A daily gridded dataset for southern North America.

J.L. Vazquez-Aguirre

University of East Anglia

Climatic Research Unit

1. Introduction

Data grids derived from irregularly spaced observations are often required in climate analyses. Some uses of gridded data are the calculation of area-averaged indices, application of multivariate techniques, objective analysis, model verification and integrated assessments. At present, most gridded datasets are available at the monthly time-scale (high spatial-resolution) or for relatively low spatial resolutions (daily time-scale reanalysis). Therefore a new daily gridded high-resolution data set of precipitation and surface temperature is being created for the area of Mexico and the southern conterminous United States of America.

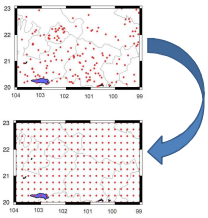

Figure 1. Irregularly spaced observations transformed into regular gridded data.

2. Data

Figure 2. Climatological station SMN 21086 "Tepeaca" Mexico.

Daily observations of precipitation and surface temperature (maximum and minimum) were obtained from the Mexican National Meteorological Service (SMN) climatic database and from NCDC's Global Histocial Climatology Network - Daily (GHCND). In Mexico, there are more than 3000 stations in record (both historical and operational), therefore a resolution of 0.25° has been selected for the grids.

Unlike other meteorological services in the world, the SMN makes its climatic data freely available to everyone. However, this implies the need to previously undertake a careful quality control process to any use of the data. In addition, various quality control steps have been applied in GHCND data.

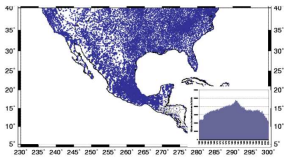

Figure 3. Observation stations used in the gridding.

3. Quality control and homogeneity

Raw station data might contain errors, outliers and suspicious data caused by changes in instruments or observation procedures. Such problems should be removed as much as possible before climate data can be transformed into regular grids.

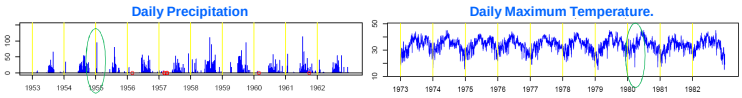

Figure 4. Examples of daily precipitation and maximum temperature time-series

Outliers and suspicious data were accepted or rejected considering:

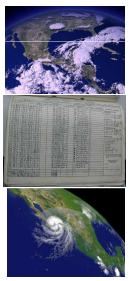

Figure 5. A frontal passage, an original data record and a tropical cyclone.

- Logical errors (Tx < Tn) and the original records.
- Outliers (exceeding 4σ for temperature & 6σ for precipitation)
- Visual inspection of the time-series plots.
- External sources (frontal passages and tropical cyclones)
- Observations in the same location at adjacent dates
- Observations in the same date at adjacent stations
- Synoptic patterns and anomalies based on Reanalysis
- Other evidence of weather extremes including local expertise

Temporal homogeneity was assessed using a simple test, but no homogeneity adjustments were made in the time-series.

4. Methods

Haylock et al., 2008 proposed a three-step methodology for the production of daily gridded datasets. This method has been successfully applied in Europe to create the E-OBS gridded dataset*. Interpolation of monthly means or totals includes high resolution elevation data.

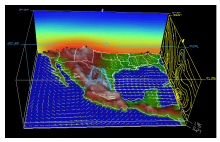

Figure 6. Terrain elevation.

The E-OBS methodology consists of three different steps using separate methods for the gridding of monthly and daily data. This combination is intended for better performance when many climate zones exist in the interpolation domain. The three steps are:

1. Gridding monthly means using thin-plate splines
2. Kriging anomalies in reference to the monthly means
3. Applying gridded anomalies to the gridded monthly means

For temperature, anomalies are calculated as the difference between daily observations and the monthly mean. For precipitation, anomalies are calculated as daily precipitation totals divided by the monthly total mean.:

Each grid value represents the areal average of observations in the correspondent grid square. A measure of uncertainty in the gridded data is provided by estimating daily standard errors in each grid square.

Once grids are completed, they will be evaluated by comparing observations and estimated values, new and existing climatologies and some statistics.

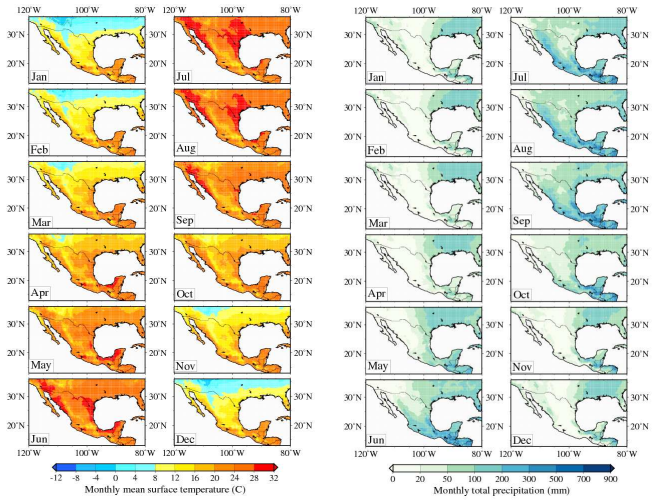

Figure 7. Monthly mean surface temperature climatology (1961-1990).for surface temperature (left) and precipitation (right). CRU-CL2.

5. Research in context

The production of improved datasets is considered in WCRP Priority Task 8: "Strengthen our Climate Information Systems". this contributes as a key element towards the improvement of climate services (http://wcrp.wmo.int).

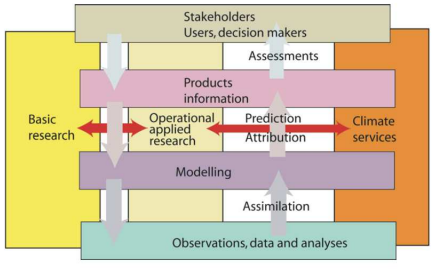

Figure 8. WCRP strategic framework showing needed interactions for a better provision of climate services.

6. Further work

Evaluation and post-processing of the gridded data in order to identify possible errors or biases in specific locations. Observed versus gridded extremes analyses. Data gridding and evaluation is still ongoing. A first dataset will be available by the end of 2010. Operational insertion of the product is expected in early 2011.

References

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•Jones, P.D. and Hulme, M., (1996). "Calculating regional climatic time series for temperature and precipitation: methods and illustrations." International Journal of Climatology 16, 361-377.

•*http://eca.knmi.nl/download/ensembles/ensembles.php.

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Jorge-Luis Vazquez-Aguirre
University of East Anglia.
j.vazquez-aguirre@uea.ac.uk

School of Environmental Sciences
Climatic Research Unit 01.03
Norwich, UK.NR4 7TJ

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