

Interactive comment on “Weekly cycles in precipitation in a polluted region of Europe” by C. W. Stjern

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Thank you for useful and constructive comments on this manuscript!

—SPECIFIC COMMENTS—

1. Page 1778 Line 13: The fact that climate is growing increasingly continental in nature towards the east is a good point and may indeed affect the nature of the weekly cycles with longitude. Mr. Hendricks Franssen also noted in his Short Comment that spatial autocorrelation is affecting the uncertainty of the regression given in Figure 9. Given these arguments I have chosen to tone down the discussion of amplitude variation with longitude, removing the figure and substantially shortening the analysis. As the MARS dataset does not extend further back in time than 1983, the suggested analysis to

C1613

check how Figure 4 looks for other time period (for instance shortly after 1900) can regretfully not be performed.

2. Page 1781 Line 1: While it would obviously be of great interest to study pollution measurements from many more stations in the area, and to look at observations of several other chemical species, the data availability of the EMEP network is limited. There are only four EMEP stations with available data in the Black Triangle area, and the Svratouch station was initially chosen as a sole representative of the area due to its long and consistent time series. The focus on SO₂ was motivated by the particular influence of sulphate aerosols on clouds. I have now performed a new analysis based on the average daily values of the four available stations. There are observations of PM at some of the stations, but only for short periods at the time and often measured only a few times a week. I did, however, take a look at measurements of NO₂, which to a larger extent than SO₂ can be expected to display weekly periodicities as the source of NO₂ is more related to traffic and less related to power plant emissions. Weekly cycles of both SO₂ and NO₂ are now presented in the manuscript, and the NO₂ cycle was strong enough to give a clear peak at 1/7 days in the periodogram and stand out with a much stronger amplitude in the 7-day than in the 6- and 8-day weeks.

3. Page 1783 Line 5-12: I have now performed the KW-test on the 6- and 8-day weeks as suggested. For SO₂, the 7-day week was already shown to have a 95% significant difference in the median of the weekdays by the KW-test. The KW-test on 6- and 8-day weeks did not give significant results. The same was found for NO₂ – only significant results by the KW-test for the 7-day week. This information is now added in the text.

4. Page 1783 Line 12: The different in time periods between your PM₁₀ cycles and my SO₂ cycles is now stated in the text, and I have also changed the wording in this section to make it clear that I don't directly compare my 10 % weekly cycle amplitude in SO₂ at four rural stations in the Black Triangle region to your 24 % amplitude of PM₁₀ based on four urban stations in Switzerland in a different time period. However, I still find it useful to provide the reader with another example of the magnitude of a weekly

C1614

pollutant cycle in Europe, even if it is for another species, area and period.

5. Page 1784 Line 12: As commented, I compare my results to other results from different time periods, and I have now strived to be entirely clear on this throughout the manuscript. However, I do not understand why it would be better to compare my results to your master thesis, where you looked at the period 1992-2006, as opposed to the results from Barmet et al. (2009), which also studies precipitation in the 1992-2006 period, and which also produced an amplitude of about 0.4 mm.

6. Page 1784 Line 22: The fact that one would already expect 1.5 of the 30 stations to have “falsely significant cycles” by chance using a significance level of 5% was also pointed out by Mr. Hendricks Franssen. I by no means meant to imply that 3 significant weekly cycles out of 30 was a strong indication of anything else than chance, and have now clarified this in the text. (As suggested, I also performed the test on 6- and 8-day weeks on the raw data for comparison. For the 6-day week 1 of the 30 stations got a p-value < 0.05, while for the 8-day week none of the stations did.)

7. Page 1785 Line 20: The wording of this sentence came out a bit too strong – my intention was not to indicate that you had any definite expectations as to the nature of the weekly cycles of precipitation in more polluted regions. The sentence is changed and now simply states that in general (and as was also found in Barmet et al., 2009) the weekly cycles are not significant, even if this is a highly polluted region.

——TECHNICAL COMMENTS——

1. Page 1783 Line 19: “The Black Triangle” has its name from the triangular shape of the meeting borders of Germany, Poland and the Czech Republic. This information is now added in the first mention of the region, namely in the final paragraph of the Introduction chapter.

2. Page 1778 Line 4: Yes, there is only one author, and the use of “we” is of course now changed throughout the manuscript.

C1615

3. Page 1778 Line 20: The test is now identified in the text.

4. Page 1782 Line 17: As suggested “measurements” is now changed to “observations”

5. Page 1788 Line 7: Thank you, “BT” is now changed to “Black Triangle”.

6. Page 1789 Line 3: I am afraid I must have misread the first sentence on page 4 of your paper, stating (after finding no significant difference in the precipitation amplitudes between a 6-, 7- or 8-day week) that “This also holds for light rains (≤ 5 mm/d following Gong et al. [2007]).” I understood from this that you had also studied light precipitation, using the ≤ 5 mm definition of Gong et al., but this is now corrected in my manuscript.

7. Page 1789 Line 9: The references to 1/7 days or 1/7 d-1 are indeed inconsistent in the manuscript, and this is now fixed.

8. Page 1796 Fig 4 and Page 1798 Fig 6: I agree that equal ordinates would improve readability particularly in Figure 8. However, as for the other figures (Figure 6, as well as Figure 9 and Figure 10) the range of the ordinates for “all day” and seasonal data are so different that I am afraid the “all day” graphs would be too compressed in the vertical. I do however thank you for the comment and will take it into consideration.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 1777, 2011.

C1616