

Interactive comment on “Photochemical age of air pollutants and oxidation products in transboundary air observed on Fukue Island, Nagasaki, Japan” by S. Irei et al.

Anonymous Referee #1

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The paper focuses on whether the use of the fractional contribution of the m/z 44 signal to the total organic aerosol mass spectra (f_{44}) can be used as an oxidation indicator. The authors have collected a certain amount of measurements of trace gases in order to draw their conclusions and make an educated guess for the missing information. The factor f_{44} was compared with the photochemical age of the pollutants ($t[\text{OH}]$) calculated from NO_x/NO_y , as the toluene/ethyne concentration ratio (NO_x/NO_y and hydrocarbon clock, respectively) is not applicable in this situation and it was found to increase as $t[\text{OH}]$ increased. This led to the conclusion that the factor f_{44} can be used as oxidation indicator and a discussion about the applicability of this method and possible causes of discrepancy with previous studies was included.

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The manuscript is in generally clear though I think some improvements in the quality of the figures are necessary. I would suggest considering moving most of the time series of trace gases to the SI or at least to create a more compact one page figure with all of them together. As they are now they do not really improve the quality of the paper or give such additional information that requires them to be plotted individually.

One major point I have is the choice of the average OH concentration for the lifetime of CO, ethyne and NO_y in section 3.3 and for the estimation of the competition of the O₃ reaction in section 3.5. It is not clear how the authors arrive at the estimated concentration of average OH. The authors should clearly justify their choice, and as it is an estimate they should give a good idea of the effect of changing the estimation, i.e. the sensitivity of their estimate. Later in that section (lines 17, page16) it is reported that a value of 3×10^6 molecules cm^{-3} would be 6 times large than the concentration reported previously by Irei et al. 2014. As far as I can tell, there is no measured OH concentration reported in the cited paper.

In addition I think that figure 9 requires some additional explanation as it is hard to understand and as some suggestions for values of background mixing ratios of NMHC in the region of East China Sea are drawn from this figure. I would suggest including a legend to make it easier to immediately identify which color is which. Would it be possible to highlight the observed trend that on line 17 on page 18 is lying between the trends for the dilution with the background air and the reaction loss? Also, how can I see (line 10 on page 19) from figure 9 that the background NMHC ratios seem to lie between -3.5 and -4?

Specific comments:

In general I would suggest to remove the “Note that” from the manuscript.

- Line 2, page 4: the wind is from west to east
- Lines 25 to 27 page 4: it is not totally clear what is given the evidence of SOA

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production

- Figure S2: I would suggest putting the cardinal points directly on the figure
- Table 1: what does n stand for?
- Lines 10 to 12 page 9: It is reported that the concentrations of organic aerosol reported by Irei et al. 2014 were relatively low. How does this fit with the current study?
- Lines 10 to 13, page 11: It is not clear to me the meaning of this sentence. High mixing ratios occurred for a small portion of the observed data or high mixing influenced by local pollution occurred for a small portion of the observed data. Is it possible to distinguish between the two cases?
- Line 1 and 2 page 12: what is the meaning of recently improved emissions in NO_y?
- Line 13, page 13: which data point?
- Line 28, page 13 to line 2, page 14: I suggest rephrasing the sentence.
- Line 3 page 16: 1×10^6 molecules cm⁻³ of OH radicals do not correspond to 0.05 ppbv...rather to 5×10^{-5} ppbv.
- I would suggest to separate in section 3.6 the two different t[OH] estimates with two subsections. It should also be stated in a clearer way that the estimate of t[OH] from the hydrocarbon clock is not possible for these conditions.

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