)	10	none	38	38	24	22	13Z	6	0	320	25	5	BR				
14Z	9	0	80	34	10	none	30	25	32	29	14Z	8	0	360	35	10	none				
15Z	12	0	80	722 (UNL)	10	none	31	29	25	18	15Z	7	0	310	120	10	none				
16Z	11	0	80	722 (UNL)	10	none	21	16	26	19	16Z	7	0	30	100	10	none				
17Z	12	0	90	722 (UNL)	10	none	27	19	33	30	17Z	7	0	60	50	10	VCSH				
18Z	13	0	80	722 (UNL)	10	none	31	28	29	23	18Z	7	0	60	50	10	VCSH				
19Z	12	0	90	722 (UNL)	10	none	28	24	31	26	19Z	7	0	60	50	10	VCSH				
20Z	12	0	100	2	0.5	FG	30	30	32	26	20Z	7	0	60	50	10	VCSH				
21Z	7	0	80	1	0.3	FG	36	29	45	23	21Z	11	0	80	722 (UNL)	10	none				
22Z	10	0	70	1	0.3	FG	39	20	36	17	22Z	11	0	80	722 (UNL)	10	none				
23Z	8	0	70	1	1	BR	38	21	34	23	23Z	11	0	80	722 (UNL)	10	none				
0Z	5	0	110	60	10	none	20	15	28	31	0Z	11	0	80	722 (UNL)	10	none				
1Z	3	0	0	5	8	-RA	8	4	22	23	1Z	11	0	80	722 (UNL)	10	none				
2Z	5	0	30	65	8	-RA	4	7	23	25	2Z	11	0	80	722 (UNL)	10	none				
3Z	0	0	0	90	10	none	18	21	11	13	3Z	4	0	50	19	10	BR				
4Z	0	0	0	90	10	none	0	1	9	9	4Z	4	0	50	19	10	BR				
5Z	0	0	0	90	10	none	0	0	1	1	5Z	4	0	50	19	10	BR				

Figure 3. Comparison of KBOS METAR and 4-Hour Look Ahead TAF, August 11, 2009

The difference in observed vs. forecast conditions had a major impact on AAR, as shown in Figure 4. Using AAR allows the user to assess the impact of a “good” or “bad” forecast on air traffic management.

