PROGRESS REPORT (YEAR 1)
ARC Project: Expanding the Mexican Global Historical Climatology Network (GHCN) and Operational Division Data Base in Mexico

Principal Investigator: Arthur V. Douglas, Creighton University
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Requisition No.: NEEF4100-9-17902
Solicitation No.: EA133E-09-RQ-1123

INTRODUCTION

The overall goal of this project is to update and expand the Global Historical Climatology Network (GHCN) data base of surface observations in Mexico. This report summarizes the Year 1 progress (to date); it also briefly describes the expected direction of future efforts including the transition of the data base to operational status.

Much of the project effort has focused on project deliverables 1 and 2: Updated monthly average precipitation and temperature for the stations that comprise the existing 18 climate divisions in Mexico. Documentation on these deliverables is included in Appendix A. It is important to note that the submitted data files contain all of the original GHCN holdings (as archived at NCDC) plus station updates obtained from the archives of the Servicio Meteorológico Nacional (SMN) for this project. In other words, the attached file effectively supersedes the earlier GHCN monthly precipitation and temperature files for Mexico.

FUTURE EFFORTS

Year 1 of the project is essentially on schedule. It is expected that deliverable 3 – Daily precipitation and temperature data for the stations in the original 18 division grid— will be submitted in early summer.

Under year 2 of the project, it is expected that deliverable 4 – Monthly and daily precipitation and temperature data for 6 additional climate divisions – will be submitted in the fall timeframe. Note that these new climate divisions will help to fill some of the spatial coverage gaps that are evident in the existing divisional framework.

The operational transition of the data base is expected to occupy much of the Year 2 effort. In essence, this part of the project involves merging/referencing the Mexican GHCN data base (which is not an operational product) with Mexico's "near real-time" precipitation monitoring data set (typically referred to as GASIR). Preliminary steps and discussion are now underway to facilitate this process. These steps include for example, the development of a spatial referencing scheme that assigns GASIR reporting stations to the appropriate climate division.

This operational transition clearly represents an evolving project. As originally conceived the operational product would be referenced to the expanded climate division system (i.e., 18 original divisions + 6 new divisions). However, recent discussions between NCDC personnel and the PI raise the possibility that the operational product and hence the scope of the ARC project might be better served by expanding to include the development of lat-long gridded fields rather than climate divisions.

Appendix A

ARC Project: Expanding the Mexican Global Historical Climatology Network (GHCN) and Operational Division Data Base in Mexico

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INTRODUCTION

The overall goal of this project is to update and expand the Global Historical Climatology Network (GHCN) data base of surface observations in Mexico. This report describes the data set submitted as the first deliverable on the ARC project: Monthly rainfall data for the stations that comprise the original 18 climate division grid (developed by cooperative agreement between the PI and the National Climatic Data Center (NCDC)).

DATA STRUCTURE

Tables 1 and 2 (below) detail the structure of the submitted data files. Table 1 provides basic metafile information; Table 2 provides the structure of the actual monthly precipitation data file. It is important to note that this new data file contains all of the original GHCN holdings (as archived at NCDC) plus station updates obtained from the archives of the Servicio Meteorológico Nacional (SMN) for this project. In other words, the attached file effectively supersedes the earlier GHCN monthly precipitation file for Mexico.

COMMENTS

1) The update represents an ~ 35% increase in the GHCN holdings for monthly precipitation observations in Mexico. Figure 1 (below) summarizes the resulting data density/availability with respect to time. As indicated, nominal data availability exceeds 50% through 2005-2006, after which it drops off fairly radically.

2) Figure 2 (below) illustrates the spatial dimensions of recent data capture/availability. As indicated, data capture in the post-2005 period is state-specific – a feature that reflects the current

decentralized observing, reporting and archival systems in place in Mexico. Our understanding is that part of the recent data availability problems (particularly evident in the large states of northern Mexico) are tied to riparian rights issues (both inter- and intra- national).

3) Figure 2 illustrates the fact that some significant gaps remain in the GHCN spatial coverage for Mexico. Subsequent portions of this project will involve defining additional divisional aggregates to reduce these coverage deficiencies.

