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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Incorporation of pollen data in source maps is vital for pollen dispersion models" *by* Alexander Kurganskiy et al.

Anonymous Referee #3

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Review of "Incorporation of pollen data in source maps is vital for pollen dispersion models"

General comments:

This manuscript compares several different methods for forecasting atmospheric pollen concentrations, specifically for the case of birch pollen emissions and transport in Europe. The authors have performed pollen hindcast simulations in the Enviro-HIRLAM regional model, using three different source maps. The simulations were performed both with and without calibration using observed pollen data. Forecast skill is compared using objective metrics, including both traditional (continuous) metrics, and threshold-based skill metrics calculated from the hit rates for forecasts of daily mean pollen concentrations falling into four classes.

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The study shows that calibration of pollen source maps using pollen observations significantly improved the model's performance on these standard metrics. Since the data used for the calibration of the model are the same data used to evaluate the model, this is unsurprising. The authors acknowledge that this is the main methodological limitation of the current study.

My main comment addresses this limitation. Specifically, the authors should consider whether a portion of the available data could be withheld from the calibration dataset, and used for evaluation. If this is not possible, they should more clearly explain why it cannot be accomplished. Also, the comment that "calibration uses annual or multi-annual average whereas the evaluation primarily concerned correlation and RMSE" should be clarified (e.g. by adding more details about the calculation of the metrics and calibration procedure).

In addition to this main comment, the authors should consider addressing the specific comments below. Additionally, the manuscript should be edited by a native speaker for English grammar and usage.

Specific comments:

1. p.5, l.19: Atmospheric models often assume aerosol shape factors and densities of 1 for simplicity; pollen grains can diverge significantly from this. Please comment on whether/how this is considered in the simulations described here. 2. p.5, l.26-27: please provide more detail about the correction for 2-m air temperature. 3. Description of SPIn method: The evaluation of maps calibrated with SPIn method plays a major role in this study. The method used for this map calibration is described in a cited paper (Prank et al., 2013). However, since evaluation of simulation results that use maps calibrated using this method is a central part of this manuscript, I think the calibration procedure should be described in a bit more detail. The method is mention on page 4 (lines 9-13), and there is a brief discussion of the method on page 5 (lines 30-34). A bit more detail should be added here to explain, briefly, how the ratio of modelled and

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observed concentrations at 15 stations has been interpolated to create a ratio that is applied to emissions across the domain. 4. Presentation of metrics: the comparison of the different approaches using statistical metrics is an important aspect of this paper. Currently, the definitions of the acronyms are buried in the text, and the threshold-based metrics, which are likely less familiar to readers, are only available in referenced literature. I recommend briefly restating the definitions of the threshold-based metrics in a table or appendix. I also recommend summarizing the threshold value Cth and the ranges of concentrations for the low, medium, and high classes in a small table, so that readers can more easily reference this information. 5. Choice of metrics: The authors point out that the RMSE is highly sensitive to outliers (large discrepancies), which may limit its usefulness as a metric for this type of forecasting. Please consider whether metrics that have more recently come into use, such as the fractional absolute error (Yu et al., 2006), might be appropriate to use in addition to, or instead of, the mean bias and RMSE. 6. p. 8, l. 30: Clarify whether the bias is related to the general behaviors of the atmospheric model (e.g. the meteorology and simulated transport), or is a feature specifically of the parameterization of pollen flowering. 7. p. 9, l. 6-12 and l. 17-19, p. 10, l. 6-9: The authors attribute the remaining errors in pollen forecasts, after calibration of the pollen maps, to a need for additional improvement in the input datasets, and in the level of detail or calibration of the maps. I do not think that the results presented here are sufficient to support that conclusion. Other possible sources of error also need to be considered, and should be mentioned here (e.g., timing of pollen release, simulation of transport and removal processes). 8. Table 1 caption: Caption should be revised to include more information about how the metrics were calculated, in order to assist readers in interpreting the results. (e.g., metrics were calculated from daily mean modelled and observed pollen counts, using all available station data for both simulated domains, over X time period). Also, please clarify what the p-value refers to here. 9. Figures 2, 3, and 5: The red/green color bar used in Figure 2, and the color choices for the line plots in Figures 4 and 5, are probably not very colorblind-friendly. The authors may wish to consider choosing different color

schemes to make these figures accessible to more readers.

Technical corrections:

References: Yu, S. , Eder, B. , Dennis, R. , Chu, S. and Schwartz, S. E. (2006), New unbiased symmetric metrics for evaluation of air quality models. Atmosph. Sci. Lett., 7: 26-34. doi:10.1002/asl.125

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