

Interactive comment on “A simple modeling approach to study the regional impact of a Mediterranean forest isoprene emission on anthropogenic plumes” by J. Cortinovis et al.

Anonymous Referee #2

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General Comments

This is an interesting paper describing the simulation of isoprene emissions on a specific regional scale, applying these biogenic emissions to a regional atmospheric chemistry model, and investigating the effect of the simulated biogenic emissions on the generation of ozone plumes downwind of two “case study” cities in Mediterranean France. While the biogenic emission simulations are believable, and the effects on ozone plumes and VOC/NO_x interesting, there appears to be no validation of the modelling results using field measurements of ozone. The authors make it clear that this

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is meant to be a comparison of the effect of two case study datasets rather than validating the model for accuracy of predicting reality, but even so, some measurements of ozone downwind of the two test sites would put the modelling results into a real context. There is also no analysis of uncertainty in the modelled ozone concentrations, nor any tests of sensitivity to the initial conditions of anthropogenic VOC and NO_x. Description of models used to generate some parameters is minimal and refers to other published work. While this is sensible and overall acceptable, a few more details would make the methods section more understandable.

Specific Comments 1. Page 7692: Abstract: line 1: Research over several decades has shown the importance of isoprene emissions in tropospheric chemistry!

2. lines 18-20: it would be helpful to know how the 2 towns differ in size and pollution emission etc

3. Page 7693: Introduction line 18: please spell out the first occurrence of “Meso-NH-C”.

4. Page 7694: Introduction line 6: just a few details to explain the geographical differences between these 2 towns would be useful.

5. Page 7695: Isoprene emission modelling line 1: why EC(t) when this depends on both temperature and PAR?

6. line 7: Owen et al 2001 is not a review.

7. line 12: estimate magnitude of uncertainty associated with assuming constant emission factor.

8. line 15: please spell out “ISBA”

9. line 18: please name the “limited number of surface parameters” here.

10. line 23: should “EC” here be “EC(t)”?

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11. line 24 et seq: are these parameters the same as specified by Noilhan and Planton (1989) (line 18) for determining temperature? This paragraph is rather confusing and needs to be re-written to explain exactly what parameters ISBA-Ags takes as input for generating temperature output, and exactly what input is needed for generating PAR.

12. line 24 et seq: it may also be helpful to include the equations used in the model to generate PAR and temperature.

13. Page 7696: Site description and forcing data: line 17: “Specific attention...” - I am not sure what this sentence means. Can it be omitted?

14. line 24: How did you estimate the emitting biomass?

15. Page 7697: Results: line 8: “A key step of the validation procedure was to characterise as well as possible the canopy microclimates”. Please briefly explain why.

16. line 9: mesophyll conductance of what?

17. Page 7698: Results: line 3: “The results can be improved.”. Please indicate by how much. Did you use air temperature in the modelling?

18. line 9: how do you define “acceptable”? It would be more rigorous to quote the uncertainties associated with biogenic emission potential estimates.

19. The Meso-NH-C model: line 16: Please spell out “CNRM” and “CNRS” when you use these for the first time.

20. line 17: Where does “soil surface scheme” come into play? You have so far described ISBA-Ags only as a scheme for estimating temperature and PAR. Please explain briefly what a soil surface scheme is, and why it is used in the MESO-NH-C model. Your paper, when published, will be read by a wide audience, not all of whom will be familiar with some of these modelling concepts.

21. Page 7699: Chemical sources and initial conditions: line 25 et seq: How representative are the anthropogenic emission sources? You are using just one diurnal course

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for VOC and NO_x for each of the 2 urban scenarios. How variable are the diurnal courses?

22. Page 7700: Chemical sources and initial conditions: line 7: the VOC/NO_x for MS varies a lot, are you referring to the minimum values here to compare with MT?

23. Page 7701: Reference anthropogenic plumes: line 3: Which of the distances d₁, d₂, d₃ or d₄ are referred to in Figs 6 and 7?

24. Page 7707: Conclusions lines 7 and 23: discrepancy. You refer to a fixed 3 m s⁻¹ wind velocity but also refer to wind speeds of 4 m s⁻¹. Please explain, or make consistent throughout the text.

Technical corrections

1. Page 7693: Introduction: line 5: change “NO_x is enhanced by” to “(NO_x) can be enhanced by”

2. line 8: change “detectable in urban area” to “detectable in urban areas in some regions”

3. line 8: change “and very important in rural sites.” To “and is very important at rural sites”.

4. line 10: change “pollutant emission must account for biogenic emissions as much as possible” to “pollutant emissions should always take account of biogenic emissions”.

5. line 11: change “At regional scale” to “At the regional scale”.

6. line 12: change “determining the regional” to “which determine the regional”

7. line 13: change “One important aspect of such studies” to “An important aspect of these studies”.

8. line 14: change “biologically regulated emission” to “BVOC emissions”.

9. line 26: change “contrasted” to “contrasting”

10. Page 7694: Isoprene emission modelling: line 20: change “is assimilated to a simple” to “is represented by a simple”

11. line 22: change “using Guenther approach” to “using the Guenther approach”.

12. Page 7695: Isoprene emission modelling: line 13: change “(typically diurnal evolution over few days simulation)” to “(typically a few days simulation of diurnal evolution)”

13. line 14: change “Calculation of the above-mentioned EC(t) factor is done” to “The EC(t) factor is calculated”.

14. line 16: change “allows to take into account an interactive vegetation for local adaptation” to “allows vegetation to be adapted for local simulations”

15. line 19: change “in the context of the Meso-NH” to “with the Meso-NH”.

