

Design of a new multi-phase experimental simulation chamber.

The paper describes the design and initial characterization of a new stainless steel chamber at LISA that is designed to study gas phase, aerosol and cloud chemistry under carefully controlled conditions, with a wide range of analytical equipment for physical and aerosol characteristics, and gas phase and aerosol composition. The chamber provides a distinctive environment capable of covering a range of temperatures and pressures. It has the potential to become a major contributor to the development of our understanding of atmospheric processes. The paper should be published, subject to a few minor changes. Some suggestions for such changes are made below:

1. A consequence of the choice of xenon arc lamps, which, when coupled with pyrex filters provide a good representation of the solar spectrum, is the inevitable variation in light intensity within the chamber. This problem is discussed in section 4.3, which states that there is a factor of 5 variation in intensity. Figure 5 seems to indicate a much larger variation, of more than a factor of 10. This problem is addressed by rapid mixing, but the discussion in section 4.3 is not very clear on the impact of the intensity variation on experiments (p334, l 14-18). It would be helpful if the Supplementary material contained results of simulations showing, for example, the variation in [OH] in the chamber for a range of accessible fan speeds and photolysis rates, using the model described in section 4.1, to help quantify the statement on p334 about the required photolysis rate for significant impact of the intensity variation.
2. The investigation of wall reactions is quite limited. There is no systematic study of intensity or relative humidity dependence, which have been shown in the SAPHIR and EUPHORE chambers to be significant. While a full analysis is beyond the scope of this paper, some indication of future plans to characterize these reactions more fully, and of the planned protocol to investigate such reactions as a function of date and chamber condition – since they depend on the history of the chamber usage – would be reassuring.
3. The agreement between the measured and modeled concentrations in the propene experiment is very impressive. It would be even more convincing, though, if similar comparisons, over the range of conditions used, were shown in the Supplementary Material. It would also be helpful if more mechanistic information were provided: The paper states that OH and O₃ contribute to the propene decay. Presumably the former is the more important. It would be useful to know the [OH] calculated in the MCM simulations, and the reactions that lead to OH formation, throughout the experiments. Presumably [HONO]₀ is a major determinant in the initial OH formation and this is an adjusted parameter. How important is it throughout the experiments? It is implied that separate values were used for each experiment. What were they? A HONO instrument is now available – are the [HONO] required compatible with present observations? Given the established yields of HCHO and CH₃CHO from propene oxidation, what are the sensitive model parameters for the species shown in Fig 8. In demonstrating a satisfactory evaluation of the chamber chemistry, it is important to establish that the adjusted [HONO]₀ is not the pre-eminently sensitive parameter

There are a number of smaller suggested corrections:

P319, l1. ? Change to 'Similarly, chamber experiments necessarily study simplified ...'

P323, l6. ? Change to '..and prevents any low ...pump from affecting the ..'

P323, l10. Change 'adjunction' to 'use'

P326 l17, should be 'globar'

P327, l1 should be 'relatively'

P331, l10. ? Change to ' that the dynamics are probably ...'

P331, l20. ? Change to 'due to changes in the zenith angle'

P332 and subsequently. The atomic term symbols are wrongly formatted – should be $O(^3P)$ etc. $J(O_3)$ is ambiguous and should be $J(O(^1D))$, or more conventionally $J(O^1D)$

P333, l2. Change isotropous to isotropic.

P333, l10, 12. Should be Table 3.

P333, l27. Change to 'greater than 70% ...which overlaps...'

P335, l16. Should give the upper limits to the trace gas concentrations in the nitrogen source.

P335, l20. Change to '...major inconvenience either ...'

P336, l25. Is the [HONO] increase really slower than the [NO₂] increase?

P373, Fig 3. The axis units are not really compatible with the numbers – better to omit the 00:.