First of all, we would like to thank the referee for the insightful and constructive comments. In our revised version of the manuscript we tried to address all his comments and suggestions in order improve the robustness of the analysis and the clarity of the interpretation.

In the following, we respond to each reviewer's comment by referring to line numbers of the revised non-tracked version, when not differently indicated.

Reviewer 1, Rupert Seidl

Forzieri et al. present the first spatially explicit collection of forest areas disturbed by wind in Europe. This is a highly timely and important effort, as natural disturbances are increasing in Europe, yet we largely lack high quality datasets for understanding and modeling these processes. Compilations such as the one presented here are thus the prerequisite for improving our predictive capacity of natural disturbances.

The current dataset follows a data compilation approach, i.e. previous records from a variety of different sources are combined in a single database. The authors thus synthesize a number of past regional efforts and make them available for the scientific community. I overall find this work to be highly relevant and useful, and commend the authors for their efforts.

We thank the reviewer for his positive comment. We have revised the text in light of it. Please, note that, inspired from some comments received from rev2, we decided to expand in the revised version the potential applications of FORWIND encompassing several challenging topics and scientific fields including forest vulnerability modelling, scaling relations of wind damages, remote sensing monitoring of forest disturbances, representation of uproot and break trees in large-scale land surface models and hydrogeological risks associated to wind disturbances. We believe that this new material further improves the manuscript and may facilitate the use of FORWIND in multiple scientific disciplines and contexts.

I also appreciated the comparison of the dataset against estimates derived from Landsat, Modis, and grey literature. However, I would not call this an evaluation or validation of the current dataset, as all these data are derived differently, pertain to different resolutions, and apply different thresholds for recording a disturbance, so it is basically comparing apples to oranges. If anything, I belief the current data to be the most accurate of all the datasets compared, and deviations between the products are largely the effect of differences in methodology (I would assume that also Landsat and Modis have a moderate correlation at best). This for me underlines the importance of ground-true datasets as the one presented here.

We agree with the reviewer's comment. Indeed, a standard validation exercise of FORWIND is not possible due to the lack of alternative datasets with similar spatially explicit representation of wind disturbances.

<u>**Action taken:**</u>

➔ We have changed the heading of section 4.1. from "Technical validation" to "Comparison of FORWIND with satellite-based metrics and national inventories".

1. *I find that two things currently limit the utility of the dataset though, and would suggest that these aspects could still be improved in a moderate revision of the manuscript before publication. First, the threshold severity that was applied in the assessments compiled here is not defined. This means that the polygons compiled here could have anything from 1% to 100% of the trees thrown or broken by wind. This ambiguity strongly limits the utility of the data for ecological analyses. It seems from the text that severity measures are available for at least some of the polygons, and I suggest that you also include them in the data where you have them.*

We agree with the reviewer’s comment on the importance of including information about disturbance severity. However, we believe that the reviewer may have overlooked this information, as it is already included in our database (see attribute “Damage_degree”).

A damage classification for forest disturbances was originally recorded for windstorms that occurred in France in 2009, in Lithuania in 2010, in Germany in 2017, in Italy in 2015 and –for part of the records - in 2018. In order to make these records comparable in terms of the severity of damage, the original classes were harmonized into a single damage metric following the rationale reported in Table 2. The resulting severity (or degree of damage) varies in a consistent range between 0 (no damage) and 1 (full destruction of forest patch). Missing data for the remaining wind disturbances are reported as -999. The harmonization of the degree of damage was already described in our previous submission at lines 121-124 and table 2. The database includes a specific attribute named “Damage_degree” (see also Table 3) in which the severity (or degree of damage) is reported.

We did not apply any severity threshold in our data collection for two key reasons. First, information on the degree of damage is reported only for a part of the database (~48%). While we agree with the reviewer that the degree of damage is key information for ecological analyses, we also believe that wind disturbances can be meaningfully characterized and analyzed when damage levels are not recorded. Second, the definition of a threshold to include/exclude records based on their degree of damage would necessarily imply a subjective choice, potentially questionable depending on the use of the data and the question addressed by the ecological analysis. Based on the above-mentioned considerations, we opted to include all records in FORWIND and report the degree of damage when available. In our opinion, this approach does not limit the use of the database but allows the user to set severity thresholds appropriate for her or his specific tasks.

