

Interactive
Comment

Interactive comment on “Synergy between middle infrared and millimetre-wave limb sounding of atmospheric temperature and minor constituents” by U. Cortesi et al.

Anonymous Referee #2

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Authors apply newly developed data fusion methods to MARSCHALS and MIPAS_STR colocated observations as an example of the synergy in microwave and infrared limb sounding techniques. Unfortunately, no comparison was made using a "standard" direct L1 to L2 joint microwave/IR retrieval. I think this would have provided a better context for the work presented. Also there are other a posteriori methods of combining L2 data (some mentioned in the paper) which would have formed an interesting comparison. Instead a less ambitious comparison is made using a retrieval of the microwave measurements with the independently retrieved infrared data as a priori. The MMS data fusion involves combining the individual MSS retrievals from both instruments. This is done in this paper by using Tikhonov-Phillips regularization. Unsigned

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systematic errors are included in the analysis.

I recommend the paper for publication in AMT.

Comments and typos etc:

Please define better what you are calling "measurement space" (I know it says rows of Jacobian matrix etc on next line, but I passed over that at first). Really most would expect this terminology to be associated with the y-vector (observations, or radiance measurements in the Rodgers terminology) and not the x (retrieved quantities). Also, in the (L1+L2) method the Fisher information matrix is referred to as being associated with the "inverse problem of measurements of vertical atmospheric profiles". This is poorly worded. If we were dealing with "measurements of vertical atmospheric profiles" we would not have an inverse problem to worry about.

P11674,L4 : is focusing => focuses

P11675,L6 : land surface [such] as

P11675,L13 : synergetic => synergistic

P11675,L18 : same => similar

P11675,L22 : to => involving

P11676,L6 : use[s]

P11676,L14 : in => of

P11676,L15: the small temperature ... (stronger temperature ...) not sure what you mean here..

P11676,L19 : temperature[s]

P11676,L25 : work in => penetrate through

P11677,L1 : one => unity in the mid-infrared

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P11677,L7 : microwave [frequencies]

P11677,L24 : moment [and therefore]

P11678,L2 : study, [but] was not

P11678,L5 : launch [such] as

P11678,L6 : ESA Call

P11678,L7 : proposed [PREMIER] mission [was] aimed

P11678,L13 : in this paper => on

P11679,L1 : embarking??

P11679,L4 : composed by => comprised of

P11679,L4 : to => with

P11679,L5 : instrument[s]

P11680,L2 : can satisfactorily meet ... so why need ir limb sounding as well??

P11680,L12 : an => a

P11680,L12 : there are also strong gradients in the stratosphere e.g. across polar vortex, Rossby wave breaking and fine filaments etc

P11680,L21 : an => a

P11681,L13 : delete /you can/

P11681,L27 : spectroscopic continuum profile ... or in other words a baseline fudge-factor/junk collector ... and what about the molecular continua for H₂O, N₂?

P11682,L7 : radiometric gain and offset ... are you actually retrieving these? if so some more detail needed here

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P11682,L24 : [a] few blocks e.g. correlations ... (it may not be clear to some what you mean by blocks)

P11683,L13 : allows [one] to

P11684,L9 : could use nW here, also ... $cm \Rightarrow cm^{-1}$ P11684,L9 : /includes [its] own

P11684,L12 : Is 0.8 arcmin how well the mirror can be controlled? Is the actual pointing knowledge any better?

P11684,L19 : 196.1 [cm^{-1}]

P11685,L7 : The retrieval temperature was inverted.... you mean the radiances (observations) were inverted

P11685,L11 : 5% error in CO2 seems overly large

P11686,L20 : see general comment on terminology

P11687,L18 : suited \Rightarrow suitable

P11688,L12 : influent??

P11688,L22 : Differently to = In contrast to

P11690,L21 : was OE previously defined?

P11691,L22-26 : I could not understand why $DOF \geq 1$

P11692,Equation 9: should be $f_i =$ and not f_1 ?

P11693,L1 : independent [of]

P11693,Equation 10: should be $f_i x_i^2 =$ and not $f_1 x_1^2$?

P11693,L6 : as [a] quantifier

P11693,L7 : as [an] alternative

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P11693,L24 : allows [one] to

P11694,L11 : consisted => consists

P11694,L26 : above Scandinavia

P11696,L5 : O3 not o3

P11700,L27 : while [it] increases

P11701,L14 : was TIR previously defined?

P11701,L17 : was SF previously defined?

P11701,L23 : infrared hardly lead[s] to

P11703,L8 : used => chosen

P11703,L16 : directly incomparable => which are not directly comparable

P11703,L17 : analysis => analyses

P11703,L24 and L26 L1+L2 => (L1+L2)

P11706,L25 : Identity => identity

P11707,L15 : option as an alternative

P11708,L10 : three-year ... part => some ?

Table 1: delete Band A heading in first column

Why degree symbol after N? Number of channels used.

Table 2: spectral bias and ... (delete spectra at the end)

CH3CL => CH3Cl

Figure 7: H3O => H2O

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