Authors response on the Anonymous Referee #2 review of "Modelling the European wind-blown dust emissions and their impact on PM concentrations" by

Marina Liaskoni (acp-2022-804)

We thank Anonymous Referee #2 for his comments. We address each of them and our point-by-point responses follow below. Reviewer's comments are *italicised*.

General comments:

In most of the cases the highest impact of wind-blown dust on PM2.5, PM10 and PM components is observed in Berlin, Munich, Prague and Warsaw. The reasons for that should be stressed in the discussion part. What are the similarities/differences for those cities?

Authors' response: Our emissions fields generated by the WBDUST produce high emission fluxes near each city in general, so this is not only the case of the mentioned cities but is evident also over e.g. the Ruhr area in Germany or over the Benelux states with dense urbanization. The reason is detailed in the manuscript and is that the MODIS data provides zero (or near zero) LAI values for urban areas. Then if there is a significant fraction of urban landcover within a model gridbox, the average LAI over the entire gridbox will be below the threshold (0.35) so the model evaluates the non-urban fraction of the gridbox as "WBD emitting", even if the LAI over the non-urban fraction (which are usually crops/forests) has LAI over the threshold. In the revised manuscript, we present a sensitivity test (new Fig. 6 in the revised manuscript) where, for such partly urbanized gridboxes, we averaged the MODIS LAI data in a way that we excluded the lowest LAI values that correspond to the urban fraction. This led to an evident decrease of emissions near cities.
The mentioned cities, in this regard, exhibit this behavior due to the fact that they are surrounded by forests so, due to what is mentioned above, the WBDUST model produces local dust emission peaks over these areas even if there should be no emissions or at least much lower emissions.

Figs. 4, 5, 9-12, 13, 14, 15, 16, 20, 21, 22 should have the same scale of Y-axis among analyzed parameters. This will facilitate direct comparison of the analyzed values. Now, e.g. in Fig. 16 the maximum concentrations on Y-axis vary between 75 and up to 200.

Authors' response: Yes, we agree that some of the plots should have the same scale of the Y-axis. We however want to keep different scales for the FCRS (fine mode dust) and CCRS (coarse mode dust) as the masses emitted in each of the modes differ greatly (which is logical). Specifically (referring the original manuscript Figure numbers - in the revision, new figures appeared so the numbering changed):

- Fig 3 and 5: for CCRS the scales are the same, but for the diurnal cycle of FCRS we have chosen a smaller scale to make the cycle more clear.
- Fig. 4: we kept the different Y-axis due to the above mentioned fact (FCRS vs CCRS)
- Fig. 9-10 will have a common Y-scale, Fig 11-12 will have also a common Y-scale, however due to the fact that PM10 values are much higher, this will be different from Fig. 9-10.

- Fig. 13: We unified the vertical Y-axis scale for all subplots. The same for Fig 14 (however, these are PM10 so different scale than for 13 which is PM2.5)
- Fig. 15: we unified the Y-scale for all PM2.5 impacts
- Fig. 16: we unified the Y-scale for all PM10 impacts
- Fig. 20-22: we unified the Y-scales, ranging from -1 to 1 (in case of PSO4, as only positive impacts are encountered, we set the range to 0-1).

Specific comments:

Line 4: replace „wind-blow dust" by „wind-blown dust"

Line 193: replace „wind-blow dust" by „wind-blown dust"

Line 292: replace „wind-blow dust" by „wind-blown dust"

Line 340: replace „wind-blow dust" by „wind-blown dust"

Line 364: replace „looked at" by „aimed at"

Line 408: replace „bair soil" by „bare soil"

Line 429: replace „wind-blow dust" by „wind-blown dust"

Line 462: replace „Mg+" by „Mg++"

Authors' response: All specific comments/corrections were implemented in the revised manuscript.

Lines 687-694: 3 references appeared between Figs. 1 and 2, they should be placed before Fig. 1

Authors' response: Resolved.