

Response to the reviewers, wes-2020-134

The authors would like to thank the associate editor and the referees once more for the review and the helpful remarks. We are certain that they helped to further improve the quality of our paper. In the revised manuscript, we considered the comments as follows (responses in blue).

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Associate Editor (Sara C. Pryor)

As you will see from the reviewers comments - they perceive - and I concur that the changes made do not fully address their concerns and the manuscript remains rather difficult to follow. I'd therefore like to request you seek to modify your manuscript in line with their suggestions - I would particularly emphasize the need to clarify and edit to reduce length in sections 4 & 5. I would also ask you to revisit the theoretical considerations and how they are described in section 5. If you can do so I will make a final determination without further review.

In accordance to your recommendations, in this revision we focused strongly on clarifying and shortening sections 4 and 5. The changes consist of the following (the line numbers refer to the revised manuscript):

- 1.) We rephrased several sentences such as in lines 283, 286, 306-307 as well as entire passages, e.g., in the beginning of Sect. 5.1 (please see track-changes file for all changes made).
- 2.) In some cases, we added further information in order to clarify the descriptions and explanations (e.g., lines 341-343, 346).
- 3.) In the former version of our manuscript, we had often justified the individual approaches in the subsections of Sect. 5 (mainly with references to the theoretical findings, which may have made things a bit confusing). We now summarized a general motivation at the beginning of Sect. 5 ("In the theoretical analysis, different factors were identified which have an impact on the accuracy in mean and variance ..."). We believe that this approach is more straight-forward and expedient.

In this context, the structure of some sections was changed to 1.) description and explanation of the observations (figures), 2.) reasons and consequences of the results. Also, the length of the sections was reduced.

- 4.) We shortened sections 4.2, 5.2, 5.3 (see track-changes file). Moreover, we reduced Sect. 5.4.3 to the bias in theoretical energy production of a wind turbine. Thus, in this context, we decided to leave out the error score Err_{ED} , i.e., the bias in energy density. This was motivated by our impression that Err_{ED} caused quite a bit of confusion with only little added value to the main findings of the paper.

Overall, despite additional explanations, we were able to shorten the manuscript by 29 lines (equivalent to almost one page of plain text). Moreover, we expect that both the theoretical and the experimental results will now be much easier to read and understand. With all the changes made, we hope that the paper now meets your expectations.

Anonymous Referee #1

Minor corrections to be made:

L261: "the questions which factors"

L298: "the ratio of the variances given by the reanalysis data" unclear

L530: "Eventual" ?

L532&574: "both, "

L561: "much" -> more

L566: "significant" ?

and probably some other English problems but I would leave that to a native English speaker.

As displayed in the track-changes file, all these technical corrections have been considered and implemented.

Anonymous Referee #2

Major remarks:

1. Abstract: The abstract elaborates quite a lot on the activities that has been employed during the study. However, the abstract should report about the conclusions and findings of the paper, i.e. what have we learnt?. Now that is covered in only a single sentence.

We revised the abstract and added the required information about the essential findings of the paper.

2. Readability: Section 3.1 as an example: From the beginning this section is difficult to follow. I think some additional explanation is needed that explains the research strategy in a more concrete way. E.g. the first sentence "Short-term periods with a duration of 90 consecutive days are selected starting at the first day of year and running through the data with an increment of three days" does not mention that you do this operation on the reanalysis products, so for the reader it is a bit shaky here: where are we suddenly heading to?

Moreover, so far often wordings like "analyse" and "statistics are generated" are used, but for the reader it is difficult to follow why this is exactly done. Perhaps a flowchart that explains the design of the research would be helpful.

We revised Sect. 3.1, especially the first passage, in order to clarify the procedure. In our view, this section is now structured in a way that makes the approach of the study easier to understand. We now explain more clearly 1.) how the selection of data in the short-term periods is done, 2.) in what way the data in these periods are analyzed, 3.) how the MCP predictions are performed.

Furthermore, we changed Figure 1 accordingly. On the one hand, this scheme now better captures the procedure of MCP prediction, on the other hand, the use of capital and lower case letters as well as the subscripts (u_{meas} , U_{corr} etc.) should become clearer.

Also the text can be more precise in terms of using the word "data" which is used for the observations and for the re-analysis products, which makes the reader easily lost what is exactly

done. For example, in Ln 136 “ensuring that 122 90-day measurement periods can be investigated”, the measurement periods that are mentioned are subsets of the reanalyses, not from the observations in Table 1. So this makes the paper confusing. I suggest to use the words “observations” and “re-analysis product”, or if you sample from a reanalysis to mimic a measurement campaign, please call this subset “pseudo observations” (or something like that).

We did not use a sample from a reanalysis to mimic a measurement campaign but understand that the explanation was a bit misleading. We hope that our changes made here (e.g., “When this sliding window reaches the end of the period of the original measurement campaign ...”, “This procedure is applied equally to measurement and reanalysis data...”, lines 145 - 148) will help to make the passage easier to understand.

In addition, in Ln 139 you talk about regression parameters but at this point the reader has no concrete idea about which regression parameters you talk about concretely! It remains all a bit vague in a cloud. In general I have confidence in the work the authors present, but less confusing wordings can help to make the paper more attractive for the readership, which will help to have a bigger impact in the field.

We sharpened the passage you refer to (see lines 153 - 158 in the revised manuscript). In addition to the revision of Fig. 1, we hope that these changes will now make the general approach taken in the study much clearer.

3. Discussion: the paper should sharpen the discussion section in which the paper shows how it has extended the science. The paper now refers continuously to three papers, but I wonder whether that can be strengthened? The reference list contains a lot of grey literature, the paper can be brought to a higher scientific level.

