

VARIABILITY OF SEVERE WINTERS IN THE MEXICO BASIN DURING THE XXTH CENTURY.

Ernesto Jauregui*, Elda Luyando* and Mario Casasola*
National University Mexico

1. INTRODUCTION

Located in the central highlands of Mexico and within the tropics (latitude ~19° N) the Mexico basin is, during winter and early spring, under the influence of modified cold air masses from Northamerica causing temperatures to drop below freezing often accompanied by snow falls on the surrounding mountain (700 to 2300 m over the valley plains). Anomalous quasi-stationary circulations over Northamerica seem to be related to an increase in the frequency of deep penetration of the cold air masses into the tropics (Magaña and Perez, 1998). The frontal passages have a frequency of about once every week (Klaus, 1973) affecting not only the area under study but most of the country's highlands resulting on occasions on crop damage. Various studies show that cold surges into Mexico and the Gulf of Mexico are common occurrences during winter (eg Hill, 1969; Klaus, 1973; Jauregui, 1971). Vazquez et al 1999 have related the number of Northers in the Gulf of Mexico with El Niño events for period 1958-98. They conclude that cold air intrusions as observed in the Gulf of Mexico were more frequent during El Niño years. Using extreme minimum temperature records from two stations, in this paper a description is made of extreme cold spells that occurred during the last century in the Mexico

Basin. Synoptic conditions at the continental /hemispheric scale linked to the cold winter periods are discussed.

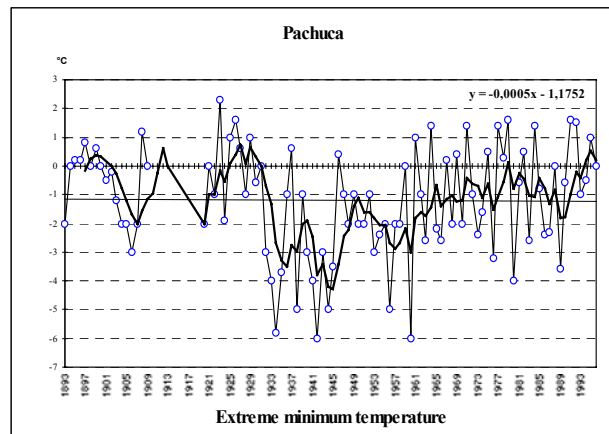
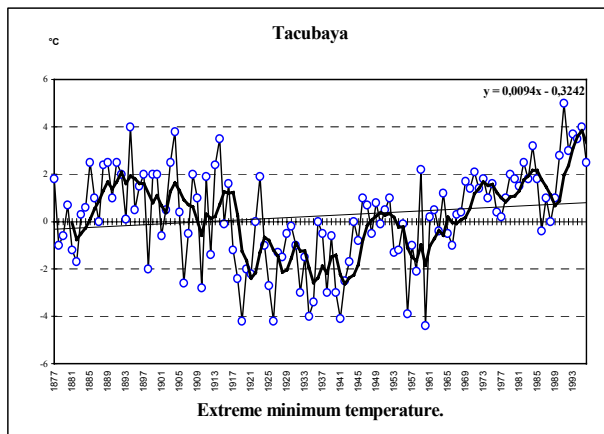
2. DATA

Extreme annual minimum temperature records of two observatories one on the western suburbs of Mexico City (Tacubaya), the other at the northern edge of the basin in the small city of Pachuca both operated by the National Meteorological Service. The mostly uninterrupted records cover from the last decade of the XIX century until the 1990's.

3. RESULTS AND DISCUSSION

Figure 1 shows the extreme annual minimum temperature series covering the XX century. Examination of the two series shows three cold period episodes in which cold winters were interspersed with near-normal winters. The periods are 1897-1910, 1918-1941 and 1957-60. During these cold events temperatures dropped to -4°C (in the south) and -6°C to -10°C (in the center and north of the basin). On occasions the cold spells were preceded by light snowfall mainly on the mountains.

The 1897-1910 cold winters. This period of extreme minimum temperatures is coincident with drought conditions recorded in the Bajío grain



* Corresponding author address: Center of Atmospheric Sciences, National University Mexico. Circuito Exterior Cd. Universitaria C.P. 04510, México D.F. email: ejos@atmosfera.unam.mx

producing region (Florescano, 1980). During the last two decades of the XIX century, winter storms were frequent, in particular in 1879, 1882 and 1883 (Puga, 1895).

The 1918-1941 cold period. This was the coldest period of the century in the Mexico Basin. Severe drought conditions occurred during the 1920's, 1950's and 1960's (Jauregui, 1997).

The 1957-1960 winters. This was the last period of cold winters in the XX century in the Mexico basin when minimum temperatures dropped to -4°C to -6°C . This period of extreme minimum temperatures preceded the cool period of the 1960's which according to Lamb (1967) was characterized by a southward shift of major circulation systems.

No apparent connection was found between the cold spells and the El Niño teleconnection. The above mentioned cold periods were in some cases coincident in time with severe cold conditions elsewhere. Synoptic situations at the continental/hemispheric scale linked to some severe winters in Mexico show a marked meridional circulation over the region (not shown). A glance at Figure 1 shows that severe winters in the Mexico basin were limited to the first half of the XXth century when the urbanization impact was small and temperature records were more representative for the whole basin. The last two decades of the last century show a trend toward warmer winters suggesting the influence of increasing urbanization (eg heat island) and perhaps in a smaller measure, global warming.

4. REFERENCES

- Hill, J. 1969. Temperature variability and synoptic cold fronts in the winter climate of Mexico. Climatological Res. Series, No. 4 Mc Gil University, Dept. of Geography, Montreal, 71 pp.
- Florescano, E. 1980. Drought, a forgotten history. *Nexos*, **32**, 9-18. (Spanish).
- Jauregui, E. 1971. Long-term variation of synoptic surface weather types in Mexico. *Bull. 4 Instituto de Geografía*, UNAM. México (Spanish).
- Jauregui, E. 1997. Changes in Mexico the historical and instrumented periods. *Quaternary International*, **43/44**, 7-17
- Klaus, D. 1973. Cold air outbreaks into the tropics-cold surges east of the Rocky Mountains. *Geofísica Int.* **13;2**; 88-143 (Spanish).
- Lamb, H. 1966. Climate in the 1960's. *Geographical Journal.* **132**, 183-212.

Puga, G. 1895. The winter storms in the Mexico basin. Ministry of Development. 30 pp. (Spanish)

Vazquez, L. and V. Magaña. 1999. ENSO and the "Nortes" of the Gulf of Mexico. Proceed. IX OMMAC Congress. Guadalajara; 80-83. (Spanish).