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Overview of the potential of floating wind in Europe based on met-ocean data derived from the ERA5-dataset

Overview of the potential of floating wind in Europe based on met-ocean data derived from the ERA5-dataset

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Abstract.
This paper provides an overview of the potential of floating wind in Europe. Wind and wave data from the ERA5 dataset as well as bathymetry data are analysed to identify regions suitable for floating wind deployment. The most promising areas are quantified according to different characteristics (wind resource, bathymetry, distance to the coast). The wind resource is quantified in terms of averaged wind velocity and wind availability at 100 m height above sea level. The results show the great potential of Ireland, Iceland, Norway and the United Kingdom. Indeed, a large part of the seas of these countries is located in water depths between 60 and 1000 meters and has a very high wind resource despite stronger wave conditions than in other countries. In addition, Spain, France, Sweden, Finland and Greece all exhibit good potential.

Keywords: Floating offshore wind (FOW), site-assessment, ERA5, Geographical information system (GIS)

1. Introduction

The installed capacity of offshore wind in the European Union (EU) is expected to reach 300 GW by 2050 [1]. For Europe including the UK and Norway, up to 450 GW of offshore wind turbines could be installed by 2050 [2]. To reach these goals, fixed as well as floating offshore wind farms will be deployed. Most maritime areas in Europe have water depths greater than 60 meters, except near to shore and in the southern North Sea and in the Baltic Sea, as seen in figure 1 (b). In deep water areas, floating wind is the most cost-effective, and often the only feasible solution [3], thus being an important technology for the future. A maritime area may be suitable for the deployment of a floating wind farm, depending on water depth, met-ocean conditions, distance to shore and ports, soil types, and various other constraints.

Bosch et al. [4] assessed the offshore wind energy potential for several countries over the world. In Europe, they identified the high potential of Norway and the UK (more than 3000 GW of

capacity for Norway). Caglayan et al. [5] studied the techno-economic potential of offshore wind energy in Europe and concluded that the areas with the lowest levelised cost of energy will be around 50 €/MWh in 2050, mainly in the North Sea and the Baltic. Díaz et al. [6] analysed potential sites for floating wind farms along the Atlantic continental European coastline. They defined an extensive list of exclusion and evaluation criteria and used a Geographical Information System (GIS) based-approach to conclude about 42 potential locations. Similar studies have been carried out for other sites [7, 8]. Gruber [9] investigated the potential of deep sea offshore wind in Europe and Africa and concluded about the most promising areas for floating wind in the different regions based on a few criteria. Soukissian et al. [10] analysed the potential of marine renewable energy in the Mediterranean Sea and identified the best locations for the deployment of these technologies, including floating wind, particularly in the Gulf of Lion.
These investigations rely on various data: met-ocean (wind, wave and current), bathymetry, ports locations, maritime routes, protected areas, etc. These data are often difficult to find, might not be accessible or are challenging to analyse in a simple manner. As part of the Copernicus program, global climate and weather data were released in 2018: the so-called ERA5-dataset [11]. The ERA5 data are reanalysis data which "combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics". These data can be used to derive wind and wave characteristics in the seas over the world. They have been validated in many studies [12]. To the authors' knowledge, few studies give an overview of the potential of floating wind in all of Europe based on a few criteria. Most of the studies focused on a specific zone with a great level of details or consider different methodologies from the one in this paper.

In this paper, an overview of the potential of floating wind in Europe is given based on metocean data derived from the ERA5-dataset and Gebco bathymetry data [13]. For this purpose, a Geographical information system (GIS) tool was developed in *Python* which was used to read, post-process and visualise data in 2D maps of Europe's various seas. Outcomes of the paper are quantifications and discussions about the potential of floating wind for each country that has a significant coastline, based on a few criteria such as water depth, distance to shore, mean wind speed, wind availability, extreme wave height, mean wave height and wave peak periods.

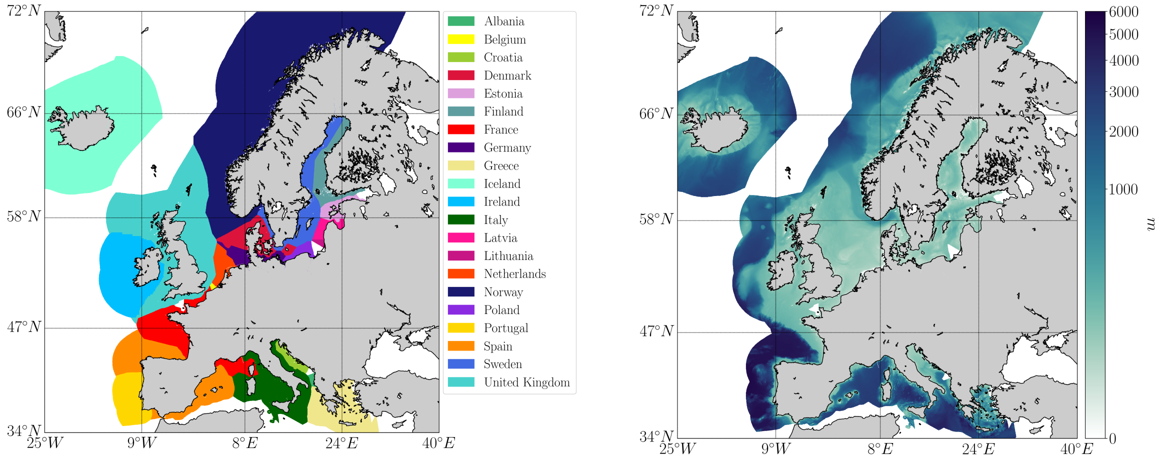
2. Methodology

2.1. Type of data

In order to assess the potential of the different European seas and oceans for floating offshore wind (FOW), the following open source data were collected or computed and analysed:

