RÉPUBLIQUE FRANÇAISE
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Cerema
CLIMAT & TERRITOIRES DE DEMAIN

Direction technique risques, eaux et mer
Département risques, eaux et littoral

CANDHIS database :

Conditions of use and data quality disclaimer

January 2021

Conditions for the use of data from the CANDHIS database

The CANDHIS data are distributed under the Etalab open licence (https://www.etalab.gouv.fr/wp-content/uploads/2018/11/open-licence.pdf).

For any re-use and concerning the obligation to mention the authorship of the "Information" (the source), it is asked to cite Cerema, but also the organisation(s) associated with the measurement campaign. The list of organisations is provided in Annex 1.

Please provide us with feedback on this data (comparison with other sources of data, possible strengths and weaknesses, observed biases, etc.). This feedback will contribute to the improvement of the CANDHIS database.

Warning about the quality of the data from the database CANDHIS

Measuring conditions

The data are taken from in situ measurement campaigns. Outliers may occur:

- in case of waveform collision or manipulation;
- if the equipment is at its autonomy limit;
- in case of system failure;
- ….

A number of tests are carried out to limit these values influence but the result cannot be guaranteed.

In storms event, transmission and/or autonomy problems may cause measures interruption.

The measurements non-homogeneous distribution over time may give more weight to a particular period in the results of global statistical analyses (quantiles, histograms, correlogram, …)

The devices used are wave measuring buoys (Datawell, Triaxys, ...). Manufacturers specify a accuracy between 0.5% and 3% depending on the type and age of the material.

The uncertainty on the sea state calculations parameters depends on the number of waves identified. For example, the average wave height is estimated to be about 10% for a recording of about 100 waves.

The number of waves is provided in the Candhis database.

Measuring step of sea state parameters

The measuring step is variable according to the measurement's age:

- 3 hours with a change to 1 hour or 30 minutes on threshold triggering in the storm event ; concerns the oldest measures; ;
- or 1 hour; ;
- or 30 minutes, for the most recent measurements..

The measurement step variation over time for the same campaign can give more weight to a particular period or event in the global statistical analyses results (quantiles, histograms, correlograms, ...).

Data control

Tests are carried out directly on the Candhis database by the "Houle4" software (measurements treatment from non-directional buoys) and " Houle5 " (measurements treatment from directional buoys) from Cerema :

- the time stamp suppression if the waves number is insufficient (less than 75);
- the orders of magnitude verification of H1/3 , Hmax TH1/3 (TH1/3 < 30s; Hmax < 3 x H1/3)

The time stamps concerned are not broadcast.

Asymmetry and flattening control

The water surface elevation distribution is controlled during the wave-by-wave analysis by skewness and kurtosis calculations (see figures A1 and A2 in Appendix 2).

Skewness and kurtosis respectively measure the distribution's asymmetry and flattening. In the presence of waves and in the absence of problems with the measurement, the water surface elevation follows a normal law (skewness = 0 and kurtosis = 3).

Skewness and kurtosis values are provided in the Candhis database. We recommend the deletion of time stamps meeting the following criteria :

- Skewness test: absolute value greater than 0.3 ; ;
- kurtosis test: value greater than 5.

This deletion is left to the initiative of the user.

For more details on the use of skewness and kurtosis values, see Appendix 2.

Visual inspection of the data

It may be important to carry out a visual check of the data in order to identify possible sequences of aberrant measures. An example of sequences that have successfully passed all the automated checks, including skewness and kurtosis tests, is shown in figure 1.

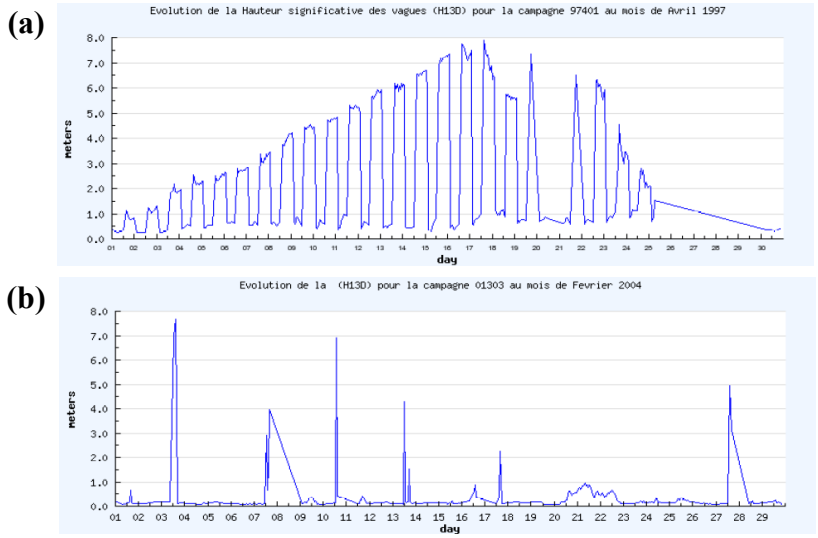


Figure 1: Two examples (a) and (b) characteristics of questionable data that have passed automatic checks

