

Interactive comment on “A portable dual smog chamber system for atmospheric aerosol field studies” by Christos Kaltsonoudis et al.

Anonymous Referee #1

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The authors of this paper developed a portable dual smog chamber to study the aging processes of atmospheric relevance. The authors report the preliminary results of the first tests experiments. One of the advantages of the developed portable chamber is that it can be irradiated with natural sunlight and it can be filled with ambient air rather than purified air as its starting point. Hence, this chamber can be used to evaluate the aging processes under different environmental scenarios (for example very aged air masses). Although there are some advantages of the developed dual chamber system there are some missing points regarding the characterization of the chamber that to my opinion the authors should consider in their analysis before this manuscript is accepted for publication.

Main comments:

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1) In the “Experimental procedure” it is not clear how many experiments were performed (it is ambiguous for the blank experiments and missing for the experiments themselves). The authors should clearly state upon how many replicates are based their conclusions and provide a table for various initial conditions and main results.

2) Sometimes, the analysis are oversimplified. Some key measurements are not given (see below my comments) and the literature survey is not wide enough.

3) The authors should have tried to better define the behavior of the chamber walls toward the NO_x/air/light system. This is a valuable exercise which is required for most of the chamber application. This is especially important since HONO was used as a source of OH radicals. They should perform deeper analysis and to build an auxiliary mechanism made of pseudo-elementary reactions with rate constants parameterized upon their experimental data. See for instance : Jeffries et al., 1976; Akimoto et al., 1979; Bloss et al., 2005; Carter et al., 2005; Hynes et al., 2005; Rohrer et al., 2005, Metzger et al., 2008; Wang et al, 2011; Wang et al, 2014.

4) Previous simulation chamber studies observed a significant background OH production that could not be attributed to known OH radical precursors (Rohrer et al., 2005). A heterogeneous formation of HONO and its subsequent photolysis was suggested to explain this so called “background reactivity” within simulation chambers (Akimoto et al., 1987; Carter et al., 1982; Glasson and Dunker, 1989; Killus and Whitten, 1990; Sakamaki and Akimoto, 1988). It was postulated that HONO is formed by the heterogeneous dark hydrolysis of NO₂ on the humid chamber surfaces (see for example Carter et al., 1982; Finlayson- Pitts et al., 2003; Jenkin et al., 1988; Kleffmann et al., 1998; Pitts et al., 1984; Sakamaki et al., 1983; Svensson et al., 1987) the mechanisms of which are still under discussion. Did the authors calculated the ratio of HONO_{walls}/HONO_{injected} ? This background HONO production could differ at varying lightning conditions. Higher light intensities as it is the case in this study ($J(\text{NO}_2) = 0.1 \text{ min}^{-1}$) would increase the quasi-stationary background OH concentrations. More significant HONO and OH background production rates can only be determined by es-

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pecially dedicated experiments including systematic variations of RH and light intensity.

5) There is no information about the estimated water quantity adsorbed on the Teflon wall or about the VOCs adsorbed on the wall. As mentioned above the blank experiments can lead to a HONO production from the chamber walls. What could be the zero order constant in ppt/s of HONO production from the chamber walls? The photolytic wall source of HONO is proportional to the $J[\text{NO}_2]$ (Rohrer et al., 2005) and somewhat related with the NO_2 concentration (for example Hynes et al., 2005 or Wang et al, 2011 or Wang et al, 2014).

Minor comments

- 1) What is the mixing ratio of HONO introduced in the chamber?
- 2) As the wall material seems to have a significant importance, please provide the precise reference of the material: producer, ref number, and product name
- 3) As the Teflon foil is new and used just before the preliminary experiments how the blank experiments were distributed during the campaign? If, they were evenly distributed among experiments, did you notice any evolution of the wall chemical behavior?
- 4) Adsorbed organics on the chamber wall can also come from the foil production process (see Carter et al, 1982 for example), it is hence not relevant to only refer to the level of VOCs coming from the ambient air.

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