Forecasting Arctic Outbreaks in the Texas Panhandle Based on the Track, Position and Strength of the Surface High

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1. Introduction

Arctic outbreaks do not occur very often in the Texas Panhandle. In the eight years from 1995 to 2002, only 25 days had temperatures reaching below 10 degrees Fahrenheit. For this paper, all the surface high pressure systems were analyzed to determine the track, strength, and position of the surface high associated with the arctic outbreak. As a result, the characteristics of the arctic high pressure systems are shown to help the forecaster to better understand how to forecast these arctic outbreaks.

2. Methodology

For this study, all of the days that reached below 10 degrees Fahrenheit in Amarillo, Texas were collected using local climatological data from the National Weather Service in Amarillo. For each day, daily weather maps from the National Meteorological Center were obtained. For the days not available, archived surface maps from Unisys Weather were used. For each day with temperatures below 10 degrees Fahrenheit, the position and strength of the surface high was noted for that morning at 12 Z.

3. Results

The days that reached below 10 degrees Fahrenheit are listed in Table 1 on the next page. In addition, the coldest high temperature during each arctic outbreak is shown with the date given. Notice, the period from January 30, 1996 to February 4, 1996 was the most significant arctic outbreak. The coldest temperature during the eight year period of minus 3 degrees occurred during this arctic outbreak on February 4th, 1996. The coldest daytime high during the eight year period was 6 degrees on January 13, 1997. Notice that only three arctic outbreaks had only one day of single digit readings. Only one outbreak had a reading below zero.

Date	Lowest Min	Lowest Max Date
Mar 3, 2002	6	26 2nd
Mar 2, 2002	5	
Mar 1, 2002	9	
Jan 3, 2002	7	25 2nd
Dec 12, 2000	8	22 12th
Dec 11, 2000	9	
Dec 24, 1998	6	17 23rd
Dec 23, 1998	8	
Dec 22, 1998	0	
Dec 21, 1998	2	
Jan 13, 1997	5	6 12th
Jan 12, 1997	2	
Jan 11, 1997	6	
Dec 19, 1996	0	22 18th
Dec 18, 1996	5	
Feb 4, 1996	-3	10 3rd
Feb 3, 1996	0	
Feb 2, 1996	5	
Feb 1, 1996	8	
Jan 31, 1996	5	
Jan 30, 1996	6	
Jan 19, 1996	4	23 18th
Jan 18, 1996	6	
Jan 6, 1996	8	23 5th
Dec 9, 1995	6	31 9th

Table 1: Single Digit Readings in Fahrenheit for the Texas Panhandle from 1995 to 2002.

On the next page in Figure 1, the track, position and strength of each surface high pressure system is shown. The circled X has been plotted at the position of the high pressure area at 12 Z on the last day of each arctic outbreak. The line extending to the north or northwest in each

case shows the previous 24 hour track with the X marking the 12 Z position on the previous day. In most cases, one surface high pressure area was associated with each case. For the late December 1998 and late January-early February 1996 case, two surface highs came down into the Great Plains for each case. In these two cases, both highs were plotted, one on the last day of the outbreak and the other on the coldest day of the outbreak as the high settled into the Great Plains.

