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Geoscientific Model Development Discussions

Interactive comment on "Tracking influential haze source areas in North China using an adjoint model, GRAPES–CUACE" *by* X. Q. An et al.

Anonymous Referee #2

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The paper "Tracking influential haze source areas in North China using an adjoint model, GRAPES–CUACE" announces the development of the adjoint component of the GRAPES–CUACE aerosol model. It describes some tests presented as an elementary validation of the module. Finally it uses a few days of data from two stations in the surroundings of Beijing in an application example. The topic is appropriate for GMD and the results may be valid and interesting, but the presentation needs significant improvements in order to qualify for publication. There is no sufficient information in the manuscript for a reader not familiar with the work to grasp the meaning and significance of the work. There are deficiencies in style, english language and mathematical notation making it difficult to read. The explanation of the actual technical development, the adjoint of the aerosol model is not sufficiently detailed nor clear. In particular the focus

of the paper is unclear: is it a technical development or an application example? In the first case the actual development of the code should be better described including better theoretical justification and a more thorough description of the testing process of the software. In the second case, two stations for a few days are not enough to constitute more that just a small application example. In order to be accepted for publication in GMD many sections of the paper should be rewritten in a more clear style. I am adding some specific comments below.

7314

Abstract

l15 "The adjoint model was used to quantify the effects of emission-sources reduction in different time intervals over different regions by one independent simulation." Independent of what?

l19: What is influence effectiveness?

l20: "The influence of emissions on the objective function decreases sharply approximately for the pollutants emitted 17–18 h ago in this episode." It is unclear what this phrase means. Does "ago" mean "previous to some point in time" that is somehow related to measurements? Which episode are you referring to?

It can be understood that the authors want to show that using an adjoint model is better for policy than targeting administrative regions. But the wording could be clearer.

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l9: DDM (and TLM) reference?

l17 is Complex Analysis relevant for this particular setting?

22 "substantial" means "large" or "many"?

27 model input parameter : only one parameter?

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l 20 Please do not use "etc." refer explicitly or delete.

l 24: What do you mean? You should't use “hopefully” in this context. It is or it is not. 7317 l12 "Some scientists consider the distribution of population density as well as pollutants exposure – healthy reaction relationships in the objective function.” The sense of this phrase is obscure. Please rewrite more clearly. l23 Where is the description of CUACE? Gong 2003 is about the Canadian Aerosol Module CAM module development.

7319

l5 Rather than how complex the task is, it would be more suitable description of the objective. How are you going to use this development? Why the task is being performed?

l6 "Abstract one small program as a vector function” what do you mean? Are you referring to coding in the general theory section?

l12: Continuously differentiable at given spots of ? what is a ‘spot’ in mathematical terms? This is not standard mathematical terminology, do you mean in a neighbourhood of a point? Do you mean at all points in a subset of the domain?

l 15 The notation for the transpose is confusing. What is the precise definition of the T next to the nabla operator? Define precisely.

l 17 Is this ”mathematical formula” an identity where the parenthesis represent an internal product (the usual one?) in the Hilbert spaces Rˆn and Rˆm? You should clarify that this has to hold for any X and Y to be valid.

7320

l2 This equation is confusing. If the T are applied to the Nabla operator you will end up with the definition in page 7319 l 15. I think you mean (\Nabla_{x_0} F)ˆT or the transpose of the matrix corresponding to the tangent linear model (a linear transformation

between vector spaces).

l5 Are the gradient factors the \Nabla Fs? Style: use of obvious. If it is obvious, omit it. If not just explain. The phrase is too long. The *number* of concerned. . .

l6 the number of concerned variables.

l9 Which information?

l 10 Demonstrated? This is not a demonstration in the mathematical sense. Rephrase. The superiority of the adjoint method for what? Do you need the passive voice here?

7321 l 9 Table 1 needs to be explained. For example: what is a? What is Index, xrow and rhop? l 12: “can then be tested on this basis”: on which basis?

l13: Need to clarify that the Eq. has to be valid for all possible combinations of X and Y

l15:it is simpler but more limited that exploring a larger subset of the domain space. Is it really sufficient to test it only for the square (the norm)? Have you performed additional tests?

p 7322

Table 2 needs more explanation as for Table 1. What are the columns and the rows?

l 7 If the focus on the paper is presenting a new model you should explain better the validation process.

l 20 tend to take?

l 21 What are 'emissions reduction enforceable ratios range'?

7323 by simple and complex you mean one dimensional vs multi dimensional? Confusing.

l13 emission inventory optimisation problems, this is not done in this article. Clarify.

l16 what do you mean by the solution of a function? Solution of some equation per-

haps?

7324

Observations: period observed, time resolution, precision, accuracy are not even mentioned.

7325

l2, l5 You can give the coordinates of these locations for those unfamiliar with the Chinese geography. Or put the names in the map.

l 24 what is the acceptability criterion? 7326

l1 Here, the objective function J is essentially a projection. Combined with the adjoint model it is analogue to the 'footprint' as it is often called in the inverse transport community.

l7 Is Q a constant in time and space?

l9 It is not essential to have the same unit as J. Sensitivities given as ratios of magnitudes can have a physical meaning.

l15 Who is 'we'? Is there a specific program of the Chinese government doing this?

l20 This sounds like the so called 'integrated footprint'

l 24 the districts are not marked in the map.

l 26 I think presenting the sensitivity coefficients in units of concentration is misleading. It would be more crear using the original unit (\mu g /m/s ?).

7327

l11 Is this just because of passive transport or there is an effect of deposition as well?

l17 Maybe complement, not compliment.

l21 Are these regions defined based on the results of the previous calculations?

28

l4: What does vertically mean? In space or in the matrix?

l17, Cutting emissions after the pollution event can never have effect on the past. What do you mean here?

l20 before giving policy recommendations the method should be put to test in more diverse meteorological situations and using more data. The statistics of one case study are hardly conclusive.

Table 4: what is the unit of the last two columns?

p 7329

l9 There is not enough detail on the construction of the adjoint to conclude that the adjoint was constructed here. Please add more details in the relevant section on how exactly the adjoint was calculated.

l22 The calculations correspond to a very limited case study. In order to conclude about the effectivity of the method and give policy recommendations you need a more substantial statistical analysis.

References: Maruk should be Marchuk

7338 fig 1: is it Frame work or framework? there is a trailing parenthesis ')'

Figure 4 shows hourly variation of ground level BC concentration in Beijing. Clarify that it is the modelled connections and make explicit what Beijing means (point or area)

Interactive comment on Geosci. Model Dev. Discuss., 8, 7313, 2015.