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Early meteorological records of Manila: El Niño episode of 1864

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RESUMEN

El objetivo de esta contribución es analizar las observaciones meteorológicas que el padre Antonio Llanos registró en las Islas Filipinas durante el periodo 1858-1865. Estos registros fueron publicados hace 140 años pero han sido ignorados hasta ahora. A partir de los datos publicados por Llanos, obtenemos esencialmente datos sobre la precipitación. Estos datos concuerdan con la existencia de un episodio de El Niño durante 1864 tal y como han mostrado investigaciones previas basadas en datos *proxy*. Además, se muestran otros registros meteorológicos históricos de las Islas Filipinas.

ABSTRACT

The goal of this contribution is to analyze the meteorological observations that the Spanish friar Antonio Llanos registered during the 1858-1865 period in the Philippines Isles. These records were published 140 years ago but have been ignored until now. The data published by Llanos are essentially information about precipitation. These data agree with the existence of an episode of El Niño during 1864 just as previous investigations based in proxy data have noted. Other early meteorological records of the Philippines Isles are presented, as well.

Key words: Historical climatology, early records, Philippines Islands, ENSO.

1. Introduction

El Niño is the most important cause of the inter-annual climate variability in the tropics and it influences the climate in many regions of the world. This is why the study of El Niño has raised a

great interest. The events variability at low frequencies is one of the more interesting aspects to investigate. To have precise information about what El Niño episodes have been more important and how the phenomenon has evolved to greater timescales, historical reconstructions with *proxy* data are necessary. Qualitative information that allows reconstructing the history of the El Niño events since the 16th century (Quinn and Neal., 1992) is available but, in general, the early meteorological records are very limited. There is a reconstruction of SOI index previous to 1866 using pressure data from Indonesia and Tahiti, and Jakarta rainy days count back to 1829 although several gaps exist (Können *et al*, 1998).

Philippines Isles are one of the more sensible zones to the El Niño events. That is why the study of its climate has a great interest. During the El Niño events, droughts are produced in the entire Indonesian zone. The oldest meteorological records that are known for the Philippines Isles were recorded in Manila (14° 37' 12'' N, 120° 58' 12'' E) by the French astronomer Le Gentil (1725-1792) during the years 1766-68. Unfortunately, only the temperature was registered and no record of atmospheric pressure or number of rainy days exists. Le Gentil only noticed that there was a north monsoon on October 1766 and November 1767, and that was a south monsoon on June 1767. These records, which were summarized by Cotte (1788), are shown in Table 1.

Table 1. Meteorological records of Manila by Le Gentil (Cotte, 1788).

Date	Maximum temperature (°C)	Sunrise temperature (°C)
August 1766	29.5 - 30	- - - - -
September	29.5 - 31	19 - 20
October	30 - 31	19.5 - 20
November	28.5	17.5 - 18.5
December	26 - 28	18
January 1767	26.5 - 28.5	16
February	28.5	13.5
March	33	16.5
April	34 - 35	20 - 21
May	34 - 35	22 - 23
June	31 - 32	21.3 - 22.3
29 June	36.3	- - - - -
July	31. 5 - 33.5	21 - 22
August	30 - 33	22 - 23
September	29 - 30	20 - 21
October	27.5 - 29.5	22 - 21.5
November	28 - 29.5	19 - 20
December	27.5 - 28.5	18 - 19
January 1768	23.5 - 25.5	15.5 - 16.5

The goal of this contribution is to analyze the meteorological observations that the Spanish friar Antonio Llanos registered during the period 1858-1865. These records were published 140 years ago but have been ignored until now (Llanos, 1859, 1866, 1867).

2. Data

The Llanos' data that we have used were published in the *Revista de los Progresos de las Ciencias Exactas, Físicas y Naturales*, a Spanish scientific journal of the 19th century. These data were published in three different papers (Llanos, 1859, 1866, 1867) which we are going to comment briefly.

The first paper (Llanos, 1859) presents monthly data of number of rainy days and mean, maximum and minimum temperatures from May 1858 to April 1859. Furthermore, some no systematic data are presented (i.e. wind directions). The place of observations is named Calumpit. Llanos offered the geographical coordinates: 14º 55' 10'' N, 127º 5' 10'' E (from Cádiz meridian) and 20 Spanish foot of altitude (5.6 m), that today correspond to 14° 54' 36'' N, 120° 46' 12'' E.

The second paper (Llanos, 1866) presents meteorological observations recorded in the telegraph tower of Manila in the year 1864. Llanos presents the monthly data of number of rainy days and precipitation for the year 1864. In order to compare, Llanos shows mean monthly number of rainy days data and collected rain amount for the period 1859-1864. Moreover, punctual data of these meteorological variables during this period were recorded. Finally, Llanos presents the frequencies of wind direction in Manila during the year 1864 deduced from two daily observations (morning and evening).

