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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Summertime free tropospheric ozone pool over the Eastern Mediterranean/Middle East" *by* P. Zanis et al.

Anonymous Referee #2

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This interesting paper by Zanis et al., try to shade light on the processes governing the summer time appearance of the free tropospheric "ozone pool" over east Mediterranean basin and Middle east. In particular, by means of a 12 yr climatological analysis, the possible role of STE in feeding upper troposphere with elevated ozone mixing ratios are investigated. Possible implication for the occurrence of high surface O3 during summer, a very important issues for Mediterranean basin, is also discussed.

The paper is well written and concise and it address a relevant scientific question well within the scope of ACP. A large number of useful references are provided in the Introduction. Overall, I think that the paper deserves publication in ACP, after that a few points are addressed.

Especially, while the paper provides a nice "average" picture of the issue and related processes, however it do not provide much information about variability with time (even just from year to year). I would like to see more information about this (e.g. is the ozone pool position/extension/strength constant with time? and contribution from stratosphere?).

Moreover it should be interesting, for the STE contribution, to evaluate (if possible) how much can be related to "local" events occurring over the investigated area (i.e. the east Med) or related with events occurring far upstream and "transported" in the upper/middle free troposphere...

Below, I reported other specific comments.

Fig. 3: A notable difference in the location of the area with O3 maximum is evident comparing ERA-interim and TES measurements. Maybe the differences are not statistically significant, but some comments should be provided. Is this a "systematic" feature or it is related to a different depiction of specific events/periods? Comparing Fig 3e and 3k it is nice to see that the region with highest subsidence is located to the West of the region with high PV. This seems to be in agreement with Sprenger et al. (2007) showing that STT (stratosphere-troposphere transport) usually occur upstream of stratospheric PV streamers. . ..

Pag 22034, line 17: I would speak about "higher" PV and "lower SH". Indeed the PV values showed for the 500hPa and the 700 hPa are far from typical values observed during stratospheric transport into troposphere (typically above 1.6-1.8 pvu). This, obviously, is also an effect of the averaging process and/or of the mixing of stratospheric air into the troposphere. . .Can you provide and information about the fraction of time by which PV exceeded these threshold values over the investigated area for the 500hPa and the 700 hPa surfaces?

Fig. 3: please make the divergence labels readable.

Fig 3 and Pag 22035, line 14: I assume that the downward transport should be traced by the vertical velocity. However, looking at Fig 3 the maximum of O3 is shifted easterly in respect than the maximum of subsidence (for the 700hPa map). This is evident also from the cross section at the 32.25N latitude where the highest subsidence is located at 20E but the O3 tongue is centered more than 10 degree eastwards. . .Please can you provide an explanation?

Pag 22037, line 9: I think that this confirm just the existence of the increasing O3 towards East, more than the enhanced subsidence. . .

Fig. 8 (714 hPa analysis): I would see the same plots from TES measurements and a comparison the model against the satellite. . .

Pag 22038, line 15-25. I'm wondering if this discussion about the shape of the annual cycle (especially about the different identification of the summer maximum between model and surface observations) is really sounding: e.g. are the differences between July and August average O3 mixing ratios statistically significant at Cyprus?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 22025, 2013.