

## ***Interactive comment on “On the aerosol weekly cycle spatiotemporal variability over Europe” by A. K. Georgoulias and K. A. Kourtidis***

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In this manuscript the authors explore the detection of weekly cyclicity in satellite-derived aerosol optical depth time series across Europe. In particular they explore the spatially varying phase of the weekly cycles detected in selected regions, explore the seasonal variability and provide a process-based explanation for the spatial patterns based around use of reanalysis wind vectors. I found this to be an interesting well-argued paper which is in good overall shape. However, I have three major points, that I believe need to be tackled before acceptance, plus a couple of minor points and some minor text changes that will improve the legibility of the text.

Major points:

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1) Perhaps this reflects how I viewed the figures, but figs 1, 5, 7 and 8 are far too small for the mapped information to be readily interpreted and for the lettering to be legible. I realise a lot of information needs to be shown, but it would be much better to have a few clear figures with the text plus additional information figures provided as supplementary information.

2) I assume the authors have used initial linear detrending of the data and generally the time series processing methodology appears sound. However, the authors are using periodograms rather than as stated power spectra as indicated by the fact that they have 2 degrees of freedom (p1395 line 7). The periodogram is well known to be a poor estimator of the spectrum and therefore requires some form of spectral window (smoothing) to increase the degrees of freedom (e.g. Percival & Walden 1996, Priestley, 1982 cited by the authors). Two observations of a variable are not enough to reliably establish a mean value, but the periodogram estimates direct from an FFT are exactly that: a (biased) estimate of the mean squared amplitude at each frequency. The choice of the (higher number of) degrees of freedom is up to the authors, but will typically be in the range of 8-14 when testing spectra for evidence of periodic or quasi-periodic components (i.e. spectral peaks) emerging from the spectral background.

3) Appendix B of Bell et al 2008 JGR (cited by the authors) discusses how TRMM estimates of precipitation incorporate small-amplitude weekly cycles simply due to variations in timing of the orbits of the satellite. Since the AOD data analysed here are entirely satellite-derived, it is important that the authors discuss, and convincingly discount, any weekly cyclicity in estimated AOD as potentially induced by 7-day or 6-day satellite orbital periods.

Minor points:

1) Fig 4 APD figures need the uncertainties indicated on the plots. Additionally, the authors apparently still need to indicate in the caption or the text the meaning of the colours used.

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2) p1401 lines 14-15 It is stated that spectral analysis was not carried out on the NEE region data due to lack of data in the winter. There are routines available for spectral analysis of data with missing data/data irregularly spaced in time.

Minor text changes:

p1391 line 25: To avoid ambiguity for the reader: move the text: “for the whole period of interest” at the end of the sentence to near the start of the line. The revised sentence will now start: “This dataset was used for the calculation, for the whole period of interest, of the average percent departure (APD)...”

p1392 line 8: Insert “of data” after “two days”.

p1393 line 5: Spelling “less” (not “les”).

p1393 line 11: Spelling “below” (not “bellow”).

p1393 line 17: Insert “later” after “we argue”.

p1393 line 23: Insert “of data” after “one day”.

p1394 line 25-26: The Mann and Lees (1996) method for robustly fitting the background spectrum should be applied to a spectrum (not a periodogram).

p1395 line 6-7: “the degrees of freedom (here 2)...” should be using many more degrees of freedom.

p1397 line 27: Delete “it was”.

p1398 line 9: Delete “it was”.

p1398 line 25: Delete “it is”.

p1398 line 25: Spelling “below” (not “bellow”).

p1399 line 17: Delete “it was”.

Fig 5 caption: Make first “(a)” bold. Change second “(a)” to “(b)”.

p1402 line 28: Change “fault WCI values” to “faulty WCI values”.

p1403 line 2: Delete “it is” and “this was”.

p1404 line 23 & 24: Change “However, as it was above mentioned...” to “However, as mentioned above...”

p1405 line 1: Change: “because as it was aforementioned...” to “because, as mentioned previously...”.

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