

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 #1

Received and published: 19 December 2004

This paper presents a study that explains a simple modeling approach to simulate isoprene emissions from vegetation within the context of a regional chemical transport model. A chemical transport model (Meso-NH-C) was applied to evaluate the sensitivity of ozone formation in different anthropogenic plumes as they interact with biogenic isoprene emissions. Anthropogenic plumes with different VOC/NO_x ratios were simulated and the impact of downwind isoprene emissions on the ozone formations and concentrations in those plumes were shown to differ substantially. In one scenario, biogenic isoprene emissions were shown to contribute up to ~ 30% of the ozone formed in the plume downwind. There have been other studies that have shown the impact of

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

rural isoprene emissions in the presence of urban air masses. However, I am unaware of any studies that directly investigate different characteristics of urban plumes (i.e., the VOC/NO_x ratios). I believe that the model presented in this paper (the biogenic emissions model run within the Meso-NH-C) is a valuable tool for regional air quality studies, and the results presented here are important. However, I think that the authors should further address the importance of the results and how they can be further applied. For example, the VOC/NO_x ratio of an urban plume that interacts with elevated isoprene emissions can control the amount and the distances from the anthropogenic source at which the ozone is formed. What is the ultimate significance of this fact? How is this help determine control strategies, or help urban planners? I do not feel that the authors address the importance and applications of their work adequately. This paper is acceptable for publication after some revision and presents a valuable tool for simulating biogenic emissions and regional chemical air quality. I am including here some general comments, and below that, some specific editorial comments.

General Comments: Abstract: The abstract provides a good description of the contents of the paper. However, I would recommend including a sentence with an example of how the results could be specifically applied.

Section 2: There are few models in which the biogenic emissions are calculated on-line with the meteorology (as the model described here does). The authors should mention the importance of this ability. Also, the authors describe the radiation balance used in the biogenic emissions model. How does this differ from other models?

Section 4: The authors discuss isoprene emissions. Were other BVOCs predicted in their modeling scheme? Could they be? How many days was the model run (for example, was a spin-up time period necessary?) Are the TOWN sources chosen for this study typical?

Section 4.5: The authors calculate the contribution of O₃ concentrations due to isoprene emissions by comparing the concentrations from the runs made with (BIO)

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

and without (NOBIO) isoprene emissions included in the model simulations. If the authors want to present the percent change over the simulation without biogenic isoprene emissions, should W_c and W_q be calculated instead as: $W = ([O_3]_{bio} - [O_3]_{NOBIO})/[O_3]_{NOBIO}$

In Section 4.5.1, a summary of the changes in maximum O₃ concentrations (perhaps in a table?) could be useful.

How do these results compare to other plume studies? (i.e., Ryerson et al., Science, 2001 ; Trainer et al., JGR, 1995). The authors should site other relevant studies.

Section 4.5: The figures that show the plume of O₃ from the TOWN source and into the FOREST areas are difficult to see. In the comparison of the O₃ plumes between the different scenarios, is it possible to address the change in area impacted by elevated surface O₃ concentrations? I am assuming that the simulated surface concentrations are shown. Is this correct?

Section 5: The percent of the maximum plume O₃ concentration contributed by the isoprene emissions is given in this section. Is this the percent of the amount above background levels?

In the first and second paragraphs, the results are described for a wind speed of 4 m s⁻¹. Yet, in the model description and in the 3rd paragraph of this section, the model is said to have run with a fixed horizontal wind speed of 3 m s⁻¹. This is inconsistent.

The authors mention the possibility of using this type of simulation for regulatory purposes. I think that the conclusions could be made stronger by providing a specific example of how this type of modeling exercise could be applied.

Technical/Editorial Comments: General Comments: - This paper has many technical errors and I have tried to address many of them here. However, I suggest that the authors edit the paper so that it reads more clearly. - The authors tend to use the phrase “deal with” throughout the paper (for example, page 7694, line 13). I suggest

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

using the words such as “address,” “focus on,” or “investigate” instead. - The verb tense used in the paper is inconsistent (for example, in section 4.2, the authors use both past and present tense when describing the model runs). This should be corrected.