The third article (Llanos, 1867) deals with the description of the storm that ocurred at Manila on the 9th and 10th of November 1865. Though almost all the article is about the account of the hurricane, Llanos also includes tables summarzing monthly data of atmospheric pressure, temperature, relative humidity, wind direction (six daily records) and state of the atmosphere (including rainy days and precipitation) for the period January-June 1865. The observations were realized in the Observatorio del Ateneo Municipal de Manila.

In summary, the most regular data that Llanos provides in the three cited papers are referred to the precipitation in Manila.

3. Analysis and conclusions

Essentially, the information provided by the data published by Llanos is on precipitation. These data are the number of rainy days in both, monthly and annual scales and, to a lesser extent, the amount of precipitation.

Figure 1 shows the annual number of rainy days during the years 1863 and 1864, and during the periods 1859-1864 and 1960-1995. The data of the 1960-1995 period correspond to the weather station of the Science Garden in Manila. Llanos (1866) noticed that, during the period 1859-1864, the year with the highest number of rainy days was 1863 (144 rainy days), and the lowest was 1864

(111 rainy days). For these two years there are also monthly data. Figure 2 shows the available monthly number of rainy days data. The most significant data is the scarce number of rainy days during most part of the year 1864. Llanos (1867) mentions that, during the 1859-1864 period, the month with the highest number of rainy days was July 1862 (26 rainy days). The months with the lowest number of rainy days were April 1862 and April 1864, in which it did not rain.

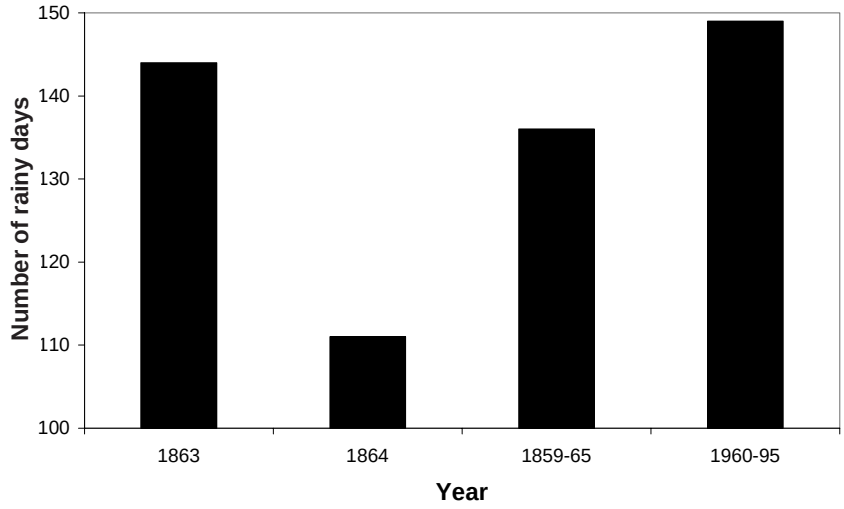

Fig. 1. Annual number of rainy days in Manila.

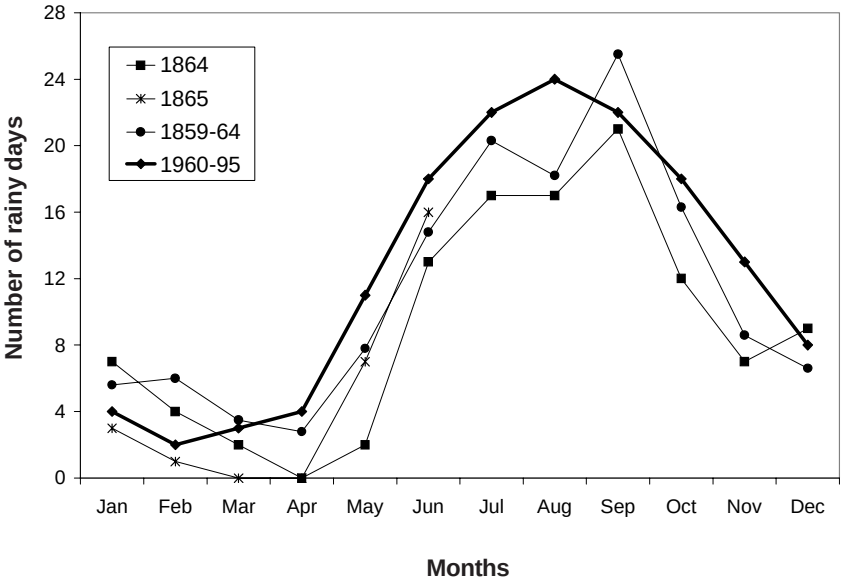

Fig. 2. Monthly number of rainy days in Manila.

