

# CLIWOC

## **Climatological database for the World's oceans: 1750 – 1850**



Universidad Complutense de Madrid  
University of Sunderland  
University of East Anglia  
Royal Netherlands Meteorological Institute  
Instituto de Nivología, Glaciología y Ciencias Ambientales  
with:  
the National Maritime Museum  
the Netherlands Institute for Scientific Information Services and  
the US National Oceanic and Atmospheric Administration (NOAA)



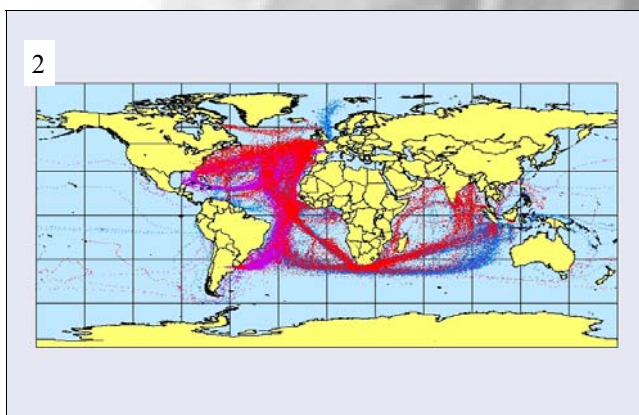
EC Framework V Project EVK1-CT-2000-00090

## INTRODUCTION

At completion of the CLIWOC project, the team can look back upon a successful undertaking. The principal objective of the preparation of a database drawing on British, Dutch, French and Spanish ships' logbook records for the immediate pre-instrumental period (1750 to 1850) has been achieved. The database is freely available and we anticipate its widespread use. CLIWOC has established early ships' logbooks as another source available to those rising to the challenge of understanding climatic change, and can be set alongside proxy and instrumental data. The restrictions on the time span embraced by the available historical marine data are compensated by the fine scale of temporal resolution of the data (daily noon observations), and by the extensive geographical range of the observational record (only the Pacific Ocean lacks detailed coverage for this period). The maritime character of the data adds further to their value as oceanic areas are not well-served by data for this period.

### LOGBOOKS IN REVIEW

Eighteenth and early nineteenth century logbooks had previously been used only in case studies of individual events of historic or climatic interest. Hitherto no comprehensive review of their scientific potential had been undertaken. CLIWOC's endeavours in this field have confirmed that they cast a new and more detailed light on the climate over the oceans in the immediate pre-instrumental period. It has also shown, however, that the data need to be treated with caution, and subjected to careful scrutiny. The range of information is consistent between the different national sources, and consists of wind force terms, wind directions and general weather descriptions. It is largely non-instrumental and based on the observations made by experienced officers.



CLIWOC data coverage: red—English sources, blue—Dutch sources and purple—Spanish sources



### THE DICTIONARY – A SCIENTIFIC KEY

The weather terms employed by mariners before 1850 could not be taken at face value; the words they used were familiar, but their exact meanings initially uncertain. Wind force descriptors presented a great challenge, but had to be 'homogenised' through conversion to their present-day Beaufort Force equivalents. Only then could their scientific value be realised. The vocabulary differed between the national sources. English mariners used a relatively narrow range of terms, whereas their Dutch, French and Spanish counterparts employed a much more varied set of descriptors. In all cases, however, the majority of wind force entries were accounted for by just twelve or so terms. Content analysis and other methods were used to prepare a dictionary in which the majority of all wind force terms were defined on the Beaufort Scale. This multi-lingual dictionary has now been published.

### ACHIEVING CLIWOC'S OBJECTIVES.

The project has achieved success in drawing a new data source into the scientific realm, and has provided an enduring legacy of methods, data and understanding. In doing so it has:

1. established a freely-available database of calibrated climatic data that will be of continued and growing value in climatic studies
2. confirmed by objective means the reliability of logbook data
3. provided a dictionary of terms that allows other scientists to decipher more readily the descriptions contained in logbooks
4. developed a statistical algorithm by which fields of collated logbook data can be used to reconstruct atmospheric pressure fields over the oceans
5. the CLIWOC database is also being used to extend the record from instrumental logbooks contained in the well-established I-COADS dataset. The CLIWOC data and investigations have also provided a valuable complement to the US Maury dataset being developed by the I-COADS team.

