Response to the reviewer's comments to the paper by Sofiev et al, MACC regional multi-model ensemble simulations of birch pollen dispersion in Europe.

We would like to thank both reviewers for their comments and suggestions to improve the paper.

Below, we provide responses to the comments.

Reviewer 1

R. However, there is a number of points that should be improved (see specific remarks). In addition, the use of the English language should be checked (especially the use of articles, some examples are given in the specific remarks).

A. The paper has been proof-read and its grammar and style have been cleaned

Specific comments.

1. Line 156: treaded => treated

OK.

2. Line 191: provide a reference or justification for stopping the pollen release for RH>80%.

Done

3. Lines 240 and 241: provide references for the diameter and for the density.

Added

4. Line 208: add article before "Alps" 5. Line 217: the language should be improved: : : :most samplers were located at heights from 10m to 30m on the roofs of suitable buildings.

OK, thanks you!

6. Line 293: what period was used to calculate the statistics?

Whole season. Clarification added

7. Line 305: add article: over the majority; replace "or" by "of"

Done

8. Line 309: How is the season start defined?

It is introduced at the Results section: the date when 5% of the cumulative seasonal total is reached. The clarification is added.

9. Line 334: How about uncertainties in the birch distribution?

Well, section 4.2 considers only two "non-trivial" uncertainties, where some analysis is possible. For the sake of completeness, we now added the habitat map in the list.

10. Table 1: Most models have just very few vertical layers. It is very hard to imagine that birch pollen transport can be modeled with just three vertical model layers (LOTOSEUROS). Please provide justification for the use of just 3 vertical levels (e.g. in line 230).

This is indeed an interesting issue but not the major limitation in the current case. In dispersion modelling, most of models use different (low) resolution of dispersion-model vertical but still analyse full resolution of the underlying meteorological data. It has been shown that accurate treatment of meteorological vertical allows for including the bulk of information with just 5-10 "thick" vertical layers inside the troposphere. LOTOS-EUROS has dynamically adjusting layers following the boundary layer top, which partly compensates the inaccuracy coming from consideration of just 3 layers. A short note and a reference are added, Table 1 is refined to make the distinction clear.

11. Figure 4: Make sure "zero" appears just once in the color bar.

This is actually a misprint: values like 0.1, 0.2 have been truncated to 0. Corrected.

12. Figure 6: It is hard to see the difference between the two left panels and the two right panels, respectively. I recommend to use a categorical color bar (as in Figures 1-5).

Well, the difference is hard to see because it is small, as also stated in the text. The whole idea of this figure is to show that the season timing is among the most-accurately reproduced quantities, including the south-north propagation of the season. And the maps of its start obtained from the model and from the measurements are very similar. We changed the color map and the legend to increase the contrast of the pictures but this certainly did not change their similarity. In fact, this very similarity is the reason why we introduced the difference map in figure 7 (see below).

13. Figure 7: the upper right plot implies that the model performance at the northeastern stations is much lower than at the rest of the stations. However, I assume that this impression is just due to the large birch pollen concentrations in north-eastern Europe. Normalizing with the median of the station data could help. Again, in the lower right panel a categorical color bar should be used. It is impossible for the reader to distinguish between 0.0 and 0.2.

Unfortunately, the absolute bias in the north is the feature of the season of 2013 and the source term, which strongly diverged. The season was anomalously low in the north (see figure 3 and related discussion), whereas the source term does not have such mechanism, which has caused the bias.

Additionally, it is important to provide information on the significance of the correlation coefficients (p-values or 5% level). Without this information, the correlation coefficients cannot be interpreted.

Significance values have been added as sizes of the station circles.

It seems to me that the upper left panel is just the difference between the left panels of Figure 6. If that is the case, it can be omitted.

This is true but, as discussed above, the maps of the figure 6 are very similar, so the zoom into the error makes sense, showing that there are still some stations where the error in the season prediction is far from perfect.

14. Figure 8: label all y-axes and provide significance information for the correlation coefficients.

Done

15. Figure 10: Why do the relative frequencies in the left panel not sum up to 1? What period is the right panel based on?

This is just a normalizing factor: the sum is 8, which is the number of ranks. Changed to 1. As all other data, 15.3-24.6 (added to the paper as stated above).

Reviewer 2

The following editorial comments have all been introduced. Thank you very much for the detailed suggestions!

