

## ***Interactive comment on “Impacts of the solar eclipse of 29 March 2006 on the surface ozone and nitrogen dioxide concentrations at Athens, Greece” by C. Tzanis et al.***

### **Anonymous Referee #2**

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#### General comments

The paper is addressed to interesting natural effect, namely solar eclipse, and its effect on the surface ozone and nitrogen dioxide at Athens. These gas species are very sensitive to the changes of the incoming radiation and data provided in the paper could be used to show that in a better way. Surface ozone is controlled not only by available sun light but also by the availability of precursors and meteorological conditions, which is not sufficiently discussed in the paper. The paper should be more focused on the topic.

#### Specific comments

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There are several points which have to be clarified.

## Introduction

An important point, mentioned in introduction, is the time delay (10 minutes) of the maximum response of the surface ozone concentration on the solar eclipse of 11 August 1999 in Bulgaria. Next cited paper belongs to the authors of the current article and mentions 1 hour delay of the similar response. It is completely unclear why such difference is observed. Authors do not give any comment on such scatter of time response.

## Data

I believe that data presentation consist the weakest point of the paper bringing authors to misleading conclusion. It is state that measurements of the surface ozone concentration and NO<sub>2</sub> are done with resolution of 30 seconds. I have a strong hesitates that authors really used the data with this resolution. If so, they would come to completely different results. ALL the graphs presenting concentration measurements are given with hourly resolution. It is very likely that hourly means indeed were used for analysis, which is wrong for the highly reactive species in the polluted atmosphere. I would recommend authors to use the data with resolution which is announced in the Data section.

Detailed description of the radiation measurements is not relevant to the topic of the paper.

## Discussion and results

1) More discussion is necessary to the species of concern. As it can be seen in Fig. 1 the difference in absolute concentration of the surface ozone between the sites is about 4 times. More discussion of such difference is necessary. Comparing absolute values with Fig. 2, which is not relevant to the discussed phenomenon of 2006, it is possible to see a principally different absolute concentration in the earlier case. At one location

surface ozone concentration is even higher than the official air quality threshold. Better description of "usual conditions" at the sites is necessary before estimating a special case.

2) Application of interpolation is not clear. Why is the polynomial fit chosen? How is it constructed? On the graphs only the first point of interpolation is shown. How many points are used to retrieve the fit equation? Response on the eclipse is presented in percents of what? What is the accuracy of the response estimate (I believe that a sign after comma in the Tables is completely meaningless)?

3) In discussion the role of photochemical processes is discussed. In the polluted atmosphere the balance in the system O<sub>3</sub>-NO<sub>x</sub> is reached within minute (not hour). Authors can make a simple estimate with box model of the change in P(O<sub>3</sub>) term in the context of changing radiation flux. Correlation between changes of O<sub>3</sub>/NO<sub>2</sub>/J(NO<sub>2</sub>) can be also useful to see the role of photochemistry. In the other hand, the role of emission changes is poorly discussed. As far as eclipse observations are conducted inside the city, the changes in the primary emissions can be different in different points of the city. Primary emissions, especially transport emissions, play a key role in ozone formation/destruction inside the city. Role of this effect should be also discussed in the paper.

The conclusions of the paper in my opinion are poorly supported by data analysis.

Technical corrections

p.14334, line 22: set the appropriate measurements devices (ozone is usually measured with UV technique). Accuracy is given in ppb, while in Figures mkg/m<sup>3</sup> is used. Unify the units in the paper.

p. 14336, line 17: "The solar..." sentence is unclear

p.14337, line 25: which analytical method do you mention here?

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