

DERIVING WIND FORCE TERMS FROM NAUTICAL REPORTS THROUGH CONTENT ANALYSIS. THE SPANISH AND FRENCH CASES

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Abstract. Records of wind strength taken onboard Spanish and French ships during the 1750–1850 period have been digitized and examined using content analysis techniques to derive the equivalent wind strength in terms of the current Beaufort scale, this conversion being a key step in any attempt to compare ancient records with modern climatologies. During the analysis it was evident that Spanish and French officers used a great number of different terms to describe the wind force. However, when the records are analyzed and homogenized, a broadly common and essentially narrow vocabulary was identified, indicating that, at this period, a great effort had been made to regulate the maritime language. Using contemporary dictionaries and navigation manuals, an equivalence was established between the original wind force terms and the Beaufort scale.

As the tree leaves . . . some voices fall and become old to leave room to other recent and foreign; not withstanding this, all must be included in a dictionary. (Timoteo O'Scanlan, 1831)

1. Introduction

One of the main difficulties when working with meteorological information from Spanish and French ship logbooks of the eighteenth and nineteenth centuries is the lack of written conventions and rules for the recording of weather events at sea. Navigators from these countries used a large number of terms to describe the meteorological phenomena that were not measured using instruments. Estimates of wind force or the general weather description constitute good examples. This situation lasted throughout the eighteenth century and for most of the first half of the nineteenth century. In addition, many of the weather observations recorded in the Spanish and French logbooks are not readily understood. They often contain ambiguous expressions and multiple qualifier adjectives. The words they used were superficially familiar, but their exact meaning was initially uncertain. As a result it was important to “homogenize” the information by converting the wind force terms into their present-day Beaufort force equivalent expressions.

A basic difficulty lies on the way in which past observers communicated the climatic evidence. To identify and homogenize wind force and the general weather descriptions kept in the ancient logbooks, the techniques of content analysis were applied. In the current context, this method permits the interpretation of observations recorded in a non-standardized form and their conversion into contemporary meteorological standards and norms. The aim of this paper is to describe the procedures used to evaluate the terms used to describe the wind strength that were included in Spanish and French logbooks between 1750 and 1850 and the manner in which they were then equated with terms on the modern Beaufort scale.

2. Historical Antecedents on the Use of Spanish and French Wind Force Terms

The Beaufort wind force scale, conceived to regulate and homogenize the weather observations relative to the wind force was implemented only over a period of time. In Britain, the current scale was first proposed in its definitive form in 1806, and constitutes the result of a long development, which can be traced from the beginning of the eighteenth century. It was not formally adopted in Britain until 1836. In Spain and France, the adoption of this scale was a yet longer and more complex process. In these countries, the Beaufort system was not widely applied until the second half of the nineteenth century. A search of the main depositories of naval documents in Spain, the *Archivo del Museo Naval* (Archive of the Naval Museum, AMN) and the *Archivo General de la Marina* (General Navy Archive, AGM) (Cedillo, 1730, 1745; González-Cabrera, 1734; Jorge-Juan, 1757; Pimentel, 1762; Fernández, 1777; Barreda, 1786; Capmany, 1791; Ulloa de la Torre, 1795; among many others), confirms that before that time there were no precise rules in the way that wind observations should have been recorded in the logbooks, or at least none have survived. O'Scanlan (1831), who makes a revision of the previous works in the prologue to his *Maritime Dictionary*, corroborates this view and he suggests that no general agreement had been reached at least until 1831, the date of publication of the Dictionary.

Going back to the earliest supporting documents, a Royal Order issued in 1575 required masters and pilots from the Spanish ships who navigated in the *Carrera de Indias* (the route from the mainland to the colonies in America) to keep a record of each trans-Atlantic journey, including a detailed description of the voyage and of any geographical discoveries, winds, currents and hurricanes. The completed logbooks had to be delivered to the Professor of Cosmology in the *Casa de Contratación*. (AGI, *Indiferente General*, 1956, L.1, f266r-266v).¹ In fact, wind descriptors can be traced in logbooks from as early as the sixteenth century. Prieto and Herrera (1999) developed a system to categorize and standardize wind force descriptors used in the logbooks from the Spanish ships that crossed the Magellan's Strait during the sixteenth and seventeenth centuries. A summary of the wind descriptors can be seen in Table I.

TABLE I

Example of categorization of wind descriptors from the Spanish logbooks crossing the Magellan's Strait (See Prieto and Herrera, 1999). In brackets approximate translations

Light wind	Smooth wind	Regular wind	Strong wind
Calma extraordinaria (Extraordinary calm)	Bonancible (Moderate breeze)	Vientos naturales (Natural winds)	Muchas tempestades (A lot of storms)
Calmo (Calm)	Vientos calmosos (Calm winds)	Ventó (Windy)	Viento tempestuosísimo (Very stormy wind)
Cesó el viento (The wind died down)	Poco viento (Little wind)	Vientos variables (Variable winds)	
Noche serena (Quiet night)	Viento escaso (Little wind)	Ventando (Windy)	
Falta de viento (Absence of wind)	Buen viento (Good wind)	Las refriegas de viento no nos fatigaron (The gust of wind did not tire us)	Gran refriega (Great gust of wind)
	No hacía tiempo para partir (The weather does not allow us to depart)	Vientos más favorables (More favourable winds)	Tempestad de viento y agua (Storm of wind and water)
	Vientos blandos (Soft winds)	Vientos moderados (Moderate winds)	Gran tempestad de agua y viento (Great storm of water and wind)
	Bonanza especial (“Special” fair weather)	El tiempo moderó (The weather was softer)	
		Muy ventoso (Very windy)	
		Próspero viento (Promising winds)	
		Viento bonanza (Good winds)	
		Abonanzó (Softer wind)	

It seems probable that mariners used the traditional terms, transmitted through the generations, and consolidated through time to record their estimates of wind strength. The need for favorable winds for navigation had led to an empirical classification of their strength, and was the consequence of the years of nautical practice. The categories in this classification were mostly based on the power of the wind to move the ship and was based on the area and number of sails that were carried at any one time. On the other hand, the need to know the wind direction and strength in the different (and frequently new) oceanic routes was prompted by the need for safe navigation and was the origin of the detailed records of the wind features since very early times.

