**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Implementation and testing of a simple data assimilation algorithm in the regional air pollution forecast model, DEOM" *by* J. Frydendall et al.

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Reviewer 512

Questions by the reviewer is highlighted with blue fonts and the answers from the authors are highlighted with red fonts to better distinction between the questions.

Page 7646, Line 20: define "chemical weather". Page 7646, Line 26/Page 7647 Lines 1-9. This statement needs to be clarified (if not deleted). "Chemical weather" prediction accuracy does depend on the meteorology driving the dispersion and chemical processes. If weather forecasts need data assimilation to produce accurate forecasts, so do air quality predictions, since the weather component is a fundamental aspect of it.

Answer to reviewer: The expression "chemical weather " is an expression recently adapted in the air pollution community (specific defined in Lawrence et al.,) so that it can be seen as analogous to the meteorological weather. The total difference between chemical weather and meteoroligical weather is that making a weather forecast without assimilating the meteorological paramters would not make any real weather - meaning results that can be compared to measurements. Making a weather forecast without assimilation gives a free model run - which of course is used in the climate modelling community. However, making a realistic air pollution forecast can be done without performing chemical data assimilation (of course we still need the meteorological data assimilation), since the model results are still bound by emissions and chemical life times.

In fact this statement seems to contradict what stated at Page 7648, Lines 6-9. Please clarify.

Answer to reviewer: There is no contradiction - even though it is possible to make realistic air pollution forecasts without data assimilation, the results from an air pollution model is still uncertain due to uncertainties in the different components included in the model (as e.g. discretisation errors or parameterisations)

Page 7647, Line 5: "long range", specify.

Answer to reviewer: The word "long range transport model" is a commonly used expression in the air pollution community for models covering scales larger than some hundreds om km. Typically the domain size is 5000 km x 5000 km.

Page 7647, line 11: "half a decade". Provide a reference.

Answer to reviewer: To the authors opinion a reference is not needed her since it is commonly known that numerical weather forecasting, including simple data assimilation started in the 1950ties. However, we have included the reference Gandin (1963)

L S Gandin. Objective analysis of meteorological fields. In Program Scientific Translalions, 1963.

Page 7649, Lines 13-17. The three-layer modeling approach should be better explained/justified since at first sounds as quite a technical limitation.

Answer to reviewer: The three layer modelling approach is a commonly used setup where the model layers represent layers physically existing the lower atmosphere. Models like LOTOS in the Netherlands or REM3 in Germany have previously used this approach. The reviewer is correct that it is a technical limitation com-pared to a full 3D model, but it has been used as a solution for saving computing time, which is important when producing air pollution forecasts on an operational basis.

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Page 7649, Lines17-18: "good results" (line 18) should be substitute with a more specific statement, and it should be briefly described which kind of models where included in the inter-comparison studies.

Answer to reviewer: The sentence in the paper is changed to "The model has been a part of various inter-comparison studies and has shown comparable results with similar models, see e.g. Tilmes et al. (2002)."

Page 7650, Line 13: is 40 km "high resolution"?

Answer to reviewer: No the 40 km x 40 km resolution is not high resolution, but an urban background model with resolution of 1 km x 1 km as well as a street canyon model with the resolution of meters has been coupled to the regional scale model, this urban model resolution is considered to be (very) high resolution.

Page 7652: "personal communication". The authors should find a peer-reviewed reference to back-up this statement.

Answer to reviewer: The "personal communication" has been removed

Page 7652, Line 19: "Given the wind...". Where?

Answer to reviewer: What is meant by "where"? The conponents of the wind V(u,v) is included in the expression (6) via phi=v/u

Page 7655, Line 23. A map with the spatial distribution of the observations would be

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useful.

Answer to reviewer: The overall testing of the performance of the different data assimilation configurations is carried out as a mean over all measurement stations and therefore a map showing spatial distributions would not give any further information. The statement in the paper at line 23, page 7655 contains a general consideration in principle valid for all locations.

Page 7656, lines 18-20. Give briefly the rational for selecting the listed experiments.

Answer to reviewer: The following sentence has been included in the text: "the rational for selcting the following experiments is based on individual and combined tests of the individual methods described in the paper".

Page 7657, Lines 13-16. Give briefly the rational for selecting the listed strategies.

Answer to reviewer: The rational for selecting the listed strategies is already included - namely different averaging methods - making it possible to distinguish the temporal and spatial signals from each other as well as together.

Page 7658, Lines 5-7. Give briefly the rational for selecting these metrics.

Answer to reviewer: The metrics are the ones commonly used when validating air pollution models. The three metrics, the correlation coefficient, the bias and rhe RMSE each gives a measure of the performance of the variability, the overall distance between observations and model results and the two together, respectively

Page 7659, Line16-17. Have the authors explained how these weights are determined?

Answer to reviewer: Yes - the weights are determined using the Hollingsworth method , explained in the paper.

Technical corrections

Answer to reviewer: All the Technical corrections have been implemented into the text.

Also the authors should check the captions of all the figures with multiple panels where at time top and bottom seems to be confused with left and right

Answer to reviewer: the mauscript is optimized towards the ACP format and therefore the figures are aligned in the rigth "upper"/"lower" format.

References

L S Gandin. Objective analysis of meteorological fields. In *Program Scientific Translalions*, 1963.