

A COMPARISON OF THE WEATHER IN U.S. CITIES DURING THE 1982-83 AND 1997-98 EL NIÑO'S

Heather L. Honnette and David R. Smith
United States Naval Academy
Annapolis, Maryland

1. BACKGROUND

The El Niño phenomenon has been shown to have a dramatic effect on the weather of locations worldwide. This air-sea interaction over the Tropical Pacific alters atmospheric wave patterns, thereby changing the movement of storm tracks, which modifies normal weather patterns. Studies have shown that El Niño shifts the tracks of extratropical cyclones to the south over North America during the winter months (Manty, 1993; Smith and Ledridge, 1999). This shift from the normal tracks of storms results in differences in weather conditions. In a previous study, Woods et al. (2001) analyzed data sets for fourteen different stations across the continental United States for the winter months of December 1997 through March 1998. The purpose was to determine deviations from normal associated with the 1997-98 El Niño. This analysis was accomplished by calculating the deviations from 30-year normals for both temperature and precipitation on a monthly basis. All of these stations' weather changed due to the El Niño event. Furthermore, the results show that most stations experienced an increase in precipitation and temperature, with southern-most stations deviating further from normal than did the northern-most stations.

In this study, the temperature and precipitation observations are examined for fourteen cities across the United States. This study will explore the effects of the 1982-83 El Niño on these weather parameters for the same fourteen studied by Woods et al (2000). Monthly averages for each of the fourteen cities will be compared for these two major El Niño events as well as against the 30-year normals for each of the cities, in order to determine the relative impact of these El Niño events and the magnitude of the deviations from normal conditions.

Corresponding author's address:

David R. Smith, Oceanography Department, United States Naval Academy, 572M Holloway Road, Annapolis, Maryland, 21402; Phone: (410) 293-6553; Email drsmith@usna.edu

2. METHODOLOGY

A series of stations were chosen to determine the effects of El Niño on their weather conditions during the winter of 1982-83, similar to those used by Woods et al. (2001). These stations were chosen for each cell block (5E x 5E) along the West Coast (four stations), central states (five) and East Coast (five). All stations south of 40E N latitude are considered southern stations and those north of this parallel are northern stations. With this distinction it can be determined which region, northern or southern, has the greatest deviation from normal temperature and precipitation. The stations selected are as follows:

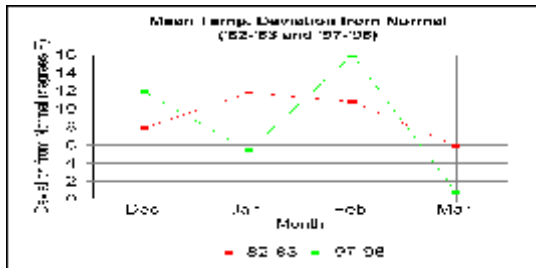
<u>West</u>	<u>Central</u>
1. Seattle-Tacoma, WA	1. Fargo, ND
2. Eugene, OR	2. Omaha, NE
3. Sacramento, CA	3. Dodge City, KS
4. Los Angeles, CA	4. Dallas- Fort Worth, TX
	5. Corpus Christi, TX
<u>East</u>	
1. Caribou, ME	
2. Boston, MA	
3. Baltimore-Washington, MD	
4. Atlanta, GA	
5. Orlando, FL	

The data for the 1982-83 and 1997-98 El Niño winters for 14 different stations were obtained from the records of state climatologists or the station web pages. Normal conditions for each station came from the "Local Climatological Data Annual Summaries." (NOAA, 1982, 1983, 1997, 1998). Spreadsheets of temperature and precipitation (actual and normal conditions) were created for each station. Graphs were also produced to display the difference between the 1982-83 and 1997-98 conditions and normal conditions for each station.

3. RESULTS

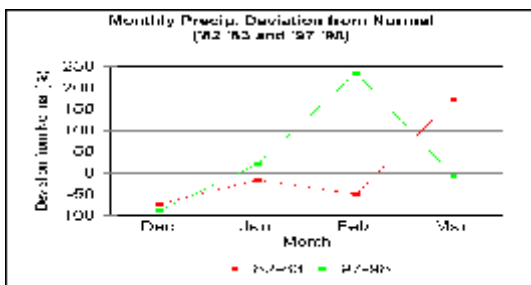
[N.B. - At the time of submission, the research was incomplete. A more complete analysis will be available for presentation at the Symposium.]

As an example, a single station, Fargo, ND, was chosen to compare temperature and precipitation values for two major El Niño events. For the winter of 1982-82, Fargo's mean monthly temperature was warmer than its normal (30-year) mean values for the months of DEC - MAR. Similarly, the mean monthly temperatures for the winter of 1982-83 were warmer than for the winter months of 1997-98, another major El Niño event. Fig. 1 provides the deviations of the mean monthly temperatures (EF) from normal values for the winter months of 1982-83 and 1997-98 at Fargo.



Month	1982-83	1997-98
DEC	7.9	11.9
JAN	11.8	5.4
FEB	10.8	16.0
MAR	5.9	0.7

Fig 2. provides the monthly precipitation amounts (in) and the percent deviation from normal (in parentheses).



Month	1982-83	1997-98
DEC	0.17 (-72.6%)	0.07 (-89.2)
JAN	0.46 (-16.4%)	0.81 (20.9)
FEB	0.21 (-50.0%)	1.51 (235.6)
MAR	2.27 (173.5%)	1.06 (-8.7%)

For both winters the monthly mean temperatures are warmer than their respective 30-year normal monthly means. This is undoubtedly due to winter cyclones tracking much further south than normal, entering

along the California Pacific Coast. As a result, milder marine air moves into the continental United States rather than colder Canadian air that is a more common occurrence during the winter months in Fargo. For 1982-83, three of the four months had lower than normal precipitation amounts. Again, this can be explained in terms of cyclones tracking further southward than normal, thereby depriving the Northern Plains of major synoptic-scale forcing to initiate precipitation. By March, storms resumed more northerly tracks and precipitation dramatically increased at Fargo. The situation in 1997-98 had some similarity. December precipitation was nearly 90% below normal, however, January required to approximately 21% above normal and February was 235% above normal. Clearly, storms resumed a more normal winter track pattern in 1997-98, resulting in the higher precipitation amounts.

4. ADDITIONAL STUDY

The work that remains is to calculate temperature and precipitation deviations from normal for the winters of 1982-83 and 1997-98 for the other 13 stations. Comparisons will be made between the two El Niño events to determine if they experienced similar changes in their weather patterns. In addition, the 1982-83 data will be examined to determine if there are consistencies in temperature and precipitation deviations on a regional basis similar to that reported by Woods et al. (2001) for the winter of 1997-98. By the time of the Symposium, this analysis will be completed and reported at that time.

REFERENCES

Manty, R. E. 1993: *Effect of the El Nino/Southern Oscillation on Gulf of Mexico, winter, frontal-wave cyclones: 1960-1989*. UMI Dissertation Services., 768pp.

NOAA, *Local Climatological Data: Annual Summaries: 1982, 1983, 1997, and 1998*. National Climatic Data Center, Asheville, NC.

Smith, D.R. and M.J. Ledridge, 1999: "The effect of El Niño on the typical path of extratropical cyclones". *Preprint Vol. of the 10th Symp. on Glob. Clim. Studies*, 77-80.

Woods, S.F., D.R. Smith and M.J. Ledridge 2000 "A Study of the Effect of El Nino on Weather on U.S. Cities". *Preprint Vol. of the 11th Symp. on Global Change Studies*, 113-6.