- Hourly mean wind speed at 100 m height above sea level from 2011 to 2020 (10 years) in Europe from ERA5 (grid: $0.25° \times 0.25°$) [11]
- Hourly mean significant wave height, H_S, and peak period, T_p, from 2002 to 2021 (20 years) in Europe from ERA5 (grid: $0.5° \times 0.5°$) [11]. It accounts for both wind sea and swell.
- Bathymetry in Europe with a $0.01° \times 0.01°$ grid resolution from Gebco [13]
- Exclusive Economic Zone (EEZ) of most countries with a large coastline in Europe [14]
- Distance of any points in the seas to the closest shore (calculated)

The wind data are used to quantify the resource at 100 m height above sea level. This height corresponds to the hub height of current offshore wind turbines, for which the rated power of a single turbine is around 10 MW (e.g. the V174-9.5MW has a hub height of 110 m). Future offshore turbines will reach 15 to 20 MW of rated power, with a larger rotor and thus a higher hub height. The wind resource might be better at heights greater than 100 m, however the overall conclusions when comparing different regions are expected to be similar.



(a) EEZ [14]

(b) Bathymetry [13]

Figure 1: Map of the EEZ (a) of each country considered and water depth in these areas (b)

In this study, 10 years of data were used for wind resource assessment and 20 years of data for wave conditions. These time periods are an adequate compromise between sufficient data to obtain relevant statistics while maintaining a reasonable computational time. Using a longer time period would likely lead to slightly different statistics. The purpose of this paper is to provide an overview of the different areas, but not to describe each region in the greatest detail. Therefore, the amount of data was considered sufficient.

2.2. Area considered

In this study, the potential for the deployment of FOW in the EEZ of the following countries of Europe is analysed: Albania, Belgium, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Spain, Sweden and the UK (see figure 1 (a)). An EEZ is within 200 nautical miles (about 370 km) of the coastline (see figure 9 in the Appendix).

2.3. Derivation of met-ocean global quantities

From the large amount of the met-ocean data, key wind and wave statistics were computed.

Wind

From the 10 years of wind speed data (W_S), the mean wind speed at 100 meters height and the wind availability were computed. The availability for a given (W_S^{min}, W_S^{max}) is the number of hours per year for which the wind has a velocity in [W_S^{min}, W_S^{max}]. Díaz et al. [6] used this parameter to quantify the wind resource in the Atlantic, however they did not mention the values of (W_S^{min}, W_S^{max}) they used. For the current study, the reference values utilised were: $W_S^{min} = 11$ m/s and $W_S^{max} = 25$ m/s which encompass typical wind speed between the rated to the cut-out wind speed for a multi MW wind turbine.

Wave

Wave data were post-processed to determine mean significant wave height H_s and peak period T_p. In addition, extreme wave conditions were computed. Extreme significant wave heights with return period, R from 1 to 50 years, noted $H_{s,max}^R$, were calculated. To do so, the distribution of significant wave height was assumed to follow a 2-parameter Weibull distribution with the

Table 1: Water depth classes

Water Depth (m)	[0, 60)	[60, 100]	(100, 350]	(350, 1000]	> 1000 m
Type of farm	Fixed OW	Hybrid OW	1^{st} gen. FOW	2^{nd} gen. FOW	Very Deep Water Future FOW

following cumulative probability function, $F_{H_s}(h)$, as mentioned in[15].

$$F_{H_s}(h) = 1 - \exp(-(h/\beta)^\gamma) = P(H_s < h) \tag{1}$$

In equation (1), $F_{H_s}(h)$ depicts the probability that a given sea state has a significant wave height lower or equal to h, thus for high values of wave height, this function tends to 1: $\lim_{h\to\infty} F_{H_s}(h) = 1$. For a given point in the grid of the ERA5 data, the discrete distribution of values of H_s over 20 years was determined with bins of 0.5 m and used to fit the law of equation (1) to determine γ and β. The likely highest significant wave height with return period R, which depicts the worst sea state that is expected to occur, on average, once every R years can be computed with the estimated probability function $F_{H_s}(h)$. Assuming that any sea state has a 3-hour window, in R years there will be $N = R \times 365 \times 24/3$ different sea states. Thus, the maximum significant wave height with return period R years, $H_s = H^R_{s,max}$, satisfies:

$$F_{H_s}(H^R_{s,max}) = 1 - \frac{1}{R \times 365 \times 24/3} \tag{2}$$

2.4. Criteria for the analysis of the potential

FOW is at the time of this analysis (end of 2022) at its pre-commercial stage, the biggest wind farm currently installed has a power capacity of less than 100 MW. The first generation of floating wind farms will be installed in areas with high wind resources, intermediate water depths (W_d < 350 m), close to shore and to construction areas. In the near future, wind farms with up to 3 GW of installed power are foreseen [16]. In order to classify the different regions where floating wind farms might be developed, a few criteria on water depth, distance to shore and wind resources were defined.