The similarity between some terms used in English, Spanish, Dutch and French should be noted, a few of which enjoyed an international currency such as fresh (*fresco* in Spanish, *fris* in Dutch and *frais* in French) or calm (*calma*, *kalm*, *calme*). They were used long before the first attempts of defining a uniform classification system. It is possible that the frequent exchanges and meetings between the sailors

of different countries during their trips across the known world and the frequent international character of the crews helped the interchange of meteorological terms from at least the sixteenth century, thus contributing to a common vocabulary that was later rationalized by Beaufort. In this regard, a significant number of the Spanish adjectives used to classify the wind during the eighteenth century are analogous to their contemporary English terms. *Fuerte* (strong), *suave* (light) or *moderado* (moderate) constitute good examples. In other cases, words used to identify local weather phenomena as typhoon or hurricane (*Tifón* or *huracán* in Spanish; *tifon* and *ouragan* in French) were adopted from foreign languages. A noticeable difference between the English and the Spanish maritime terminologies is the relative persistence over time of the Spanish expressions. In fact, it can be verified that some basic terms such as: *calma* (calm), *bonancible* (moderate breeze), *bonanza* (fair weather), or *calmoso* (light breeze) had been used with the same meaning since the first Spanish travels, according to the dictionaries from the sixteenth century (Covarrubias, 1994). This does not seem the case of other languages. For example, Wheeler et al. (2005) shows the evolution over the centuries of the meaning of the term “gale” in the English language.

Despite the similarities, Spanish attempts to standardize wind observations do not seem to have produced systematic rules. Nevertheless the use of more precise wind descriptors in the Spanish logbooks increased along the eighteenth century. In the second half of this century, some new terms, similar to those used in English, started to be used. A comparison between two periods of the eighteenth century, shows that prior to 1750, most of the Spanish authors of nautical treatises seem to have ignored the terms used in other countries to qualify the wind types, their strength and direction. For example, in the *Tratado de la Cosmographia y Nautica* (Treatise on Cosmology and Navigation), Cedillo (1745), referring to winds, states that: ‘they are divided in steady and unsteady . . . , others are tempestuous as hurricanes, others still or calm. Others are called *terral* (from land) which blow from land . . . Others are marine which blow from the sea and are steadier and healthier. Others are simple, which blow from the same part, others mixed, which blow from different parts’. On the other hand, Jorge-Juan (1771) went so far as to quantify some wind forces: ‘The wind running at 24 feet per second is *bastante violento* (*quite violent*) in such a way that it is difficult walking [. . .]. The wind running at 66 English feet is a *tempestad fuerte* (strong storm) and if it is more, a *huracan* (hurricane)’. Later, during the second half of eighteenth century, Ulloa de la Torre (1795) defines the different wind intensities with great rigour to meet the requirements of navigation. In the words of this author (for a description of the sails, the reader is referred to Harland, 2003): ‘According to its strength, and starting to count, from *calma muerta o chicha* (dead calm), when no wind is felt, it is said to be only *calma* (calm), when, from time to time a very light wind is felt; *vagajillo*, which others write *vahajillo*, when some very weak wind, not reaching water surface, is noted; *ventolina* (light airs), when this *vagajillo* points from different parts, without any of them fixed or preferred; *viento entablado* (settled wind), when it points from

a specific direction; *viento fresco* (fresh wind), which is also called wind of all sails and, in other style, topgallant wind, when all the sails are set and they do not flap; *frescachón* (near gale), when it is rough and does not allow to use topgallant sails; *cascarrón* (rough), when it is needed to take in the topsails; *ventarrón* (gale), when it obliges to furl the sails except the mainsails; *temporal* (storm), when it is needed to stay only with the staysails and foresail. Besides, there are squally and gusty winds and hurricanes’.

This early interest in using more standardized terms does not seem to have led to the adoption of any formal system until as late as 1831, when the *Diccionario Marítimo Español* – the first and more complete Spanish maritime dictionary – was issued (Spanish Maritime Dictionary, O’Scanlan, 1831). In fact, this dictionary does not make direct reference to the Beaufort scale when treating wind intensity (p. 553), which was in use in Britain, but includes most of the terms used by Beaufort. This is not surprising. Although already used by some British navigators during the last part of the eighteenth century, the Beaufort scale was only officially adopted by the British Navy as late as 1838 and even later (1874) in other countries following the First Conference on Maritime Meteorology in London. In 1863, the third edition of the Spanish translation of the ‘Storm compass or Manual of hurricanes for the use of the navigant’ written by the French A. Becher, was published under the title ‘*La aguja de las tormentas o sea Manual sobre huracanes para uso del navegante*’ (Becher, 1869). The translator included in this version a 12-point scale containing the ‘method which is used in the English Navy to indicate wind strength’ translated into Spanish to help provide a better understanding of the logbooks included in the manual’. It must be emphasized that such a scale is undoubtedly Beaufort’s, but no reference to the author is included. Since this was the third edition, it is likely that the scale was well known, and probably used by some Spanish sailors by that time. The balance of evidence suggests that by the end of the eighteenth century, there was no formal agreement among the Spanish sailors on the terms with which to describe wind strength.

