

Interactive comment on “Evaluating model performance of an ensemble-based chemical data assimilation system during INTEX-B field mission” by A. F. Arellano Jr. et al.

Anonymous Referee #3

Received and published: 19 October 2007

Overall this is a very good manuscript. The topic of atmospheric constituent assimilation is relevant and the application in context of an intensive airborne field campaign makes excellent use of available assets. The presentation of the assimilation technique and construction of constraints is sufficiently detailed, and through citations the authors present a useful overview of assimilation approaches to date. The figures shown and analysis of results are insightful and should be of immediate use to the satellite, airborne and modeling scientific communities.

I have two general comments. The first is that I don't particularly see the value of Fig 15. All it seems to say is that mean forecast RMS errors are always larger than analysis

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errors. For conciseness it seems the Figure could be omitted without significant impact to the paper. The second general comment is that the introduction and discussion of Taylor diagrams (section 4.2.2 and Fig 9) needs to be improved. I have made guesses as to certain details of Fig. 9, elaborated below. If my guesses are correct I suggest minor clarification and if incorrect, more significant clarification is needed. (1) Definition of "sigma" (horizontal axis) - I assume it simply refers to concentration, but also seems to apply to RMSE. (2) Definition of the iso-lines on Fig 9a (labeled 0.2, 0.4, 0.6, 0.8, 1.0, 1.2). After studying your text I assume this is the skill? If so, what is the significance of values larger than 1? (3) If I understand what sigma is, I think I understand how the model predictions are plotted - in (sigma, R, Skill) space. I don't understand how the total RMSE points (large open circles) are plotted - or more precisely, what (if any) the relationship is to R and skill values.

Technical corrections may be summarized as follows:

P. 9718 line 22: further demonstrate (not demonstrates)

p. 9720 line 11: do you mean pollution <control> strategies?

p. 9725 line 11: not clear what you are referring to as "(for initial assimilation)"

p. 9728 line 11: sentence fragment. ...observations <from the> MOPITT...?

p. 9730 line 16: need additional info regarding this paper (i.e., citation, submitted, in preparation). If "in preparation", change text to "will be discussed".

P. 9732 line 23: "subset of NCEP data" is not clear. Do you mean subset of the observations used in the assimilation?

p. 9735 line 14: "at 700 hPa <is> translated"

p. 9735, discussion of Fig 10: In this qualitative evaluation it is important to acknowledge that assimilation sometimes results in worse prediction. Specific clear examples include the DC8 comparison, observation points approximately 1550 and 2100.

p. 9735, discussion of Fig 11: You note that bias correction applied to the assimilation results, which begs the question of biases inherent in REFSIM results. I think it would help to point out that, given the differences between observed and REFSIM vertical profile shapes, a simple bias correction of REFSIM would not significantly influence your findings.

p. 9736, discussion of Fig 12: The differences would be more easily seen (and perhaps described) if you added a difference plot as a third panel.

p. 9736 line 7: "...not accurately represented in the REFSIM." Rather than REFSIM, this should say "model" or "both simulations", as any CO source and transport deficiencies are essentially the same in your simulations. The CO assimilation is presumably helping to compensate for these inherent deficiencies.

p. 9736, Section 4.4: Suggest changing the same to "Illustration of CO forecast sensitivity"

p. 9738, lines 1-2: "ensemble spread still appears to be under-estimated..." On what do you base this statement? A most interesting aspect of Fig. 14 concerns where larger differences are found in panel (b) than in panel (a). I speculate that what you are trying to say is that this situation indicates where the CO error estimates are too small. If so, you should clarify the text - and if not, I have missed the meaning, and you should clarify the text!

p. 9738 line 15: "forecast diverge<s> from..."

p. 9740, line 24: The statement made in the first sentence is only true given an independent set of measurements - ie, the aircraft insitu data. I would suggest rewriting as "Constraining CO using the assimilation system, and evaluating against independent measurements, provides important..."

pp. 9735-9738, section headings: You use symbol notation in these headings that does not appear anywhere else in the manuscript. You should either omit them, or fix

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important define them in the text and/or a table and make use of them in the discussion.

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