Specific Comments: Page 7693, line 3: Remove the word “scale”

Page 7693, line 7: Change to “biogenic emissions” (NOTE: Keep this consistent throughout the paper. There are several places throughout the paper where this should be changed).

Page 7693, line 11: Change to “At regional scales, the spatial extent”

Page 7695, line 4: Change to “species-specific leaf biomass”

Page 7695, lines 12-13: This sentence should be reworded. It is unclear. For example: “EP is assumed to remain constant for the time scales of our model runs (on the order of days to weeks).”

Page 7695, lines 14-29: the term “taken into account” (or “take into account”) is used 3 times in this paragraph (lines 16, 24, 25). The authors can remove the phrase in line 16, and reword those used in lines 24-25 so that the paragraph flows better.

Page 7696, line 13: What do the authors mean by “primary parameters”?

Page 7696, line 21: Leaf-level could be used to replace the term “cuvette.”

Page 7697, line 2: A space and a “-“ are needed between 22 and 75 (remove the comma).

Page 7697, line 8-9: This sentence is confusing. How is characterizing the leaf-level temperature a validation of the model output?

Page 7697, line 10: Change to “net radiation and latent and sensible heat flux measurements by minimization of the root mean ”

Page 7698, line 2: Change to “through the canopy as a function of leaf ”

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

Page 7698, lines 7-9: These sentences could be reworded to make the point more clearly. For example: “ Despite the tendency of the model to overpredict isoprene emissions, the simulated fluxes are well within the uncertainties of the model, and we consider these results to be acceptable for input to a regional chemical transport model.”

Page 7698, line 22: Change to: “The chemical mechanism used in these simulations was the Ę”

Page 7699, line 9: Remove “situated at”.

Page 7699, line 17: Change to “correspond”

Page 7700, line 22: Change to “two simulations Ę”

Page 7701, line 8: Change this sentence: “characterized by a NO_x concentration of 2.5 ppbv and a VOC/NO_x ratio of 6.5.

Page 7701, lines 9-10: I am confused by these sentences, and it is not clear to me what the authors are trying to say here.

Page 7701, line 19: Change to “15:00 UT and at a farther downwind distance.”

Page 7701, line 21: Remove “as in MS scenario”

Page 7702, line 18, Change “Taken into account” to “included”

Page 7703, line 4: What is the d1 configuration? Do the authors mean at the cell d1? This is confusing, and is used at several points in the manuscript besides here.

Page 7703, lines 4-6: What effect are the authors talking about? Please be more specific and explain the figure in the text.

Page 7703, line 8: Change to “the maximum ozone concentration.” (This could also be changed in several other places throughout the manuscript).

Page 7703, line 19: Remove “latter”

Page 7703, line 24: Since the plume is physically moving away from the TOWN source, it is not appropriate to say that “as the plume approaches the TOWN.” Perhaps this sentence could be changed to read “at closer distances to the TOWN source.”

Page 7703, line 25: Add a space between distance and d3.

Page 7704, line 2: What are VOC/NO_x ratios characteristic of high O₃ concentrations?

Page 7704, line 5: Change to “isoprene emission is at its’

Page 7704, line 6: This sentence could be re-written. For example, it could be changed to read: “The simulated maximum O₃ concentration is located at d1 between 15:00 and 17:00 UT.”

Page 7704, lines 8-12: These sentences are confusing and should be reworded to better explain the changes in the plume O₃ concentrations and the reasons for the changes.

Page 7704, line 9: The term “O₃ gap” should be defined. At what concentration is the O₃ considered depleted- below 40 ppb?

Page 7704, line 11: Change to “Ědiurnal cycle of the VOC/NO_x ratio is also Ě”

Page 7704, lines 17-19: Why is “more integrative information” important?

Page 7705, lines 3 and 5: Again, what are the d1 and d3 configurations? Are these the grids?

Page 7706, line 22: Change “dynamical” to “dynamic”

Table 2: Is this table necessary? Could the information be included in the text?

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

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)