In common with the Spanish terms, the analysis of French wind terms from the second half of the eighteenth century has revealed a notable number of expressions with which to describe the wind strength. No specific references were found to indicate the use of standard wind scales during this period (see Bougher, 1753; Leveque, 1779). This suggests that during that period and until the beginning of the nineteenth century there was no convention for the use of terms used amongst French mariners to describe wind force. It should be kept in mind that, as in the rest of Europe, the Beaufort scale was regularly used only after 1874.

During the seventeenth century, the French captains did not record the meteorological events in logbooks. Georges Fournier (1593–1652), a French Jesuit prepared a logbook in which he described his observations during a long crossing to America. He was the author of a Hydrography Treatise published in 1643, a 20-volume work which is considered the first French nautical encyclopedia (Vergé-Franceschi, 1991). From volume 10–18, Fournier reveals his knowledge about

navigational instruments, compasses, longitude, latitude, marine charts, winds, etc. A model standard logbook based in his experience was even proposed in this work. Fournier considered it essential to include information about hour (*Horloges*), date (*Jours et mois*), bearing (*runs*), wind direction (*vents*), wind quality (*Qualité de vents*), distance (*lieues françoises*), estimated latitude (*Latitude estimée*), longitude difference (*Difference de longitude*), observed latitude (*Latitude observée*), declination (*Declinason d'aymant*) and “happenings” (*Avantures*). Regarding the “wind quality”, each category was denoted by a capital letter. For instance, fresh wind (*Bon fres*) is denoted by “B”, Moderate breeze (*Petit fres*) with a “P” and fresh breeze (*Molli*) with “M”. A few French logbooks survive from the seventeenth century that have a structure and format similar to those from the eighteenth century.

3. Description of the Sampled Documents

3.1. THE SPANISH LOGBOOKS

The analysis of the Spanish language in this paper is based on the logbooks of the mail ships that sailed between Spain, La Havana and Buenos Aires-Montevideo.

The Spanish Crown was very interested in the state and private communications between Spain and the American colonies. During the eighteenth century, the ancient system of *Navíos de Aviso* (Warning ships) was under the direct supervision of the State. Later, Charles III transformed it into the *Correo Marítimo de Indias* (Maritime Mail of the Indies) by a royal decree dated from 6th August 1764. This led to the establishment of two regular routes between Spain and the Americas. The first one was the *Carrera de la Habana* (Havana route), which was created in 1764 and connected La Coruña in north-western Spain to Havana in a round trip on a planned monthly basis. From Havana, the correspondence was distributed to New Spain, Tierra Firme, Nueva Granada and Perú (present day Mexico, Central America, Colombia, Ecuador and Peru). Three years later, on 5th December 1767, the *Carrera de Buenos Aires* (Buenos Aires route) started. It connected La Coruña with the port of Montevideo in a round trip. The vessels anchored in Montevideo due to the difficulties of the Buenos Aires port. This route operated on a quarterly basis until 1771, when it began to operate on a bimonthly basis. However, the conflicts between Spain and France that erupted in 1780 caused this service to become less reliable and frequent. The final decline of the service occurred following the declaration of war with England in 1796, which led to the blockading of the Spanish ports and the British control of the seas. Between 1797 and 1800 no logbooks were recorded and the mail ships were only mentioned when they were captured during naval actions, and on 6th April 1802 a decree abolished this institution (Garay-Unibaso, 1987). These documents have been preserved because the ship’s captain had the duty of delivering the logbook to the Mail Administrator of La Coruña,

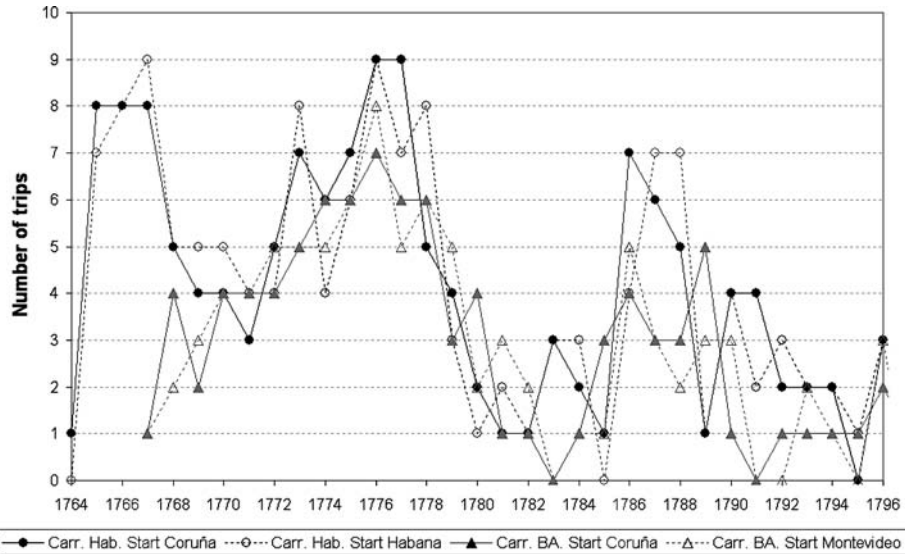


Figure 1. Number of logbooks per year for the *Carrera de la Habana* and the *Carrera de Buenos Aires*.

when returning from the round trip. The logbook content is described in detail in García-Herrera et al. (2005). The relevant facts of the journey were described and recorded according to strict rules. The pilot and the master had to record daily the navigation details following the common practice that included latitude, longitude, celestial observations, the state of sea and atmosphere, and a special entry to record wind strength and direction.

