

Response to referee comments on “Overview of the LADCO winter nitrate study: hourly ammonia, nitric acid and PM2.5 composition at an urban and rural site pair during PM2.5 episodes in the US Great Lakes region” by C. O. Stanier et al.

Response to comments of anonymous referee #2

The reviewer noted that a relatively simple way to assess the geographic extent of the episodes was not used. Ten of the thirteen episodes seen at the Milwaukee monitoring site include IMPROVE and CSN speciation samples collected on the national 1 in 3 day sampling schedule. Earlier work using these data has indicated that winter nitrate episodes can cover multistate regions. An examination of the data from the dozens of rural and urban sites in the Midwestern region has the potential to provide much broader geographic context that may be important to fully understanding the causes, sources, and effects of these episodes. For example, it would be useful to know if the six episodes seen in Milwaukee, but not in Mayville were geographically small episodes, or larger scale episodes with Milwaukee within and Mayville beyond it influence. The authors have already used these speciation sampling data in a different way to show that the 2009 study period had somewhat higher concentrations than the same months in other recent years. It would be a relatively simple matter to use these data to map the spatial extent of particulate nitrate concentrations for the 10 episodes that are coincident with the speciation sampler schedule to provide broader scale geographic context for the high time- and composition-resolved information from this two site special study.

We are working on a full publication that includes this type of spatial analysis. The appendix to Baek et al. (2010) does include kriged maps of PM2.5 concentration with the sampler concentrations shown (by a color scale). A preliminary analysis of the figures from the Baek et al. appendix gives the following. A summary of this table has been put in the text of the manuscript. Spatial extend can also be found in Figure 4.2.10 of Spak et al. (2012).

Episode	Notes
J-I (1/7)	“both site” episode occurring on a 1 in 3 sampling day for the CSN network. Geographic extent appears to cover Chicago and Southern Wisconsin (but not Green Bay).
J-II (1/11-1/13)	“both site” episode. The 13 th is a 1 in 3 sampling day for CSN but is mainly after the episode. What samples are available indicates elevated PM in Chicago, Madison, Green Bay, Milwaukee, but not Eastern Iowa or Minneapolis.
J-III (1/21-1/23)	“both site” episode with a 1 in 3 sampling day on the 22 nd . This was a multistate episode including Wisconsin and parts of Minnesota, Iowa, Illinois, Indiana, Ohio and Michigan
J-IV (1/27)	“Milwaukee only” episode but not on a 1 in 3 sampling day. The J-IV episode is not very distinct from the both site J-V episode on

	the 27 th and 28 th . Samples on the 27 th were elevated, however, in Green Bay and Appleton.
J-V (1/27-1/28)	“both site” episode with a 1 in 3 sampling day on the 28 th . Some multistate character, with elevated PM2.5 in eastern Wisconsin (Madison, Milwaukee, Green Bay), Minneapolis, and Eastern Iowa. PM2.5 was elevated but not to an episode threshold in Chicago and La Crosse / Winona.
F-I (2/5-2/7)	“both site” episode with a 1 in 3 sampling day on the 6 th . The episode was multistate and included most of Wisconsin and the Minneapolis area. Elevated PM2.5 but not as severe in Chicago, northern Illinois, and eastern Iowa.
F-II (2/7-2/10)	“both site” episode with a 1 in 3 sampling day on the 9 th . Episode appears to extend from Green Bay to Chicago. Elevated but not as severe PM2.5 from Minneapolis through Iowa, Central Illinois, Indiana, and Ohio.
F-III (2/17)	“Milwaukee only” episode not on a 1 in 3 schedule. What sample values are available indicate a broad increase in PM2.5 to near the threshold level through multiple states.
F-IV (2/24 – 2/26)	“Milwaukee only” episode with a 1 in 3 sampling day on the 24 th . Samples appear to indicate a broad region of increased PM2.5 but not to the episode threshold in all locations.
M-I (3/5 – 3/8)	“Milwaukee only” episode with a 1 in 3 sampling day on the 5 th . Samples appear to indicate a broad region (Minneapolis, MN to Indianapolis, IN) of increased PM2.5 but not to the episode threshold in all locations.
M-II (3/14 – 3/16)	“Milwaukee only” episode with a 1 in 3 sampling day on the 14 th . Samples appear to indicate a fairly small area of increased concentrations along the coast of Lake Michigan (Green Bay, WI, Milwaukee, WI, Chicago, IL). Mayville concentration did not exceed 20.
M-III (3/17)	“Milwaukee only” episode on a 1 in 3 sampling day. Some elevated PM2.5 regionally but the episode seems localized to Milwaukee, WI.
M-IV (3/21 – 3/22)	“both site” episode but not including a 1 in 3 sampling day. What samples there are indicate an area of elevated PM2.5 including Eastern Iowa, Madison, WI, Green Bay, WI, Chicago, IL, Milwaukee, WI, and South Bend, IN.

Page 14125, line 11 to 16 – The first of these sentences could more clearly indicate that the data adjustment is to the continuous data (as opposed to the filter data). The second sentence states the mean absolute errors for the adjusted continuous data, but doesn’t indicate how the adjustments were done, nor how the mean absolute errors were calculated. A little more detail provided in this paragraph or at least referenced there would make these two sentences more informative.

Wording has been improved to indicate what was adjusted. The citation to Edgerton (2006) should be sufficient for those needing more information on the method. The method used in the current (LADCO ACP) work is the data analysis section and is fully described.

Section 5.2 (and perhaps elsewhere) – The first sentence in this section start “The continuous and integrated measurements: : :”, while elsewhere the term “semicontinuous” is often used. Are there three categories of measurement, or is the continuous and semicontinuous measurements in-fact the different terms for the same category? Some clarification here would be helpful.

Wording has been standardized to continuous.