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Interactive comment on "Modelling photochemistry in alpine valleys" *by* G. Brulfert et al.

G. Brulfert et al.

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General comment:

We thank the referee 3 for helpful comments especially for the analysis in chapter 5. In the process of validating a model, a strong focus is necessarily put on agreement between results from the model and measurements but the referee is fully right in insisting upon what can be understood not only from this agreement but also from disagreements. This is considered later below.

A sentence was added to the abstract to make clear that this paper covers only the part of the POVA (Pollution des Vallées Alpines) project which is related to 3D numerical modelling in the summer time and in Chamonix Valley. Topics addressed by POVA

were wider with a significant effort devoted to detailed chemistry measurements, this is to be related in papers by colleague authors (papers being at a submission stage).

The referee considers that the title could be misleading by mentioning alpine valleys although the whole study is based on Chamonix valley only. As POVA dealt with Chamonix and Maurienne valleys, the paper was initially planned to cover the two valleys. But in order to keep the paper length acceptable, it was decided to focus on Chamonix case which was better documented, more typical of narrow glacier shaped alpine valleys, took the advantage of a more sunny weather during the IOP and hence both better quality measurements and better correspondence with the frame of modelling. Nevertheless we prefer to keep the title unchanged not to create confusion since it has already been referenced. Few words were added in the abstract and the text to explain this focus on Chamonix site and tell that dynamics and ozone photochemistry is quite similar in Maurienne valley.

As the referee questioned about the 50% reduction of the VOC and NOC emissions, it has to be stated that these reductions were arbitrarily defined in order to assess the ozone regime in the valley and then plot indicator values. Nevertheless, it is interesting to note that reduction of 50% of NOx corresponds to the reduction between 1998 (with the transit traffic in the valley) and 2001 (without the transit traffic). The reduction of VOC induced by this change in traffic in not as large since corresponding to a reduction in 10% of VOC emissions. The inventory gives 709 tons of VOC and 762 tons of NOx in 1998, over 647 tons of VOC and 394 tons of NOx in 2001. We add few sentences in chapter 6 about this evolution of emissions.

As above mentioned, in the validation process agreements are more emphasized than disagreement. When addressing phenomena at local scale and under nyctemeral cycle, time and space distribution has to be considered and it may be observed that the model behaves satisfactorily. Nevertheless there are limitations which are due to both

ACPD

5, S1586–S1590, 2005

the measurements and the models : in complex heterogeneous terrain, measurements are local to the station site and because of valley narrowness may be under dependence of surrounding ground cover (trees,..). A detailed model of soil under ground level is not feasible because of the variety at small scales which affects humidity at the bottom boundary and therefore heat exchanges which results in discrepancies in extreme temperatures. As regards chemistry, most of the uncertainty comes from the emission inventory.

Specific comments:

As suggested by the reviewer, the reference to TRANSALP in the introduction was completed as follows. The program TRANSALP (a component of EUROTRAC-TRACT) included several field campaigns, with, among others, **i)** an intensive sampling campaigns with high density network for ozone measurements on a 300x300km2 area (Löffler-Mang et al., 1998) **ii)** an intensive sampling campaigns with the follow up of the dispersion of a passive tracer released in the Rhine valley (which is about 40km width on average) (Ambrosseti et al., 1998).

Instead of the percentages of land use type, and according to the referee suggestion, the new figure 2 is a 3D map which details the land use in the valley with infrastructure, grassland, forest, high altitude vegetation, rock and snow, the main road

In order to answer the question about the necessity of applying ARPS model for the finer grids, we have added a sentence in chapter 3.1. ARPS was used because of the discrepancies we observed from MM5 simulations at a resolution under 1 kilometre (Chaxel et al., 2004). This computation chain has a real homogeneity since MM5 and ARPS share a lot of sub models and algorithms.

Chaxel, E, Brulfert, G, Chemel, C, and Chollet, J.P.: Evaluation of local ozone production of Chamonix valley (France) during a regional smog episode. 27th NATO/CCMS International Technical Meeting on Air Pollution Modelling and its Application. 25-29/10/2004, Banff, Canada. Available on: http://www.dao.ua.pt/itm/27th/Presentations

ACPD

5, S1586–S1590, 2005

About the question on the use of the two models CHIMERE and TAPOM, it should be noticed that these two models are based on chemical mechanisms which are close one to the other (MELCHIOR and RACM respectively) For domain 1 and 2, the code in use is CHIMERE; for domains 4 and 5 the code in use is TAPOM. table 1 and chapter 3.2. have been completed to that end.

In response, to the question about the emission resolution, we add sentences in chapter 4: "The emissions are then distributed for modelling at the hourly level by taking account of the season and the day of the week. A specific article on this inventory can be found in (Brulfert et al., 2005). Brulfert, G., Chollet, J.P., Jouve, B., Villard, H. : Atmospheric emission inventory of the Maurienne valley for an atmospheric numerical model. Science of the Total Environment, in press, 2005."

In the chapter 'Validation' the simulation of a simplified case is mentioned but as no results were presented and discussed, this part was deleted as being not relevant enough . These process studies were run at a preliminary stage of POVA in order to assess the strength of slope wind systems under local dynamics without any synoptic meteorological forcing. The present study deals with a real case with regional mesoscales interfering with scales local to the valley. Besides it seems that realistic valley winds cannot be simulated in a simplified configurations.

Technical comments :

- the scale of the vertical coordinate was harmonized across the different stations;
- line 15 p 1803, the simulation by CHIMERE is really run at grid sizes 27 and 6 km;
- figure captions were developed;
- domain D3 grid resolution is 3 km (table 1 in the on line version);

ACPD

5, S1586–S1590, 2005

- time is universal time, especially in figures 7 and 8;
- an information related to the reopening of the tunnel was added to the introduction: The reopening of the tunnel was staged in different phases from March 2002 (for personal vehicles only) until March 2003 (open to all vehicles without restriction). International traffic through the tunnel during the last two intensive period of observations (IOP) had not returned to the level of the period before the accident, with only about 1840 personal vehicles and 590 trucks/day on average during the winter 2003 IOP and about 4180 personal vehicles and 910 trucks/day on average during the summer 2003 IOP.

ACPD

5, S1586–S1590, 2005