Figure 1 shows the distribution of the surviving logbooks for the whole period for both routes. The original documents are kept at the AGI in Seville, Spain, in the Correos (Mail) section. Here can be found 277 logbooks from the Havana route with a total of 14432 records (an average of 52.1 days per logbook). Of these, 66% contain data for wind strength. The original data cover the period from 1st December 1764 to 9th February 1797. A total of 182 logbooks from the Buenos Aires route are kept and contain 17395 records (an average of 95.6 days per logbook), of which 89% include observations on wind strength. The period of record extends from 11th October 1767 to 29th October 1798.

The current sample was selected in respect of the following advantages:

1. They constitute a series within a fixed and relatively narrow time frame, which allows a better control of language variability.
2. The routes were regular and homogeneous by virtue of being constant for almost 40 years.
3. Captains, pilots and masters belonged to the Spanish Navy, with similar origins, training and expertise, which should further increase the linguistic homogeneity of the logbooks.

4. The ships used for this service were of the same type (packet boats) having been built specifically to transport the mail as fast as possible. This assured a similar behavior with respect to wind and sea conditions, which should be reflected in the language. These packet boats transported passengers, mail and cargo, but from their naval architecture they were, in reality, frigates. They were sturdy and robust and of not less than 300 tons. See Garay-Unibaso (1987) for further details.

Therefore the sources of variability in the language can be reduced to two: the style and predilections of the captain and the meteorological conditions of every journey. Additionally, they can be considered as representative of the rest of the contemporary Spanish logbooks, even though they correspond to different 2 routes.

3.2. THE FRENCH LOGBOOKS

A sample of 99 logbooks covering the period from the seventeenth to eighteenth centuries was located at the *Archives Nationales, Marine, Service Hydrographique*, included in the “*Marine Subseries 4 JJ 7–26: Journaux de bord*”. These logbooks were microfilmed in 1974 for the Library of Congress, The University of Southwestern Louisiana, Loyola University of New Orleans, Memphis State University and the Mississippi Department of Archives and History. The series devoted to Louisiana and its geographical surroundings was made by the Louisiana Colonial Records Project under the terms of the Library of Congress Wilbur Fund. The historical context of production of these sources can be found in García-Herrera et al. (2005). Nine microfilm rolls were selected to obtain a comprehensive data sample. The various destinations covered Canada and the Caribbean during the second half of the eighteenth century, the most frequent routes from the northern French ports to Québec, New Orleans and Fort Louis, Dominique, Guadalupe, Tobago, Grenade Louisbourg, Margarita, Santo Domingo and La Havana.

4. Analysis and Quantification

4.1. THE CONTENT ANALYSIS METHOD

In order to reduce, homogenize and standardize the wind strength terms, we have initially considered the linguistic characteristics of the period and the way the meteorological phenomena were perceived and recorded. There are several techniques with which to unify similar expressions of the same phenomenon from historical documents. The technique known as Content Analysis permits the researcher to interpret the sailors’ many observations and to convert them to contemporary climatic standards. Moodie and Catchpole (1975) established a methodological approach for this type of study in their analysis of old meteorological journals of

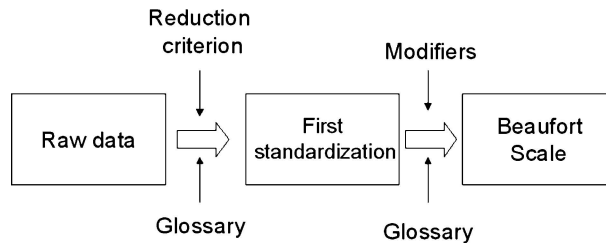


Figure 2. Schematics of the process to convert raw logbook data into its Beaufort equivalent.

the Hudson's Bay Company. They recognized that in the communication of issues related to the environmental sciences it is necessary to assess two sources of information (Catchpole, 1992). First, the environmental process under investigation itself and, second, the nature of the documents that described it. Content analysis allows for the extraction of the relevant information and for its calibration against the perception of the past observers. It has been already applied to climatological studies (Baron, 1982) to minimize the subjective character of the historical documents. However, this transformation is often difficult since the norms followed in the historical documents are usually not explicitly stated. Moodie and Catchpole (1975) affirm that "once this [interpretation] has been achieved, the historical standards and norms can be compared with their contemporary counterparts and the question is reduced to the relationship between them". In this scheme, the two standards that must be related consist in the ancient terms used to describe the wind force in Spanish and French and the current equivalent: the Beaufort scale. The general method proposed by the preceding authors was adapted to the requirements of the present study. The stages followed in this process are summarized in Figure 2.

4.2. SPANISH LOGBOOKS: THE RAW DATA

A digital database containing the relevant information from each page of the logbooks was developed. All statements in the logbooks relating to meteorological events were transcribed manually, maintaining their original spelling and grammar.

During the analysis, the first stage consisted in identifying all the expressions (roots and phrases) employed to describe wind strength in the logbook collection. The total number of different wind descriptors was 821, mainly due to the large number of terms found only in logbooks of the *Carrera de la Habana* route (600 different descriptors). This number is considerably larger than those found for the equivalent analysis over English and Dutch logbooks (Koek and Können, 2005; Wheeler et al., 2005). In order to identify their exact sense, a glossary containing all the meanings of the wind strength descriptors was assembled. Two principal and contemporary dictionaries were used: the Spanish Maritime Dictionary of 1831 (O'Scanlan, 1831) and the Dictionary of the Castilian Language, composed by the

Royal Spanish Academy in 1796 (Real Academia Española, 1796). No specific dictionaries have been found prior to 1831.

