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Interactive comment on "Sub-continental transport mechanisms and pathways during two ozone episodes in northern Spain" *by* G. Gangoiti et al.

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We will like first to thank reviewer #2 for his careful reading and his comments, which we appreciate. There are 4 main points to be addressed by the authors, all of them contained in his specific comments:

1) "...they (the authors) follow passive tracers and neglect transformation processes, this severely limiting their ability to predict ozone levels in a quantitative sense...". "... the reader would have welcomed remarks on, e.g., the timing of ozone build-up and the chemical characteristics of the interaction between air masses differing in their pollution burden..."

Chemical species and vertical layering of ozone and other fresh and aged pollutants were documented in 1989 during a flight campaign in the Basque Country (BC) under typical summer synoptic weather conditions (Alonso et al., 2000). The interaction between fresh pollutants at lower layers and old emissions above and within the elevated inversion layers, transporting pollutants from the Western European Atlantic (WEA) region was discussed in that article. This reference was already included in our present contribution. We also described in Alonso et al. (2000) the importance of the ozone reservoir layers transported from the WEA region in order to explain the observed ground concentrations of ozone in the BC coastal area and inland mountains. For the present contribution we do not have flight measurements, which would have show us a 3-D distribution and a speciation of pollutants. Instead, we make use of the in-valley an elevated ozone stations to describe the onset and decay of the selected episodes.

The ability to predict ozone concentrations, which was not addressed neither in Alonso et al. (2000) nor in our present contribution, depends not only in selecting the adequate chemical mechanisms, but also in a good emission inventory and an adequate representation of the meteorological processes (wind, turbulence and cloud microphysics) at the appropriate scale. This latter issue is necessary to be addressed for a correct representation of the venting mechanisms to the middle troposphere, the stabilization-layering and accumulation of aged species in reservoir layers aloft, and the subsequent long-range transport of these ozone-enriched reservoir layers. In our present contribution we are showing these type of venting-transport mechanisms and pathways, as stated in the title and the objectives, and point to different source regions during the episodes forced by blocking WEA anticyclones. Some of these source regions were not so evident after a general NE'ly circulation forced by the anticyclone. In the following step we will incorporate the photochemistry and an adequate emission inventory, to simulate the 3D distribution of pollutant concentrations.

For the revised version of the manuscript we will include a direct reference to the above mentioned flight campaign results in the section 2 (Area description and observed

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ozone concentrations).

2) "...Air quality measurements are certainly also available for sites close to the boundaries of domain 3, and here one could have expected a different behaviour than in Bilbao and its surroundings..."

As stated by the reviewer, out of the BC, and specifically at the north and north-western coast of Iberia, ozone concentrations follow a different behaviour than in the BC coastal strip during these episodes. They seem not to be affected by the discharge of the residual layer of the Ebro Valley and its analysis merits a specific contribution. The analysis, which we expect to finish this year (2006), will incorporate air quality data at the Upper Iberian Plateau and the whole north Atlantic coast of Iberia.

3) "...the comparisons between observations and model results (Figs 4 and 5), the agreement is overall very satisfactory, but why did the authors decide not to use any standard statistical means for their assessment?..."

In complex terrain, in-valley meteorological surface stations and those located at coastal sites show a sharp preference for a certain limited number or wind directions, due to channelling effects, up-slopes/down-slopes flows or the occurrence of land and sea breezes. Under such conditions, when the objective is to track pollutants at the regional scale and to document venting mechanism at the lower/middle troposphere, comparisons between simulations and observations should be based in upper air observations. Thus, vertical layering and time-evolution of winds at the boundary layer and at the free troposphere, transporting the pollution burden should be tested against observations. When dealing with a limited number of data (description of episodes) we prefer to compare side-to-side all vertical profiles available and discussed the observed agreements and departures between simulations and observations (section 4 of the manuscript). At this respect, if the editor consider it necessary, we can included all those NMC profiles (15 selected stations) and the Bilbao WPR profiles, as supplementary data associated with the manuscript, so that it can be visited by all those who

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have an special interest in the details. If this is the case, we would also add a short reference to the annex, in page 10665 (line 20) and page 10666 (line 15-16).

4) "...Overall, the paper is very well written, both from the structure and the language point of view. There seem to be almost no printing errors (exception: 'tritation' instead of, correct, 'titration' in line 25 of page 10662)..."

Thanks for the correction. We will include it in the final version.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 10657, 2005.