

We thank the reviewer for the useful comments. In the following, we answer the specific comments (included in “**boldface**” for clarity) and, whenever required, we describe the related changes implemented in the revised manuscript. Page and line numbers indicated refer to the original version of the paper published on AMTD.

## **Anonymous Referee #1**

### **Review**

**This is a comprehensive mathematical analysis of the data fusion methodology, with many of its features already discussed in previous papers by Ceccherini et al. The paper should be of interest to the Earth Observation community. However, before the paper is suitable for publication, the authors should address a few general points, identified immediately below, as well as the specific comments, also identified below.**

**As indicated in the AMTD review, the authors should address the following three points:**

**(i) In the introduction provide more detail on how this paper is different from the previous works by Ceccherini et al. on data fusion. This should allow the reader to follow better the development of the data fusion ideas.**

The new achievement presented in this paper is the solution to the problems that occur to the CDF method when the fusing profiles are either retrieved on different vertical grids or referred to different true profiles. The solution is to take into account the interpolation and the coincidence errors in the fusion method. We determine the expressions of the interpolation and coincidence errors and show how they enter in the CDF formula.

We added these details in the introduction of the revised paper (P. 2 L. 5).

**(ii) In the discussion of previous work in the introduction, identify whether the papers discussed consider real or simulated data (e.g., Natraj et al. consider simulated data).**

We included this detail in the revised paper.

**(iii) On the issue of studies using multispectral simulated observations (discussed in the introduction) I suggest the authors consider including the following references, which include other combinations besides IR and UV, and two review papers:**

**Timmermans, R., W.A. Lahoz, J.-L. Attié, V.-H. Peuch, L. Curier, D. Edwards, H. Eskes, and P. Builtjes, 2015: Observing System Simulation Experiments for Air Quality. Atmos. Env., 115, 199-213, doi:10.1016/j.atmosenv.2015.05.032. This is a review paper.**

**Hache, E., J.-L. Attié, C. Tournier, P. Ricaud, L. Coret, W.A. Lahoz, L. El Amraoui, B. Josse, P. Hamer, J. Warner, X. Liu, K. Chance, M. Hoepfner, R. Spurr, V. Natraj, S. Kuwalik, and A. Eldering, 2014: The added value of a geostationary thermal infrared and visible instrument to monitor ozone for air quality. Atmos. Meas. Tech., 7, 2185- 2201. This paper uses the thermal infrared and the visible. Note that Natraj et al. considers other combinations besides IR and UV.**

**Lahoz, W.A., V.-H. Peuch, J. Orphal, J.-L. Attié, K. Chance, X. Liu, D. Edwards, H. Elbern, J.-M. Flaud, M. Claeysman, and L. El Amraoui, 2012: Monitoring air quality from space: The case for the geostationary platform. Bull. Amer. Meteorol. Soc., 93, 221-233, doi: 10.1175/BAMS-D-11-00045.1, 221-233. This is a review paper.**

We included these references in the revised paper.

#### **Specific comments:**

##### **P. 2**

##### **L. 40: Why choose 6 km for the correlation length?**

The correlation length is used to reduce oscillations in the retrieved profile. A value of 6 km is typically used for nadir ozone profile retrieval.

References:

Liu, X., Bhartia, P. K., Chance, K., Spurr, R. J. D., and Kurosu, T. P.: Ozone profile retrievals from the Ozone Monitoring Instrument, Atmos. Chem. Phys., 10, 2521-2537, <https://doi.org/10.5194/acp-10-2521-2010>, 2010.

Kroon, M., de Haan, J. F., Veefkind, J. P., Froidevaux, L., Wang, R., Kivi, R. and Hakkarainen, J. J.: Validation of operational ozone profiles from the Ozone Monitoring Instrument, J. Geophys. Res., 116, D18305, doi:10.1029/2010JD015100, 2011.

Miles, G. M., Siddans, R., Kerridge, B. J., Latter, B. G., and Richards, N. A. D.: Tropospheric ozone and ozone profiles retrieved from GOME-2 and their validation, Atmos. Meas. Tech., 8, 385-398, <https://doi.org/10.5194/amt-8-385-2015>, 2015.

We added a sentence and these references to the revised paper.

##### **P. 6**

##### **L. 19: Why choose a 5% a priori error?**

For the estimation of the coincidence error we consider 5% of the a priori profile because this value is consistent with the difference between the true profiles of TIR and UV measurements used in the simulations.

We specified this in the revised paper.

##### **P. 7**

##### **L. 23: I suggest you remove “indeed”. Same elsewhere. Please omit needless words.**

In the revised paper we replaced “Indeed” with “In the latter case” and we removed “if these identities are not present” at P. 7 L. 21-22.

We removed “indeed” at P. 7 L. 35.

##### **L. 24: Please avoid anthropomorphising the data fusion algorithm. I suggest you use a word other than “misled”.**

In the revised paper a different sentence is used.

##### **P. 17**

##### **Fig. 6 caption: “: :with the fused profile added: :”. Same for Fig. 7 caption.**

In the revised paper we rephrased captions 6 and 7.