Table 1. Metafile for Mexico GHCN precipitation version 2 (.xls)

COLUMN NO.	DESCRIPTION
1 (A)	Climate Division No. (1-18)
2 (B)	Old GHCN station identifier (superseded)
3 (C)	New GHCN station identifier
4 (D)	Station Name
5 (E)	Latitude (decimal degrees)
6 (F)	Longitude (decimal degrees)
7 (G)	Elevation (m)

Table 2. File format for Mexico GHCN precipitation version 2 (.xls)

COLUMN NO.	DESCRIPTION
1 (A)	Climate Division No. (1-18)
2 (B)	Old GHCN station identifier (superseded)
3 (C)	New GHCN station identifier
4 (D)	Element Code (Total Precipitation = 208)
5 (E)	Year
6-17 (F- Q)	Jan-Dec Monthly Precipitation
18 (R)	No. of months with reported monthly value (by year)

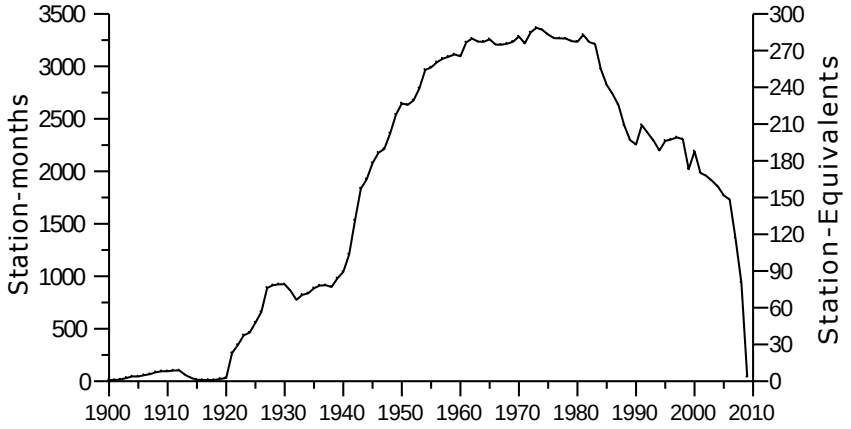

Figure 1. Station density through time.

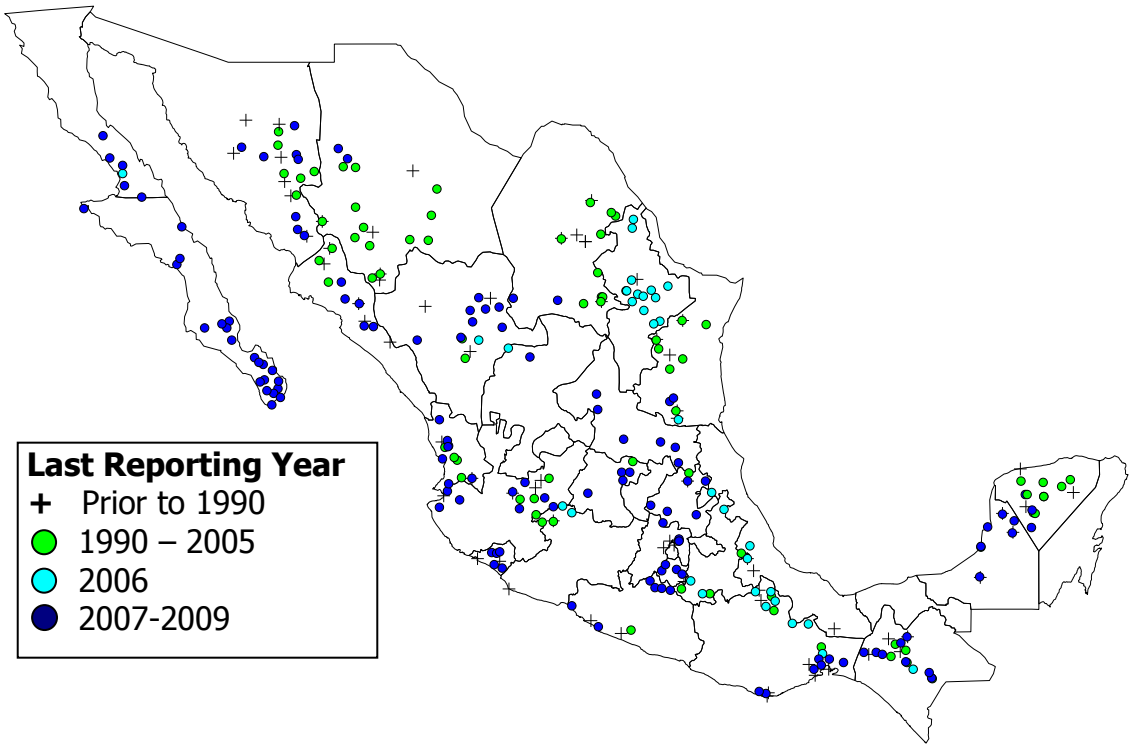

Figure 2.

