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# Unexplored documentary sources to assess climate variability in the Mediterranean sea(*)

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**Summary.** — The CLIWOC project has recently shown the potential of 18th and 19th century logbooks to reconstruct wind climatology in the open oceans. This paper examines the availability of non-digitised logbooks covering the Mediterranean Sea during the same period. It is shown that the combination of logbooks kept in British, French and Spanish archives would provide a high density of observations which could result in a significant wind climatology for the Maditerranean Sea.

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PACS 92.70.Gt – Climate dynamics.
PACS 92.60.Wc – Weather analysis and prediction.
PACS 01.30.Cc – Conference proceedings.

## 1. – Introduction

Weather observations on sailing ships were taken daily, with almost military routine since the mid seventeenth century; however they have been poorly used with climatic purposes, mostly because on board observation were not first standardized until 1853. On board each of these vessels the senior officers maintained a daily logbook account of events, particularly the weather. A typical page of one of those logbooks is depicted in fig. 1. On the top, it shows a table where most of the information is written: date, hour, route, wind direction and strength, sea state, kind of sails, ranges, etc. At the bottom there is a small table with several data regarding longitude and latitude; and finally the most important events of the day, as storms, meetings with other ships, punishments to the crew, diseases, deaths, etc were recorded. Sometimes, several meteorological observations as the state of the sea and sky or direction and force of the winds were also written as remarks in this section. Not surprisingly, the similar content and structure

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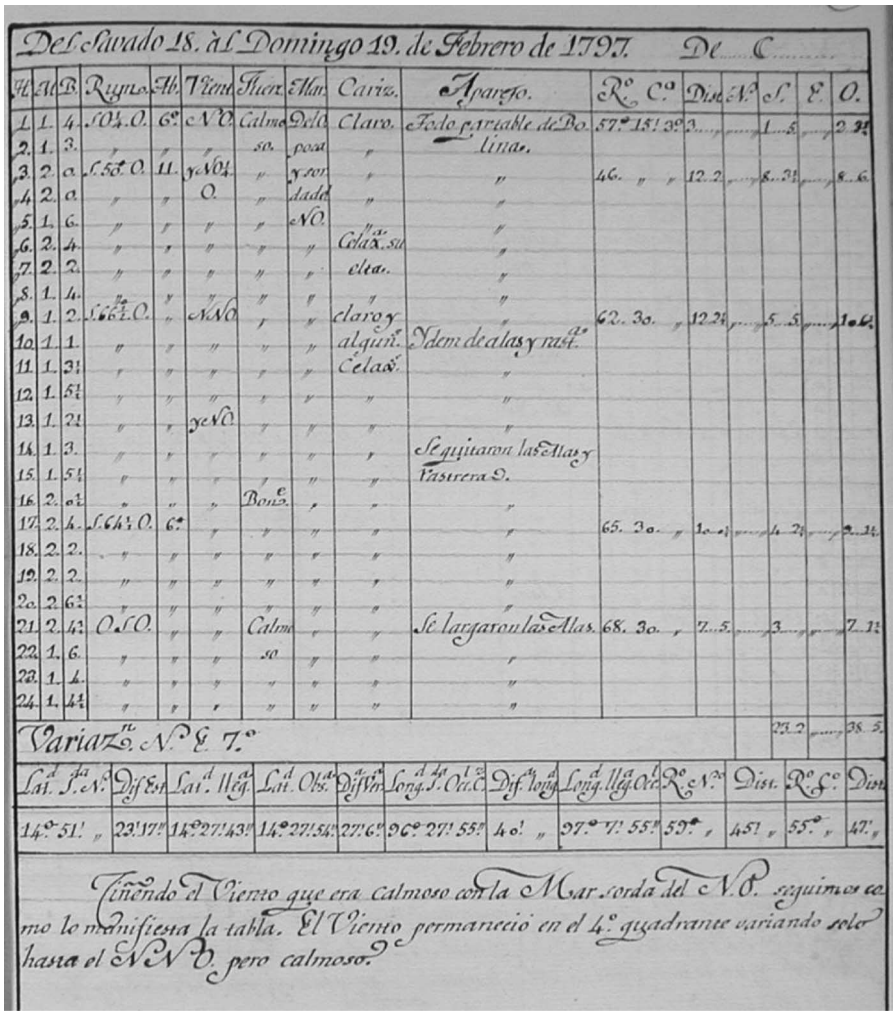


Fig. 1. – An example of a Spanish logbook page of 1797.

can be found in most of the European sailing countries [2]. Meteorology determined the routes followed by the ships, the time of sailing and the safety on the voyage. As can be seen in fig. 1, wind direction and force were recorded at least daily at noon, but often at other times providing a picture of short-term variation. These two key parameters were estimated by direct observation of the state of the sea, the behavior of clouds, the effect on the sails and a number of other phenomena. Those for wind direction were based on a magnetic compass, usually of 32 points. The observations were made only by the ships' officers, most of whom were skilled and experienced seamen, familiar with their ships and the weather conditions with which they had to contend. They used descriptive terms to describe wind force. So, it is evident that the use of these records for climatological purposes implies transforming them into their present-day equivalent. This was one of the major undertakings of the European Union funded project CLIWOC (*A Climatological Database for the World's Oceans 1750-1850* [3]). It worked from a sample of the main

