Reply to reviewer #2

We are grateful for the helpful comments on the submitted version of the manuscript. Our point-by- point replies are shown in italic font.

We have edited and rewritten much of the paper to improve the use of English and also to improve the clarity of the scientific content.

Reviewer 2:
Review of *amt*2017463, Dorrestijn et al.
Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-463-RC2, 2018 Interactive comment on Instantaneous variance scaling of AIRS profiles using a circular area Monte Carlo approach by Jesse Dorrestijn et al. Anonymous Referee #2
Received and published: 6 February 2018

Overall / general comments
The paper presents a circular area Monte Carlo approach to assess scale invariance properties and scale breaks from AIRS measurements. Overall the paper is very well written but the statistics and correlations showed here are not always convincing. This is a promising technique but it needs to be apply to more data and to acknowledge the poor correlations observed in section 4.5 (and more data will help with correlations). Also, why sometime the authors use /alpha and sometime β? Is generally more known, especially when its concerns the well-known -5/3 value. There is no such reference for /alpha. I suggest using through the whole manuscript for consistency reasons.

We agree that the datasets used for the correlation analysis are small. As this manuscript is meant to be a methodology rather than a full exploration of the potential of AIRS data, the computational expense of calculating the exponents is large, and the single infrared field of view retrieval of Irion et al. (2018) has not yet been operationalized, we are unable to go much further with more robust statistics in this initial study. In response to the reviewer comment, we have removed the three panels with the smallest correlation coefficients from Fig. 10. We argue that the six panels with the largest correlation coefficients are sufficiently large that, in our opinion, add value to the paper. We acknowledge that the usage of α and β values could be somewhat confusing at times. Despite this, we choose to include them both in the new manuscript because many of the referenced studies use both types of exponents. The left and right axes on Figures 5–8 are intended to help guide the reader between these two exponents. The variance scaling exponents that we calculate are actually α values, also used by KT09, therefore we choose to show them. Omitting the β values would devalue the paper, since these are better known.

We have added the following to the manuscript starting on Page 8 and line 33: "...the sample size from the limited set of granules is unable to yield a robust histogram. Our intent is to instead demonstrate the new scaling approach. A much larger and statistically robust dataset is outside the scope of this work."

Minor comments: Abstract Line 2: 13.5km is not really what I call high spatial resolution. May be higher is better for the comparison with 45 km.

We agree and use the word "higher".

Introduction: Line 18: Please add also the reference: Kolmogorov, A. N.: Dissipation of Energy in the Locally Isotropic Turbulence, Proceedings of the USSR Academy of Sciences (Russian), translated into English by Kolmogorov, Andrey Nikolaevich (8 July 1991), 23, 16 18, 1941.

Thanks. We now include this reference.

2.2 Line 9: Why Retrieval System have their first letter in capital?

This was a mistake. It should indeed be lowercase.

Figure 3: Please increase text/label font size It would be interesting to highlight (using arrow, line, marker, etc) the position of the scale break for each case. It would be more easy for the reader to see if there is a common off-set between the AIRS-xxx in the 4 locations.

We agree and changed the sizes. Scale breaks are introduced later in the paper and we think it would be too much information for the reader to digest if we put them into these figures before they are explained.

Figure 4c: The large decreasing of standard deviation as a function of the length scale in the case AIRS-OE need to be more developed. This slope catches the eye directly when looking at the figure. This is probably due to small scale processes that are resolved with the higher resolutions but it should be mentioned.

We agree this needs some additional description, and we added a comment to the manuscript starting on Page 7 and line 10: "In Fig. 4c, the discrepancies between the four retrievals are more significant at larger l, where AIRS-OE shows a decreasing standard deviation as a function of increasing l. However, the AIRS-OE with a peak around 8° may be a result of finer-scale fluctuations that are only captured by AIRS-OE."

4.5 Line 13: To me well-correlated is above 0.80, we can argue that the fig 10a is close to this value but then the correlation decrease. It becomes dangerous to me to talk about correlation below 0.7. This is especially true for water vapor where the values are too low. I can be simpler to remove WV from this plot and keep temperature only.

Per the earlier comments above, we removed the three panels with the lowest correlations from figure 10. We believe that the six panels shown in the figure adds additional value to the paper."

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-463, 2018.