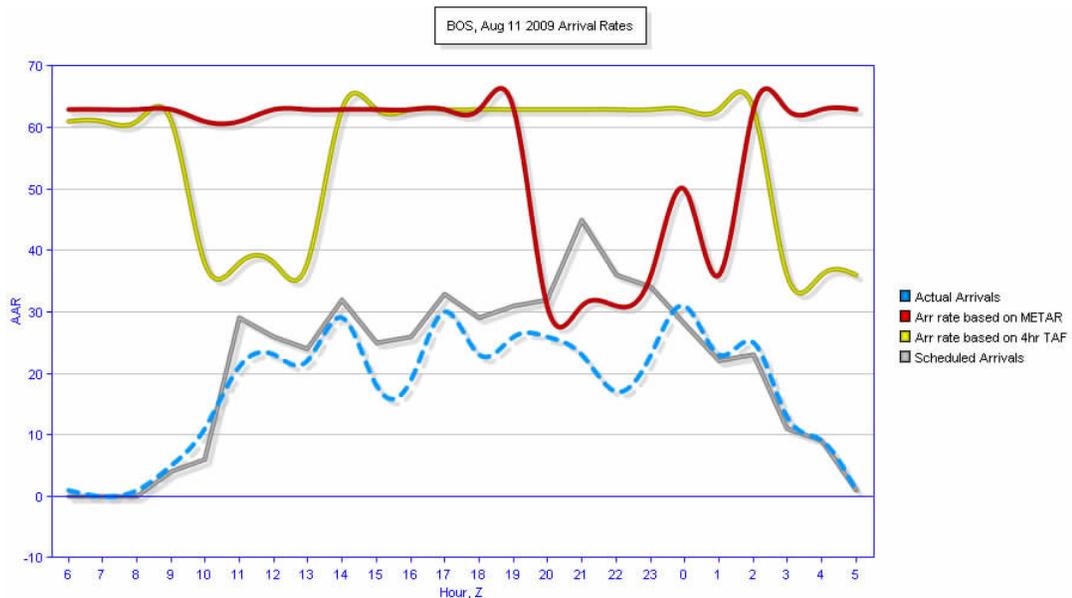


Figure 4. Airport Arrival Rates (AAR) at BOS, August 11, 2009

The TAF AAR (yellow) was much higher than the METAR AAR (red) between 20 UTC and 23 UTC, which corresponds to the time of the greatest Delta values (and corresponding under forecast of LIFR conditions). Actual arrivals (blue) were significantly lower than scheduled arrivals (gray) during the time of the afternoon push (20 UTC to 22 UTC).

The fog bank started to affect the approach to 04R/L about 30 to 40 minutes before it was indicated on the RVR. There were several missed approaches starting around 2015 UTC. This forced a runway change to 15R when the fog rolled in, since the approach was clear, but that cut arrival rates in half (28 to 30). In all, about 20 to 25 flights had to be diverted and there were considerable delays, since inbound aircraft were already en route. Visibility did improve around 2230 UTC and a runway change back to 04R was made.

More details on the impact of the fog bank can be seen in the FAA logs:

ZBW SUMMARY...BOS LAND 4R/4L AAR 61 UNTIL 2000Z THEN **AN UNEXPECTED FOG BANK ROLLED IN** CAUSING 4R ONLY OPERATION WITH AAR OF 30-RESULT WAS A BOS GROUND STOP/METERING-**SEVERAL GO AROUNDS CAUSED A RWY CHANGE** TO 15R AAR 28-RESULT WAS ANOTHER GROUND STOP AND THEN AN EDCT PROGRAM FOR BOS-RVR WENT BELOW MINIMUMS FOR A 30 MINUTE PERIOD CAUSING ANOTHER GROUND STOP/EDCT REVISION-DIFFICULT NIGHT FOR BOS ARRIVALS.

3. Summary and Recommendations

Conditions were significantly under forecast at BOS on August 11, 2009. This had a major impact on AARs for about a 2 hour period coinciding with the afternoon "push."

Although forecasters were aware of the fog bank from satellite imagery, it was not expected to affect BOS until that evening. In hindsight, the TAF should have been amended sooner (especially once LIFR conditions developed). In low confidence situation such as this, it is even useful to amend for a scattered low cloud deck (SCT003) and/or include at least MVFR visibility (4SM) as a heads-up. The fact that this event occurred around the time of the afternoon shift change may also have been a factor. Forecasters should make sure TAFs are representative before finishing their shift and issue amendments, if necessary.

Often, BOS TRACON does an outstanding job of notifying WFO forecasters whenever a fog bank is located offshore and is not reflected in the surface

observation. It is possible there was little time to phone the WFO in this instance, given the rapid deterioration of conditions and associated increase in workload to manage air traffic. Certainly, it would be beneficial if there was an observation platform with the capability to report ceiling and visibility located outside Boston Harbor.

In cases such as this, where WFO forecasters are monitoring convection and there is a potential for weather to affect operations at BOS, it would be useful for CWSU forecasters to serve as a “second set of eyes” and monitor the BOS TAF as well.

WITI has been integrated into the aviation forecast program at WFO Boston, in order to assess verification from an air traffic management perspective. T-WITI score graphs, METAR and 4-hour look ahead TAF tables, and AAR impact charts are used to gain a complete understanding of the role weather plays at the terminal (in this case, BOS, which is one of OEP 35).

These brief reviews are written on an as-needed basis for significant weather events. Other WFOs (especially those with an OEP 35 airport) are strongly encouraged to integrate WITI into their aviation forecast programs, so forecasters can gain a better understanding of how weather impacts air traffic management.