Special cases concerning the "02902 - Ouessant large" and "07603 - Le Havre LHA " campaigns

The measures for the "02902 - Ouessant large" (dpt 29) and "07603 - Le Havre LHA" (dpt 76) campaigns come from the instrumentation of a lighthouse buoy.

The lighthouse buoy is a maritime signal buoy with a diameter of 11.5m, a draught of 1.18m, and a height of 13.2m above sea level and a total weight of around 80 tonnes. The buoy is anchored by means of a mooring composed of a chain connected to an anchor. This buoy is not dimensioned to follow faithfully the swell movements. The swell measurements taken on the flagship buoy are made experimentally .

Of particular note is the likely wave heights underestimation. The lighthouse buoy capacity to reproduce swell behaviour was studied in the report by the Lighthouse and Beacon Technical Service " Béatrice - Directional swell measuring station off Ouessant - Measurement catalogue Year 1988 ". The main results are as follows :

- the transfer function is :
    - stable in the interval of periods between 4.5s and 17s ;
    - falling for periods shorter than 4.5s and longer than 17s ;
- the average swell period is overestimated :
    - on average of the order of 0.8s ;
    - up to 2.5s for H1/3s less than 2m and/or Tavd less than 6s.

APPENDIX 1: List of data provider organisations

Campaign no°	Name	Data provider(s)
00601	Nice	CEREMA / DDTM 06
01101	Leucate	CEREMA / DREAL Languedoc Roussillon
01301	Camargue	CEREMA
01302	Port de Bouc	CEREMA / Grand Port Maritime de Marseille
01303	Fos	CEREMA / Grand Port Maritime de Marseille
01304	Marseille	CEREMA / Grand Port Maritime de Marseille
01305	Le Planier	CEREMA / Grand Port Maritime de Marseille
01306	Golfe de Fos	CEREMA / France Energie Marine
01702	Oléron	CEREMA
01703	Oléron (SHOM)	CEREMA / SHOM
01704	Oléron Large	CEREMA / La Rochelle LIENSs university
02201	Lézardrieux	CEREMA
02202	Les Minquiers	CEREMA
02203	Les Minquiers Nord	CEREMA
02204	Bréhat Nord	CEREMA
02901	Eckmuhl	CEREMA
02902	Ouessant Large	CEREMA
02903	Le Toulinguet	CEREMA
02907	Blancs Sablons	CEREMA
02908	Porsmilin	CEREMA
02909	Brest (Port du Château)	CEREMA / Brest Métropole Aménagement
02910	Roscoff (Port de Bloscon)	CEREMA / CCI de Morlaix
02911	Les Pierres Noires	CEREMA / PREVIMER
02913	Ile Longue	CEREMA / Ministry of Defence
02914	Penmarc'h	CEREMA / DGA
02915	Ile de Sein Sud	CEREMA / SHOM
02916	Ile de Sein Nord	CEREMA / SHOM
02917	Ouessant Sud	CEREMA / SHOM
02919	Kéréon	CEREMA / SHOM
02920	Ile de Sein	CEREMA / SHOM
02921	Esquibien	CEREMA
02922	Ile de Batz	CEREMA
02B02	Cap Corse	CEREMA
02B03	Bastia	CEREMA / Port de Bastia
02B04	La Revelatta	CEREMA / SHOM
02B05	Alistro	CEREMA
03001	Espiguette	CEREMA / DREAL Languedoc Roussillon
03302	Cap Ferret	CEREMA / university of Bordeaux / SHOM
03303	Cap Ferret	CEREMA
03401	Sète (Marseillan)	CEREMA / DREAL Occitanie
03402	Sète (Frontignan)	CEREMA / DREAL Occitanie