4.2.1. First Standardization

The second stage was to reduce the number of wind descriptors paying attention to the purely grammatical aspects of the descriptors. The following criteria were applied:

- The terms *brisa*, *en fugadas*, *en ráfagas*, *constante*, *contrario*, *variable*, *terral*, *ventolinas* and *pampero* were eliminated when appearing jointly with other wind descriptor, since they mostly indicate directions rather than strengths. Thus, cases as *fresco en ráfagas*, *brisa fresca*, *frescos contrarios*, *ventolinas frescas*, have been considered as *fresco* (fresh wind), since these modifiers indicate direction or small changes in direction/force.
- When the previous terms appeared alone, without modifying any other term, they have been kept in the record, i.e. *ventolinas* has been left as it stands. However, their meaning is difficult to assess, and seems to indicate only light and variable wind.
- Since the terms had all been transcribed textually further duplication arose as a result of different spellings of the same word. In these cases the spelling was unified, using the modern form. For instance (the first word indicates the old spelling): *bentolina* vs *ventolina*, *flogito* vs *flojito* or *quasi* vs *cuasi*. When plural and/or feminine was used, only the singular masculine form is considered, with the only exception of *ventolinas*, which has no masculine form in Spanish.
- When more than one descriptor was used, only the first one has been considered; i.e. *fresco y alegre* has been considered as *fresco*.
- When only direction descriptors are included, the field has been considered as missing. Examples of this form are *terral* (from land), or *del ese* (from east-southeast).

After applying these criteria, the number of wind force descriptors was significantly reduced. For the Havana route, 88 descriptors remained of which 33 appear only once. In the Buenos Aires route, only 55 were retained, 12 being used only once. The total number of descriptors from the ‘pooled’ sample was 104. The results at the conclusion of process is summarized in Figure 3, which shows the 14 most frequently used terms, for the total data set and for the two different routes. When they are considered jointly, *bonancible* (moderate breeze) accounting for 23.1%, *fresquito* (fresh breeze) 19.5%, *fresco* (fresh-strong breeze) 18.5%, *calmoso* (light breeze) 8.7% and *flojo* (gentle breeze) 6.7% are the most frequent terms. The same order holds for the Buenos Aires route, with the following percentages: *bonancible* 24.5%, *fresquito* 21.0%, *fresco* 16.7%, *calmoso* 9.2% and *flojo* 7.2%. In the Havana route, *fresco* is in second place: *bonancible* 20.9%, *fresco* 21.5%, *fresquito* 17.5%, *calmoso* 7.9% and *flojo* 5.8%. It should be noted that *calmoso*,

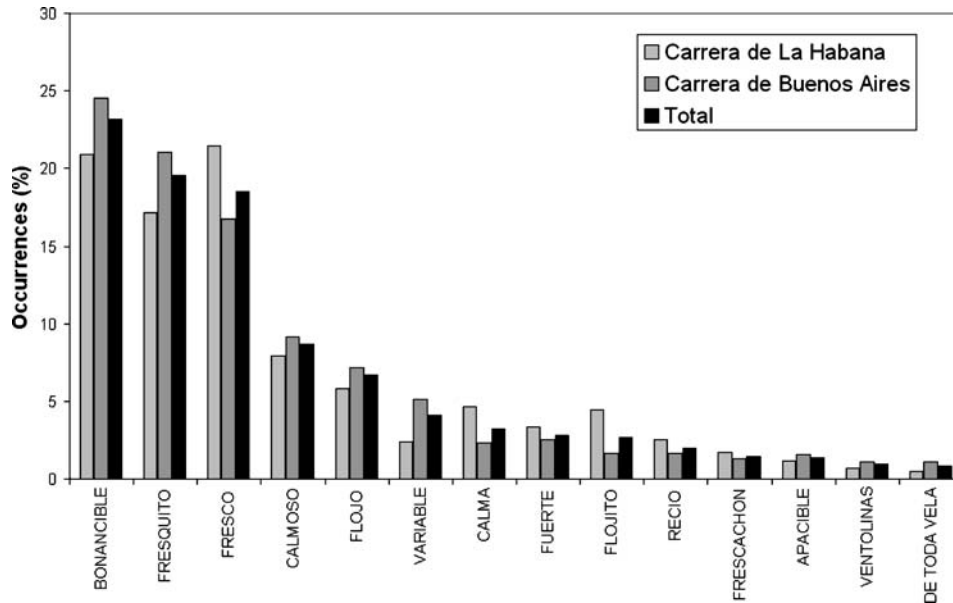


Figure 3. Relative frequency of the 14 most frequent terms in the logbook data after reduction (see text for details).

fuerte, recio, apacible y de toda vela were very frequently used although they were not included in the Beaufort scale.

4.2.2. Comparing with Beaufort Scale

The next stage was to equate these descriptors with the wind force categories included in the Spanish Beaufort scale (Table II). Two main linguistic constructions were identified (a) the wind force descriptor employed without any modifying or qualifying adjective, e.g. *tormenta* (storm) and (b) a wind force term comprised of a descriptor with some modifier that might be either a single adjective, e.g. *viento fuerte* (strong wind) or a double qualification, e.g. *viento muy fuerte* (very strong wind). Adverbs of quantity or manner were also frequently used.

For those cases included in (a) a semantic analysis was carried out. Thus, the meaning of each term was carefully analyzed and compared with each of the 12 Beaufort categories (including calm), with the term in question being assigned to one of them. For those cases included in (b) the process was more complex, since it was necessary to consider the role of the modifiers. Table III shows a list of them. It can be noted that these modifiers are mostly adverbs, prepositions and other grammatical terms that can modify the original meaning of a term, increasing or reducing its strength.

The following rules to descriptors accompanied by modifiers (adjectives and qualifiers) were applied.

