Geoscientific
Model Development
Discussions

Interactive comment on "A prognostic pollen emissions model for climate models (PECM1.0)" *by* Matthew C. Wozniak and Allison Steiner

Anonymous Referee #1

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This is an outstanding body of research for which I congratulate the two authors (Matthew Wozniak and Allison Steiner). The development of models of pollen emissions for use within regional and global climate models to simulate pollen counts over the seasonal cycle based on geography, vegetation type and meteorological parameters is cutting-edge research with, as the authors point out, a number of important applications.

The manuscript is beautifully written and presented.

Thank you.

The following comments and corrections will further improve this already excellent manuscript.

General: Throughout the manuscript the word "climatological" or "climatology" is used instead of the word "average" or "mean" with regard to pollen. For example, lines 161-162 state that: "For deciduous broadleaf forest (DBF) taxa, the Southeast has the highest climatological pollen maximum reaching up to about 700-1200 grains m-3 around day 100.". This is confusing because it is applied to a non climatic/meteorological variable, and because it is used in a manuscript which also focusses on climate. It would be much better to simply state: "For deciduous broadleaf forest (DBF) taxa, the Southeast has the highest average pollen maximum reaching up to about 700-1200 grains m-3 around day 100.".

Similarly, lines 159-160 could be modified from: "Figure 2 shows the observed climatological PFT daily pollen counts averaged over all stations within the defined subregions." to: "Figure 2 shows the observed average daily PFT pollen counts averaged over all stations within the defined subregions.".

And so on.

Line 17, Abstract: "PFT" is used without being given in full earlier in the Abstract, so please provide both the full and abbreviated form here.

Line 40, Introduction: The authors may wish to refer to two recently published works that relate to the introductory material here and/or elsewhere in the Introduction:

Sofiev M, Prank M. Impacts of climate change on aeroallergen dispersion, transport, and deposition. In: Beggs PJ (Editor). Impacts of Climate Change on Allergens and Allergic Diseases. Cambridge University Press, Cambridge, 2016. pp 50-73.

Beggs PJ, Šikoparija B, Smith M. Aerobiology in the International Journal of Biometeorology, 1957–2017. International Journal of Biometeorology 2017. DOI: 10.1007/s00484-017-1374-5 [see section on "Aerobiological modelling and forecasting"]

Line 98: This sentence makes reference to "the Finnish emergency modeling system

(SILAM)". It would be better to change this to "the Finnish System for Integrated mod-eLling of Atmospheric coMposition (SILAM)" as given in the Introduction section of Sofiev et al. (2013).

Line 130, paragraph 1 of section 2.1: Table 1 does not relate to "NAB pollen count data ranging from 2003-2010 at all stations in the continental United States", so delete reference to it and just refer to Figure 1.

Line 139: This line includes a reference to Table 2. There is no Table 2 in the manuscript. Should it be Table S2?

Line 140: Change "Cupresseceae" to "Cupressaceae".

Lines 155-159, paragraph 1 of section 2.2: Currently just two of the four boundaries of each of the five subregions are provided. Please provide upper and lower limits of both latitude and longitude for each subregion.

Lines 161-170: The paragraph in these lines seems to contain several values that do not match what is shown in Figure 2. Specifically, deciduous broadleaf forest (DBF) taxa in the Southeast does not have an average pollen maximum reaching up to about 700-1200 grains m-3. Figure 2b shows that it only reaches up to about 500 grains m-3. In the Northeast, DBF does not reach up to an average of 400 grains m-3. It peaks just above 240 grains m-3. And finally, a sharp maximum of 775 grains m-3 does not appear in the Mountain subregion. The sharp maximum is only about 360 grains m-3. The paragraph should be carefully checked.

Line 173: As above, please check the numbers 400 and 200 in this line.

Lines 184-186: The discussion regarding C3 and C4 grasses here and/or elsewhere in the manuscript may be enhanced through reference to the following article:

Medek DE, Beggs PJ, Erbas B, Jaggard AK, Campbell BC, Vicendese D, Johnston FH, Godwin I, Huete AR, Green BJ, Burton PK, Bowman DMJS, Newnham RM, Katelaris CH, Haberle SG, Newbigin E, Davies JM. Regional and seasonal variation in

C3

airborne grass pollen levels between cities of Australia and New Zealand. Aerobiologia 2016;32(2):289-302. DOI: 10.1007/s10453-015-9399-x

Line 278: Change "met" to "meteorological".