Action taken:

➔ We have clarified this in the revised text. We hope that the reviewer agrees on this strategy.

➔ Furthermore, following a comment from reviewer 2, we explored in the revised version the scaling relations of degree of damage across different plant functional types.

2. *Second, while the sampling via a PubMed and Scopus search is clearly described, it remains unclear how representative the compiled polygons are for the wind disturbances that occurred within a year in a given country. Looking at Table 4, I for instance wonder whether the 64 polygons on record for Switzerland are the total forest area that was affected by wind in this country, or whether this is a (random?) sample of all areas affected by wind. Again, information on the representativeness of the sample would be important for making ecological inference. As for my previous point, I have the feeling from reading the text that you have an understanding of how representative your database is for at least some countries and storm events. Adding this type of information would certainly increase the value of your dataset for the further analyses.*

We agree with the reviewer’s comment. The overall aim of the study is to develop a database of forest disturbances that is as comprehensive as possible. To this aim 26 research institutes and forestry services from different European countries were involved in the data collection. The database includes all major windstorms occurred over the observational period (e.g., Gudrun, Kyrill, Klaus, Xhynthia and Vaia). Despite such unique joint effort (89,743 records have been collected in this first release), we recognize that FORWIND could miss some wind damage occurrences, as also explicitly mentioned on lines 245-246. For this reason, further data contributions are encouraged in order to continuously update and improve FORWIND (lines 306-307).

Evaluating quantitatively the degree of representativeness of FORWIND is very challenging because the known wind events may represent only a fraction of the overall occurrences. Wind disturbances may remain unknown for a long time. On the other hand, we agree with the reviewer’s comment on the importance of providing an estimate of the representativeness of FORWIND. This information, may also serve to drive more effectively future efforts to populate the database.

Action taken:

➔ According to the institutions responsible for the data acquisition, the wind disturbances recorded in FORWIND exhaustively represent the damaged forest areas caused by those specific events. However, some known damaging wind events are currently missing in the database. In order to provide a more comprehensive assessment of the representativeness of FORWIND, we derived for each country the ratio between the number of sampled wind events and the number of all wind events occurred which are known to have caused forest damages. The number of known damaging events is derived by summing up the number of distinct events recorded in FORESTORM and FORWIND during the 2000-2018 period. Therefore, the temporal representativeness ranges between 0 (all known wind disturbances are missing in FORWIND) and 1 (all known wind disturbances are included in FORWIND). Estimates of representativeness ranges between 0.13 and 1 amongst the countries included in FORWIND, with average value of 0.64 at Europe level (new table added in the revised version). However, when also countries currently missing in FORWIND are accounted for the average representativeness decreases to 0.37. These values should be viewed with caution as the estimated number of total damaging wind events resulting from FORWIND and FORESTORM could likely deviate from the actual ones. Future efforts should be aimed to populate FORWIND with those damaging wind events actually missing.

➔ We have described the representativeness metric in the revised version of the manuscript and added a dedicated new table. We also recall the representativeness of FORWIND in the abstract.

Overall, I find this to be a highly relevant dataset, and recommend publishing it after moderate revisions. Some more minor comments are below:

In the following lines, we tried to address all the remaining issues.

Minor comments

l59: their excess... meaning unclear

Action taken:

➔ We have rephrased with "occurrence".

l66, l70, and many other instances throughout the text: a space is missing before the parenthesis

The issue was due to the setup of the plug-in used for citations and bibliography.

Action taken:

➔ We have fixed the problem in the revised version.

l69: of the average annual harvest rate... where? in all of Europe? in the effected countries? Be more specific here. The same applies to a similar statement in line 70.

Action taken:

➔ We have rephrased the statements and the percentages now refer to the corresponding countries affected. Percentage values are retrieved from official roundwood statistics, used here as a proxy of harvest, reported in the FAOSTAT database.

l78: substitute "Europe" for "European"

Action taken:

➔ According to the reviewer's comment, we have corrected the text.

l80: not true for Senf et al. (2018), which is based on satellite information as far as I recall

Senf et al. (2018), amongst a series of other data sources, utilized country-scale estimates of natural disturbances reported in previous publications (Schelhaas et al., 2003; Seidl et al., 2014). However, we recognize that the mentioned article has implemented a sophisticated approach mostly based on satellite data and where country scale estimates are only partially exploited. Therefore, in agreement with the reviewer's comment, we agree that it may be not fully appropriate to cite Senf et al. in this context.

