Wind Energ. Sci. Discuss., author comment AC2
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# Reply on RC2

Robin Marcille et al.

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Author comment on "Gaussian mixture models for the optimal sparse sampling of offshore wind resource" by Robin Marcille et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-39-AC2, 2022

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Response to Reviewer 2 Gaussian Mixture Models for the Optimal Sparse Sampling of Offshore Wind Resource by Marcille et al

**Note: Your comments and questions are reported in this document, and we use bold text for our responses. The line numbers in the responses correspond to the corrected pdf file with highlighted differences.**

(1) According to the current situation of vigorously developing renewable energy, this article proposes a novel, effective and practical method for wind farm reconstruction and optimization of the optimal sensor network, both for the evaluation of offshore wind resources and the development of offshore wind energy. It has very important theoretical value and practical significance.

(2) The three locations selected by the author in the article are very representative. At the same time, as the focus of wind power development in France at present and in the future, the research results made by the author will have good reference significance.

(3) The author proposes four methods for selecting the position and number of sensors in the article, and at the same time gives a detailed introduction to these four methods, with concise language and clear organization.

**Thank you for your positive comments.**

revise opinion

(1) An explanation should be given at the end of the Introduction as to why the three regions of Normandy, South Brittany and the Bay of Lions in the Mediterranean were chosen.

**The three areas are major areas for the future development of offshore wind in**

**France and could require the development of a wind observational network for planning and execution of the projects. Precisions were added in the timeline at the beginning of the "Study Data set" section:**

- **136 – 137 "three major development areas for offshore wind in France with numerous planned offshore projects, listed in Table 1 with future tender processes for respectively 1.5GW of fixed offshore wind, 250MW of floating offshore wind and 2 x 250MW of floating (expected date of commissioning in 2030)."**

(2) The GMM method is good at reconstructing the weather situation while discarding points of high variability that may be associated with extreme events. How did you come to this conclusion?

**This conclusion comes from the scores displayed in table 2. It shows that the GMM method is not systematically better than EOF extrema and QR pivoting in reconstructing the maximum wind speed of the map (Max wind speed RMSE in Table 2.) while it is clearly better for the mean wind speed and RMSE.**

**The interpretation is that the selected points in the GMM method are very different from the "salient" points of both the QR pivots and EOF extrema. Those point carry the most variability in the dataset but are not spatially representative of what's happening at the regional scale. Coastal points can be associated with extreme events due to the influence of the coast (Extreme in the sense of extreme variability compared to other grid points). While the centroids selected by the GMM methods are the most spatially representative points, discarding the extreme points that are not relevant for the regional reconstruction.**

**A precision was added:**

- **408 – 410 "Indeed, coastal points that can have a high variability due to the coastal orographic effects, are selected as salient points by the EOF extrema and QR pivot, and discarded by the GMM that assign them to a wider cluster. This is efficient to reconstruct the mean situation in the whole map but can lead to higher errors on high variability areas."**

(3) The author deleted a part of the data in the dataset, why did they delete them, and what are the criteria for deletion?

**Basically 65 days in the open source dataset are corrupted files. The rest of the data was complete and coherent.**

- **172 – 173 "A total of 65 days (□ 6%) of the 3-year data set are unusable due to largely missing data. The days identified as erroneous are similar for each area and were removed from the analysis."**

(4) "Although the clustering itself may find the best of 5 clusters for the Mediterranean, this may result in a higher reconstruction error than the other regions." Why does this result?

**This result is illustrated by figure 4 and 5, showing that the BIC score indicated number of sensors yield to a much higher error in the Med Sea than for other areas. It comes from the fact that the BIC score is not directly linked to the reconstruction error, but only from the likelihood of the obtained clustering. Precisions were added :**

- **359 – 363 "Although the clustering itself might find an optimum of 5 clusters for the Mediterranean Sea, this can lead to much higher reconstruction error than for the other areas as illustrated in Fig.5(a). In particular for the Mediterranean Sea, the considered region is wider with several different wind regimes, which implies a higher variability. It then seems natural that more sensors than other areas would be needed to reach the same error level"**

(5) When testing the sensitivity of the method, an area 20 km from the coast was excluded, why choose 20 km instead of other ranges.

**This range will be approximately the distance to the coast for future offshore projects in France. Furthermore, it is wide enough to exclude any impact from the coastal orography. In the paper from Barthelemie et. al in 2007 (Offshore Coastal Wind Speed Gradients: Issues for the Design and Development of Large Offshore Windfarms), the coastal zone is between 20 and 70 km in Europe (Results suggest that the distance from the coastline over which wind speed vertical profiles are not at equilibrium with the sea surface (which defines the coastal zone) extends to 20 km and possibly 70 km from the coast). The 20km buffer is considered, because of the proximity of next tender processes in France.**

**Added precision: L. 472 – 473 "It roughly corresponds to the minimum distance to the coast for future offshore wind parks and ensures that the impact of the orography is limited."**