

Interactive comment on “On the changing seasonal cycles and trends of ozone at Mace Head, Ireland” by D. C. Carslaw

Anonymous Referee #1

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In this paper a specific statistical technique has been applied on monthly ozone concentrations at Mace Head in order to investigate changes in trends and seasonal variation for different origin of the air masses.

In general, the first impression given to the reader is that a lot of attempt is consumed to the explanation of the used technique rather than the interpretation of the results. This fact makes the work in its current structure a very good “manual” for future users of this methodology, but lacks focus as a self standing article. Concerning the novelty of the results, even though interesting findings are revealed, they are kept well hidden under thorough descriptions of the statistical processes followed, leading to the early conclusion that the work does not add much on similar analysis performed for Mace-Head

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ozone data e.g by Simmonds et al. 2004. However, the current work is scientifically sound with a number of interesting findings and if the structure is improved and the results with appropriate interpretation are highlighted, then it merits publication in ACP. In the following, a number of suggestions will be given to this direction and some points that need certain clarification will be raised:

Comments on the structure:

i. In the introduction a more detailed description of previous works on ozone at Mace-Head would help the comparison with the here presented additional results. On the other hand, the description of statistical techniques not used here is probably too extended and it would be more preferable if only the advantages of the Loess method against other methods are clearly stated. General expressions like pg 5991, In 6, “STL was used in preference ... applications” should be avoided.

ii. The description of filtering depending on the air mass origin would fit better in the “Data and Methods” section.

iii. In the “Results and Discussion” section the information should be given in a more strict order: 1) general description of the decomposed series, 2) trends, 3) seasonal components + amplitudes, 4) uncertainties.

iv. Section 3.3 is much too extended. It is supposed to be an auxiliary section to highlight some aspects concerning the confidence of the findings however it is longer than the rest of the results. So, please remove unnecessary details on the procedure and do not go into deep description of the diagrams but just refer to the conclusions derived by each plot.

v. Finally, in the “Conclusions” section one would expect to see what is added to the current knowledge, especially in contradiction with previous works for the same data set and also other studies concerning the changing behavior of tropospheric ozone. Some different features of the analysis have led to similar conclusions e.g NO_x changes in-

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fluencing trends and seasonality. There should be a grouping of all results pointing out to a specific conclusion followed by a circumstantial cause-to-result relation, supported by references.

Specific comments:

Pg. 5992, In 1: Monthly means are extracted from hourly means. Depending on possible gaps in the time-series would it be different if daily means were first calculated and then the monthly means were extracted? Has the same analysis been performed with daily values as well? In that case do you obtain similar results?

Pg. 5992, In 25: How is the decision for an outlier s made? Please mention the confidence level at which extreme values or outliers are discriminated.

Pg 5993, In 21: The slight increase is not easily visualized. A simple regression line to the trend component (dash line) would help. Additionally, charts with seasonal cycles would be easier to follow with either horizontal grid lines or smoothed lines connecting maxima and minima or both ways e.g Figs 1 & 2.

Pg 5993, In 22: A peak in the trend component in 98-99 has been attributed to biomass burning or also to El Nino. The 2003 peak might as well be related to the heat wave that occurred in central Europe resulting to a very dry and warm summer. Is there a chance that these events can have masked a possible decrease of ozone concentrations after 1998 or 1999? Even though the covered period is not very long it would be interesting to investigate the trends for different sub-periods especially when a smaller number of stations refer a decreasing ozone trend during the last decade.

Pg 5993, In 25: When referring to changes to the amplitude of the seasonal cycle additional information to be given is the % ampl. change per year as well as the contribution of the increase or decrease of minima and maxima to the amplitude change.

Pg 5994, In 3: Please support the pollution episodes with references.

Pg 5994, In 28: How many trajectories per day are used to characterize the origin of

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the air masses for that day? If only one, then what impact can changes in the wind flow within a day have? It is mentioned that if at least 50% of the trajectory positions are found within a sector then this day is allocated accordingly; does this mean that all trajectory points are equally weighted and that the increase of uncertainty as one goes back in the trajectory-history is not taken into account? Since monthly means are used, how the information of the air masses origin is passed to the time series? Is this by calculating different monthly means for each air mass type, and then perform the decomposition methodology to each distinct time-series? In this case, are the different types equally distributed throughout the year or there are months that the mean e.g for the “polluted” type is calculated from a very limited number of days? Such information together with its influence on the results should be included. The seasonality of the occurrence of the different types would also be helpful. The large proportion of unattributable trajectories is still a problem.

Pg 5998, In 8: (Table 1) From the table it is not evident that the autumn and winter periods have higher error terms.

Pg 6001, In 26: “This finding ... baseline air”, is it a steadily increasing influence of baseline air or a steadily attenuated impact of pollution?

Since there is extensive discussion about trends and changes to the seasonal cycle of ozone it would be useful to have a comparison with similar studies at different stations covering different parts of N. Hemisphere or only Europe.

Fig. 5 can be combined to only two plots, one with the trends in the amplitude and the other with the seasonal changes. All eight graphs are too small in this version.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 5987, 2005.

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