TABLE II
Spanish, English and French terms of the Beaufort scale

Beaufort	Wind descriptor		
	Spanish	English	French
0	Calma	Calm	Calme
1	Ventolina	Light air	Très légère brise
2	Flojito	Ligh breeze	Légère brise
3	Flojo	Gentle breeze	Petite brise
4	Bonancible	Moderate breeze	Jolie brise
5	Fresquito	Moderate breeze	Bonne brise
6	Fresco	Strong breeze	Vent frais
7	Frescachón	Near gale	Grand frais
8	Temporal	Gale	coup de vent
9	Temporal fuerte	Strong gale	Fort coup de vent
10	Temporal duro	Storm	Tempete
11	Temporal muy duro	Violent Storm	Violent tempete
12	Temporal huracanado	Hurricane	ouragan

TABLE III

Modifiers from the logbooks of the *Carrera de La Habana* and the *Carrera de Montevideo-Buenos Aires*. In brackets approximate translations

ALGO (A LITTLE)	MAS (MORE)
ALGO MAS (SOMETHING MORE)	MAS O MENOS (MORE OR LESS)
ALGUNA (A LITTLE)	MEDIANAMENTE (FAIRLY)
ALGUNA COSA MAS (ONE MORE THING)	MEDIO (FAIRLY)
ALGUNAS (SOME MORE THINGS)	MENOS (LOWER)
BASTANTE (A FAIR AMOUNT OF)	MUCHO MAS (MUCH MORE)
BIEN (WELL)	MUY (VERY)
CASI (ALMOST)	NO MUY (NOT VERY)
CASI ENTERAMENTE (ALMOST ENTIRELY)	NO TAN (NOT AS)
CON (WITH)	PARECIA HURACAN (LIKE A HURRICANE)
CONTINUAS (CONTINUOUS)	RAZONABLEMENTE (REASONABLY)
EN REFREGONES (IN GUSTS)	RECIAS (STRONG)
ENTERAMENTE (ENTIRELY)	SUMAMENTE (EXTREMELY)
ENTERAMENTE MUY (ENTIRELY SO)	SUMAMENTE MUY (EXTREMELY SO)
ESCASO (SCARCE)	TAN (AS)
EXTREMA (EXTREME)	TERRIBLE (TERRIBLE)
FUERTE (STRONG)	UN POCO MAS (A LITTLE BIT MORE)
HURACANADO (HURRICANE-FORCE)	

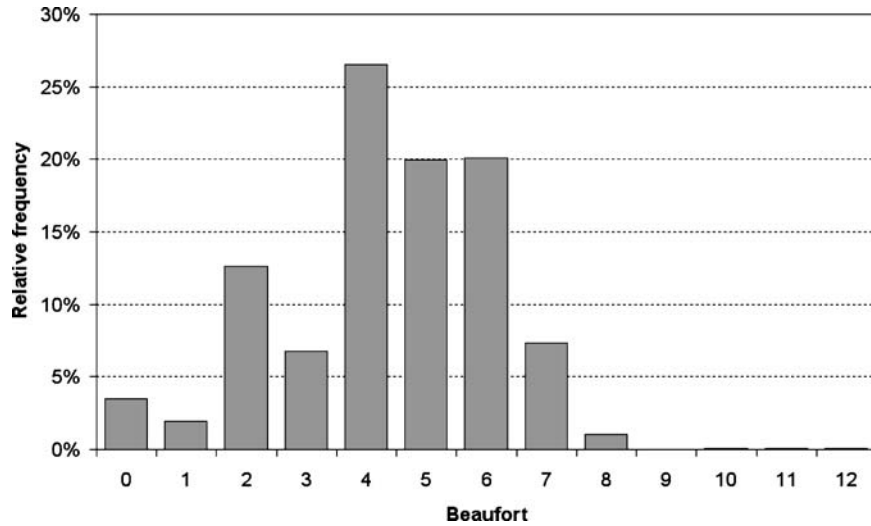


Figure 4. Relative frequency of the converted Beaufort scale wind observations for the Spanish case.

- When the modifier accompanies categories of intensity lower than *bonancible* (as *flojo* or *flojito*), the modifier moves the wind descriptor to the immediate lower category, e.g. *muy flojo* is equivalent to the category labeled *flojito*.
- If the modifier goes with categories of greater strength, the wind descriptor is located the next higher category, e.g. *muy fresco* is equivalent to the category *frescachon*.
- If the term has two modifiers, only the first one is included.
- If comparative, distributive or disjunctive modifiers are included, only the first term is considered.

Figure 4 shows the relative frequencies of the resulting Beaufort conversion of the Spanish database.

4.3. FRENCH LOGBOOKS: THE RAW DATA

4.3.1. First Standardization

The meaning of the French terms has been mainly assessed through contemporary texts. The *Diccionario Marítimo Español* (O'Scanlan, 1831), although a Spanish item, contains a useful appendix with French–Spanish translations. The *Nuevo Diccionario Francés-Español y Español-Francés* (Salvá, 1897) was also useful. Alexander Dalrymple's late eighteenth unpublished treatise entitled *Practical Navigation* also contains a summary table showing the correspondence between English and French terms, and is one of the earliest attempts at direct translation. Falconer's *Universal Dictionary of the Marine* (1780) includes French translations of many of its terms, but contains also a valuable appendix of French terms and provides

another opportunity for comparing contemporary terms in different languages. As in the Spanish dataset, a great number of different terms describing wind intensity can be found in the French logbooks. Consequently, a very similar procedure was used to homogenize and quantify these terms, mostly based in the previously referred content analysis technique.

First, the terms used to describe wind intensity were identified and included in a text-form database. All the words, expressions and sentences relating to the wind strength were abstracted, giving 8215 wind force entries. As in the Spanish case, the different terms used to describe wind strength shows a large heterogeneity and 690 different descriptors were found.