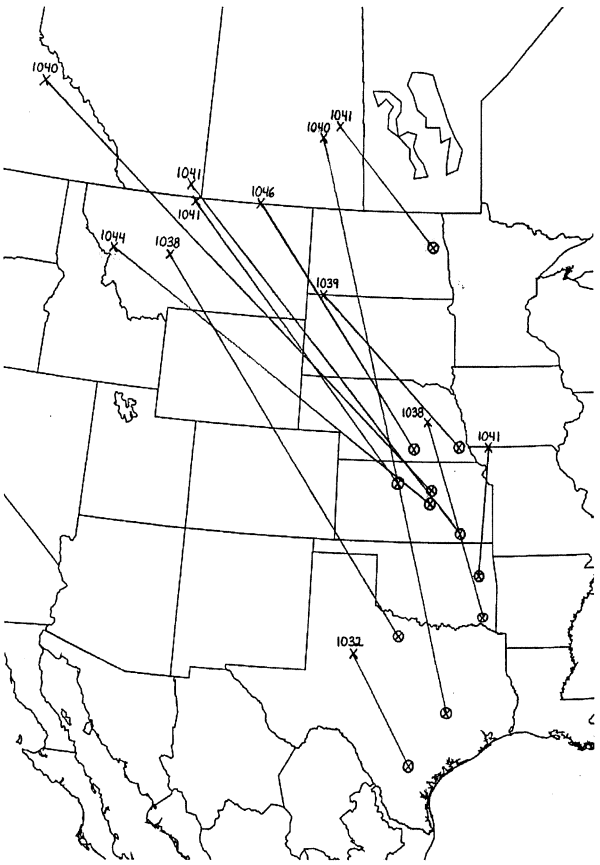

Figure 1: The position and track of each arctic surface high pressure area is shown from 1995 to 2002. The circled X designates the position of the high on the final day of the outbreak. Where two highs occurred during the outbreak, each high is shown separately as it settled into the Great Plains. The strength of the high on the second to last day is shown in millibars.

Of the 12 surface highs, ten came through Montana. Two came through North Dakota. Only two highs came through the Texas Panhandle on the way down. The other ten highs tracked through the central Plains. One thing to keep in mind, nine of the 12 highs shown above also had single digit readings the day before the high settled into the Great Plains. That means that for 11 of the 25 days with readings below 10 degrees, the high was still positioned in the northern United States or in southern Canada.

Strength in Millibars	Number of Surface Highs
1046	1
1045	-
1044	1
1043	-
1042	-
1041	4
1040	1
1039	1
1038	2
1037	-
1036	-
1035	-
1034	-
1033	-
1032	1

Table 2: The strength of the surface high one day before settling into the Great Plains. The strength is shown in millibars with the number of highs at that pressure.

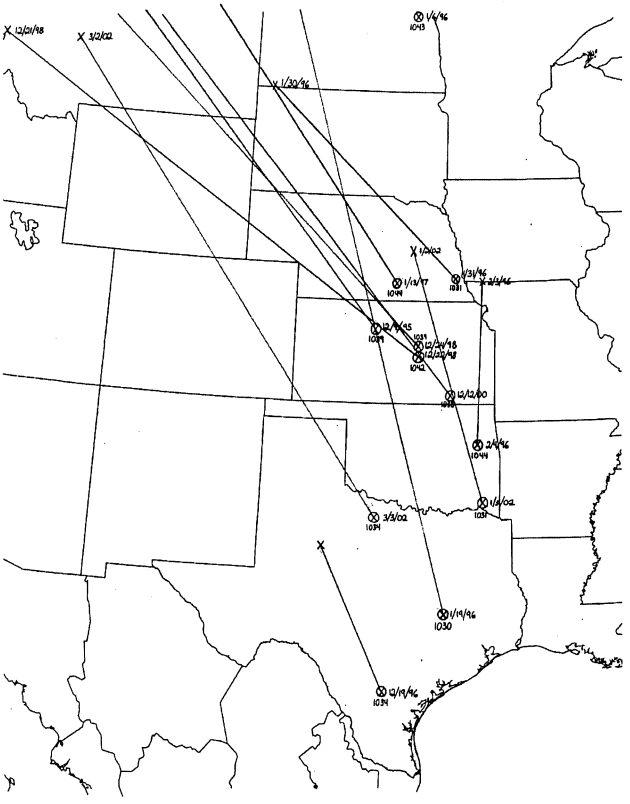

Figure 2: A close up image of the position and track of each arctic surface high pressure area is shown. Again, the circled X designates the position of the high at 12 Z on the final day of the outbreak. The strength of the high at 12 Z on the final day is shown in millibars.

