

## ***Interactive comment on “An uncertainty-based protocol for the setup and measurement of soot/black carbon emissions from gas flares using sky-LOSA” by Bradley M. Conrad and Matthew R. Johnson***

**Anonymous Referee #3**

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This manuscript presented an uncertainty-based guide/instruction for potential users of the sky-LODA technique to measure soot/black carbon emissions from flares in the oil and gas industry. Although the method itself and the details of various models involved in the data analysis have been published by the authors, the paper is useful to help potential researchers/engineers to better understand and apply this promising technique. The paper is well written as deserves publication. I have few questions/comments for the authors to consider. 1. In line 29 on page 4, please explicitly list the eight soot properties. 2. In the derivation of Eq. (4), do you need to assume that the mass-normalized

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extinction cross section of soot is constant everywhere in the flare? Otherwise, it cannot be taken out of the second integral on the right hand side of Eq. (4). 3. In this work, the authors dealt with the in-scattering term by expanding the SPF in Fourier-Legendre series. As the authors admitted, this expansion requires a large number of terms to have an accurate representation of the SPF, especially when it is highly-forward peaked. There are other methods to more efficiently deal with highly-forward peaked SPF, such as the Henyey-Greenstein and transport approximations, have the authors considered such approaches in the calculations of the in-scattering terms? 4. In this paper, the authors did not provide the detailed soot properties, but reference to a previous study. It appears that the authors assume that the soot properties are uniform over the entire flare under consideration and also remain the same from one flare to another. Is this correct? If yes, the authors need to justify this assumption. The soot properties in a flare with soot emission reduction measure (such as partial premixing) may not be the same as those without any such measures. 5. The choice of sky model group seems not straightforward and has a strong influence on the measurement. I wonder if the authors can provide more useful ‘tips’ to make such a choice for new users of sky-LOSA.

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