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INTRODUCTION

The overall goal of this project is to update and expand the Global Historical Climatology Network (GHCN) data base of surface observations in Mexico. This report describes the data set submitted as the second deliverable on the ARC project: Monthly temperature data for the stations that comprise the original 18 climate division grid (developed by cooperative agreement between the PI and the National Climatic Data Center (NCDC)).

DATA STRUCTURE

Tables 1 and 2 (below) detail the structure of the submitted data files. Table 1 provides basic metafile information; Table 2 provides the structure of the actual monthly temperature data file. It is important to note that this new data file contains all of the original GHCN holdings (as archived at NCDC) plus station updates obtained from the archives of the Servicio Meteorológico Nacional (SMN) for this project. In other words, the attached file effectively supersedes the earlier GHCN monthly temperature file for Mexico.

COMMENTS

1) The update represents a very substantial (roughly a factor of 3) increase in the GHCN holdings for monthly surface temperature observations in Mexico. This increase largely reflects two considerations: 1) the original data collection emphasized collection of historical precipitation records over temperature records; and 2) subsequent to the original data collection, the SMN devoted considerable resources to digitizing paper copy records of surface observations (including surface air temperature). Figure 1 illustrates the improved spatial coverage resulting from this project.

2) Figure 2 provides an overview of monthly temperature data density/availability with respect to time. As one might expect, the overall pattern very much parallels that seen for precipitation (as documented in the project's first deliverable): Station availability begins to increase rapidly in the immediate post-WWII years with high availability over the period from the early 1950s through the mid-1980s after which there is a noticeable decline in data availability.

3) Figure 3 illustrates the basic point that the original GHCN stations typically have longer nominal record lengths (last year of available data – first year of available data) than the new CLICOM stations. Approximately 20% of the new CLICOM stations are short records (<30years nominal record length).

4) Figure 4 illustrates the fact that data recovery percentages (total number of monthly values available divided by nominal record length) are generally higher for the original GHCN stations as compared to the new CLICOM stations. About 75% of the original GHCN stations exhibit data recoveries >90% as compared to 62% of the new CLICOM stations with data recoveries >90%.

5) Figures 5 and 6 illustrate a basic QC statistic for the monthly temperature data set. Here, record breaks are defined with respect to the year variable so that a break of n=1 would for example indicate one or more months available in 1952, no monthly data available in 1953, and then one or more months available in 1954. Based on this statistic, Figure 5 indicates that approximately 1/3rd of the stations exhibit a record break of 2 or more years. Figure 6 shows the temporal distribution of record breaks $\geq$ 2. Note that some stations may have multiple record breaks.

The remaining deliverable for year 1 of this project will be to provide daily precipitation and temperature records for the stations comprising the original 18 division grid.

Year 2 of the project will first involve extending the data base to include both monthly and daily temperature and precipitation for an additional 6 climate divisions. This effort will help to reduce many of the existing gaps in spatial coverage.

Table 1. Metafile for Mexico GHCN temperature version 2 (.xls)

COLUMN NO.	DESCRIPTION
1 (A)	0 = New CLICOM station; 1 = Original GHCN station
2 (B)	Climate Division No. (1-18)
3 (C)	Old GHCN station identifier (superseded)
4 (D)	New GHCN station identifier
5 (E)	Station Name
6 (F)	Latitude (decimal degrees)
7 (G)	Longitude (decimal degrees)
8 (H)	Elevation (m)

Table 2. File format for Mexico GHCN temperature version 2 (.xls)

COLUMN NO.	DESCRIPTION
1 (A)	0=New CLICOM station; 1=Original GHCN station
1 (B)	Climate Division No. (1-18)
2 (C)	Old GHCN station identifier (superseded)
3 (D)	New GHCN station identifier
4 (E)	Element Code (Monthly Temperature = 203)
5 (F)	Year
6-17 (G- R)	Jan-Dec Monthly Precipitation
18 (S)	No. of months with reported monthly value (by year)