The data abstraction was a difficult process, due to the condition of the microfilms and the calligraphy, leading in some cases to doubtful interpretations. Thus, a preliminary information treatment was made.

- Capital letters that were used at the beginning of every word or sentence starting a new line were substituted by lowercase.
- Terms as *single*, *belle* or *beau temps*, related with the sea state or present weather were eliminated for the purposes of wind strength studies. Expressions of unclear meaning, such as: *des mêmes vents*, *vents contraires*, *à stribord*, *augmenté*, *inégal*, *étant plus forte* were not considered.
- The sense of some words was also homogenized by paying attention to the spellings. Among the most relevant changes, since they refer to the meaning of the sentence, were the following replacements: *fresque* by *Presque*; *foible* by *faible*; *rafales-raffalles* by *rafales*; *tremant* by *tremblant*; *Impetuoist* by *impetueux*; *brenasse* by *grenasse*; *petitte-pertite* by *petite*; *aiver* by *air*; *vens* by *vent*; *intervale* by *intervalle*; *rizé* by *risée*, etc.
- Terms with ancient spelling were substituted by the present form. Accents were included in the corresponding present form: *joly* by *joli*; *violant* by *violent*; *frechi*, *frechy*, *fraichy* by *fraichi*; *bonfires-bon fres* by *bonfrais*; *brisse*, *brize* by *brise*; *fraichiur* by *fraîcheur*; *afreche* by *affraichi*; *beaucoup* by *beaucoup*; *inegal* by *inégal*.

After this treatment, the number of terms of wind force was reduced to 520. This was followed by, a second reduction that involved the following steps:

- Exclusion or union of different grammatical elements: The terms *par grince*, *en rafales*, *en grains* or *par grains*, *variable*, *varié*, *inégal*, *par risée*, *contraire* have been eliminated when appearing as modifiers. Terms expressing only direction (*au NNO*, *du golphe*, *de terre*) were not considered. Thus, *grand frais par rafales* and *grand frais par intervalles* have been retained as *grand frais*; *frais en grains* and *frais en grenasse*, as *frais*.
- In all the terms but *rafales* the singular form was retained.
- Some wind intensity categories in French referred to breeze (*belle brise*, *legère brise*, *petite brise*, *jolie brise*). However, breeze and wind were used with

seemingly little discrimination. There were cases when the qualifying *petite* (feminine) was used before *frais* (masculine; *fraîche* is the feminine term). The masculine singular version has been preferred, except when associated with breeze (for instance, *brise forte*, *brise grosse*).

- When the term *brise* appeared alone, it has been excluded due to its ambiguous meaning. It has been retained when associated with a specific qualifier (*brise faible*, for instance).
- In the French logbooks, the use of up to three descriptors is rather common. In these cases, only the first one has been retained (*calme et faible brise* is equivalent to *calme*).
- When the qualifier appeared isolated from the wind descriptor (*gros*, *grand*, *petit*), the use of the wind descriptor was considered implicitly (*gros vent*, *petit vent*).

As a result of this second filtering, 100 different descriptors were retained; 35 of them being used only once. The corresponding frequency distribution is shown in Figure 5. *Bon frais* shows the highest frequency (1814 occurrences), followed by *Petit frais* (1677), *Joli frais* (630), *Variable* (404) and *Bon petit frais* (382). Among the most widely used terms used, only *Joli frais* is part of the Beaufort scale (Table II). Terms such as *Grand Frais* or *Calme* also belong to the current French Beaufort scale, but their relative frequencies of usage are low (about 3%). On the other hand, terms very frequently included in the Beaufort scale as

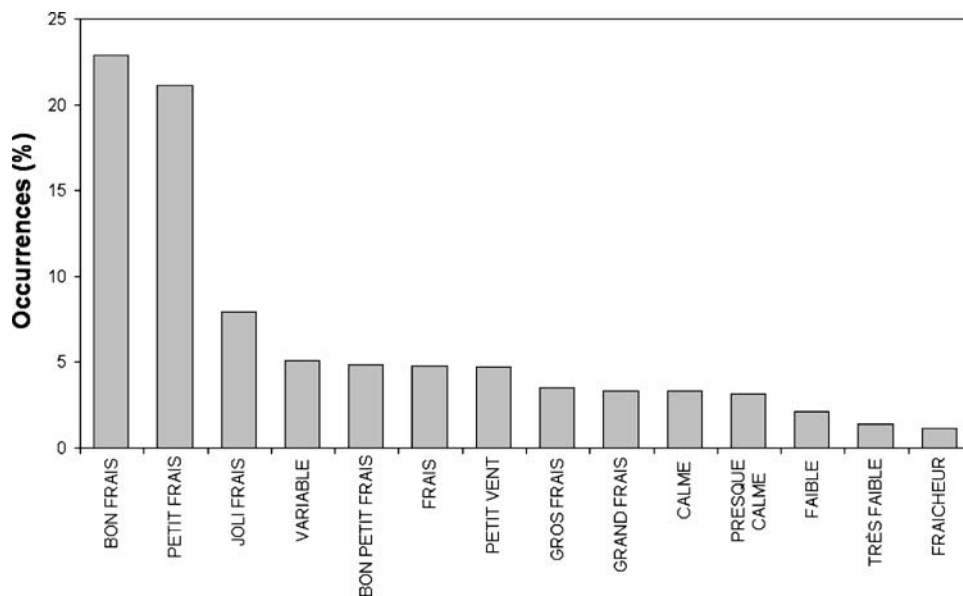


Figure 5. Relative frequency of the 14 most frequent terms in the French logbook data after reduction (see text for details).

legère brise (light breeze), *petite brise* (gentle breeze) or *bonne brise* (fresh breeze), were only occasionally used and their relative frequencies in the logbooks are less than 1%.

