

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 #2

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This paper describes and analyses the OH reactivity measurements carried out at the Wangdu site, denominated as "rural site" in the title. The aim of this work is to improve the knowledge of radical chemistry in Chinese megacity area and complete the analysis of this chemistry at the Wangdu site based on the comparison between measured and modeled concentration of OH, HO₂ and RO₂ radical, described in an accompanying paper (Tan, 2016). In the present paper, the site and the instrumentation used for ancillary measurements are briefly described. The newly built OH reactivity instrument (similar to the one used in previous campaigns in China) and the fitting procedures are described. The results are presented as follows:

- first a general description of the time series of OH reactivity, including 2 different

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periods : one with higher reactivities, related to local biomass burning activities, and one at lower reactivities ,

-then a comparison between measured and calculated reactivity on the basis of ancillary measurements including for the first time some OVOCs, contributing to a large fraction of the OH reactivity. In the second period of the campaign (low reactivity), the agreement is good, but during the first part of the campaign, for some periods, during the night and at high nitrogen oxide concentrations, unexplained missing reactivity is found

-a discussion based on the OH reactivity measurement in other campaigns in China and at some locations influenced by anthropogenic emission is done,

- finally, an analysis of the OH budget based on the calculation of the production and destruction rate is done using OH reactivity, HOx, ozone, HONO, NO, photolysis frequencies and alkenes measurements. This analysis highlights a production rate slightly larger than the destruction rate the afternoon, this difference decreases with increasing NO concentration, as observed, more clearly in previous field campaigns in China. Comparisons of the conditions point out the differences with the present campaign with lower NO (factor 2), lower reactivity (factor 1.5-3), different HONO profiles.

The article is well written and is suitable for publication in ACP however, I would suggest to add :

- more connections with the conclusions from the accompanying paper (Tan, 2016) in the present paper, particularly because the modeled OH reactivity is presented in (Tan, 2016) as well as sensitivity run constrained on the basis of OH reactivity measurements,

- a more detailed discussion on the missing reactivity,

- gathering the discussion on the comparison with previous campaigns to avoid repetition and to help the reader to better see the new understanding brought by this

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campaign and in particular the reactivity measurements.

L29 : It is mentioned in the introduction that " the effort to improve our knowledge of radical chemistry in Chinese megacity areas was continued by a comprehensive field campaign at a location close to the city Wangdu" please resume the conclusion of the accompanying paper (Tan, 2016) and put in the conclusion of the article the key results from this campaign which contribute to this improvement. What type of environment should be studied in future campaigns to bring complementary information as in the present study the low reactivity and potential OH interferences seem to prevent to draw clear conclusion concerning the OH budget ?

It is confusing to see in the introduction that the site is described as "close to the city Wangdu", described at rural in the title and that the campaign location is in a botanic garden close to the "small" town Wangdu. Please clarify how and why this site has been chosen and how it is classified.

Linked comment : how the comparison with other campaigns has been chosen ? L350-365, related to anthropogenic emissions but without the comparisons with reactivity measurements done in Paris or Mexico, whereas these campaigns are discussed later (I453-460) concerning HONO. I would propose to gather the comparison paragraphs.

L73 : Particle measurements are also available. Could it be commented ?

L156 : how the delay to start the fit is defined (which level of deviation is considered to discard the points ?)

L157 : the reason for the deviation is attributed to the non homogeneity of the OH distribution: could this be clarified? Is it due to the heterogeneous distribution of the laser energy ? L165 : which species considered as contaminations have been identified in the gas cylinder ?

L184 : why the assumption of a bi-exponential fit would better describe the conditions with recycling ?

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L189 : which criterion is used to decide that the measurements appear as single exponential decays ?

L206 : would be useful to show other correlations with individual species (provide also more details in the repartition of the reactivity for specific periods (L310)

L214/Figure 4 : difficult to identify the different trajectories

L232 : other species correlate with acetonitrile (could provide the profile in Figure 2) ?
New peaks (GC, PTR-MS) have been observed during the biomass activities?

L264 and 302 : influence of products due to oxidation by nitrate radical could be discussed, parallel with particle profiles could be discussed.

L280-291 : some repetitions with 3.1

L297 : "It is most prominently seen in median alkene and alkane concentrations".
Where ?

L322 : possible to use ratio of species with different rate constants with OH to estimate this photochemical age ?

L350-365 : see comment above. What can be concluded from these comparisons ?

L382 : What is missing ? How it has been concluded that "results do not change significantly, whether the first part is included or not"? Please detail.

L419 : possible to show the results with the bias subtracted ?

L432 : Please detail

L439 : why introducing the term turnover rates there ? Useful ? Check the consistency of the terms used in the Figure 8

L475 : but there are periods with significant missing reactivity. It could be mentioned in the conclusion.

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