

***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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Referee #2 does not recommend the publication of the paper in ACP because he/she asserts that an iterative method that converges properly should not be dependent on the path taken during the minimization.

As we have discussed in the reply to the short comment of Dr. von Clarmann this statement is true only for well-conditioned problems reaching numerical convergence within the machine precision. In ill-posed and ill-conditioned problems the Levenberg-

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Marquardt (LM) method acts as an external constraint selecting one solution among all the possible ones. Therefore, as any other external constraint, the LM method impacts the solution, the variance-covariance matrix and the averaging kernel matrix.

Even if the "LM damping was only invented to stabilize the search path" (as referee #2 states), it is well-known that the LM term acts also as a constraint to the solution in ill-posed and ill-conditioned problems. An example of this effect in inverse atmospheric problems is given in Doicu (2004).

Referee #2 interprets the results obtained in the discussion paper supposing that the minimizations did not converge.

The answer to this point is included in our reply to the short comment of Dr. von Clarmann, where we provide evidence that our retrievals have properly converged.

The ill-conditioning and the good physical convergence of the retrievals presented in the discussion paper will be better clarified in the revised paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 25663, 2009.

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