It is not entirely clear to us which discussion section you are referring to, but we assume that the relevant passages in Sect. 5 (especially Sect. 5.4.1) are meant. We added a further passage on how the paper adds value to existing publications in lines 455-458 (in order to account for these changes, the conclusion was slightly adjusted accordingly).

Furthermore, we conducted a further literature search which, however, did not reveal any additional studies outside of grey literature on this topic. Therefore, we expect that all relevant journal papers have been considered. (Please also see the papers cited in the introduction which, however, did not provide further analysis on seasonal biases.) Again, this shows that there is a lack of reviewed publications. With our paper, we aim to contribute to this issue. The large amount of grey literature might be explained by the application proximity of the research. Industrial research unfortunately tends not to publish in journals.

Minor remarks:

Ln 32: MCP: the MCP method should be explained briefly or with a schematic (see below as well), since from section 3.1 the manuscript is difficult to follow, which can be circumvented by including a flowchart or other schematic about how the MCP works (inputs, output, procedures, regressions; so an extension of Figure 1), and a flowchart illustrating the experiment. From Fig 1 it is still not clear what is the difference between a u and capitalized U.

We have taken up this suggestion of a schematic by revising Fig. 1 (see above). We believe that this scheme better reflects both the procedure of MCP predictions and the use of upper and lower case

letters. In addition, the general explanation of the use of upper/lower case letters (and subscripts) in lines 139 - 141 as well as several brief notes when the respective parameters are used (e.g., lines 185, 200, 288, 291) should make the definitions of the parameters clearer to the reader.

Ln 41: scientific publications -> studies

Ln 41: In Carta et al. (2013) an extensive review is given on -> Carta et al. (2013) presents an extensive review on

Ln 42: It is concluded that -> They concluded that....

Ln 78: An overview of the measurement campaigns is given in Tab. 1. -> Table 1 presents an overview of the measurement campaigns used in this study.

Ln 102: WRF (2020))-> the usual reference to the WRF model is either Powers et al 2017 (BAMS) or Skamarock et al 2019.

Ln 132: I recommend to replace the labelling of the subscript "ref" with the more direct subscript "reanalysis". I understand in general other reference wind speeds can be used as well, but for the readability of the paper I think it is wise to make the terminology as direct as possible.

Ln 138: three-month -> to avoid confusion, just call it "90-day periods", so the wording remains consistent with the previous paragraph.

We have fully considered these recommendations and implemented them in the revised manuscript accordingly.

Ln 138: In a first step, the data in these three-month data portions 90-day periods are analyzed with respect to, e.g., mean and variance of wind speed. For the reader it is unclear why these statistics must be generated at this point. Again, adding a flowchart or a scheme in the beginning of section 3.1 can help to make the workflow more easy to understand for the reader.

We clarified this passage as stated above. E.g., we added specific reasons for why these statistics are generated and investigated (see lines 150 - 152 of the revised manuscript). In order to avoid confusion, we restricted the flowchart (Fig. 1) to the procedure of MCP predictions.

Ln 153: few negative wind speed values can occur. -> You mean that the MCP method may generate a few negative wind speed values. Be more precise in the wording, it will help the reader!

We changed the wording here accordingly.

Figure 1: the location and role of the grey bars "benchmark Umeas" are unclear. The grey bars next to the dark blue bar now look purely like they act to refine the layout. Also, there are no black arrows pointing to/from it. Please revise.

We revised it as stated above.

Ln 166: reference wind speed. For readability purposes, it would be good that uref refers to the reanalysis products in this case right?

We changed the index "ref" to "rea" (for reanalysis) consistently.

Ln 173: please add that the subscript LR stands for linear regression

We added this remark in lines 198 - 199.

Ln 193: what is the difference between Eq 4 and Eq. 6 since they effectively do the same job? Is it not more confusing to mention them twice?

The main difference of these two equations is that in one case the residuals are considered, while in the other case they are not. While this does not change the mean, it does have a significant effect on the variance. Therefore, although the equations look similar, they produce quite different results. We therefore would like to keep both equations in order to illustrate this difference between simple linear regression and linear regression with residuals.

Ln 215: one-year time series: please be more precise. It is a daily, hourly or sub-hourly time series?

We added the information on the temporal resolution (line 234).

Ln 254: Inserting in Eq. (10). What are you inserting in Eq. 10? A is already present in that Equation.

We added the missing information ("Inserting this mean value of A in Eq. (10)..." in line 270).

Ln 265: suddenly overbars appear above the U's in the equation, but without further explanation. What was the averaging timescale? Unclear (again).

We added "the bar denotes the mean" once more in line 280. The parameters which are used in Eq. (11) - (13) were already defined several times before (Fig. 1, caption of Fig. 1, lines 185 and 200), with the definitions directly containing the respective timescales (long-term / short-term period). Note that Eq. (11) - (13) are valid independently of the exact duration of short-term or long-term period. We added that remark in line 297. Together with the general explanation on lower/upper case letters in the beginning of Sect. 3, we believe that this section should be clear now.

Ln 335: the authors should introduce better why d_{mean} is needed. It is well explained what it does and how you can calculate it, but why do we need it? Which research question does it answer?

In order to further clarify the purpose of d_{mean} , we added "It therefore indicates the average "error" of the reanalysis data sets in reflecting the annual course of wind speed. According to the theoretical considerations in Sect. 4.2, this is an important aspect regarding the seasonal biases of an LTC." in lines 341-342. Furthermore, we noted one result in lines 353-354 ("the largest amplitude prevails for the EMD-WRF Europe+ data set").

Figure 10: the caption should mention the height of the wind speed that is discussed

We added the required information in the form of a reference to Tab. 1 and Sect. 2, where all heights are specified.

Ln 561: much -> much more?

Yes, thank you, we changed that in the revised manuscript (line 534).