## DATA VERIFICATION

The intrinsic reliability and consistency of the logbook weather record was determined by sampling from the large number of logbooks where ships were in convoy or travelling in close company. These voyages often lasted several weeks giving large replicate samples. The degree of correlation in recorded wind forces was consistently high, as was the degree of similarity in recorded wind directions. On a number of occasions, however, small but persistent differences were found between absolute wind force records prepared on vessels of different sizes. Whilst not materially influencing the scientific outcome of the project, it remains a matter for further investigation. Further tests have been carried out to compare the aggregated logbook wind field records with the I-COADS maritime database and the NCEP/NCAR reanalysis.

## THE DATABASE

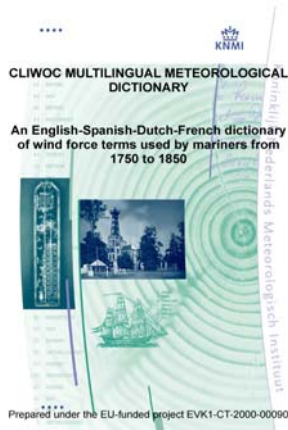
Version 1.0 of the database was released in late 2003. The database is available as a CD-ROM, but can also be interrogated through a dedicated CLIWOC website (see below). An important development is its simultaneous availability through the I-COADS site. Release version 1.0 is based on the International Maritime Meteorological Archive (IMMA) format, which is being developed under the joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (documentation at I-COADS website; see contacts). Version 1.0 has over one quarter of a million records, but this will increase quickly in the planned later versions as more data are processed for inclusion. The database includes information

on date and time of each observation, the latitude and longitude of the recording vessel and its country of origin. This is followed by the key climatic information for wind direction and wind force. Where such data are available, and this is generally only found in the more recent records, instrumental observations are also included.

## DATA CORRECTION

Logbook data often need correction as well as verification. Not only did archaic wind force terms require conversion to Beaufort scale equivalents, but wind directions had to be adjusted if they had been made by reference to magnetic, as opposed to true, north. This correction varied over space and time, but could be as much as 30 degrees. Latitude and, more especially as precise navigational methods were commonplace only towards the close of the study period, longitude sometimes required correction using specifically designed software to detect and rectify logbook errors.

3



Front cover of CLIWOC's multilingual dictionary

## CLIWOC DATA APPLICATIONS

The CLIWOC team are calibrating statistical models with which the database information for wind force and direction can be processed to provide monthly pressure field reconstructions for the Indian and the South and North Atlantic Oceans. These will provide a means for studying climatic change over the oceans in the 100 years beginning in 1750, and will permit important measures such as the North Atlantic Oscillation and Southern Oscillation indices to be estimated for this pre-instrumental period.

## CLIWOC IN THE FUTURE

The CLIWOC project closed in 2003, and has as its most durable legacy the database and the knowledge that a new climatic data source has been confirmed. The British, Dutch and Spanish sources have contributed equally to the database, each providing approximately 100,000 days of noon observations. French logbooks have also been used, but no other significant European sources exist for ocean voyages prior to 1850. The database will, however, continue to develop. Whilst the Spanish logbooks have been extensively studied, over 50 per cent of Dutch and over 90 per cent of British and French logbooks remain wholly unexamined. There are several thousand such items. They cover most of the oceanic areas and embrace the CLIWOC period and earlier times as far back as the mid-seventeenth century. All national sources, however, include many non local-noon observations that also require consideration. In many respects the close of the formal CLIWOC programme serves only to open a longer phase of fruitful investigation.

To obtain a copy of the data (CD-ROM or via ftp) please go to [www.ucm.es/info/cliwoc](http://www.ucm.es/info/cliwoc) for details.