Llanos also offers data about the amount of precipitation. Despite we do not know the conditions of installation of the rain gauge used by Llanos, it is possible to compare the data provided by Llanos and the precipitation data in Manila during the period 1865-1990 extracted from the numeric data package *The global historical climatology network: Long-term monthly temperature, precipitation, sea-level pressure and station pressure data* (Voce *et al*., 1992). In Figure 3, annual precipitation in Manila during the periods 1860, 1864, 1859-1864 and 1865-1990 is displayed. Figure 4 shows the available monthly data. The Llanos' period of observation (1859-1864) was dry when compared to the data of the 1865-1990 period. Furthermore, during 1864 precipitation accounted for only 69% of the mean annual value of the 1865-1990 period. Moreover, the 1864 annual rainfall value does not reach the interval delimited by one standard deviation of the climatological average of the 1865-1990 period (Fig. 3).

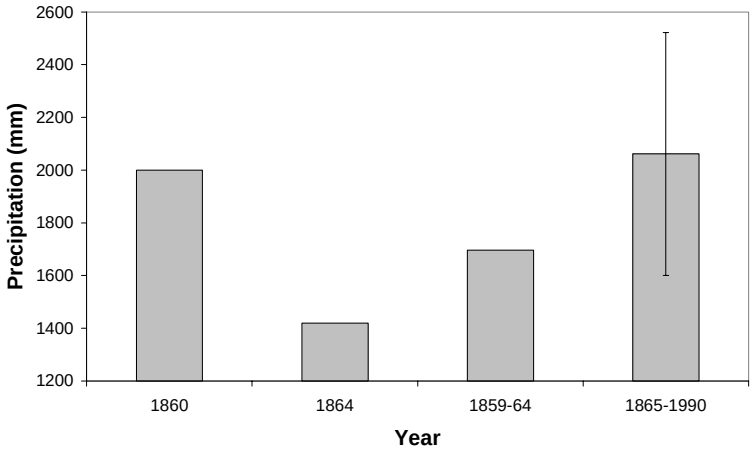

Fig. 3. Annual rainfall in Manila.

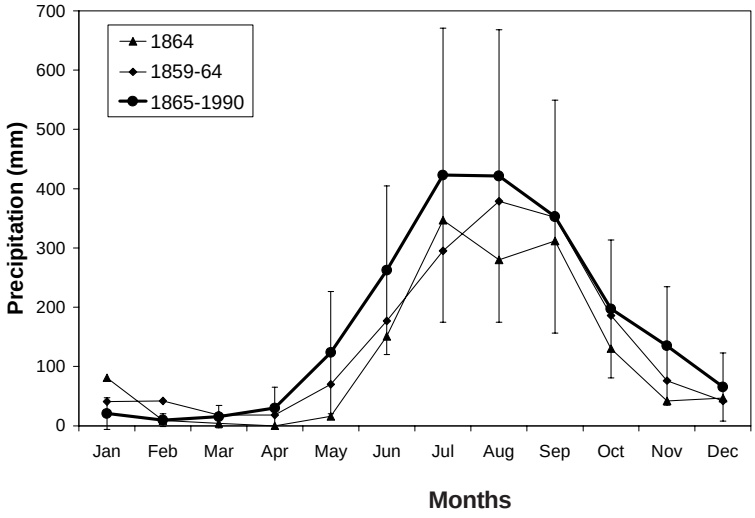

Fig. 4. Monthly rainfall in Manila.

Data about the scarce rainfall produced during the 1859-1864 period, and especially during the year of 1864, agree with the *proxy* data offered by Quinn and Neal (1992) related to the existence of El Niño events. Quinn and Neal (1992) made a reconstruction of the El Niño phenomena from data of floods, droughts, loss of harvests, plagues, etc., in different places of South America (Perú, Bolivia and Brazil, among others), and from the levels of the Nile. These levels depend on the rains over the Ethiopian plateaus that register values lower than the mean value when an episode of El Niño is produced. According to Quinn and Neal (1992), moderate El Niño events were produced in 1857-58, 1860, 1862 with confidence levels of 5, 4 and 4 respectively (maximum confidence level is equal to 5) and an El Niño event with a strong character was produced with a maximum confidence level in 1864. Llanos' data, as most of the ancient meteorological records, are incomplete and partial; for that, they must be interpreted with caution. Nevertheless, even the non instrumental data of father Llanos, as the number of rainy days, agree with the existence of an El Niño event occurred in 1864, as Quinn and Neal (1992) noted.

Aknowledgements

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