Earth Syst. Dynam. Discuss.,
doi:10.5194/esd-2017-10-RC2, 2017

Earth System Dynamics Discussions

Interactive comment on "Estimation of the high-resolution variability of extreme wind speeds for a better management of wind damage risks to forest-based bioeconomy" *by* Ari K. Venäläinen et al.

Anonymous Referee #2

Received and published: 21 April 2017

General

The manuscript provides a framework in assessing the damage potential of extreme wind speeds on Finish forests applying a geospatial remapping technique on the ERA40-reanalysis. Results are compared to the original re-analysis output and on in-situ meteorological observations to assess the skill of the approach for a local test area. In general the manuscript is well written and structured, the area of research fits into the scope of ESD and also the topic is important in the perspective of interdisciplinary research, supporting the publication of the article in ESD. However, for final pub-

lication the authors should include some additional information on other mechanisms potentially affecting forests and re-visit and explain some of their statistical approaches including uncertainties, e.g. that the length of their observational data might be critical in assessing decadal return periods of wind extremes.

Specific

Title: The title includes a bit more promises than actually addressed in the body of the manuscript – for risk management an assessment of potential future changes is necessary. Investigations about future scenarios are however not addressed in this study. Therefore I suggest to modify/correct the title for this missing part of the analysis.

Abstract: The abstract is very extensive – At the end of the review the authors find a suggestion for a shortened version with focus on the very background and the most important findings.

1 Introduction

p1. l. 5: could you please add a few examples from the papers you cite which specific risks are impacting on the forests in Finland. p2. l. 35ff: The authors should add one or two sentences on the drawbacks of reanalysis data sets when the network of stations used for assimilation changes in space and time affecting the temporal and spatial covariance patterns. p3. l. 1ff: In my opinion the authors could improve the intro by adding a short paragraph on their downscaling cascade from large to their localized scale. I guess that at least three levels of complexities are involved. An important issue in this context is that a consistent approach is desirable where the subsequent downscaling steps comprise over the at least as complex structure as the preceding. For instance, given the assimilated or GCM derived large-scale circulation shows too strong biases (e.g. blocking frequencies) also the following steps do not compensate this shortcoming but inherent the information from the boundaries. This should at least be kept in mind to consistently interpret results and according uncertainties.

2 Material and methods

2.2 Estimation of return level for regional maximum wind speeds

p4 l. 1ff: I assume that also a seasonal component is into the variability of maximum wind speeds. The authors could add some information which processes drive maximum wind speed during different seasons (e.g. frontal based cyclonic maximum wind speed in cold fronts during winter half year vs. wind gusts originating from thunder storms that are operating during the summer seasons).

Another important information relates to the temporal basis. As much as I could infer authors use maximum monthly wind speeds. Using maximum daily wind data would provide a better statistical basis. However, in this case one also needs to account for the effect of serial correlated data.

A third issue involved in the analysis of extremes relates to the procedure of averaging – Are the values used for comparisons based on 6(x)hourly means or are they related to certain reading hours, i.e. instantaneous measurements without any temporal averaging ? This could for instance explain already part of the differences between ERA40 and observations. Given the comparable short length of the observational basis with the high value of return period it might also be useful to calculate shorter term return period, i.e. two and five years.

Discussion and conclusion:

How do other climate change studies (e.g. Bärring et al. 2017) addressing other climatic variables compare to changes that are potentially controlled by changes in extreme wind speeds?

Figure and Tables:

In general, on the small scale geographic information is missing at borders. It would also be helpful to include an inset covering the large scale surroundings. In addition, each map should have its own frame with lat/lon coordinates.

Table 1:

Please include the length of the individual meteorological recordings to better visualize the robustness in the estimation of the 10yr return period. If the length between the ERA40 and the meteorological station varies then only the common overlap period should be used. Another question is whether the direction of strongest wind direction is the same for both, the ERA40 data set and the meteorological observations, respectively.

Appendix Figure 1: For the comparison a similar basis should be used. Obviously the ERA40 data are based on maximum monthly wind speed whereas the boxplot is based on 10min readings. Again, it would be important to know the averaging procedure, especially for the Era40 interim data set.

Suggested Reference:

Bärring, L., Berlin, M. and B.A. Gull (2017) Tailored climate indices for climate-proofing operational forestry applications in Sweden and Finland, International Journal of Climatology, 37, 10.1002/joc.4691, 123–142.

Suggestion for modified abstract:

Abstract The bioeconomy has an increasing role to play in climate change mitigation and the sustainable development of national economies. In a forested country, such as Finland, over 50% of its current bioeconomy relies on the sustainable management and utilization of forest resources. In this paper, we examine the feasibility of the wind multiplier approach for downscaling of maximum wind speed, using 20 meter spatial resolution CORINE-land use dataset and high resolution digital elevation data. A coarse spatial resolution estimate of the 10-year return level of maximum wind speed was obtained from the ERA-Interim reanalysed data. These data were [Using a geospatial re-mapping technique the data] were downscaled to 26 meteorological station locations to represent very diverse environments typical for Finish landscape.

Applying a comparison, the downscaled 10-year return levels represent 77% of the observed variation among the stations examined. In addition, the spatial variation of wind multiplier downscaled 10-year return level wind was compared with the WAsP-model simulated wind. The heterogeneous test area was situated in Northern Finland, and it was found that the major features of the spatial variation were similar, but in the details, there were relatively large differences. The results indicate that the wind multiplier method offers a pragmatic and computationally feasible tool for identifying at a high spatial resolution those locations having the highest forest wind damage risks. It can also be used to provide the necessary wind climate information for wind damage risk model calculations, thus making it possible to estimate the probability of predicted threshold wind speeds for wind damage and consequently the probability (and amount) of wind damage for certain forest stand configurations.

Interactive comment on Earth Syst. Dynam. Discuss., doi:10.5194/esd-2017-10, 2017.