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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Surface ozone at the Caucasian site Kislovodsk High Mountain Station and the Swiss Alpine site Jungfraujoch: data analysis and trends (1990–2006)" *by* O. A. Tarasova et al.

Anonymous Referee #2

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Surface ozone at the Caucasian site Kislovodsk High Mountain Station and the Swiss Alpine site Jungfraujoch: data analysis and trends (1990-2006) by Tarasova et al.,

The paper discusses ozone data from two mountain sites in Europe. Long time series of ozone at mountain sites are attractive since they offer the opportunity to study long term developments of ozone in the free troposphere. In the light of the ongoing discussion on background ozone and whether or not background ozone concentrations are increasing, long time series of ozone at mountain sites are very important. The article touches upon a very relevant subject.

The article is structured well, describing data sets, tools, characteristics of the ozone concentrations at the two sites, finally resulting in a trend analysis. The emphasis in the article is on trends which covers a substantial part of the discussion. The trend section is separated in two discussion blocks for each of the two sites. The discussion on trends is rather lengthy, it suffers from an excess of detail, and it is hard to digest. Eight tables on trends are presented showing about 300 linear trend results. The main criticism on this article refers to the trend section for the following reasons:

1) it fails to address properly the main features of the trend results:

1a) why are there (large and significant) opposite trends at the two sites for the first interval (1991-2001)?

1b)why do both sites show a discontinuity in their trends from the first to the second interval?

1c) the PBL and FT trends are rather similar. Why is that? Are the two cases not separated enough, is there an underlying common cause?

2) it uses technique to cluster trajectories (1-8) and to separate FT and PBL parcels. A tacit objective of applying these techniques is to create more homogeneous subsets with less variability and consequently smaller margins of errors in the trend estimates. The article does not discuss variability of the ozone subsets. The results as presented in table 9 (cluster 3 and 5) and table 10 suggest that there is a large portion of variability left in the subsets, which might have a large effect on the trend results, in particular the results of the smaller subsets.

3)in explaining the trend results different mechanisms are presented: changes in the stratospheric influx, emission reductions in Europe, ship emissions, etc. The trend section is a large compilation of possible explanations which are not discussed consistently and which are not presented as a whole. European emission reduction as an explanation for a trend in one of the 300 trend cases should also be considered as an

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explanation for a number of other cases. How does it impact the other trend cases?

4) The authors have chosen to analyse trends by means of a simple linear regression. Results based on linear regressions are known to be sensitive to the values of start and endpoints. How robust are the results against shifting the time frame of the regression with one or two years, e.g.: shifting the time interval from 1991-2001 to 1993-2003 or 1991-2003? Meteorological fluctuations within cluster subsets might also offer explanations for trends. The literature provides examples of methods to address meteorological variability in ozone trends.

Technical notes The use of articles is not always correct. At a number of occasions 'the' is missing or redundant. Examples: p.911/line27 'air masses being in the contact': remove 'the'.

P.912/line9 'at some point of 'trajectory'. Insert 'the'.

p.908 line 29: European NO emissions: European NOx emissions.

p.909 line 26: 'in the paper' : in this paper

p.910 line 4 Elbrus mount: mount Elbrus or Elbrus mountain

p.913/line 3: changes at both site (sites)

p.913/line 12: there in: therein.

p.919 line 8: transport patters: transport patterns.

p.923 line 14-17: taking into consideration ... ship emission increase. Very unclear. Rephrase.

p.925 line 5: in-situ. How are in-situ, local and regional defined? Do they reflect different scales or is different phrasing of the same?

p.926 line 22 'in the longest clusters travelling quite high': Unclear.

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