

## ***Interactive comment on “Retrieval of vertical profiles of atmospheric refraction angles by inversion of optical dilution measurements” by D. Fussen et al.***

### **Anonymous Referee #1**

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#### General Comments

This paper describes an approach for determining atmospheric refraction angle versus altitude from optical dilution. The paper is very well written, does an excellent job of establishing the relevant theories and analysis approach, and successfully applies the established methods to derive refraction angle profiles from different data sets. The established method will be useful in past and future experiments, and the authors have described the approach such that others will be able to implement it.

#### Specific Comments

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My main concern is that the utility of a refraction angle profile is not clear from this work. While there may be other uses, in my experience refraction is a means to obtaining vertical profiles of atmospheric density (and ultimately temperature/pressure). The reason I mention this point, is that the errors in the retrieved refraction angles ultimately determine the uncertainties in the atmospheric property of interest (e.g., density). Establishing these connections will make the paper more meaningful to a broader audience.

In rough terms refraction angle and density both vary logarithmically in height, and so it can be anticipated that density and refraction angle errors will be proportional. More rigorously, refraction angle and density are related through an Abel transform, which yields a straightforward analytic solution. In either case it should be a minimal effort to relate refraction angle and density uncertainties.

#### Technical Corrections

The manuscript is very well written and technical errors were rare.

line 65: "refraction" should be "refractive"

line 194: There is no need to use all capital letters.

equation 28: Use full size brackets.

line 266: "depending" should be "dependent"

line: 277 (and elsewhere): "percents" should be "percent"

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