**Atmospheric
Chemistry
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Discussions**

Interactive
Comment

Interactive comment on "Contribution of atmospheric processes affecting the dynamics of air pollution in south-western Europe during a typical summertime photochemical episode" *by* M. Gonçalves et al.

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Received and published: 22 December 2008

Interactive comment on "Contribution of atmospheric processes affecting the dynamics of air pollution in south-western Europe during a typical summertime photochemical episode" by M. Gonçalves et al.

The authors gratefully acknowledge the comments of the Anonymous Referee #2, which may help to improve this manuscript quality and to clarify some issues that were not previously addressed. Please find below the item by item response to the Referee comments.

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Interactive Discussion

Discussion Paper

This paper describes a model-based process study of a summertime pollution episode over Spain, contrasting a hilly area with a flatter region. The model setup is appropriate and the scientific approach is rigorous. Although most of the key results are qualitatively familiar from previous, similar studies of other regions (e.g., that ozone is titrated directly in the main NOx source regions and peaks downwind of these), the quantitative assessment for the characteristics of this particular region is of sufficient value for designing mitigation approaches that it definitely merits publication in ACP after several minor revisions.

Nearly all of my technical comments were adequately addressed in the ACPD access review stage, and most of the other points I would make have already been covered very well by referee #1, and answered appropriately by the authors in the online discussion.

I only have the following few additional minor comments:

Language: Q1- Throughout there are several minor grammar errors. The first referee and I have noted many of these (see also below), but probably not all - it would be worthwhile having a colleague, particularly a native English speaker, go through the final version before submission for publication in ACP.

A1- The authors have revised again the English grammar and wording along the document, expecting to improve its quality and facilitate the readers' understanding.

Abstract: Q2- It would be helpful to indicate here what altitude range is meant by "high levels", where gas-phase chemistry contributes to O3 in the coastal domain.

A2- The maximum O3 production occurs in the coastal domain at high levels, the specific height depends on the geographical location and the considered period. The specific height of maximum O3 production was not estimated for each cell of the domain. The North-eastern Iberian Peninsula domain was divided in three areas: (1) over the Pyrenees region, (2) over the coastal region and (3) over the inland flat area.

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The atmospheric processes contributing to O3 concentration were assessed in those areas for different height ranges: from 0 to 500 m agl, from 500 to 1500 m agl and from 1500 to 5000 m agl. Those were selected according to previous studies (Jiménez et al., 2006 [1]). This analysis permitted to locate the maximum production in the coastal areas in the range from 500 to 1500 m agl. These results were not included specifically in this manuscript because the analysis focused on the evaluation of the processes contribution below the PBL height and the general description of the processes occurring in the coastal and the continental domains. Further information on this issue can be found in the presentation of the ACCENT-GLOREAM 2007 workshop: "Contribution of atmospheric processes to photochemical pollution by using a process analysis tool in the north-eastern and central Iberian Peninsula" by María Gonçalves, Pedro Jiménez-Guerrero and José María Baldasano, available at http://www.geo.fu-berlin.de/met/ag/trumf/Veranstaltungen/ACCENT_GLOREAM/presentations/ACCENT_GLOREAM_Goncalves.pdf

Acording to the reviewer comment the range of maximum production: from 500 to 1500 m agl was included in the manuscript, as follows: "The maximum positive contributions of gas-phase chemistry to O3 occur in the coastal domain at high levels (around 500 to 1500 m agl), while in the continental domain they take place in the whole atmospheric column under the PBL"

[1]Jiménez, P., Lelieveld, J., Baldasano, J.M.: Multiscale modelling of air pollutants dynamics in the northwestern Mediterranean basin during a typical summertime episode, J. Geophys. Res., 111, D18306, doi:10.1029/2005JD006516, 2006.

Q3- "advective flows sets the maximum O3", replace "sets" with "determines"

A3- This change was included in the manuscript

Introduction: Q4- The importance for health is pointed out - isn't this also a region with notable agriculture, especially downwind of the populated regions, where ozone peaks, and may have a detrimental influence on agriculture as well? The authors should check this. and if it is correct, mention it here.

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A4- The authors agree with Referee#2, although the most worrying consequence of air pollution is the effect on human health, the agriculture and ecosystems damage has also to be considered. Related to this aspect in the specific area of the North-eastern Iberian Peninsula affected by the urban pollution plume, the northern and north-eastern region, the agriculture and livestock activities are commonly developed. The Central Iberian Peninsula domain considered is characterized by a higher rate of urban land use, nevertheless rural areas can be also affected for the urban air pollution plume. This aspect is now highlighted in the introduction as follows:

"They house the largest Spanish urban centres, Barcelona and Madrid, and therefore photochemical pollution episodes are of special concern by their direct effects on population. In addition the urban pollution plume effects can spread hundred of km away from the cities affecting not only human health, but also damaging crops and agricultural activities developed in those areas."

Methods: Q5- The spatial resolution noted for the model (1 km2) is appropriate for a study of this nature. The temporal resolution is indicated to be 1 h. What exactly is meant by this? Normally a timestep of 1-5 seconds is used with WRF at this resolution, so it is probably either a typographical error that needs to be fixed (note that it is repeated two paragraphs later), or something other than the timestep is meant. In any case, this should be clarified.

A5- The temporal resolution is here referring to the outputs of the model, both from the WRF-ARW and the CMAQ photochemical model, not to the computational time used in the calculations. The WRF-ARW integration time is around 5 seconds and the CMAQ model considers a self-calculated time step which depends on the estimated wind speed (around 30 seconds). Obtaining the outputs of a mesoscalar model with 1 km2 and 1hr of spatio-temporal is considered as high resolution, as pointed out for the authors.

Q6- p. 18463, point 1: "It considers horizontal and vertical advection sum" should be

"It considers the sum of horizontal and vertical advection" Conclusions: p. 18478, line 25: "permits to test the mass" should be "permits testing of the mass" p. 18479, line 10: reword this to "but with the chemical formation becoming important at low levels." p. 18479, line 23: change "involves" to "implies"

A6- These changes were included in the manuscript

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 18457, 2008.