Atmos. Chem. Phys. Discuss., 10, C10682–C10685, 2010
www.atmos-chem-phys-discuss.net/10/C10682/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Physical properties of iodate solutions and the deliquescence of crystalline I_2O_5 and HIO_3" *by* R. Kumar et al.

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Received and published: 3 December 2010

Authors Response to Anonymous Referee 3

General comments:

1. Hygroscopic nature of IOPs

Response:
We were aware of this discussion paper. However, as the authors didn't address the referees' comments and the work was therefore not published in final ACP form, we

were/are hesitant to include it in the paper. In addition, one of us (RWS) also submitted online a number of questions/concerns regarding the data and analysis set out in the paper, and similarly, these were not addressed.
The main point which we would make to the referee concerning particle composition-hygroscopic nature is that an observed lack of growth for particles subsequent to water vapour uptake and condensation, is not necessarily indicative of a non-hygroscopic chemical nature for the particles (as inferred indirectly) but is consistent with either (i) hygroscopic particles (of sizes larger than approx. 10 nm) with open or ramified structures (as observed directly in our previous, cited studies) or (ii) smaller, compact particles of hygroscopic nature whose deliquescence point is raised significantly (in excess of 90% RH, i.e. beyond that routinely used in H-TDMA experiments) above the 'bulk' values indicated from this latest study - we make these points in our earlier paper – Saunders et al. (2010). These points have been added to the Conclusions section of the revised version of the new paper.

2. IOP composition

Response:
Particle composition, resulting from the oxidation of I atoms (the primary route to IOP formation), has been shown by direct quantitative analysis to be that of I_2O_5 (Saunders and Plane, 2005 – as cited), and therefore we feel that our original assertion is justified. The Jimenez et al. conclusion was indirect, based upon observed hygroscopic growth behaviour (or more specifically the lack of – see response to previous point), and the Saunders et al. paper concluded that I_2O_4 was most likely the gas-phase species which initially forms, clusters and nucleates, but these clusters subsequently undergo rapid re-arrangement in the solid phase to form the observed I_2O_5 end composition in IOPs. I_2O_4 particle composition has not been reported from direct analysis of particles sampled either in the field or in the laboratory, and so we feel further discussion of this

species is not warranted. To clarify this, we have now added text in the Introduction of the paper to clearly delineate between measured and inferred particle compositions.

3. Atmospheric implications

Response:
See response to previous point.

4. Further atmospheric discussion

Response:
The condensation of iodine oxides and HIO_3 onto nucleated IOPs of the same compositions will lead only to further particle growth and not alter the chemical or physical properties of the particles. The role of organic species is essentially completely unknown – insights from the laboratory or the field are badly needed to resolve this situation. Our earlier work (Saunders et al., 2010) showed that H_2SO_4 vapour is readily accommodated on IOPs, leading to measured particle growth, but beyond that, the effect of this species on the physico-chemical properties of the particles are unknown. As this current paper is focused on the bulk solution/crystal properties of I_2O_5/HIO_3, we feel that further speculation on the interactions of nanoparticles of such species with ambient vapours is unjustified in the context of this paper.

Specific comments:

1. Reference clarification

Response: Page 20825 – the cited work is a detailed review of the topic which contains

many source references. We feel it unnecessary to list all of these, so will delete 'and references therein' and refer only to the review.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 20823, 2010.