4.3.2. Comparisons with the Beaufort Scale

It has been observed that the French sailors used various descriptors with similar meanings when they had to describe wind strength. Thus, the original terms have been grouped into categories of equal or similar wind strength. In common with the Spanish logbooks, two different cases have been considered: (a) descriptors which are not accompanied by modifiers and (b) descriptors with one of more modifiers. In the first case they were grouped according to the categories of the modern wind Beaufort scale (see Table II). As described in the section dealing with the Spanish logbooks, every descriptor was analyzed and tested against the glossary to assess its proper meaning. Then it was assigned to the Beaufort category with which it had the closest correspondence. In the second case, the categorization is more difficult. Wind terms that included some modifier were treated according to the following criteria:

- When the modifier occurs with categories lower than *joli frais* (*moderate breeze*), such as *Petite brise* (*gentle breeze*) or *lègere brise* (*light breeze*), the terms are included in the next lower category. For instance, if the modifier is *très* (*very*), the term *très faible* (*very weak*) is included in the category *très légère brise* (*light airs*).

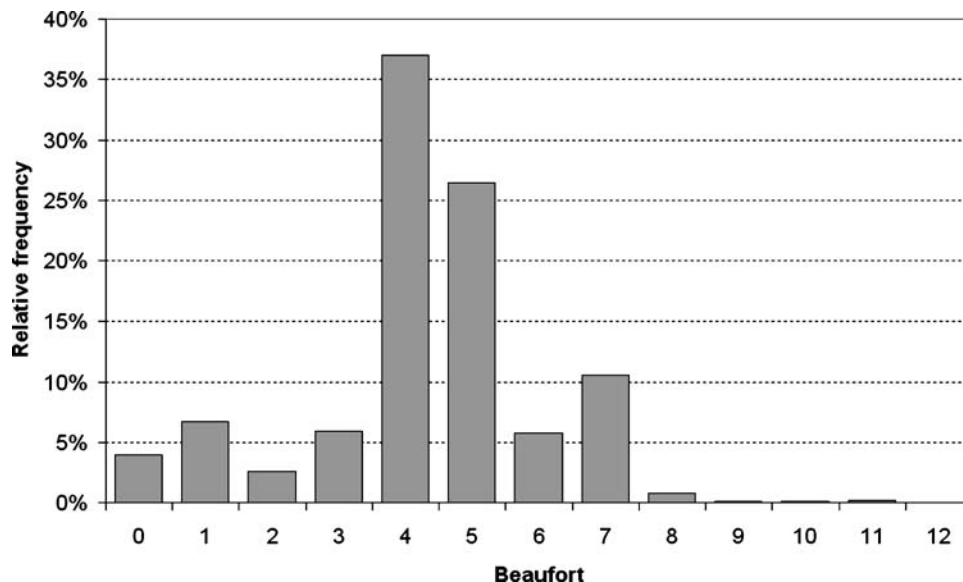


Figure 6. Relative frequency of the converted Beaufort scale wind observations for the French case.

- When the modifiers denote higher intensity, the descriptor is included in the immediately higher category: For example, *très frais* (strong breeze) will be classified as *grand frais* (near gale).
- If the descriptor is formed by the union of two common descriptors through the conjunction *et* (and), it is classified in the category corresponding to the first of the two terms.
- When comparative, disjunctive or distributive expressions such as *quelque fois* (*some times*), *parfois*, or *bien*, appear in the descriptor, only the first one is considered.

After this treatment each descriptor was assigned to its corresponding Beaufort number. The resulting histogram is shown in Figure 6.

5. Conclusions

A significant difference in the number of diverse terms used to describe the wind force by the Spanish/French and British mariners (Wheeler et al., 2005) points a relatively low degree of uniformity in the meteorological terminology of early times in Southern Europe. During the analysis carried out for the present work, it has been established that the expressions used depended, to a great extent, on the particular style of the captain (or the pilot), and did not necessarily conform to any conventional system of usage. The individual mariners, mostly drawn from a variety of cultural and environmental backgrounds, when observing similar events from widely separated vantages in time and space, would employ correspondingly varied styles and expressions.

However, despite the variety of terms employed by the different captains and officers, it was found that there was notable agreement and relatively little semantic variation in the majority of their commentaries. This fact is made more evident when the grammar and the spelling variations are homogenized. It is important to note that the 10 most frequently used Spanish and French account for 89.4% (Spanish) and 81.6% (French) of the total number of entries (see Figures 3 and 5). This indicates that the vast majority of the raw terms found in the database were only sporadically used. The meteorological information kept in the Spanish and French ship logbooks of the eighteenth and nineteenth centuries has a huge potential to assist in the study the climate during a period in which instrumental information is very scarce or even non existent over the oceans. The absence of any widely agreed system to record this information makes it difficult to compare directly those data to the modern instrumental records. However, in this paper it has been shown that during the last quarter of the eighteenth century, the Spanish and French logbooks demonstrated a gradual tendency toward a standardization of the expressions relating to the wind force. This characteristic has opened the way for content analysis techniques to translate the original data to standard Beaufort scale measures.

In consequence, we can be confident that, by the end of the eighteenth century, the Spanish and French logbooks were prepared using a system that was quickly converging with the vocabulary in use today to record meteorological observations at sea, limiting the terms used to standardized categories. This represents a notable, if unofficial attempt to arrive at an important linguistic consensus.

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Note

¹References to manuscript sources in the *Archivo General de Indias* (Seville) are denoted by the initials AGI, followed by the name of the section of the Archive where the manuscript is located, and a number identifying the bundle, to which the manuscript belongs.

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