03403	Sète	CEREMA / DREAL Occitanie
03404	Sète	CEREMA / DREAL Occitanie
04401	Saint-Nazaire	CEREMA / Grand Port Maritime de Nantes St-Nazaire
04402	Le Croisic	CEREMA / Grand Port Maritime de Nantes St-Nazaire
04403	Plateau du Four	CEREMA / Grand Port Maritime de Nantes St-Nazaire / Ecole Centrale de Nantes
05002	Cherbourg (petite rade)	CEREMA
05003	Cherbourg (grande rade)	CEREMA
05004	Cherbourg (grande rade)	CEREMA
05008	Cherbourg (extérieur)	CEREMA / Ports Normands Associés
05009	Flamanville	CEREMA / EDF
05602	Belle-Ile	CEREMA / École Centrale de Nantes
05901	Dunkerque	CEREMA
05902	Ruytingen	CEREMA / DREAL Nord Pas de Calais
05903	Gravelines	CEREMA / EDF
06201	Vergoyer	CEREMA / DREAL Nord Pas de Calais
06202	Calais	CEREMA / DREAL Nord Pas de Calais
06401	Bayonne	CEREMA
06402	Anglet	CEREMA / university of Pau
06403	Saint-Jean-de-Luz	CEREMA / Department of Pyrénées Atlantiques (LE64)
06601	Banyuls	CEREMA / DREAL Occitanie / Oceanology Observatory of Banyuls
07601	Antifer	CEREMA / Grand Port Maritime du Havre
07602	Le Havre	CEREMA / Grand Port Maritime du Havre
07603	Le Havre LHA	CEREMA / Grand Port Maritime du Havre
07604	Dieppe	CEREMA
07605	Le Havre 2	CEREMA / Grand Port Maritime du Havre
07606	Le Havre Metzinger	CEREMA / Grand Port Maritime du Havre
07607	Paluel	CEREMA / EDF
07808	Penly	CEREMA / EDF
08001	Cayeux	CEREMA
08301	Porquerolles	CEREMA
08302	Porquerolles (dir.)	CEREMA
08501	Ile d'Yeu	CEREMA
08502	Ile d'Yeu	CEREMA
08503	Ile d'Yeu	CEREMA
08504	Ile d'Yeu Nord	CEREMA / Department of Vendée (LE85)
97101	Port Louis	CEREMA / Météo-France / Port Autonome de Guadeloupe
97102	La Désirade	CEREMA / Météo-France
97103	Pointe de la Grande Vigie	CEREMA / Météo-France
97104	Pointe-à-Pitre	CEREMA / Port Autonome de Guadeloupe
97105	Port du Moule	CEREMA / Météo-France
97106	Côtes Caraïbes	CEREMA / Météo-France
97201	Grand' Rivière	CEREMA / Météo-France / Martinique's County Council
97202	Basse Pointe	CEREMA / Martinique's County Council / Météo-France
97204	Fort de France	CEREMA / Météo-France / Martinique's County Council

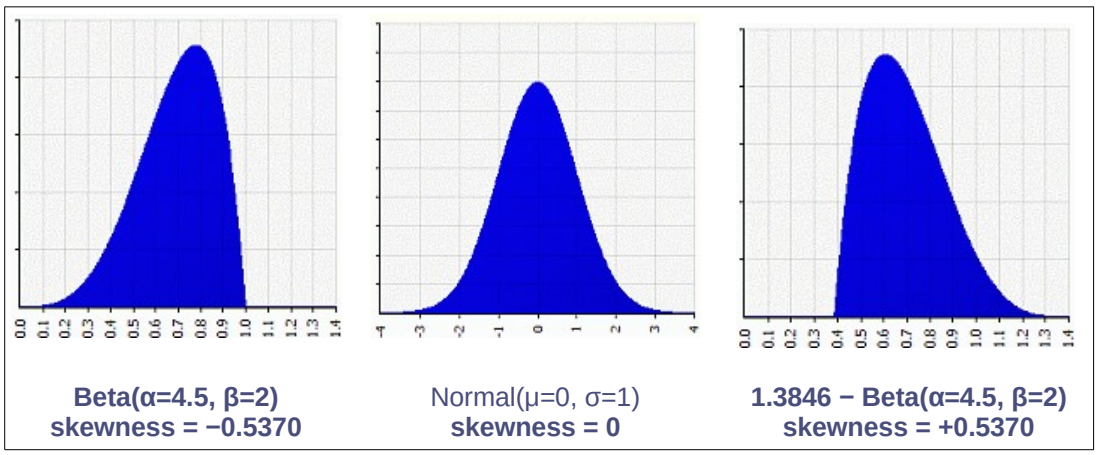
97205	Sainte Lucie	CEREMA / Météo-France / Martinique's County Council
97301	Guyane Mahury	CEREMA / DM 973
97302	Guyane Mahury	CEREMA / DM 973
97303	Kourou	CEREMA / DEAL 973
97304	Ile de Cayenne	CEREMA / DEAL 973
97401	Baie de la Possession	CEREMA / Commune de Saint-Denis
97402	Pointe du Phare	CEREMA / DEAL 974
97403	Rivière des Galets	CEREMA / Grand Port Maritime de La Réunion
97404	Pointe du Gouffre	CEREMA / Commune de Saint-Denis
97405	Saint-Pierre	CEREMA / Commune de Saint-Pierre
97406	Sainte Rose	CEREMA / DEAL 974
97407	Vincendo	CEREMA / Commune de Saint-Joseph
97501	Saint-Pierre et Miquelon	CEREMA / DTAM 975
98000	Monaco	CEREMA / Monaco, Service des Travaux Publics

APPENDIX 2: Asymmetry and flattening control

► Principe

Skewness and kurtosis tests allow, only in the presence of linear swells, to judge the distribution's quality of the water surface elevation.