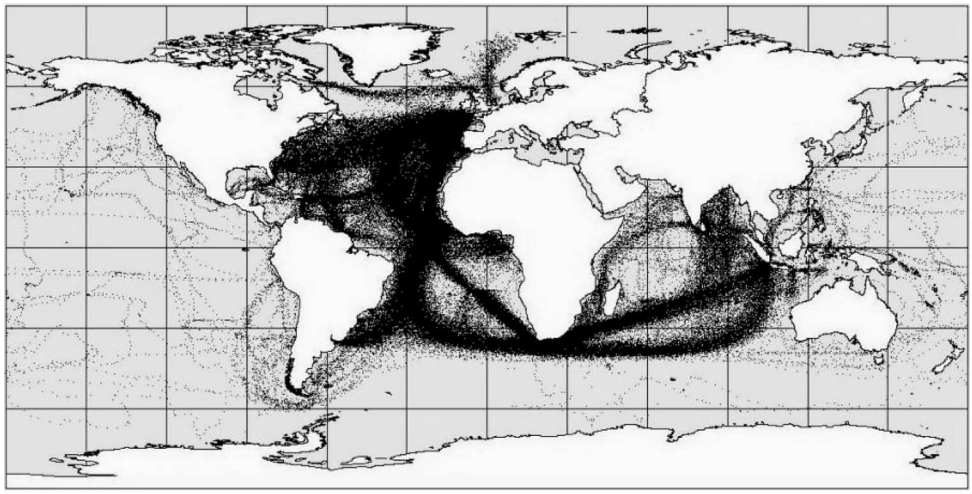

Fig. 2. – CLIWOC 1.5 data coverage. Each dot represents a daily observation.

logbooks collections found in Britain, France, the Netherlands and Spain to obtain a climatological database over the oceans for the period 1750-1850. Perhaps the main challenge was to transform archaic nautical terms in four languages into their modern Beaufort scale equivalents. After applying content analysis techniques, a multilingual dictionary was built [1]. After checking the quality and consistency of the observations and adjusting the proper ships positions [6, 5] a database containing wind data for over 280000 days is currently available (`http://www.ucm.es/info/cliwoc`). CLIWOC has shown that the quality of these observations is much higher than previously expected and can be applied to extend back current climatic databases, such as ICOADS [7] by almost a century. But, even more importantly, this project provides the tools to properly interpret and process pre-1850 onboard weather observations and make them directly comparable with instrumental observations.

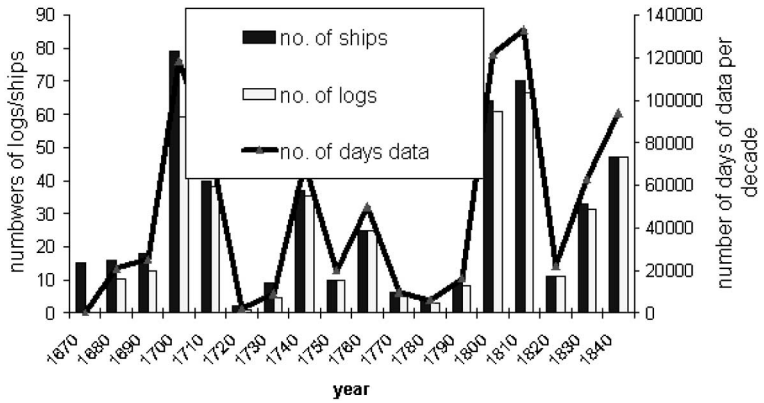


Fig. 3. – Distribution of estimated logbooks for the period 1670-1840 in the British archives. Courtesy of Dennis Wheeler, University of Sunderland.

## 2. – Logbook availability for the Mediterranean Sea

However, the logbook abstraction has, by no means, been completed with CLIWOC. It is estimated that more than 130000 logbooks are still available in different European archives and that they may contain more than 10000000 day observations for the period 1650-1850. However only 3000 logbooks have used in CLIWOC. Figure 2 shows the final coverage obtained by CLIWOC. It can be seen that the Atlantic and the Indian Oceans are the areas with the denser data density, since they were the busier open oceans at that time. CLIWOC has not examined data from closed seas, such as the Baltic and the Mediterranean. However, during the period 1700-1850, the Mediterranean Sea was specially busy, not only with ships from the coastal nations, but also with the English fleets, which possessed different ports in the area, such as Gibraltar, Mahon, Naples, Alexandria and Cyprus. This has left an important legacy of logbooks covering the Mediterranean. Figure 3 shows the estimated availability from British archives (Wheeler, personnel communication). About 500 non-abstracted logbooks are estimated in the French archives, while the estimation for the Spanish archives is around 100. The situation in the rest of the Mediterranean countries has not been evaluated yet. It must emphasised that these data are unique in providing direct observations of contemporary wind conditions. Thus, they are free of uncertainties associated to proxies.

## 3. – Final remarks

It is evident that the information contained in these logbooks is essential to obtain an accurate picture of past Mediterranean climate. Their use combined with data from contemporary land-based stations opens the way to new analysis, similar as those made with the CLIWOC data [4].

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