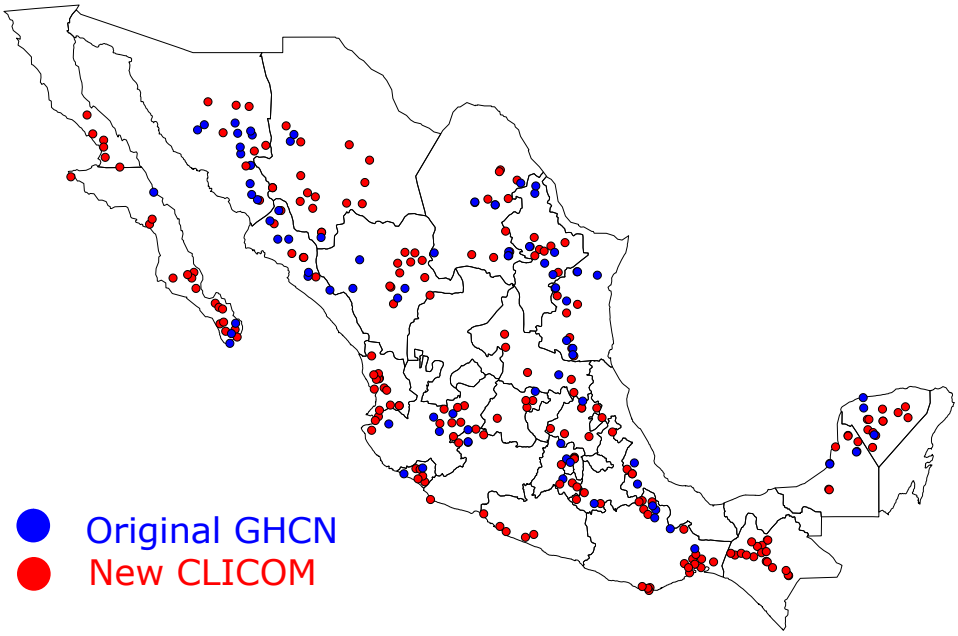

Figure 1. Station locations.

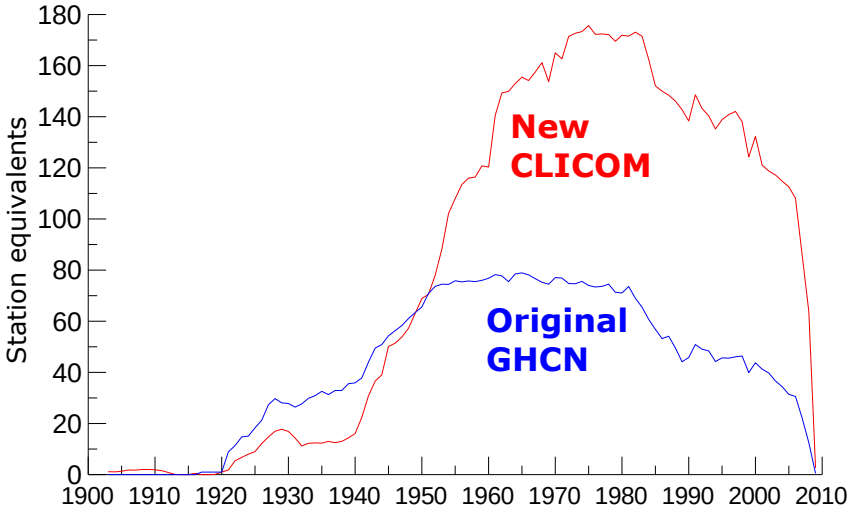

Figure 2. Station density through time

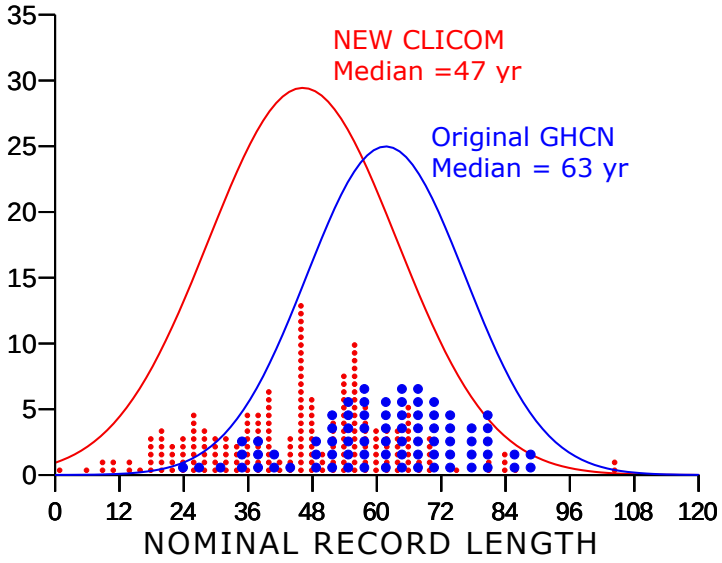

Figure 3. Record length comparison: Original GHCN versus New CLICOM stations.

