

## ***Interactive comment on “CRISTA-NF measurements during the AMMA-SCOUT-O<sub>3</sub> aircraft campaign” by K. Weigel et al.***

**Anonymous Referee #2**

Received and published: 27 May 2010

Referee#2 Comments on Weigel et al

### **GENERAL COMMENTS**

The paper describes the measurements taken with the airborne CRISTA-NF spectrometer during the AMMA SCOUT-O3 campaign in Africa during 2006, and the application of the JURASSIC forward model and retrieval scheme to extract profiles of various species.

While there is nothing particularly wrong with the paper, it has to be said that neither is there anything particularly new in it. The CRISTA-NF instrument and H<sub>2</sub>O retrievals have been described in Hoffmann et al 2009 (although not for this campaign) and the JURASSIC forward model/retrieval scheme has been applied to numerous different

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instruments: this paper doesn't appear to add anything to what has been previously explained. However, since this is a special issue on limb-sounding, this paper probably serves as a useful illustrative example.

I accept that the main emphasis is on technique (as in AMTD) rather than validation but I am left unconvinced that the CRISTA-NF retrievals perform any better than climatology - the comparisons shown are qualitative and not with instruments sampling the same atmosphere. As part of a campaign, I would expect a wider variety of measurements to be available. Also, while the attempt at a full error analysis is commendable, there is a noticeable lack of any mention of the potential errors due to horizontal structure in the line-of-sight, ie the robustness of the assumption of horizontal homogeneity in the forward model, particularly when coupled with the claim that fine vertical structure is retrievable. The use of "Total Error" for comparisons is also rather naive: for example, spectroscopic uncertainties - a significant contribution to the total error budget - would presumably not contribute to the differences between forward and backward scans. However, since this is not a validation paper, I just make these comments for the benefit of the authors in case they plan on further publications.

### **MINOR COMMENTS/TYPOS/GRAMMAR**

P924 L6: suggest “\*tangent\* altitude range” for clarity.

P925 L4: change to “optics \*are\* adapted”

P925 L11: change to lower case “emphasis \*on\*...”

P925 L14: (and multiple later occurrences) change “Quagadougo” to “Ouagadougou” (also mis-spelled as “Quagodougou” elsewhere)

P925 L11: Any particular reason for focussing on this particular flight L5?

P926: It would be helpful to mention at this point that CRISTA-NF views perpendicularly to the flight direction since this is key to performing a 1D rather than a 2D retrieval.

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P926: Suggest "Helium cooling also results in an excellent signal-to-noise ratio for the limb-observations ..."

P928 L2: "dominated by H<sub>2</sub>O" ? From Fig2 it seems that H<sub>2</sub>O contributes only about a third of the total radiance, CO<sub>2</sub> and O<sub>3</sub> contributions being comparable. I assume H<sub>2</sub>O becomes dominant at lower altitudes.

p928 L3: spurious "(?)" - missing a reference here?

P929 L3: "maximum a posteriori ... solution". Needs to have "likelihood" or some other noun before "solution" to make sense.

P930 L6: "In addition ... have been defined." I don't understand what this sentence means. Are these percentage SDs used instead of the climatological SDs? Replacing them at some altitudes? Taken literally, it seems you just define the percentage SDs but don't say anything about using them.

P930 L16: Remove paragraph indentation before "where ..."

P930 L16: Change "standard deviations" to singular to match "is" and "altitude"

P931 L16, L18: suggest changing "that means" to "i.e."

P931: It would be useful to explicitly state how many profile levels you have in your analysis (totalled over the four ranges).

P932 L23: change "One" to "one"

P932 L24: suggest hyphenating: "instrument-related"

P933 L26 (and P934 L4): change "convoluted" to "convolved"

P934 L5: suggest changing "continued" to "extended"

P934 L13: change "is taken..." to "are taken ..."

P934 L18: insert space between "O<sub>3</sub>" and "for"

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P937 L3: saying that the vertical resolution reaches 500m for some altitudes is slightly misleading. What Fig 5 seems to show to me is that the resolution for H<sub>2</sub>O is about 1km for most altitudes, with some fluctuations due, presumably, to numerical artefacts.

P937 L13: Is a resolution of 20km useful for HNO<sub>3</sub> and O<sub>3</sub>? 20km seems to be equivalent to the thickness of the layer containing most of the atmospheric HNO<sub>3</sub> and O<sub>3</sub> in which case there is almost no vertical resolution at all. So saying "better than 20km" seems to mean "capable of resolving some vertical structure".

P937 L18: Suggest removing "for": "Like the CRISTA-NF ..."

P938 L23: Change "stareboard" to "starboard"

P940 L20 (also "descend" in P941 L26): Change "ascend" and "descend" to "ascent" and "descent"

P943 L3: Change "well to in situ" to "well with in situ".

Fig 5 caption: caption refers to "measurement content" but figure legend uses "measurement contribution"

Figs 7 etc: where the horizontal axis is time, it would be useful to also have at least an approximate indication of corresponding horizontal distance.

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Interactive comment on Atmos. Meas. Tech. Discuss., 3, 923, 2010.

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