Figure 3 below shows the final position of the surface high during the arctic outbreak for the Texas Panhandle. In most cases, this would be the final day of the outbreak. For the two cases with two surface highs, each high was treated separately and the final position of both are included. Notice that most of the highs ended up in the central Plains across Kansas, southeastern Nebraska or eastern Oklahoma. Three high pressure areas ended up in Texas and one stayed in eastern North Dakota.

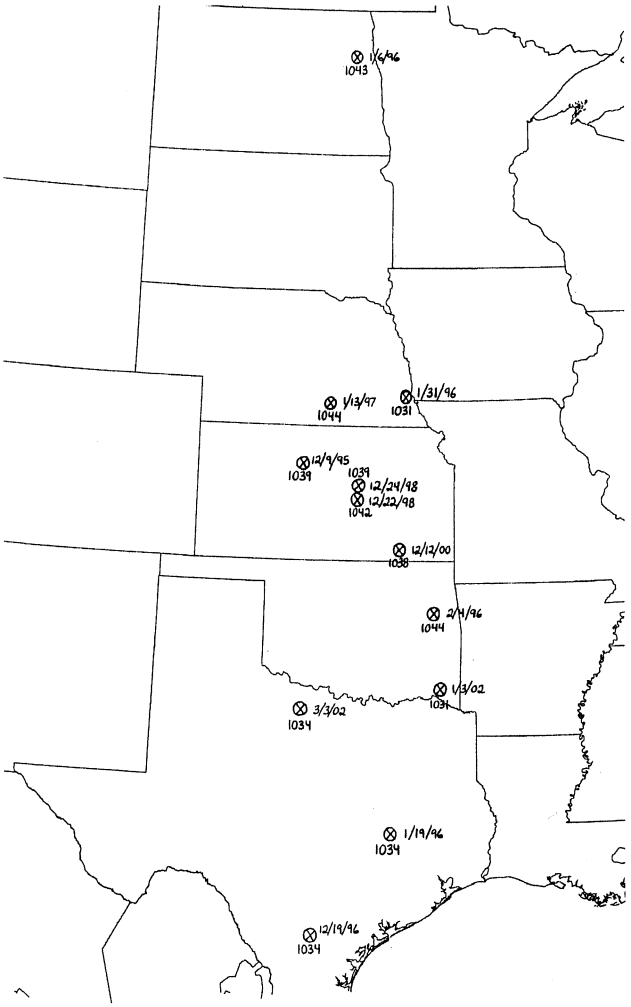

Figure 3: The position of the surface high pressure area at 12 Z is shown at its final position as each high settled into the Great Plains. The strength of the high is shown in millibars for each case.

At the top of the page in Table 2, the strength of the surface high in millibars is shown at its final position as each high settled into the Great Plains. The number of each occurrence is given.

Strength in Millibars	Number of Surface Highs
1044	2
1043	1
1042	1
1041	-
1040	-
1039	2
1038	1
1037	-
1036	-
1035	-
1034	3
1033	-
1032	-
1031	2

Table 2: The strength of the surface high at its final position as each high settled into the Great Plains. The strength is shown in millibars with the number of each occurrence.

4. Summary and Conclusion

Forecasting the surface high pressure area in an arctic outbreak can be tricky. For the Texas Panhandle, the cold air will come into the area despite the position of the high being hundreds of miles to the east or northeast. Out of 12 surface highs associated with arctic outbreaks from 1995 to 2002, ten surface highs came through the central Plains with only two coming through the Texas Panhandle. And the single digit readings in 11 of the 25 days occurred while the surface high was still positioned in Canada or the northern United States. All but one of the highs had a surface pressure of 1038 millibars or higher as it came out of Canada. As the surface high settled into the Great Plains, many weakened. Four of the 11 highs with pressures above 1037 millibars, weakened into the 1031 to 1034 millibar range by the next day.

As one can see, single digit readings in Amarillo are possible with surface highs positioned over the central Plains. In fact, most of the surface highs took this track.