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

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This referee makes many useful suggestions that would lead to an improved article. The principal concern was related to the structure of the paper, together with appropriately highlighted interpretation, which has been addressed in the revised submission. Specific criticisms have been addressed as outlined below.

Comments on the Structure i. A more limited explanation of other techniques has been given, thus highlighting the benefits of the STL technique that was actually used. A more detailed description of work at Mace Head has also been provided.

ii. Agreed - this has been moved.

iii. Agreed - a more structured description of the results has been given.

iv. A proper consideration of the uncertainty in the findings is considered to be important. This section also includes discussion on how the seasonal component has changed over time, which is a key part of the paper. To reflect this, the title of this section has been changed to “Changes to the seasonal component and estimation of uncertainties”. It is however accepted that this section is long and it has been reduced accordingly. Additionally, a more thorough description of the findings has been given elsewhere (based on the specific comments from both referees), which produces a more balanced article.

v. The conclusions have been expanded to highlight the findings in a more comprehensive way, drawing on other recently published results.

Specific comments

Pg. 5992, ln 1 There is no difference in the calculated monthly mean value if daily values are first calculated. The overall data capture was 96.7 % for hourly data. The analysis was not performed using daily values because the seasonal variations in the different components would be too noisy. A comment was made about weekly values on p. 5994, line 5.

Pg. 5992, ln 25 The treatment of outliers is an inherent part of the Loess technique as is described in some detail in Cleveland (1979) and references therein. It is more the case that outliers are given less weighting when attempting to apply locally weighted regression, rather than them being removed from any calculations. This is achieved using ‘robustness weights’ which take the form of a bisquare weight function, which is implicit in such approaches. It is not relevant therefore to determine the confidence with which points are identified, put it is in principle possible to calculate the errors associated with Loess fitting.

Pg. 5993, ln 21 Slight increase in slope shown on graphs has been addressed together with grid lines to improve the clarity.

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Pg. 5993, ln 22 These are interesting points. A comment has been added on the effect of not including 2003 and 2004 on the slope, which does in fact decline from 0.18 to 0.15 ppb yr-1 for unfiltered baseline data. Although it would be interesting to investigate these points further, additional work has not been carried out for this paper.

Pg. 5993, ln 25 Done.

Pg. 5994, ln 3 The text has been changed to reflect that these events are probably associated with short-term pollution events.

Pg. 5994, ln 28 The method employed is based on that described by Derwent (1998a). Furthermore, Simmonds (2004) describes how the method compares with alternative approaches. Four trajectories are calculated for each day i.e. one every 6 hours - this has now been clarified in the text. The trajectory positions are weighted equally and no account is taken of the increasing uncertainty as one goes back in time.

Each day within one month is classified according to the system described. Therefore the monthly mean O3 concentrations for baseline air for example, is determined by averaging all those days in one month where days are classified as baseline, and then the decomposition technique is used.

No trend is observed in terms of how the air mass origin varies by month of the year. However, the referee is correct in saying that some months have a limited number of days for particular air mass origins. This is most important for the polluted sector, because as the text describes on page 5995 line 4, polluted air masses account for only 14 % of air masses arriving at Mace Head. The manifestation of this is that the error terms calculated from the seasonal decomposition are higher for polluted air mass trajectories, as shown in Table 1 (2.8 vs. 4.3 ppb). Additional text has been added to amplify this point.

Pg. 5998, ln 8 The average of the autumn and winter terms is 4.37 cf. 3.43 for spring/summer. However, it is accepted that this is not always the case for individ-

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ual air mass components.

Pg. 6001, ln 26 It is probably better to describe the change as the steadily attenuated influence of pollution (and hence the patterns have more of the characteristics of baseline air). This has been modified on this page and the abstract.

Fig. 5 It is not possible to condense these eight plots to two and retain clarity. Instead, they have been split up into pairs, which is more consistent with the way in which they are discussed.

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