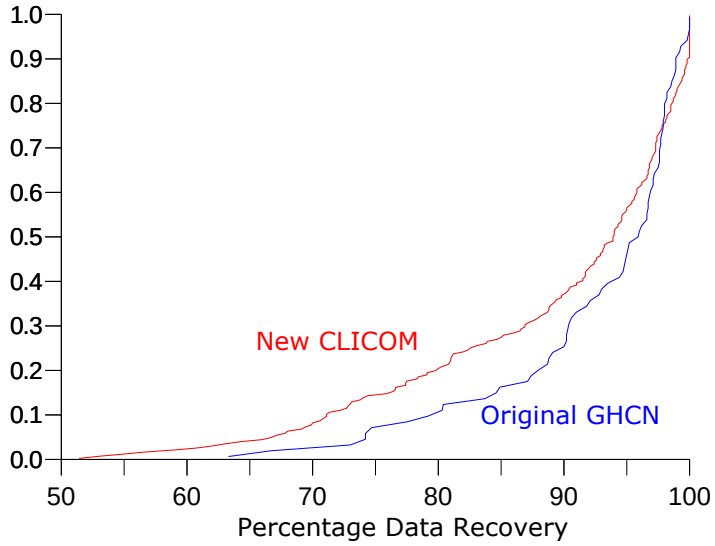

Figure 4. Distribution of nominal data recovery percentages.

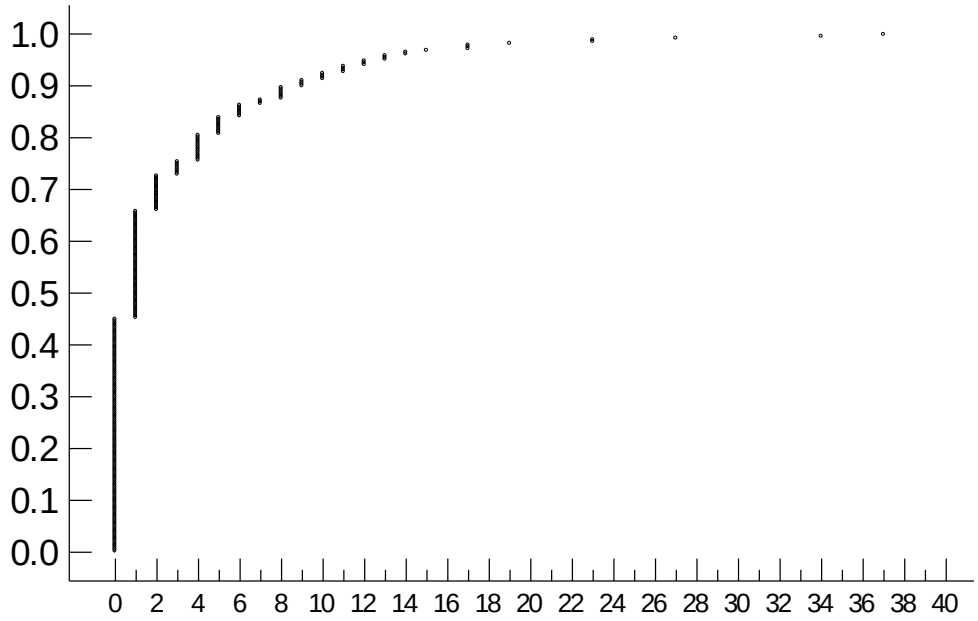

Figure 5. Distribution of record breaks.

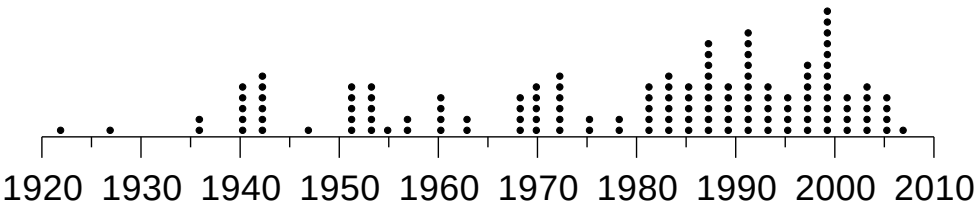

Figure 6. Record breaks ($n \geq 2$) as a function of time.