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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects on surface atmospheric photo-oxidants over Greece during the total solar eclipse event of 29 March 2006" *by* P. Zanis et al.

Anonymous Referee #2

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General comments:

The paper 'Effects on surface atmospheric photo-oxidants over Greece during the total solar eclipse event of 29 March 2006' by P. Zanis et al. presents simultaneous measurements of air quality levels at 2 urban polluted and 2 remote sites during a total solar eclipse. The impact of the eclipse on NO, NO2 and O3 is investigated with use of a photochemical box model and a regional air quality model. The paper presents an interesting dataset and scientifically sound modelling analysis of what is a rare, natural photochemical perturbation event and shows that the regional air quality model reproduces observed O3 NO and NO2 well during the eclipse period. The manuscript

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is generally well written and I recommend publication subject to consideration of the following comments.

Specific comments:

The presentation of the measurements could be made clearer. In figure 1 the chosen scale makes it difficult for the reader to see any change in ozone at any of the sites. The scale for ozone should be changed to something more appropriate. I would also suggest changing the figure to also show data from the day before and day after the eclipse (such as is plotted for the photochemical model results), with a second part showing the zoomed-in eclipse period. In the description of the measurements at the Finokalia unpolluted site, a statement is made saying there is no drastic change in O3, NO2 and NO due to the solar eclipse, then the next sentence describes a 9ppb decline in ozone that can be 'partially associated with the eclipse'. These statements would appear to contradict each other. A correlation between O3, NO2 and NO with radiation during the eclipse period for all of the sites would give a more rigorous analysis of how the sudden change in radiation is affecting concentrations. Table 3 shows how O3, NO2 and NO change between eclipse and non-eclipse periods by using time periods before and after the event. The authors should also consider looking at average data for the identical time periods to the eclipse on other, non-eclipse days.

The section presenting the box modelling results could be expanded to describe the box model results from all 4 sites. It is stated that the simulations have been performed so it would be interesting to see how the ozone production budget is affected at the 2 polluted sites as well as the rural sites described in the paper. This could also be shown in figure 2 which currently only shows results from one site. OH radicals are calculated by the model and for the Finolkalia rural site show the expected result with concentrations dropping rapidly. Reference should be made to the paper Abram et al. (Hydroxyl radical and ozone measurements in England during the solar eclipse of 11 August 1999; GRL, vol 27, page 3437), which presented measurements of OH and ozone during a near total eclipse at a semi polluted site near London, UK. When

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looking at the O3 loss term (QO3) was the reaction of O3 with NO included? I would guess that even at the relatively rural sites this would be a significant factor in the O3 loss and certainly would be for the polluted sites. My other concern with this section is the input parameters for the model. In the experimental details section the model is described as taking into account the oxidation chemistry of C1-C5 hydrocarbons including isoprene but no mention is made of how these species are constrained in this study. Presumably, the amount of hydrocarbons present (especially fast reacting species like isoprene) will have an effect on the behaviour of ozone during the changes in photolysis rate. If not this should at least be stated.

Technical:

In the description of measurements (section 2.1) it would be useful to have information about the accuracy of the measurements. Later on in the paper, NOx data is described as having dropped to below the instrument detection limit but there is no information as to what this is.

P11404 line 24: should read 'have been carried out'

P11403 line 21: a better term would be 'nitrogen oxides (NO and NO2)' as is used later in the paper

Section 2.3: Is there a reference where the CAMx model is described in more detail?

P11409 line 27: Fig 2a cited twice

P11410 line 2: should read 'are increasing'

P11410 line 6: should be 'sudden' not sadden

P11414 line 6: should be 'Sea' not 'See'

P11414 line 16: remove 'with'

Tables 1 and 2 could be combined so the reader can more easily see the difference

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between observed and modelled species.

Table 4: Only contains data for 2 sites - the caption and text indicate that data from all four sites are shown

Figure 4: I am not sure this figure is necessary. If it is kept, then the measurement of JNO2 from Finokalia could be included to show the level of agreement.

Figure 6: It may be useful to add a 4th panel showing the non eclipse NOx concentration to allow the reader to see where the areas of high pollution are and thus compare with the changes in O3, NO and NO2 during the eclipse.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 11399, 2007.