1. L60: may be better "tree" instead of "plant" 2. L69: replace "transportation" to "atmospheric transport" 3. L71: may be better to use "XX century" instead of "previous century" 4. L81: replace "Mikhail Sofiev et al" to " Sofiev et al" & replace "Yli-panula" to "Yli-Panula" 5. L95: replace "M. Sofiev et al" to "Sofiev et al" 6. L94: may be make a web-link to the model (SILAM) here or on L166; can be it also done for other 6 models used 7. L110: replace "to present the results" to "to present and evaluate the results" 8. L112-L116: may be this paragraph can be omitted 9. L124: replace "pollen transport" to "pollen atmospheric transport" 10. L126, L134, L141, L150, L154, L159, L166: it will be better if all model names will be spell-out in complete as it is done for the SILAM model in lines 94-95 11. L146: replace "An Eddy diffusion" to "An eddy diffusion" 12. L156: replace "treaded" to "treated" 13. L160: replace "semi-lagrangian" to "semi-Lagrangian" 14. L172: make similar writing for 3D & 4D-VAR for L143 15. L176: may be add in title of 3.2 word "pollen" 16. L183: replace "temperature sum" to "air temperature sum" 17. L189: may be better to use "accumulated to-date" instead of "accumulated to-day" 18. L190: replace "humidity" to "relative humidity (RH)" 19. L194: may be better to use "calm conditions" instead of "still conditions" 20. L202: replace "following members" to "following 11 members" 21. L215: "from March to September" vs. "from March till September" (e.g. location/to vs. time/till) 22. L226: is it necessary to mention "GMD MACC special issue" -> omit?; or it is enough to use the reference + add it to the section 8 "References"; + same on L123 23. L227 vs. L231: identical values for domains; write only once, just mentioning in words the same boundaries 24. L234- 235: use/write only once "m" for vertical levels (fx. : : :3000 and 5000m) 25. L239: may be better "were used" instead of "were picked" 26. L253: replace "The season was" to "The duration of the season was" 27. L261: clarify: "tens of times" vs. "ten time" vs. "ten-fold" 28. L271: may be replace "pollen index" to "SPI" (defined in L258) 29. L280: replace "four time moments" to "four episodes" 30. L287: re-write "southern blow shown" 31. L292: replace "all relying" to "all are relying" 32. L297: may be re-write in passive voice instead of "we" 33. L297-298: replace "features of the pollen season" to "features of the 2013 birch pollen season"; and then exclude "of the 2013 birch pollen season" from title of section 5.1 (L301-302) 34. L304: re-write "Comparison of : : : Figure 7 demonstrates that" to "Analysis showed (see Figs. 6-7) that" 35. L310: replace "largely decided" to "largely influenced" 36. L311: replace "affecting or passing" to "affecting or pollen cloud/plume passing" 37. L313: may be better "large-scale"

instead of "continental-scale" 38. L317: replace "over the continent" to "over the European continent" 39. L323: may be better "Central Russia" instead of "Moscow"; see L443 40. L348: replace "plumes from" to "pollen plumes from" 41. L349: replace "exacerbated by" to "influenced by" 42. L358: replace "is largely" to "was largely" 43. L370: replace "thevertical wind" to "the vertical wind" 44. L384: replace "by the long-range transport" to "by possible long-range transport" 45. L399: replace "doubts" to "concerns" 46. L403: replace "has proven beneficial" to "has proven to be beneficial" 47. L405: may be better "shortest shifts" instead of "smallest shifts" 48. L407: may be better "new area" instead of "young area" 49. L432: replace "is created" to "was created" 50. L433: replace "European chemistry transport" to "European atmospheric chemistry transport" 51. L444: replace "was jeopardized" to "was influenced"

Extra general comments:
it might good to include also reference(s) to publication(s)/ guidelines for ensemble model comparison statistics (in section 4.2; L290+).
Clearly specify for which period (exactly: start-end of pollen season, number of days) statistical evaluation is performed/ done in this study. Clarify that/if results are statistically significant (in particular, fx: for estimated correlation coefficients). In section 3.2, although there are useful references which are listed in Sofiev et al. (2012) paper, but may be some of those can be added in this section too, where it is applicable.
Recheck all references to publications throughout the text comparing with section "References" as well as recheck places where links to Figures are pointed. Make an extra check for English language throughout the text.

The references have been added into the section 4.2, where we also specified the period; p-values are added to the figures; references in the paper are maintained by the reference manger, so their consistency is automatically enforced. We also tried to improve the language.

Comments to illustrations:
1. Table 1: as main birch pollen sources are placed within the lowest layer, include also information on how many (vertical) levels are included within the atmospheric boundary layer
Well, this is not straightforward: boundary layer thickness varies strongly during day, so as the number of model layers within it.

2. Fig 3: is it also possible to include a difference plot between 2010 & 2013
Done

3. Fig 4: may be this figure can be omitted
This figure is introduced as a single answer to two questions: (i) whether birch pollen is transported sufficiently far to require the regional-model forecasts, (ii) how different the models can be if the source term and input meteo are identical. The corresponding discussion in the paper relies of this figure, so its removal would create problems in the text.

4. Fig 6: may be better to use/ replot colorbars at the same scale
The figure contains three distinctly different types of quantities: two bi-directional ones (bias and time shift) should be shown in binary colour map ("over-under" still distinguishing the absolute concentration from time), one fixed-range quantity (correlation) can also be shown as binary ("bad-good"), whereas the RMS is good with typical colour palette of "the higher the worse" type. These quantities also have strongly different physical meaning, which we reflected in choosing the different scales. Turning them all into a single palette would make them non-distinguishable for a quick look.

5. Fig 9: may be better to use the logarithmic-scale for the left figure
Done

may be better to write for figures — a), b), c), d) instead of – left-top, low-right, etc.;
Done

enlarge individual figures (in Figs. 5,6,7) by excluding empty-white areas between;
Done

where it is possible (e.g. when all 4 colorbars are on same scale) keep only one legend/colorbar;
Done

note - all captions/ text for each figure should be self-explanatory
The captions have been reviewed and extra information added to make them self-sustainable