Line 343: With respect to the Parry et al. 2007 citation, it should be Confalonieri et al. 2007 because the former are the book editors and the latter are the chapter authors. Change also in the References list (i.e., chapter authors first, book editors later in the reference). Further, here and/or elsewhere in this paragraph (lines 342-352) could benefit from reference to the following:

Ziska LH. Impacts of climate change on allergen seasonality. In: Beggs PJ (Editor). Impacts of Climate Change on Allergens and Allergic Diseases. Cambridge University Press, Cambridge, 2016. pp 92-112.

Ziska L, Knowlton K, Rogers C, Dalan D, Tierney N, Elder MA, Filley W, Shropshire J, Ford LB, Hedberg C, Fleetwood P, Hovanky KT, Kavanaugh T, Fulford G, Vrtis RF, Patz JA, Portnoy J, Coates F, Bielory L, Frenz D. Recent warming by latitude associated with increased length of ragweed pollen season in central North America. Proceedings of the National Academy of Sciences of the United States of America 2011;108(10):4248–4251. DOI: 10.1073/pnas.1014107108

Line 359: This line includes a reference to Table 2. There is no Table 2 in the manuscript. Should the reference be to Table 1?

Lines 505-507, section 5.2.4: This sentence, and this section, seems to neglect any mention that the first of the two observed ragweed peaks in the Mountain subregion (from about day 100 to day 140) is entirely missed by the model.

Note also that the lower row of plots in Figure 12 is mislabelled (except for the first in the row). What are currently r-u should really be q-t. q was missed somehow.

Line 532: See earlier comment regarding Parry et al. 2007. Also, a couple of additional references that would be strong support for this sentence are:

C4

Lake IR, Jones NR, Agnew M, Goodess CM, Giorgi F, Hamaoui-Laguel L, Semenov MA, Solomon F, Storkey J, Vautard R, Epstein MM. Climate change and future pollen allergy in Europe. Environmental Health Perspectives 2017;125(3):385–391. DOI: 10.1289/EHP173

Ziello C, Sparks TH, Estrella N, Belmonte J, Bergmann KC, Bucher E, et al. Changes to airborne pollen counts across Europe. PLoS One 2012;7(4):e34076. DOI: 10.1371/journal.pone.0034076

Line 570: Change "estimating" to "estimation".

Line 584: Change "Association for" to "Academy of".

References: These should be carefully checked to ensure the details and format are correct. Details should be carefully checked against the PDF of each article.

Line 731, Figure 1 caption: Instead of using the word "black" to describe the shading of the Pacific Northwest subregion, perhaps the term "dark grey" would be better.

Figure 2: The RAG and GRA lines are too similar. They are fine when enlarged on screen but when printed they are difficult to tell apart. Perhaps one could be red and the other black (meaning the four lines would be black, red, green, and blue).

Line 733, Figure 2 caption: As stated earlier in the comments with respect to the manuscript as a whole, remove the word "climatological" and replace it with "average", such as: Average daily observed time series of pollen count data . . .

Line 740, Figure 3 caption: BELD is defined as "Biogenic Emissions Landuse Database" in Section 3.1 paragraph 2, not "Biogenic Emissions Land cover Database" as it is here in the figure caption. Which is correct?

Line 748, Figure 4 caption: Indicate that ragweed is "(g)".

Line 757, Figure 6 caption: Change the start of the caption to: Monthly average pollen emissions potential . . .

Lines 777-782, Figure 12 caption: Change the three occurrences of climatological/climatology. The caption can start: Average daily (2003-2010) time series of pollen counts . . .

Line 778: Change RAG from "p-u" to "p-t".

Line 782: Add to the end of the very last sentence "by region and PFT", i.e.: Note: scale of y-axes varies by region and PFT.

Table 1: The numbers in the production factor (P) column should include the same number of numbers after the decimal point (I suggest 1, e.g., 89.1, 210.0, etc.), and the numbers should be aligned right in the column, not aligned left.