

## ***Interactive comment on “Implementation of the Bessel’s method for solar eclipses prediction in the WRF-ARW model” by A. Montornès et al.***

### **Anonymous Referee #1**

Received and published: 8 February 2016

#### General comments

Astronomical phenomena like solar eclipses provide a unique opportunity for the study of the atmosphere and its response under such abrupt events. From this point of view, the subject of this research is interesting, as it incorporates the eclipse events in a mesoscale model. The authors use the Bessel’s method for first time in the WRF-ARW model and evaluate the model’s performance. The advantages and deficits from the use of Besselians elements must be further highlighted and compared to other methods. Moreover, the performance of the eclipse-WRF as regards the response of surface layer response (surface air temperature and wind speed) must be further analysed and discusses, since no comparison with real measurements is performed. Results should be compared against findings from other studies.

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## Specific comments

Abstract should be more informative as regards the main findings and conclusions of the study. It should contain at least one quantitative information, as for instance information on the validation of the Bessels's method or GHI improvement.

A schematic representation of besselians elements showing the outline of umbra during eclipse on Earth's surface and its projection on the fundamental plane would be helpful.

Apart from wind speed, wind direction has also been proven to undergo changes in many events of solar eclipses. The authors should mention on wind direction sensitivity as well (if any), from the simulations of eclipse and control WRF.

Tables 1 and 2 should be more informative (their titles as well). The first contact, MOT and last contact should be all included in tables. Total cloud cover at the stations during the eclipse must be provided as well.

Instead of FCTD and MOT, it would be useful to see in Figures an additional vertical line corresponding to the last contact (the time after which, obscuration percentage becomes zero again). Changes in meteorological variables after the end of the episode and relevant time lags and delays should also be discussed, commented and compared with other relevant studies.

It would be helpful, to include a table in which you can illustrate together all results of WRF-ARW response. For instance, maximum changes in air temperature or wind speed, time of occurrence, time lag etc. for all stations.

In the discussion of the results, the authors should also evaluate and comment their findings against the results from other relevant studies.

The response of the model is estimated only from the differences between the 'eclipse' and control simulations. However, the model performance can't be evaluated from real measurements, because the temporal resolution of the weather variables (air temper-

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ature and wind) in the BSRN stations is 3-hourly and thus they do not provide the required temporal resolution for an eclipse event. Given the density of climatic stations (especially in Europe), I was wondering on the availability of higher resolution meteorological data from neighbor (highly correlated) stations. A discussion about the daily (24-hour) variation of air temperature and wind speed/direction from SYNOP reports at BSRN stations and detection of possible differentiations between days before/during/after the eclipse should be of some value as well as regards the real response of surface layer at the sites of interest.

Some syntax and technical issues

Line 5 (page 1): avoid the phrase ‘..adding additional..’

Page 2, lines 2-4 , rephrase

Page 3 , line 16. Leave space Page 5, line 12, , equation (3): t must be subscript, please correct

References of the same author should be put in chronological order (e.g Fernandez et al 1993a,b 1996).

Some references are wrong or incomplete, e.g.: Founda and Melas (2007) should be cited as Founda et al. (2007) in the text and as following in the reference list : Founda, D., Melas, D., Lykoudis, S., Lisaridis, I., Gerasopoulos, E., Kouvarakis, G., Petrakis, M., and Zerefos, C.: The effect of the total solar eclipse of 29 March 2006 on meteorological variables in Greece, Atmos. Chem. Phys., 7, 5543-5553, doi:10.5194/acp- 7-5543-2007, 2007.

Also, Montorne (2015) and Fernandez 1993b seem to be wrong or incomplete in the text and reference list.

Figure 1, x-axis : labels appearance should be improved

Page 9 lines..1-10. The presentation of these results are somewhat confusing. Phrases

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like..‘the worst europa site..’ must be avoided, please rephrase.

Fig 4: GH is not included in station PAY?

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2015-781, 2016.

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