

***Interactive comment on “Technical Note:  
Variance-covariance matrix and averaging kernels  
for the Levenberg-Marquardt solution of the  
retrieval of atmospheric vertical profiles” by  
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We analyze the three points raised by referee #1 that make him concerned about publishing the paper in ACP.

(1) From the web page of ACP we read that "The journal scope is focused on studies with general implications for atmospheric science rather than investigations that are primarily of local or technical interest." Accurate estimations of the variance-covariance matrices (VCMs) and of the averaging kernel matrices (AKMs) of retrieved atmospheric  
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concentrations are essential for both the evaluation of the quality of the retrieved profiles and for their correct use in subsequent applications such as data comparison, data assimilation and data fusion. Indeed, the results of these applications strongly depend on the VCMs and AKMs associated with the retrieved profiles. Since many analyses performed to retrieve the atmospheric concentrations use the Levenberg-Marquardt (LM) method we think that the paper treats a problem that has general implications for atmospheric science and for which, furthermore, a common understanding does not exist, as the short comment of Dr von Clarmann shows.

(2) This point concerns the thesis of Dr von Clarmann that converged LM retrievals are characterized by the same VCMs and AKMs as Gauss-Newton retrievals and that the retrievals presented in the discussion paper are non-converged.

The answer to this point can be found in our reply to the short comment of Dr. von Clarmann. In that reply we show that the conclusions of Dr. von Clarmann apply only to well-conditioned retrievals reaching numerical convergence at machine precision, i.e. a very special class of retrievals. We also show that the retrievals presented in the discussion paper are well converged from a physical point of view.

(3) The discussion paper deals with the problem from a general point of view. It is this general point of view that makes our study having "general implications for atmospheric science" and not being "investigations that are primarily of local or technical interest". We believe that focusing the discussion on MIPAS retrieval products by ESA is limiting rather than making more general its implications.

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