Skewness and kurtosis respectively measure the distribution's asymmetry and flattening (see figures below). For linear swells (linear theory) and in the absence of the water surface elevation follows a normal law (skewness = 0° and kurtosis = 3).

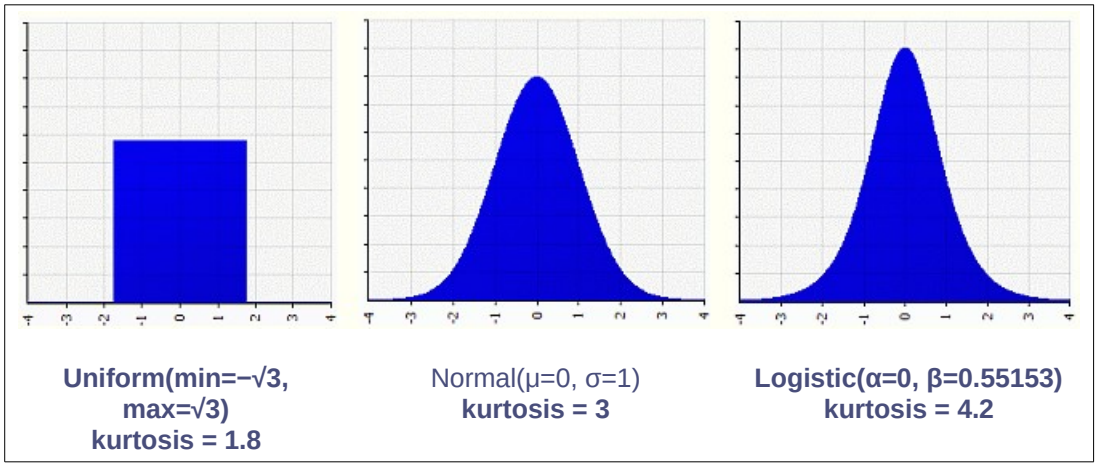


Beta(α=4.5, β=2)
skewness = −0.5370

Normal(μ=0, σ=1)
skewness = 0

1.3846 − Beta(α=4.5, β=2)
skewness = +0.5370

Figure A1: Skewness: symmetry measurement
(source: copyright © 2008-2012 by Stan Brown, Oak Road Systems).



Uniform(min=−√3, max=√3)
kurtosis = 1.8

Normal(μ=0, σ=1)
kurtosis = 3

Logistic(α=0, β=0.55153)
kurtosis = 4.2

Figure A2: kurtosis: flattening measurement
(source: copyright © 2008-2012 by Stan Brown, Oak Road Systems).

► Validity domain

The linear theory is valid if the following condition is verified :

$$\frac{\gamma}{\tanh(2\pi d/L)} \ll 1 \quad ,$$

with $\gamma = H/L$ the camber, H the wave height, L the length wave and D is depth.

► Practical utilisation

In practice, we rarely end up completely within the linear theory. For a given sea state, there are almost always a few strong camber waves for periods of less than two or three seconds. However, if the associated energy is low, these waves will have little impact on the sea state.

The rule proposed here is as follows:

- the linear theory is considered valid if

$$\frac{\gamma_s}{\tanh(2\pi d/L_{H1/3})} < \frac{1}{10} \quad ,$$

with $\gamma_s = H_{1/3}/L_{H1/3}$ the significant camber
and $L_{H1/3}$ the significant wavelength corresponding to $T_{H1/3}$

- and in this case the skewness must be between -0.3 and +0.3 and the kurtosis must be greater than 5.

However, the skewness and kurtosis tests' results interpretation is not easy. As it is more a question of pointing out a few isolated values that deserve to be confirmed, rather than real values rejection tests.

For a more detailed tests of normality analysis, it is possible to apply, for example, an Agostino's c2 test (R. B. D'Agostino, A. Belanger, R. B. D'Agostino Jr, 1990, "A suggestion for using powerful and informative tests of normality", The American Statistician 44-4: 316–321).