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Comment

## ***Interactive comment on “Evolution of the complex refractive index in the near UV spectral region in ageing secondary organic aerosol” by J. M. Flores et al.***

### **Anonymous Referee #1**

Received and published: 31 March 2014

This paper reported the evolution of real part of refractive index (RI) in the near UV region for three types of SOAs generated from (i) a mixture of biogenic VOC (alpha-pinene and limonene), (ii) biogenic VOC mixture with subsequent addition of an anthropogenic VOC (p-xylene-d10), or (iii) a mixture of biogenic and anthropogenic VOC and their relations with chemical properties (such as O/C and H/C ratios) and SOA densities were discussed. They found that the real part of RI significantly increased with aging for the SOAs produced from the mixture of biogenic VOCs and anthropogenic VOC and slightly increased for SOAs generated from the sequential addition of the VOCs. Understandings of the influence of the aging process and interaction of biogenic and

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anthropogenic SOA precursors on RI values are very important for the understandings of the impacts of aerosols on climate change and atmospheric environment and this paper provide useful information. Although there are several points that should be revised, most part of the manuscript is logically written and the topics and results are relevant to this journal. I therefore recommend publication once the comments and questions below are addressed.

#### Major Comments:

1) The author proposed that "The increase in the real part points to the fact that it can be associated with an increase in the aerosol density". As suggested by the authors it is a possible explanation for the results that the real part of RI slightly increased from 4.5 to 7 h when O/C ratio did not increase but not from 7 to 29.5 h when O/C ratio increased in case of sequential experiment. In contrast, Lambe et al. (2013) reported the decrease in real part of RI with aging, they also reported the positive correlation between O/C ratio and density of alpha-pinene SOA in their supplemental material. How do you explain the difference between your results with their results? I recommend adding some possible reasons to cause the increase in the density from 4.5 to 7 h (if possible).

2) I think the discussion on the assessment of the change in the radiative forcing (RF) is not adequate. First, the assumption that the real part of RI between 420 and 950 nm are same with that of 420 nm seems to be unrealistic. Second, the main suggestion that negative RF values are obtained for all calculations conducted seems to be obvious (especially for first two cases when  $k$  is assumed to be 0.0001). Third, although I think that the difference in the wavelength dependence of SFE between 1.5 and 29.25 h data is mainly due to the difference in the assumed diameters of SOAs. It might be better to use same diameter if the influence of the change in RI to SFE are examined.

#### Minor Comments:

1) Title I think it is better to replace the "complex refractive index" to "real part of refrac-

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tive index", because this paper focused on real part.

2) Page 4159, line 4: "the imaginary part reached zero at all wavelength". => I think the upper limit of the imaginary part of RI should be given.

3) Page 4159, lines 11-14: "the errors for each wavelength were averaged and the average of the errors is shown on the left side of each panel (red symbols)" => What do the absolute values of the red symbols in Fig.3 indicate? These values do not seem average values for all measured wavelength.

4) Page 4159, lines 11-14: "Due to technical problems only two retrievals could be obtained for this experiment." => What are the technical problems?

5) Figure 4: => The authors reported "Size selection measurements were done, if possible, approximately every two hours..." in Page 4158 lines 6-7. Why could the authors determine the n values for 1.5h and 2h aging time (within 0.5h)?

6) Figure 2, caption (in Interactive comment by Flores et al.): => "...NO<sub>x</sub> levels were below 1 pptv" may be "...NO<sub>x</sub> levels were below 1 ppbv"

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