Table 1 depicts the categories of water depth (noted W_d) defined for the analysis. For low water depths, i.e W_d < 60 m, fixed foundations are the most-cost effective solution for the deployment of offshore wind turbines. For W_d in $[60, 350]$ m, two classes are defined. For W_d in $[60, 100]$ m, floating foundations, jackets or other types of fixed foundations may be suitable for the deployment of turbines, making them hybrid farms. A lot of the offshore wind farms foreseen in the coming years (2025-2030) will be deployed in areas with such water depths [17]. For W_d > 100 m, at the time of this analysis, floating wind is the only cost-effective solution. The areas where W_d is in (100, 350] m are referred to as 1^{st} gen., because several floating wind farm projects under development (UK, Norway, Spain, France, etc) are located in such range of water depths, thus being part of the first generation of floating wind farms. The second generation of floating wind farms (2^{nd} gen. of FOW) is defined for W_d > 350 m, for which installation is more challenging than for lower depths but will still be achieved in the near-future. Finally, wind farms deployed in W_d > 1000 m will be installed in the far future, mainly due to technical constraints.

Regarding the wind resource, based on the wind classes defined in the IEC-61400-3 norm [18], 5 classes are used for the analysis (see table 2). The following parameters are also considered:

Table 2: Wind speed classes

Mean wind speed (m/s)	< 6	[6, 7.5]	(7.5, 8.5]	(8.5, 10]	> 10
Class	VI	III	II	I	I^+

- **Wind availability:** sites with a wind availability greater than 2000 h/year are considered to have a rather good potential.
- **Distance to shore:** a wind farm has to be far enough from the coast to reduce visual impact but close enough to avoid excessive costs (e.g. during installations or for the export cable). The best sites are identified as the ones for which the distance is between 10 to 150 km to the shore (see §§3.4).
- **Extreme significant wave height:** the identification of the areas where the severest sea states are likely to occur is important. In fact, too harsh conditions might add extra cost to the final design of the sub-structure of a FOWT.
- **Mean wave height and peak period:** the different regions are discussed in terms of mean H_s and T_p mainly for the sub-structure design.

2.5. Limitations
This study focuses on met-ocean and bathymetry data but does not consider the complex aspects of maritime planing as well as energy need in Europe. Indeed, among the total surface area suitable for floating wind, some regions might be used for fishing activities, maritime routes, oil and gas extraction, be protected or be exploited for other activity. The knowledge on the type of soil and location of main ports and industrial areas as well as locations where power plants are the most needed is also omitted. These aspects will play a key role for the development of FOW but are out of the scope of this analysis.

3. Results
The results on wind resource and wave conditions are first presented. Then, based on the classes (wind speed and water depth) defined in §§2.4, different regions are identified. For each country, the area covered by each category is determined, giving details of the area available for FOW. Finally, a targeted analysis is carried out on the countries with the highest potential.

3.1. Wind resource
The wind resource in Europe is depicted in figure 2. Figure 2 (a) shows the mean wind speed at 100 m and figure 2 (b) the availability (defined in §§2.3). The wind resource in the north of Europe (seas of Ireland, the UK, Iceland and Norway) is the greatest (mean speed greater than 10 m/s and high availability up to 4500 h/year). Other good regions are located in the Atlantic (north of Portugal and west of Spain, Brittany in France). The north of the Mediterranean Sea (the Gulf of Lion) exhibits a good wind resource mainly due to two “regional” winds, so called Tramontane and Mistral [19]. The rest of the Mediterranean Sea has relatively low wind resource compared to the North Sea, with the exception of some areas in Greece.

3.2. Wave conditions
Mean wave data are shown in figure 3 (mean H_s (a) and mean T_p (b)). Wave conditions are milder in the Mediterranean Sea (maximum mean H_s of 1.5 m) compared to the Norwegian Sea and the Atlantic (up to 4.0 m). Waves are shorter in the Mediterranean Sea: there are about 5 s of differences of the mean values of T_p (accounting for both wind sea and swell) between the

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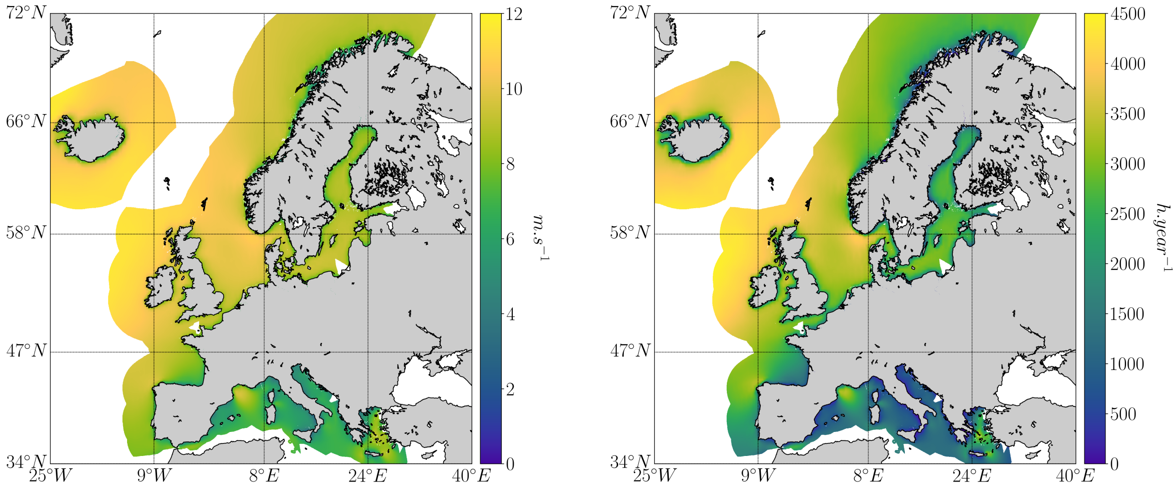