16. line 21: change “ISBA-Ags treats one single” to “ISBA-Ags models one single”

17. line 23: change “To perform the calculation of EC” to “To calculate EC”

18. line 24: change “in the simple layer canopy. Following Roujean et al (1996), direct and diffuse radiation influence is taken into account.” to “in the simple layer canopy using direct and diffuse radiation influence (Roujean et al, 1996)”

19. line 29: change “Gauss” to “Gaussian”?

20. line 29: re-write:

“..(Calvet et al, 1998). Evolving isoprene fluxes are calculated for the considered ecosystem accounting for all these considerations. In the following sections, the above described isoprene emission scheme is referenced as the BVOCEM scheme”

as follows:

“..(Calvet et al, 1998), and evolving isoprene fluxes are calculated for the case-study ecosystem. In the following sections, this isoprene emission scheme is referred to as the “BVOCEM” scheme.

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21. Page 7696: Site description and forcing data: line 8: change “have been considered” to “were considered”.

22. line 14: change “References about the experimental” to “References for the experimental”

23. Page 7697: Site description and forcing data: line 5: change “has been considered to get the” to “was used to obtain the”

24. Results. Line 11: change “minimization” to “minimizing”

25. lines 17-18: change “through ISBA-Ags” to “through the ISBA-Ags”

26. Page 7698: Results: line 6 et seq: Delete the sentence “The scatter plot in Fig 2 presents the results obtained on the four studied ecosystems. It outlines the tendency for overestimation of simulated fluxes as described above”. It repeats what has already been said.

27. line 8: change “with regards to the numerous” to “in view of the numerous”.

28. The Meso-NH-C model: line 19: change “has been” to “was”.

29. Page 7699: Chemical sources and initial conditions: line 26: change “(referred to as MS scenario in the following)” to “(henceforward referred to as the MS scenario)”

30. Page 7700: Chemical sources and initial conditions: line 11: change “As for biogenic emissions, the diurnal FOREST isoprene emission is directly calculated by the previously described BVOCEM scheme.” To “The diurnal FOREST isoprene emissions is directly calculated by the BVOCEM scheme described above.”

31. Page 7701: Reference anthropogenic plumes: line 8: change “characterised by with a NO_x concentration about 2.5 ppb” to “characterised by a NO_x concentration of about 2.5 ppb”

32. line 9: change “ Then, the NO_x” to “Then the NO_x”.

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33. Page 7703: MT scenario: line 25: a space is needed between “distance” and “d3”.

34. Page 7704: Integrated ozone amount: line 18-19: change “can yield a more integrative information about the ozone” to “can give an integrated insight into ozone formation throughout the day within the plumes”.

35. line 19: change “has been” to “was”.

36. Page 7705: MS scenario: lines 17- 18: Change “ The biogenic contributions for the d3 and d4 scenarios are insignificant, as discussed in Sect. 4.5.1, no interactions between the forest emission and the anthropogenic plume for these distances.” to “ The biogenic contributions for the d3 and d4 scenarios are insignificant, with no interactions between the forest emission and the anthropogenic plume for these distances (section 4.5.1).”

37. Page 7706: Conclusions: line 19: change “the above defined” to “this”.

38. Page 7707: Conclusions: line 8: change “sensible” to “sensitive”.

39. line 12: change “on the morning” to “in the morning”

40. Page 7708: Acknowledgements: line 9: change “there the work done in..” to “their work in..”

41. Page 7709: References: line 20: Better not to use a project report. This material is published in Owen et al 1998 and Owen et al 2001.

42. Page 7712: Table 1 references: use Owen et al 2001 and Owen et al 1998, not the unpublished report of Hewitt et al.

1) Does the paper address relevant scientific questions within the scope of ACP?

Yes, this paper presents a system to model the impact of biogenic VOCs in urban plume chemistry

2) Does the paper present novel concepts, ideas, tools, or data?

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Yes, the paper describes a coupling of an isoprene emission model to a chemical model for simulating ozone production on a regional scale.

3) Are substantial conclusions reached?

The fairly substantial conclusions are that (i) the isoprene emission models work “well enough” for predicting regional emissions from 4 different forest types, and (ii) coupling this model with a regional chemistry model can predict the effect of biogenic hydrocarbons on the development of ozone in anthropogenic plumes at different distances downwind from 2 urban centres. A reservation I have is that there is no way of testing the coupled models’ outputs with measurements.

4) Are the scientific methods and assumptions valid and clearly outlined?

The scientific methods and assumptions are valid, and the limitations of the method acknowledged. However, there could be more detail provided of the methods used (see below).

5) Are the results sufficient to support the interpretations and conclusions?

Yes, the authors are careful not to over-interpret results.

6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

I found this was a small problem. The modelling algorithms and assumptions are described in detail in other literature, but even so, it would ensure better understanding and traceability if more details were presented in the methods section of parameters and algorithms used in the models. For example, what equations were used to estimate leaf temperature?

7) Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Yes

8) Does the title clearly reflect the contents of the paper?

Yes

9) Does the abstract provide a concise and complete summary?

Yes

10) Is the overall presentation well structured and clear?

Yes. The subsections are logical and well-labelled.

11) Is the language fluent and precise?

I have made suggestions for amending numerous small errors or awkward phrases.

12) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

yes, except for where I have noted discrepancies

13) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

There are a huge number of figures! I suggest: Figure 2 is not necessary: just describe results in the text Figure 5 is not necessary Figures 6 and 7: omit showing NO_x, but describe in the text, and combine these 2 figures Figures 9 and 10: combine these 2 figures

14) Are the number and quality of references appropriate?

I have noted above where it is better not to use unpublished report references

15) Is the amount and quality of supplementary material appropriate? n/a

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 7691, 2004.

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