Action taken:

➔ We have removed the citation in the revised version of the manuscript.

l86: Full stop is missing after "decades"

Action taken:

➔ We have corrected the typo.

l104: regardless of the degree of damage: Does this mean that it was enough for a single tree to fall within a 100 ha tract for the area to be admitted to your database?

Each polygon represents the spatial delineation of the forested area affected by wind damage (uprooted and broken trees). Following the example hypothesized by the reviewer, the area of the polygon where only a single tree felt, will reflect the approximate area covered by such single tree, surely much lower than 100 ha. Consider that the acquisition of the polygons was made by aerial photointerpretation or field survey. Therefore, the polygons are delineated when a reasonably homogeneous patch of damaged forest is detected form the ground or remotely. As detailed in the response to your comment #1, we intentionally avoided to fix thresholds on the degree of damage and areal extent of affected forested patches. It is up to the user to decide what screening to implement based on their specific purpose.

Action taken:

➔ We have further clarified this concept in the revised version of the manuscript.

l133: impressive!

Thank you! We are considering to implement FORWIND in a web portal complemented by a dedicated tool to automatically integrate and check new data acquisitions.

l135: forest disturbance patch

Action taken:

➔ According to the reviewer's suggestion, we have corrected the text.

l243: one issue that I see there (that also might account for the differences you find) is: If you use ForestEurope values for GSV these are the averages per country. However, wind disturbances are predominately affecting older stand and more productive sites (as both have taller trees), which means that the actual GSV of areas affected by wind might be considerably higher than the country-level averages.

We agree with the reviewer.

Action taken:

➔ In order to account for the presence of typically more productive forests in areas affected by wind disturbances, Forest Europe-derived GSVs were rescaled based on the ratio between the average tree height computed over the wind-affected areas and the average tree height computed over all vegetated lands in the country. In such simplified approach, we implicitly assume a linear relation between GSV and tree height. Tree height values where retrieved from 1-km spaceborne light detection and ranging (lidar) data acquired in 2005 by the Geoscience Laser Altimeter System (GLAS) aboard ICESat (Ice, Cloud, and land Elevation Satellite), (https://webmap.ornl.gov/wcsdown/dataset.jsp?ds_id=10023) (Simard et al., 2011). Results are largely consistent with our previous estimates, yet the discrepancies between estimates derived from FORESTORMS and FORWIND are slightly lower than before. The tree height-based rescaling factors ranges between 0.8 and 1.24, with value lower than 1 only for the event Klaus occurred in France in 2009. We have noted that in our previous estimates we used the wrong damaged GSV for the Gudrun event. Now, numbers are correct. We have described the afore-mentioned method in the revised version and updated figure 3.

l268-270: I don't fully understand this

Action taken:

➔ We have rephrased the sentence as follows: "The high spatial variability of the considered metrics and the potential effects of additional environmental factors not considered in this exercise may potentially mask the functional relations between response variable and predictors. In order to reduce such potential sources of noise, response variables and predictors were spatially averaged over the sampled range of the predictors (bin sizes of 10% and 2 m/s for fraction of ENF and annual maximum wind speed, respectively)."

l276-277: I don't agree with this statement (think about Abies alba or Pinus sylvestris); I think it is mainly the prevalence of Picea abies that drives the relationship (for which the statement you give is correct).

We thank the reviewer for this comment. We agree.

Action taken:

➔ We have modified the sentence in the revised version as follows: "The emerging relation is likely driven by the relatively high abundance of Picea Abies in the sampled forest areas. Indeed this tree species is typically characterized by shallower rooting systems than other common species."

Figure 1: Can you put the units next to the scale bar, rather than in the figure header?

Action taken

➔ We have modified the figure according to the reviewer's suggestion. For consistency, we have also modified Figure 5.