



**Western Region Technical Attachment  
No. 91-01  
January 8, 1991**

**FORECASTING LARGE CHANGES IN SUMMERTIME  
SPOKANE, WASHINGTON MINIMUMS**

**Greg Hooker - WSFO Seattle**

**Introduction**

Verification statistics were supplied by Techniques Development Laboratory last winter for the 1989 summer season. These showed that the Seattle staff lost to the LFM Model Output Statistics when the WSO Spokane observed or forecast minimum differed by at least 10 degrees from the previous minimum. It was decided to investigate the cause of these large changes as a staff forecast improvement project.

**Discussion**

To accomplish this, a worksheet was kept in AFOS during the "summer" verification season from April through September 1990. Day shift public forecasters were encouraged to log the 18Z Spokane low, plus their forecast lows, for the next two nights. (The day shift was chosen since verifying the recent lows would provide immediate feedback for the afternoon forecast.) Space was provided for the apparent cause if the observed low changed by at least 10 degrees. A portion of the worksheet is reproduced in Table 1.

There were eight events during the summer season which met the criteria, listed in Table 2. The staff averaged 7/10 of a degree worse on the first period lows but a shade better on the third period. This paralleled their track record for all the Spokane lows on the 12Z forecast cycle.

**Conclusions**

- (1) A change in cloud cover appeared to be the main factor causing the rapid change in minimums. It was a factor in all eight cases compared to four where there was a significant change in air mass and two where the wind speeds differed, allowing for multiple factors. During the two events in April, in fact, it was colder during a warm advection pattern and warmer following a cold front.
- (2) The LFM MOS is usually very competitive when there are migratory short waves or changes in air mass causing large changes in temperature. The staff usually fares best during settled weather regimes with little change in air mass when a systematic MOS bias can be determined. Partly for that reason there was very little deviation from MOS. Examination of the cases, however, shows that MOS didn't do a very good job unless the change in minimum temperature matched a major change in air mass, i.e., May 7, 1990. The staff may be able to improve on MOS by giving the expected change in cloud cover more weight, assuming that it can be accurately forecast.

- (3) All of these cases occurred in the early portion of the "summer" season. During the real summer, when the polar jetstream shifted well north of the state, there were no cases with large fluctuations in these minimums.

**WORKSHEET FOR CHANGES IN SPOKANE MINIMUMS OF AT LEAST 10 DEGREES**

Day shift public forecaster: Enter the 18Z Spokane low plus your low temperature forecast for tomorrow and the day after. Try to determine the cause if the observed 18Z low changed by at least 10 degrees. Was it mainly due to a change in cloud cover? In dew point? First or second night after a cold front? Thanks.

DATE	18Z LOW	TMRW FCST	3RD PD FCST	POSSIBLE CAUSE OF CHANGE IF 10 DEG OR MORE
4/14	46	43	43	
4/15	35*	42	40	RN AND LOW OVC FRM MINOR S/W KEPT TEMP UP ON 14TH. AMS ACTUALLY WRMR BUT DRIER ON 15TH. FRZLVL 14TH 12Z 8600 15TH 12Z 10300
4/16	42	43	45	
4/17	41	43	42	
4/18	43	41	42	
4/19	38	43	41	
4/20	48*	44	42	RN AND PVA CLD BND KEPT TEMP UP ON 20TH. NO SGFNT FNTS BUT WK CDFNT MOVD THRU ELY ON 20TH. FRZLVL 20TH 00Z 9700 12Z 9300
4/21	46	42	44	
4/22	42	44	38	
4/23	45	41	37	
4/24	40	35	40	
4/25	36	36	35	
4/26	33	36	38	
4/27	38	38	34	
4/28	32	32	29	
4/29	30	29	34	
4/30	31	35	39	
5/1	39	44	45	
5/2	45	43	41	
5/3	44	45	48	
5/4	45	47	49	
5/5	47	50	34	
5/6	42	29	31	
5/7	32*	33	33	STRONG COLD ADVCTN BHND CDFNT. LESS WIND AND CLDS 2ND NGT AFT FROPA. FRZLVL 7TH 12Z 4900 6TH 12Z 8700 00Z 11900

**TABLE 1: FORECASTER'S WORKSHEET**

DATES	OBSERVED LOWS		1ST PERIOD ERROR		2ND PERIOD ERROR	
	DAY 1	DAY 2	FORECASTER	MOS	FORECASTER	MOS

4/14-15/90	46	35	+8	+8	+10	+12
------------	----	----	----	----	-----	-----

CAUSE: RN AND LOW OVC FRM MINOR S/W KEPT TEMP UP ON 14TH. AMS ACTUALLY WRMR BUT DRIER ON 15TH. FRZLVL 14TH 12Z 8600 15TH 12Z 10300

4/19-20/90	38	48	-5	-3	-6	-6
------------	----	----	----	----	----	----

CAUSE: RN AND PVA CLD BND KEPT TEMP UP ON 20TH. NO SGFNT FNTHS BUT WK CDFNT MOVD THRU ELY ON 20TH. FRZLVL 20TH 00Z 9700 12Z 9300

5/6-7/90	42	32	-3	-1	+2	+3
----------	----	----	----	----	----	----

CAUSE: STRONG COLD ADVCTN BHND CDFNT. LESS WND AND CLDS NGT AFT FROPA. FRZLVL 6TH 12Z 8700 7TH 00Z 11900 12Z 4900

5/26-27/90	42	55	-8	-7	-9	-9
------------	----	----	----	----	----	----

CAUSE: SOME WRM ADVCTN BUT MAIN DIFFERENCE IN CLD CVR. MOCLR NGT OF 26TH, BKN AC DECK AFT 06Z NXT NGT. WND SAME. FRZLVL 5/26 12Z 7500 5/27 12Z 9600

6/5-6/90	40	51	-6	-6	-6	-6
----------	----	----	----	----	----	----

CAUSE: MAIN DIFFERENCE WAS CLD CVR. M80 BKN AFT 04Z, MOCLR PREV NGT. LGT WNDG BOTH NGTS. FRZLVL 6/5 12Z 7200 6/6 12Z 8000

7/2-3/90	53	42	+6	+6	+9	+9
----------	----	----	----	----	----	----

CAUSE: COLD ADVCTN BHND CDFNT BUT MAIN FACTOR WAS CLD CVR AND RAIN DURG 2ND WHICH KEPT AFTN TEMP COOL. CLRG THAT EVE. FRZLVL 7/2 12Z 12800 7/3 00Z 8300 12Z 8600

7/4-5/90	51	64	MM	MM	-9	-7
----------	----	----	----	----	----	----

CAUSE: NGT OF 4TH CLDS SCT-BKN. NGT OF 5TH HIGH OVC. INCR IN CLD CVR AND WRM ADVCTN ABT EQUAL. FRZLVL 7/4 12Z 11300 7/5 12Z 12700

7/6-7/90	55	45	+4	+4	+5	+5
----------	----	----	----	----	----	----

CAUSE: NOT MUCH CHG IN AMS. ON 6TH BKN-OVC WND 15-20 KTS AHD UPR TROF. BHND SCT CLDS + LGT WNDG. FRZLVL 7/6 12Z 9600 7/7 12Z 9000

AVERAGE ERROR FOR CHANGES >9 DEG	5.7	5.0	7.0	7.1
AVERAGE ERROR FOR ALL FORECASTS	2.2	2.0	2.8	2.9

TABLE 2: CASES WITH CHANGE IN SPOKANE LOW OF AT LEAST 10 DEG.