(a) Mean wind speed (b) Availability

Figure 2: Map of mean wind speed and availability (h/year for which WS in $[11, 25]$ m/s) at 100 m above sea level in Europe over 10 years

Atlantic and the northern part of the North Sea.
Figure 4 depicts the extreme significant wave height with two return periods of 1 and 20 years (see §§2.3). $H^{20}_{s,max}$ is about 50 % higher in the Atlantic and the North of Europe compared to the Mediterranean (except for the area between Sardinia and Spain). Values of $H^{20}_{s,max}$ can be as high as 14.5 m, which needs to be taken into account when designing a floating platform for such a site. Site-specific design might enable overall cost reduction, as shown by Ferri et al. [20], where specific floaters were designed for Italian sites. The lowest wind resource in the Mediterranean counteracts the milder wave environment, for which smaller floaters might be required. An interesting region lies between Scotland and Norway, where the wind resources are excellent and the waves are not too extreme compared to other northern or western regions, making it an excellent region for floating wind farm deployment.

3.3. Water depth and wind classes
Figure 5 (a) shows a map of water depth in Europe organised in five classes (cf §§2.4). Figure 5 (b) is a map of the wind speed classified in five categories. In figure 5 (a), the areas highlighted in green ($W_d < 60$ m) are very close to the coast for most countries. The only exceptions are the southern part of the North Sea and the Baltic Sea, where most of the fixed wind farms installed in Europe are located. Figure 6 (a) shows the percentage of the EEZ area covered by each water depth class. Finland, Germany, Poland, Sweden, Denmark, Latvia, Lithuania, Belgium and the Netherlands have more than 50% of their seas at depths less than 60 meters (most even more than 70%). The absolute values are listed in table 3.

With regard to the other water depth classes, figure 5 (a) is commented as follows:

- Hybrid: the hybrid areas are mainly located in the northwest and southeast of the UK and in the Baltic Sea.
- 1^{st} gen.: the second most covered area of the EEZ is the region with water depths between 100 and 350 m, with about 1050×10^3 km^2 of surface covered in Europe (table 3). In these areas, only floating wind is suitable. It covers a large part of western France and Ireland,

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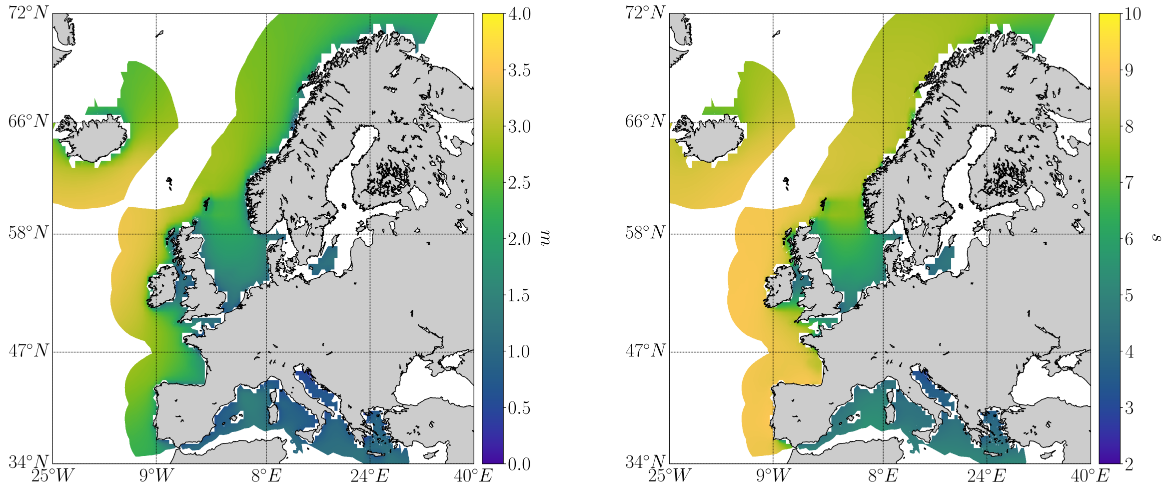
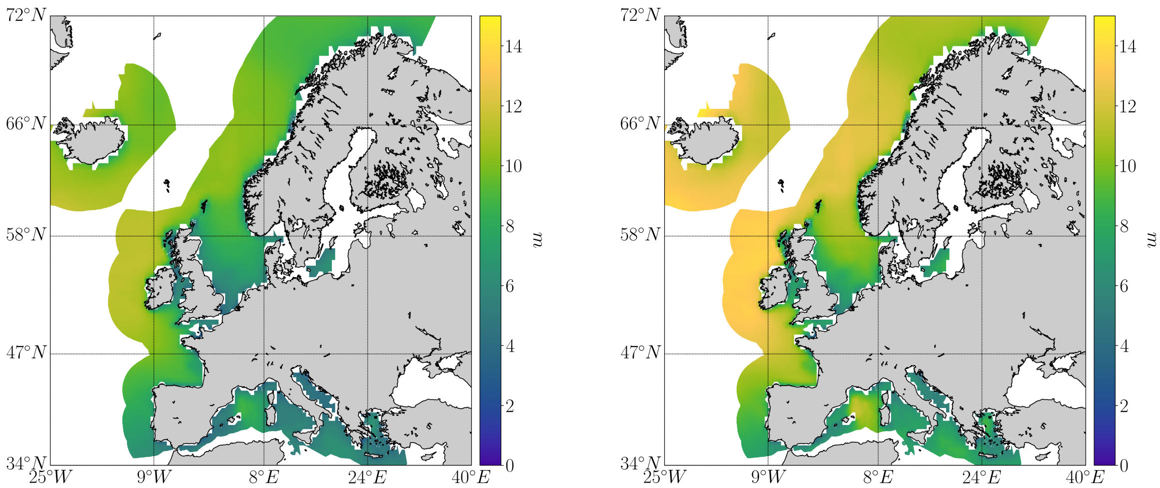


