

Overview

Importance of interpolation and coincidence errors in data fusion Simone Ceccherini, Bruno Carli, Cecilia Tirelli, Nicola Zoppetti, Samuele Del Bianco, Ugo Cortesi, Jukka Kujanpää, Rossana Dragani

This is a well-written paper on a subject of interest to the atmospheric measurement community. The use of data from different instruments and different spectral regions to better constrain vertical profiles is an important step forward in improving and simplifying the production and use of data from the advanced satellite systems currently under development. The methodology appears sound and is based on an earlier development published by the authors. It is recommended that the paper be published. Some copy editing will improve the readability of the paper and detailed comments are included later.

It is not clear to this reviewer that the methodology presented actually achieves the complete goal represented by the authors. Since the two profiles being combined have been determined by constraints independently applied to the observations of the two instruments, there is no direct component of the fitting cost function that requires the simultaneous best fit to the actual observations. Of course, it is difficult to evaluate this distinction because the peculiarities of each data set (UV and TIR) are determined by the two instruments and may be difficult or impossible to model adequately in the test data sets. The recommendation here is to discuss this issue so that the good work being presented is presented in context.

Some more discussion of the appropriate interpolation approach for the covariance matrices should also be considered. The outcome of the fusion process will depend on the assumptions made regarding this process.

General comments

1. Since CDF refers to 'Complete Data Fusion' most cases referencing 'CDF' should probably be replaced by 'CDF method'.
2. This reviewer prefers to see scientific literature written in the third person unless it is absolutely necessary to do otherwise.
3. It would appear that the increase in DOFs achieved by the method is primarily due to extending the vertical range of observational response over which the system is sensitive to changes in the profiles. This might be a useful remark to include in the conclusions.

Specific comments.

Page 1

1. Line 32. Missing commas in the reference call-outs.
2. Line 33. Delete 'as'

Page 2

3. Line 1. '... is reduced to about one quarter with this approach.

4. Line 8. '... the advantages in using ... observing ozone profiles ... space exploits the synergy of measuring ...'
5. Line 25. '... the TIR ...'
6. Line 30. It isn't clear to this reviewer what the reason for merging two data sets that are known to be different.
7. Line 36. 'Ceccherini et al. (2014).'
8. Line 22. '... independent, simultaneous ...'
9. Line 24. Since the estimates all contain some portion of a priori information, they are not truly independent. Perhaps some other description would be more appropriate. Furthermore, it is not obvious to this reviewer how to use any numerical estimate of the interdependence to improve the subsequent analysis.
10. Line 29. '... obtained by propagating ...'
11. Line 32. Suggest: 'The CDF solutions of the profiles considered are given ...'

Page 4

12. Line 6. '... obtained by propagating ...'
13. Line 8. '... profiles, x, ...'
14. Line 20. '... in the presence ...'

Page 5

15. Line 9. Lost comma.
16. Line 11. Delete last equal sign.

Page 6

17. Line 20. '... in the central and right ...'
18. Line 25 '... wide range ...'

Page 7

19. Line 33. '... provides, in general, ...'

Page 8

20. Line 9. Suggest: 'RD contributed extensive revisions to the manuscript.'