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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Summertime tropospheric ozone assessment over the Mediterranean region using the thermal infrared IASI/MetOp sounder and the WRF-Chem model" *by* S. Safieddine et al.

Anonymous Referee #1

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This is an interesting study which investigates the high tropospheric ozone values over the Mediterranean region using satellite observations and regional air quality modelling with WRF-chem. The interpretation and discussion of the results can be improved. I suggest publication of the manuscript after taking into account the following comments.

1) Introduction: They authors refer to the specific summer circulation conditions by linking to the descending branch of the Hadley cell (Bolle, 2002). Then they refer to the theory of Rodwell and Hoskins (1996) in which though (and in contrast to their pre-

vious sentence) it is proved that the subsidence center in the eastern Mediterranean is governed by Asian monsoon (and not the Hadley circulation) through the interaction of eastward propagating equatorially trapped Rossby waves (induced by the Asian monsoon heating) with mid-latitude westerlies. There are also recent studies on the influence of South Asian monsoon on summer circulation over Eastern Mediterranean (see e.g. Tyrlis et al., The summer circulation in the eastern Mediterranean and the Middle East: influence of the South Asian Monsoon, Climate Dynamics, 2013). I would suggest more thorough discussion of the dynamical processes of the summer circulation over Mediterranean.

2) In page 12385, lines 8-9: The authors state that spring is the season known for stratosphere to troposphere exchange events. This is not absolutely true. The fact that STE maximises in late winter/early spring does not mean that is the only period that takes place (see e.g. Stohl et al., Stratosphere–troposphere exchangeâĂŤa review, and what we have learned from STACCATO, J. Geophys. Res., 2003; Zanis et al., An estimate of the impact of Stratosphere-to-Troposphere Transport (STT) on the lower free tropospheric ozone over the Alps using 10Be and 7Be measurements J. Geophys. Res., 2003).

3) In Figure 6 they WRF-chem ozone values are compared with the station data. However the comparison in Figure 6 mixes the data from the different stations into one time series. I would suggest a more clear presentation of the model evaluation with EMEP observations for each station separately. This does not mean to add more figures for each station but maybe a Table with the evaluation scores for each individual EMEP station.

4) Mind that in Figure 10 the middle troposphere IASI ozone values are higher than the respective modeled values resulting in steeper ozone gradient at upper troposphere in the modeled values. Does this mean that maybe WRF underestimates the downward transport?

5) It should be clarified that the O3-inflow tracer cannot distinguish between horizontal and vertical transport. Hence it is useful in the study the use of stratospheric tracers such as Potential Vorticity (PV) and water vapour mixing ratio to distinguish the transport from the stratosphere. The discussion though in this part is limited lacking of interpretation of the dynamical transport processes. Why it is shown in Figure 11 only the layer between 350-250 hPa and not the 4, 6 and 8 km levels for comparability reasons with Figure 9? Also mind that theoretically the water vapour mixing ratio is a better transport tracer than relative humidity (which is used in Figure 11).

6) The fact that the northeastern corner of the modelled domain in panels 9d-f show anthropogenic contribution between 20 and 40% needs more elaboration and justification.

7) The section with the conclusions should be elaborated more with discussion in association with previous published studies. There are a number of published studies that have looked the high mid-tropospheric ozone values over Eastern Mediterranean.

8) The authors may consider that there is another similar study about summer ozone over Mediterranean from IASI under discussion in ACPD (Atmos. Chem. Phys. Discuss., 14, 13021–13058, 2014).

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 12377, 2014.