(a) Mean H_s (b) Mean T_p

Figure 3: Mean significant wave height and peak period (wind sea and swell) in Europe over 20 years

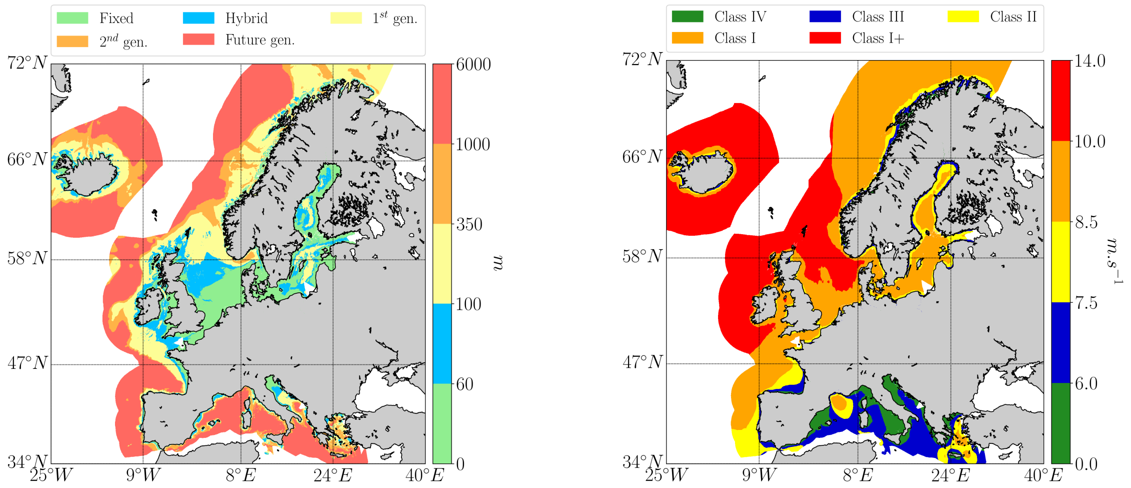


(a) Period: 1 year (b) Period: 20 years

Figure 4: Extreme significant wave height, $H^R_{s,max}$ with return period, R of 1 year and 20 years

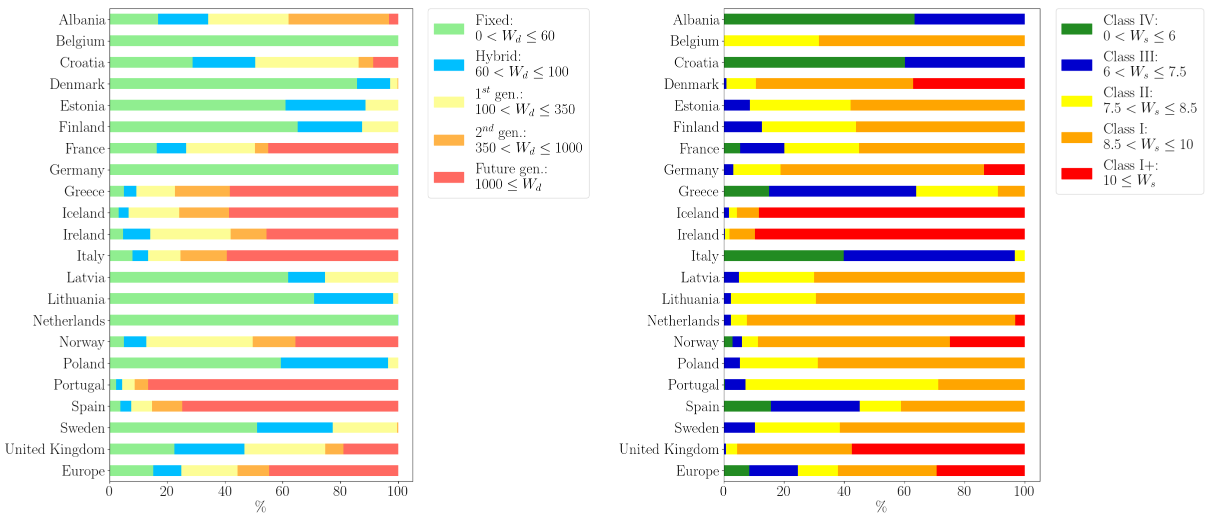
northern United Kingdom, Norway and Iceland, as well as some areas in the seas of Spain, Portugal, Italy and in the Baltic Sea.

