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Atmospheric Chemistry and Physics Discussions

Interactive comment on "OH reactivity at a rural site (Wangdu) in the North China Plain: Contributions from OH reactants and experimental OH budget" *by* Hendrik Fuchs et al.

Anonymous Referee #3

Received and published: 19 September 2016

This manuscript describes measurements of OH reactivity made in Wangdu, China, using the laser photolysis with laser induced fluorescence (LP-LIF) technique, and makes comparisons with the calculated OH reactivity based on measurements of OH reactants. In general, the observed OH reactivity can be explained by measurements of OH reactants (which included OVOCs), with a limited role for unmeasured oxidation intermediates.

Measurements of OH radical concentrations, presented in a separate paper, are also used with the OH reactivity to assess understanding of the OH production rate at the site. The OH production and destruction were generally balanced throughout the campaign, although there is potential for a bias in the OH concentration measurements

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which may impact the analysis of the OH production rate reported in the manuscript.

The paper is within the scope of ACP, and I recommend publication once a number of issues have been addressed. The analysis of the OH reactivity is generally well presented, but it is poorly quantified. There are numerous instances throughout the manuscript where claims are made regarding 'good correlations' or 'good agreement' between measurements and calculations but these statements must be quantified. The comparisons between measured and calculated OH reactivity are presented only as time series, the manuscript would benefit from a scatterplot showing the calculated OH reactivity against the measurements, enabling a more direct comparison.

The manuscript reports a limited role for oxidation intermediates. Model results reported for OH concentrations in the manuscript by Tan et al. could be used to quantify the contributions of unmeasured oxidation intermediates to the total OH reactivity, but are only briefly discussed.

In places, the manuscript is also poorly written and could be clarified significantly. Please see specific comments below.

Specific comments: Abstract: Mention the technique used to make the OH reactivity measurements. Lines 7-8: Quantify 'good correlation' and 'high contribution'. Line 15 (and elsewhere): 'hydroperoxy' is preferred over 'hydroperoxyl'. Line 20: 'oxidization' to 'oxidising'. Line 33: 'aerosols' to 'aerosol' or 'properties of aerosols'. Line 49: State the isoprene oxidation products that were measured. Line 63-69: Can you comment on the prevailing wind direction? Line 70: 'sea containers' to 'shipping containers' and perhaps replace 'partly stacked up' by 'raised'. Line 84: 'well agreed' to 'agreed well', and quantify the agreement (and elsewhere, e.g. line 102). Line 85: How many instruments? What was the standard deviation of the average? How did one of the instruments 'appear to be more precise'? How does the uncertainty in the NO measurements impact the analysis of OH reactivity? Line 93: How small is 'rather small'? Quantify the impact. Line 98: 'glyoxal'. Line 100: 'mass spectrometry'. Line 101: 'part

of the same species' – please rephrase to clarify the meaning. Line 113: Please clarify that it is the previously reported Zeppelin instrument that is being used in this campaign. Line 121: Does the length of the sampling line affect the measurements? Line 126: How does the change in temperature affect the measured OH reactivity? What is the difference from the external ambient temperature? Line 141: 'In a distance' to 'At a distance'. Line 150: Clarify what you mean by 'sufficiently precise'. How does the summing of decay curves affect the reported values? Does it make any difference to simply average 60 decays before fitting as opposed to summing ten decays and then averaging six summed decays? Line 153: 'equalizes' to 'equalize'. Line 165: What is the uncertainty/precision of the measurements? Line 181: '??'. Line 187: What was the mean/standard deviation/median NO? 'Thus' is mis-used, it doesn't necessarily follow that no bi-exponential behavior was observed because NO concentrations were low (i.e. high NO concentrations are not the only possible explanation for bi-exponential behavior). Line 203: Quantify the correlation. Lines 215-234: Much of this is poorly phrased and difficult to follow (particularly lines 224-228), please consider re-writing. Line 220: 'measurements' to 'measurement'. Line 229: 'are' to 'is'. Clarify what 'reason' is explaining. Line 239: Comma after 'OH reactants'. Line 243: Remove 'concentrations', or replace 'VOCs' with 'VOC' and remove 'species'. Line 260: Comma after 'small alkenes'. Line 262: 'in the late night' to 'late at night'. Line 269: Avoid use of 'opposite', it implies a more perfect mirror relationship than I expect was observed. Replace 'than' with 'to'. Line 274: 'range' to 'ranged'. Switching from one tense to another throughout the following section. Line 300: 'degree' to 'degrees'. Line 305: Remove the comma after 'times'. Line 308: Re-iterate the source of the uncertainties and why they have been separated into two terms. Line 310: What were the differences between? The wording of the sentence implies it could be between nighttime and early morning as opposed to measured and calculated reactivity. Line 315: Quantify the 'exceptionally good agreement'. Line 345: 'accounted also' to 'also accounted'. Line 355: Avoid 'like in this campaign', perhaps 'Similarly to observations in this campaign'. Line 364: The measured OH reactivity in London contained significant contributions from

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model-generated intermediates. Line 384: Avoid use of ‘like for’. Line 389: ‘during the daytime’. Line 402 and following paragraph: Quantify ‘nearly balanced’, ‘slightly larger’ and ‘hardly significant’. What was the ‘systematic trend’? Line 411: Quantify ‘much larger and highly significant’. Line 422: What about the possibility of OH regeneration through peroxy radical reactions with the nitrate radical? Line 431: ‘hypothesis’ to ‘hypotheses’. Line 438: Define the term ‘turnover rate’. Line 445: Quantify or define the level of significance in the term ‘clearly above the level of significance’. Line 464: Comma after NO. Line 467: ‘OH reactants’ to ‘OH reactant’. Line 475: ‘all’ to ‘most’.

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