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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.

Anonymous Referee #2

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In this research, physical properties of iodine solute and crystalline I2O5 and HIO3 particles have been studied (e.g. water activity, density, viscosity, deliquescence and efflorescence). Iodine oxides are one of the main compounds suggested being involved in secondary particle formation in coastal areas. However, there is little data available for physical properties of iodine compounds. The study presents novel and important results on properties of iodate solutions and iodine oxide particles. In addition, the results show some evidence that aqueous iodine oxide droplets can form amorphous/glassy particles at low RH levels. The scientific methods used in this study are valid and clearly outlined. The manuscript is well written and clear and the scope of the study is suitable for publication in this journal. However, there are some minor comments, suggestions and technical comments that should be considered before publication.

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Interactive Discussion
Discussion Paper

There is already some discussion on deliquescence properties of freshly formed iodine oxide particles in coastal areas and from laboratory experiments in the manuscript (chapter 4, Conclusions and atmospheric implications). It might be useful if the current results will be compared to hygroscopicity tandem differential mobility analyzer (TDMA) results obtain during new particle formation events in marine environments (e.g. Väkevä et al., 2002) and discuss atmospheric implications of the results.

Furthermore, the results indicate the glassy (amorphous) iodine oxide particles (or highly viscous droplets) can be formed when droplets are dried at low humidity. I think that this could be easily confirmed, e.g., by X-ray diffraction analysis (XRD) if a suitable equipment is available. It is recently showed (Virtanen at al., 2010) that biogenic secondary organic aerosol (SOA) particles can also be amorphous solids (glassy) in their physical state, which might have important atmospheric implications (partitioning of semi-volatile compounds, reaction rates, etc.). As stated in the manuscript, non-crystalline state of iodine oxide particles might have effects on vapour uptake and growth of the particles. Since the state of atmospheric particles seems to be very interesting topic now, the atmosphere implications of non-crystalline (glassy) iodine oxide particles could be discussed in more detail.

Technical comments/corrections:

a) Please clarify how the uncertainty of different results or values (i.e., $\pm$ XX in text, tables and figures) has been determined (standard error, standard deviation, estimation by author, etc.).

b) There are paragraphs with only one sentence that can be merged with the next/previous paragraph (e.g. page 20831 line 8, page 20835 line 3).

c) Page 20833 line 3: Please clarify a definition of parameter p (see page 20827 line 8).

d) The figures (Fig. 2, Fig. 3, Fig. 5) will be easier to read if the differences in val-

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ues shown in y-axis will be rearrange (e.g , 0.08 => 0.05, 0.4 => 0.5 and 0.4 => 0.5, respectively).

e) Fig 2. The last line in the caption: ... by the square dotted line => by the dotted line?

f) Fig. 7 and 8. Please identify the meaning of the error bars (standard error, standard deviation, etc.)

g) Fig 9. The quality of the figure is poor compared to other figures (bitmap, not vector graphics).

h) Fig. 10. How has the ice saturation line been determined?

References:

Virtanen A, et al., An amorphous solid state of biogenic secondary organic aerosol particles. Nature 467, 824-827, 2010.

Väkevä, M., K. Hämeri, and P. P. Aalto, Hygroscopic properties of nucleation mode and Aitken mode particles during nucleation bursts and in background air on the west coast of Ireland, J. Geophys. Res., 107(D19), 8104, doi:10.1029/2000JD000176, 2002.

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