- 2^{nd} gen.: deeper regions are further from the coast (mainly in the Atlantic, Irish, Italian and Albanian seas, as well as in Norway, the UK and Iceland). Notably, the Baltic Sea has almost no area where $W_d > 350$ m.
- Very deep sea: most of Europe's EEZs are in water depths greater than 1000 m. Much of the Mediterranean, the Atlantic and the northern part of the North Sea is in very deep waters. Countries such as Spain, Portugal, Italy, Greece, Iceland, France and Ireland have a significant area of their EEZ in deep water, which limits the possibility of installing floating wind turbines in these areas, at least in the near future.



(a) Water depth by class (b) Mean wind speed by category

Figure 5: Map of water depth per class (see table 1) and mean wind speed (see table 2)



(a) Water depth (b) Wind speed

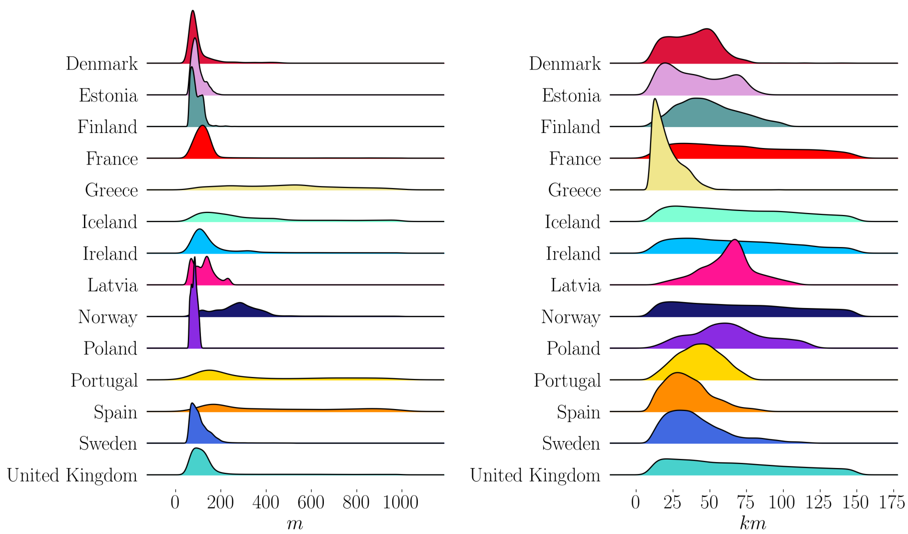
Figure 6: Distribution of water depth and wind speed per class for each country (in % of the surface area of the EEZ)

Regarding the wind classes (figure 5 (b)), from the Atlantic to the whole of northern Europe, the average wind speed is above 8.5 m/s almost everywhere, with high resource regions in the UK, Ireland, Noway and Iceland ($W_S > 10$ m/s). In comparison, the Mediterranean is less windy, with average winds below 7.5 m/s, making it less advantageous for wind energy.

3.4. Areas with the greatest potential

Based on the above analysis, the countries with the greatest potential are identified. This is done by determining for each country the areas for which the following criteria are met:

- Water depth between 60 and 1000 m



(a) Distribution of W_d (b) Distribution of distance to shore

Figure 7: Distribution of water depth and distance to the shore by country in the EEZ for which the criteria defined in §§3.4 are met

- Distance to shore between 10 and 150 km
- Mean wind speed over 7.5 m/s
- Availability over 2000 h/year

Figure 8 shows the areas that meet the criteria for each country. Figures 7 and 10 highlight for each country the distribution of W_d, distance to shore, average wind speed, and availability in areas that satisfy the above criteria. Table 5 in Appendix shows the surface area.
Very interestingly, Iceland, Norway and the United Kingdom have the largest area covered, with 178, 300 and 314 $\times$ 10^3 km^2 of suitable area respectively. The UK has the advantage of having most of its surface area at a depth of less than 200 metres, which makes it very suitable for floating wind. In comparison, Iceland and Norway have greater water depths, but on average less than 400 metres (figure 7 (a)). The three countries have a similar distribution of distance to shore, with a median of about 70 km (figure 7 (b)). In terms of wind resources, the UK and Iceland have most of their areas with an availability of more than 3000 h/year against a median of 3000 h/year for Norway. (figure 10 (b)).

Moreover, Sweden, France and Ireland also have a good potential with a surface area respectively of 68, 83 and 126 $\times$ 10^3 km^2. Most of the seawaters in these three countries are less than 200 meters deep. Regarding the distance from the coast, Sweden has the advantage of having a shorter distance, most areas being less than 70 km to the shore, unlike France and Ireland. The wind resource is better in Ireland with average median speeds of 10.5 m/s compared to 9 m/s for Sweden and France and the same is true for availability (figure 10)

Other countries, such as Greece, Finland and Spain, also have good potential for floating wind energy. The water depths of the areas in Greece and Spain are deeper, from 60 to 1000 metres, compared to Finland where the depths are less than 200 metres. In terms of distance to shore, Greece and Spain have shorter distances, with almost all values below 60 km, compared to Finland. The wind resource is however better in Finland.

