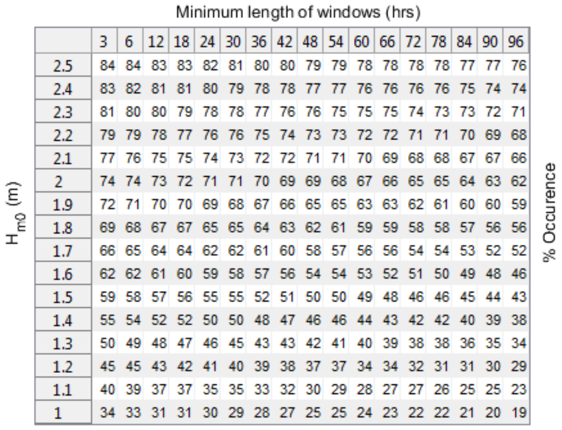
Weather Windows (weather_windows.nc)

The statistical characterization of weather windows for a particular site is typically used to design tasks and sea operations so they can be safely carried out in appropriate sea conditions within a specific time frame. For marine energy applications, this information is of primary importance when estimating the availability of the energy production devices that, eventually, will impact the overall profitability of the project. Operational criteria for the characterization of the sea accessibility are typically based on the wave height.

Persistence exceedance

Persistence exceedance tables account for the percentage of a certain time period (year, season) a parameter will not exceed a certain amount during a set time frame. For instance the percentage (or probability) that the significant wave height (H_s or H_{m0}) will not exceed 1.2 m during at least 18 hours. According to Figure 1, this percentage is 42% for the site and season (here annually) considered.



Minimum length of windows (hrs)

H_{m0} (m)

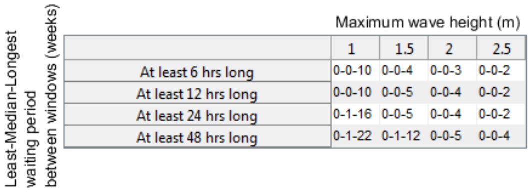
% Occurence

	3	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96
2.5	84	84	83	83	82	81	80	80	79	79	78	78	78	78	77	77	76
2.4	83	82	81	81	80	79	78	78	77	77	76	76	76	76	75	74	74
2.3	81	80	80	79	78	78	77	76	76	75	75	75	74	73	73	72	71
2.2	79	79	78	77	76	76	75	74	73	73	72	72	71	71	70	69	68
2.1	77	76	75	75	74	73	72	72	71	71	70	69	68	68	67	67	66
2	74	74	73	72	71	71	70	69	69	68	67	66	65	65	64	63	62
1.9	72	71	70	70	69	68	67	66	65	65	63	63	62	61	60	60	59
1.8	69	68	67	67	65	65	64	63	62	61	59	59	58	58	57	56	56
1.7	66	65	64	64	62	62	61	60	58	57	56	56	54	54	53	52	52
1.6	62	62	61	60	59	58	57	56	54	54	53	52	51	50	49	48	46
1.5	59	58	57	56	55	55	52	51	50	50	49	48	46	46	45	44	43
1.4	55	54	52	52	50	50	48	47	46	46	44	43	42	42	40	39	38
1.3	50	49	48	47	46	45	43	43	42	41	40	39	38	38	36	35	34
1.2	45	45	43	42	41	40	39	38	37	37	34	34	32	31	31	30	29
1.1	40	39	37	37	35	35	33	32	30	29	28	27	27	26	25	25	23
1	34	33	31	31	30	29	28	27	25	25	24	23	22	22	21	20	19

Figure 1 : Annual persistence exceedance table

Waiting period (Time between acceptable wave conditions)

The time between 2 appropriate weather windows for sea operations also affects offshore activity and costs due to downtime penalties. Figure 2 shows, in weeks, the shortest, median and longest waiting period between 2 suitable weather windows. For instance, the longest waiting period encountered, during the investigation time, between 2 successive weather windows of at least 48 hrs with wave heights lower than 1 m is 22 weeks at this site.



