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Comment

Interactive comment on “Influence of altitude on ozone levels and variability in the lower troposphere: a ground-based study for western Europe over the period 2001–2004” by A. Chevalier et al.

Anonymous Referee #1

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General comments

The paper presents a comparison of French surface ozone data measured from 2001–2004 at eleven stations in the EMEP observation network MERA and the network on pollutants at synoptic scale (PAES), respectively, with surface ozone data from sixteen other western European surface sites. The ensembles of surface stations is between 115 m asl and 3550 m asl and located in Italy, Switzerland, Germany, Austria, Spain and France; the vertical ozone gradients are compared with vertical ozone profiles above Frankfurt from the MOZAIC programme.

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The analysis aims at nesting averaged (2001-04) surface ozone data in averages since the 1990s reported in the open literature, in investigating the vertical distribution and the variability of surface ozone at the 27 selected sites, to what extent high altitude ozone measurements are capable to capture the stratification of background ozone in the lower troposphere, and whether or not surface stations at high altitude are representative of the free troposphere.

The paper addresses scientific questions that are relevant within the scope of ACP, and offers an interesting data set from high-elevation stations. The issue of background ozone is critical, and the question of representativeness of surface ozone stations at high elevation of the free troposphere is fundamental. Appropriate credit is given to related work published in the open literature, and the summary given at the end of each section is useful.

However, the focus of the paper is not clear, there are methodological weaknesses, and far-reaching conclusions are derived from the results obtained. For example, the period of investigation encompasses the extreme values of the summer heat wave in 2003, and this needs some methodological reflection on the treatment of extreme values in time series. Furthermore, there is no information on how trends were calculated, and on the statistical confidence limits. It is also not evident why a vertical ozone profile above an urban area is selected for comparison with vertical profiles at surface ozone stations representing so-called background conditions.

It is suggested to revise the paper towards a clear focus, to remedy the methodological weaknesses and to adapt the (far-reaching) conclusions.

Specific comments

Section 2: Description of the data

Table 1 should indicate the lat/long, and the country of the stations used in the study. It is stated in the text that Frankfurt / Paris data from the Mozaic programme are only

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available until July 2004 (hence, half of the year is missing). How is this missing data treated in the analysis? How is other missing data treated (e.g., in averaging)? Given that neither Paris nor Frankfurt represent rural and certainly not background conditions it is advised to find other vertical ozone profiles (e.g., Payerne).

Section 3: Trends

Trend calculations are tricky, especially if heterogeneous data sets are used such as in this study where different methods were used in the open literature to determine trends. It is hence imperative that (i) careful citation is done of the published trends and (ii) confidence levels are indicated. As far as averages are concerned, the average for 2001-04 is clearly influenced by very high ozone levels as reported in summer 2003 (see Figure 9 and published literature), see above comments on the treatment of extreme values in time series. If a focus of the paper is put on the evolution of background ozone levels over western Europe since the 1990s, then a more careful trend study should be carried out, including the treatment of extreme values.

There is no reference to Table 2.

Section 4: Influence on altitude on ozone levels and variability

The vertical ozone profile over Frankfurt is taken as representative for western Europe but the focus of the study is on mountain sites and background levels. The comparison between the vertical profiles above Paris and Frankfurt is not clear (how was it done?), and it is not evident why Frankfurt is better than Paris. If the paper focuses on the representativeness of surface stations for the free troposphere then a revision of the paper should put weight on this aspect.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 1327, 2007.

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