Francis Beaufort's first wind and weather scale (1806)

## ACKNOWLEDGEMENTS

The project could not have been conducted without the help of a large number of individuals and organisations. We are pleased to acknowledge the assistance of the following: our two official advisers, Dr. David Parker (Hadley Centre, UK Met Office) and Dr. Henry Diaz (NOAA), the staff at the National Maritime Museum (Greenwich), the British Library, the Public Record Office (Kew), the School of Earth Sciences (University of Leeds), Archivo del Museo Naval, (Madrid), Archivo General de Indias, (Seville), the Nationaal Archief of the Netherlands (The Hague), and the staff of the Netherlands Institute for Scientific Information Services (Amsterdam). Illustration 1 is by courtesy of the National Maritime Museum, Greenwich, UK. Illustration 4 is by courtesy of the UK Met Office.

## CLIWOC PARTNERS AND PARTICIPANTS: contacts and addresses

### CO-ORDINATION

#### Universidad Complutense de Madrid

Prof. R. Garcíá Herrera, Prof. E. Hernández Martín,  
Prof. L. Gimeno Presa, dr. A. López-Gutiérrez,  
Departamento de Física de la Tierra II,  
Facultad de CC Física, Ciudad Universitaria s/n,  
Madrid 28040 SPAIN

Tel. +34 (91) 394 4456  
Fax. +34 (91) 394 5195  
e-mail rgarcia@6000aire.fis.ucm.es  
URL www.ucm.es/info/cliwoc

### PARTNERS AND PARTICIPANTS

#### University of Sunderland

Dr. D. Wheeler,  
School of Health, Natural and Social Sciences,  
Priestman Building,  
University of Sunderland, Sunderland SR1 3SD UK

Tel. +44 (0) 191 515 2233  
Fax. +44 (0) 191 515 2229  
e-mail dennis.wheeler@sunderland.ac.uk  
URL www.nmm.ac.uk/cliwoc

#### National Maritime Museum

Dr. N. Rigby, Dr. C. Wilkinson,  
Greenwich,  
London SE10 9NF UK

Tel. +44 (0) 208 312 6792  
Fax. +44 (0) 208 312 6508  
e-mail nrigby@nmm.ac.uk  
CWilkinson@nmm.ac.uk

#### University of East Anglia

Prof. P. D. Jones,  
Climatic Research Unit,  
University of East Anglia, Norwich NR4 7TJ UK

Tel. +44 (0) 1603 592090  
Fax. +44 (0) 1603 507784  
e-mail p.jones@uea.ac.uk

#### Royal Netherlands Meteorological Institute

Dr. G. Können, F. Koek,  
KNMI, PO Box 201, 3730 AE, De Bilt,  
THE NETHERLANDS

Tel. +31 (30) 220 6911  
Fax. +31 (30) 221 0407  
e-mail Konnen@knmi.nl  
Frits.Koek@knmi.nl  
URL www.knmi.nl/~koek/cliwoc.htm

#### Instituto de Nivología, Glaciología y Ciencias Ambientales

Dr. M. del Rosario Prieto, CRICYT-CONICET,  
Calle A. Ruiz Leal s/n, Medoza (5500) ARGENTINA

Tel. +54 261 4288797  
e-mail mrprieto@lab.cricyt.edu.ar

#### Netherlands Institute for Scientific Information Services

Dr. P. Doorn, B. Feith  
NIWI, Joan Muyskenweg 25, 1096 CJ Amsterdam,  
THE NETHERLANDS

Tel. +31 20 462 8600  
e-mail Peter.Doorn@niwi.knaw.nl  
Berry.Feith@niwi.knaw.nl

#### US National Oceanic and Atmospheric Administration (NOAA), and the International Comprehensive Ocean-Atmosphere Data Set (I-COADS) Project

Scott Woodruff  
NOAA Climate Diagnostics Center  
325 Broadway, Boulder, CO 80305 USA

Tel. +1 303 497 6747  
Fax. +1 303 497 7013 or 6449  
e-mail Scott.D.Woodruff@noaa.gov  
URL http://www.cdc.noaa.gov/coads &  
http://www.cdc.noaa.gov/e-doc/  
imma/imma.pdf