Least-Median-Longest waiting period between windows (weeks)

Maximum wave height (m)

	1	1.5	2	2.5
At least 6 hrs long	0-0-10	0-0-4	0-0-3	0-0-2
At least 12 hrs long	0-0-10	0-0-5	0-0-4	0-0-2
At least 24 hrs long	0-1-16	0-0-5	0-0-4	0-0-2
At least 48 hrs long	0-1-22	0-1-12	0-0-5	0-0-4

Figure 2 : Least, median and longest time between 2 successive weather windows

Access the tables

All the Persistence exceedance tables and the Waiting period tables have been computed seasonally for more than 73000 points, over an area covering the west coast of France, from the shore to 50 km offshore (Figure 3). This analysis is based on the hourly outputs of the 19-year sea state hindcast Homere (Boudière et al. 2013) that was identified as the most appropriate, accurate and up-to-date source of sea state variables for precise characterization of marine resources for marine energy purposes along the western coast of France (Dubranna et al. 2015).

The information has been stored in four 4-D tables. One of them is dedicated to the Persistence exceedance tables, three of them are dedicated to the Waiting period tables. The tables can be downloaded here. Make sure you know the node_number (s) before you start downloading.

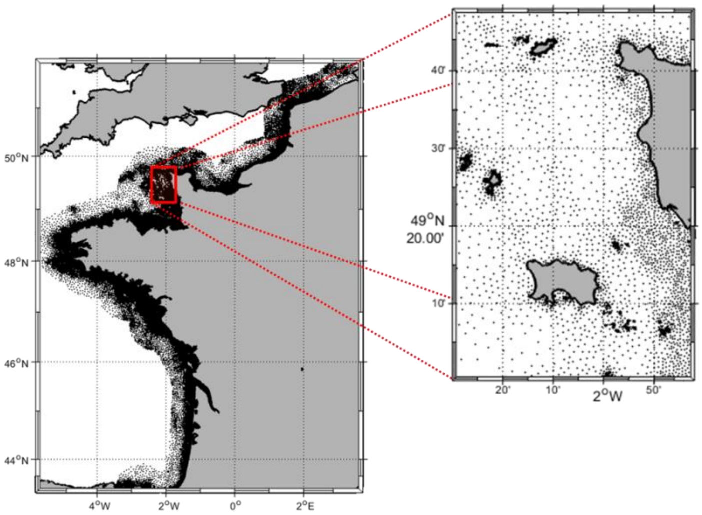


Figure 3 : Study area and detail of the computational points where weather windows information is available

Description of the tables

*Persistence exceedance tables (*Figure 1*)*
The 4 dimensions (I × J × K × L) are dedicated to : max wave height (Hs from 2 to 1 m) × Minimum length of window (from 3 to 96 hrs) × node_number (0 < node_number < 110803) × Season (winter/spring/summer/fall), corresponding to a table size of I=11, J=15, K= 1100804, L=4. For instance, the probability the wave height will be lower than 1.4 m, during at least 30 hours, at node_number 2345, in summer corresponds to indexes : i = 4, j = 8, k = 2344, l = 2 (**NOTE : Indexes are starting at 0**).

Waiting period tables
There are 3 tables, each have 4 dimensions. The dimensions are the same as the dimensions described for the *Persistence exceedance tables*:
waiting_25 : waiting time between 2 acceptable weather windows reached by 25% of the situations
waiting_50 : waiting time between 2 acceptable weather windows reached by 50% of the situations
waiting_75 : waiting time between 2 acceptable weather windows reached by 75% of the situations

References

Boudière, E., C. Maisondieu, F. Ardhuin, M. Accensi, L. Pineau-Guillou, and J. Lepesqueur. 2013. A suitable metocean hindcast database for the design of Marine energy converters. International Journal of Marine Energy **3-4**: e40–e52.

Dubranna, J., T. Ranchin, L. Ménard, and B. Gschwind. 2015. Production and Dissemination of Marine Renewable Energy Resource Information. *11th European Wave and Tidal Energy Conference*.

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