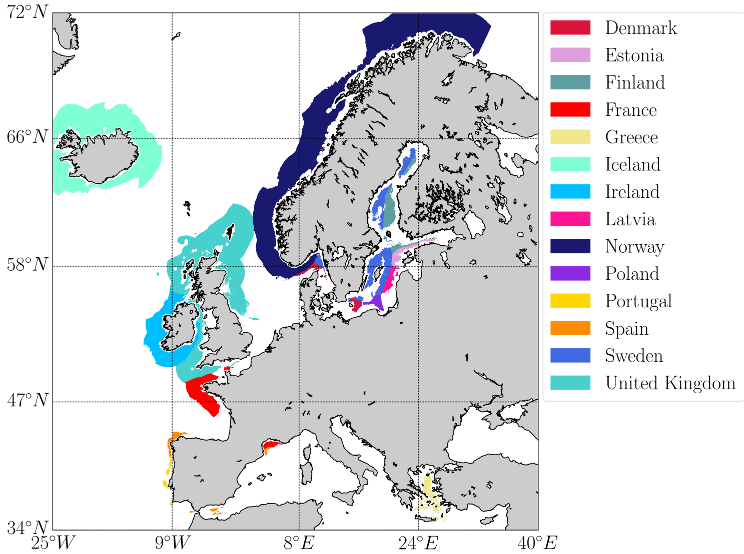


Figure 8: Map of high potential areas for floating wind deployment in Europe, for which the criteria defined in §§3.4 are met

Last but not least, other countries: Denmark, Estonia, Latvia, Poland and Portugal have about 10.10^3 km^2 of available surface, which could be used for the deployment of floating wind turbines.

3.5. Discussion
The results shown in figure 8 are consistent with the findings of similar studies by Bosch et al. [4] and Caglayan et al. [5]. Bosch et al. [4] computed an estimation of the potential average energy production (AEP) from offshore wind in the UK (∼7000 TWh/yr) and Norway (∼15000 TWh/yr). In their study, Norway shows almost twice as much potential, which is not reflected in the results of this paper (the UK and Norway have very similar available area, see table 5). In the present study, the potential production was not estimated, which limits the direct comparison. In addition, differences could be attributed to different exclusion criteria. The results of Caglayan et al. [5] provide an estimation of the Levelised Cost Of Energy (LCOE) for offshore projects in Europe based on future technologies. Notably, the areas in deep water ($W_d > 60$ m) which have the lowest LCOE (around 50 €/MWh) match well with the area identified in figure 8. Moreover, their findings highlight higher LCOE for the Mediterranean (on averaged more than 100 €/MWh) which is attributed to less wind resource and larger water depth. Despite the large area, such regions are less attractive for floating wind.

4. Conclusion
In this paper, the ERA5 and Gebco bathymetric dataset were used to derive met-ocean data to assess the potential of FOW in Europe. The analysis highlights the areas with high potential for the deployment of floating wind. Figure 8 shows these regions. Among them, the UK, Norway, Iceland and Ireland have the most covered area and the greatest potential. In fact, a large part of the EEZ surface of these countries is covered by regions suitable for FOW deployment, about 314×10^3 km^2 for the UK for example. This explains why Scotland has already planned more than 10 GW of floating wind for the coming years [16]. Despite good potential, Iceland and Norway are located far from highly populated areas, which is a limiting factor for the deployment of FOW. Norway has the possibility to strengthen its grid connection to the EU countries and the UK. This would be beneficial to contribute to a grid allowing a better sharing of offshore

wind power through Europe and thus accelerate the deployment of floating wind farms.

Other countries analysed with good potential are Sweden, Finland, France, Spain and Greece. Large areas of the Baltic Sea are suitable for the installation of floating wind farms. Overall, countries with coasts around the Mediterranean have a lower potential due to weaker winds compared to other regions. On the other hand, the milder wave conditions could allow for smaller floaters than in the harsher environment of northern Europe and the Atlantic. Furthermore, more than 40 % of the total EEZ of the countries considered is located in areas with water depths deeper than 1000 meters, where it is considered too technically challenging at present to deploy floating turbines. This situation could change with the development of new cost-effective solutions for installation and with new materials.

This study provides an overview based on a few criteria, omitting the complex aspect of maritime planning as well as the knowledge of existing infrastructures (ports, electrical network), the type of soil and any restrictions that could prevent the development of floating wind. Of all the available surface areas, a substantial amount might not be used for floating wind for many reasons (already exploited, protected area, too costly to deploy, etc.) that should be taken into account for future more detailed analyses.

