

Interactive comment on “Observations of glyoxal and formaldehyde as metrics for the anthropogenic impact on rural photochemistry” by J. P. DiGangi et al.

Anonymous Referee #2

Received and published: 16 April 2012

This is a potentially important study of glyoxal and formaldehyde in low-NO_x rural conditions, and the effects of short-term perturbations from pollution events including a wildfire. The authors make the case for the ratio of the concentrations of these species, termed R_{GF}, being a useful indicator for the type of air mass that is being observed, particularly when combined with the absolute concentrations. The paper is clearly written (very few typos – see below), and appropriately illustrated, with quite a bit of additional material in the Supplement. Given the high degree of interest in glyoxal as an indicator of photochemical activity, and as a source of secondary organic aerosol, these measurements in a comparatively unexplored environment are important. I recommend that the paper is published, after the authors consider the points below.

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It is remarkable that the R_{GF} values are quite constant even when air masses change substantially, or when there is a perturbation such as a rain shower (when, as stated in the paper, one would have expected R_{GF} to change because of the very different solubilities of glyoxal and formaldehyde). The most significant change to R_{GF} is a solar dependence, with a peak around noon. The authors use this fact to promote the idea of using R_{GF} as an indicator of air mass type, particularly the influence of anthropogenic pollution. But how reliable is this likely to be, given that biogenic emissions (both primary and secondary) in different environments affect R_{GF}, combined with the observation that the ratio is not very sensitive? Surely there are simpler (and more reliable) ways to tell if there is anthropogenic pollution in a rural setting?

Another concern is the disagreement with satellite observations of R_{GF}. The paper makes the point that the ratio of column abundances observed from space over rural areas should, if anything, be smaller because of production of formaldehyde in the free troposphere, whereas it is larger than measured at the ground in these field campaigns. The satellite observations have the possible advantage that both species are measured by DOAS, whereas these ground-based measurements use different spectroscopic techniques to measure glyoxal and formaldehyde. Is it possible that the glyoxal is systematically underestimated? The only discussion related to this point is a statement that when R_{GF} was measured at an urban site (Bakersfield), the ratio was similar to that measured in other urban areas. I think a more convincing discussion about the absolute accuracy of the glyoxal (and formaldehyde) measurements would be welcome.

Minor corrections: Page 6058 Line 15 – insert “the” before campaign Page 6064 Line 26 – change “between” to “by” Page 6065 Line 7 – remove “significant” Page 6067 Line 5 – change “peak” to “peaked” Page 6067 Line 6 – change to “near doubling of RGF” Page 6067 Line 7 – remove “or deviation” (redundant) Page 6068 Line 3 – insert “the” before source