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Appendix

***All areas provided in the following tables are accurate to about ±5%, which is due to the grid resolution of the bathymetry, wind and EEZ data.*

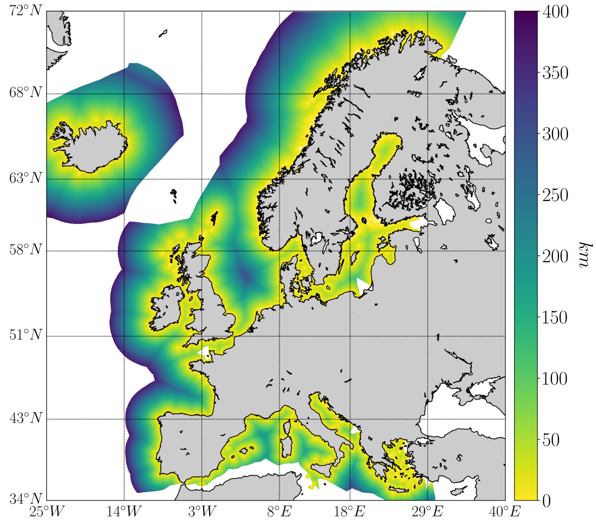
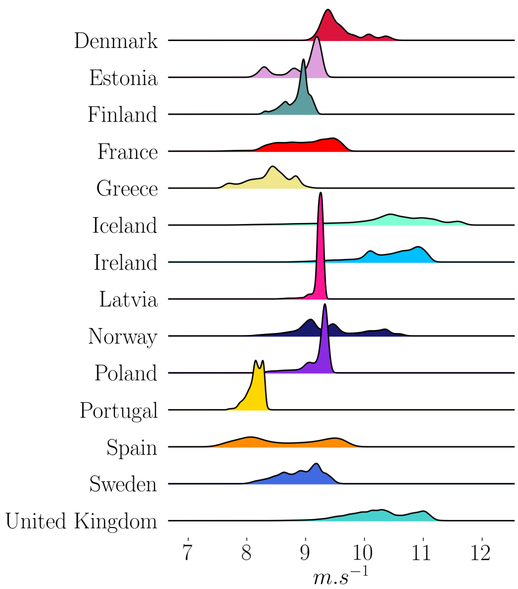
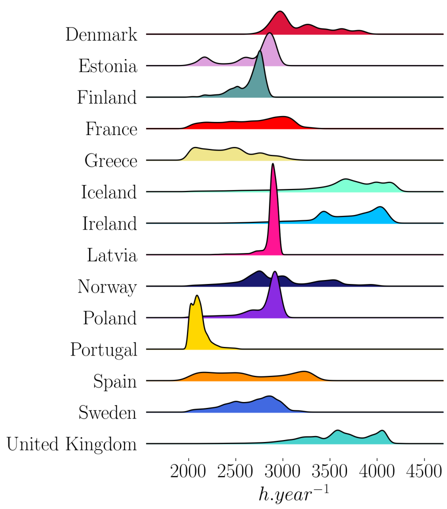


Figure 9: Map of distance to shore in the EEZ of all countries considered



(a) Distribution of mean speed



(b) Distribution of availability

Figure 10: Distribution of mean wind speed and availability by country in the EEZ for which the criteria defined in §§3.4 are respected

Table 3: Surface area covered for each class of water depth defined in §§2.4 (see figure 5 (a)) in 10^3 km^2

Country	Fixed	Hybrid	1^{st} gen.	2^{nd} gen.	Future gen.	Total
Albania	2	2	3	4	-	11
Belgium	3	-	-	-	-	3
Croatia	15	12	20	3	5	55
Denmark	89	13	3	-	-	105
Estonia	22	10	4	-	-	36
Finland	52	18	10	-	-	80
France	55	34	83	16	155	343
Germany	54	-	-	-	-	54
Greece	22	19	60	85	261	447
Iceland	20	20	106	104	353	603
Ireland	19	39	120	53	194	425
Italy	42	29	61	86	318	536
Latvia	17	4	7	-	-	28
Lithuania	5	2	-	-	-	7
Netherlands	63	-	-	-	-	63
Norway	37	58	277	112	267	751
Poland	17	11	1	-	-	29
Portugal	7	6	14	14	273	314
Spain	20	21	41	59	420	561
Sweden	78	41	35	1	-	155
United Kingdom	161	176	208	46	138	729
Total	801	516	1053	584	2384	5338

Table 4: Surface area covered for each class of wind speed defined in §§2.4 (see figure 5 (b)) in 10^3 km^2

Country	Class IV	Class III	Class II	Class I	Class I+	Total
Albania	8	4	-	-	-	12
Belgium	-	-	1	2	-	3
Croatia	33	22	-	-	-	55
Denmark	-	1	10	54	40	105
Estonia	-	3	12	21	-	36
Finland	-	10	25	46	-	81
France	19	50	85	191	-	345
Germany	-	2	9	37	9	57
Greece	67	218	122	41	-	448
Iceland	1	10	15	44	535	605
Ireland	-	1	7	36	384	428
Italy	212	305	19	-	-	536
Latvia	-	1	7	20	-	28
Lithuania	-	-	2	5	-	7
Netherlands	-	1	3	56	3	63
Norway	21	24	40	476	191	752
Poland	-	2	8	21	-	31
Portugal	1	21	200	93	-	315
Spain	87	165	78	232	-	562
Sweden	-	16	43	96	-	155
United Kingdom	-	5	27	272	427	731
Total	450	863	713	1744	1589	5359

Table 5: Surface area covered by the seas that satisfies for each country the criteria defined the in §§3.4 in 10^3 km^2

Country	Surface area
Denmark	12
Estonia	12
Finland	27
France	83
Greece	43
Iceland	178
Ireland	126
Latvia	11
Norway	300
Poland	11
Portugal	9
Spain	22
Sweden	68
United Kingdom	314
Total	532