Atmos. Chem. Phys. Discuss., 6, S6530–S6532, 2007
www.atmos-chem-phys-discuss.net/6/S6530/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Technical Note: Regularization performances with the error consistency method in the case of retrieved atmospheric profiles" *by* S. Ceccherini et al.

T. von Clarmann

thomas.clarmann@imk.fzk.de

Received and published: 26 January 2007

This technical note on the error consistency method is interesting. However, I think that it would benefit from further clarification of some details:

1. Eq. 7: Is this an ad hoc requirement just to balance smoothing error and noise error in some way, or does it follow from χ^2-statistics? If the latter is true, some more details should be given, because it is not quite obvious how χ^2-statistics is applied to the difference between constrained and unconstrained profiles retrieved from the same measurements.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

EGU

2. First line after Eq. 7: S_x is never diagonal in remote sensing of vertical profiles of atmospheric state variables, because the weighting functions in the **K**-matrix are never delta functions (i.e. the measured signal always depends on the atmospheric state in more than one altitude), except for $n = 1$. The paper would benefit from a discussion of this issue and its relevance to the EC-method.

3. The EC method assumes that a stable maximum likelihood solution is existent, i.e. that the original retrieval problem is not severely ill-posed. The regularization seems to be applied to an already (more or less) stable retrieval. The existence of an unambiguous maximum likelihood solution suggests that the retrieval grid has been chosen coarse enough. This, however, is a constraint in itself. What is the purpose of the additional smoothing? Is the method also applicable to really ill-posed retrieval problems (i.e. such where the unconstrained solution heavily oscillates, with data points far outside the linear domain around the constrained solution)?

4. The averaging kernel matrix of a converged Levenberg-Marquardt retrieval without further regularization is unity, regardless how large α has been chosen! This is because both the Levenberg-Marquardt method and the Gauss-Newton method minimize the same cost function, i.e., they search the same 'exact' (i.e. unconstrained) solution. The Levenberg-Marquardt retrieval modifies only the path along which the solution is found but not the solution itself. Eq. 9 is not the Levenberg-Marquardt method. The Levenberg-Marquardt method is defined only in the environment of Newtonean iteration and is

$$x_{i+1} = x_i + (K_i^T S_y^{-1} K_i + \alpha M)^{-1} K_i^T S_y^{-1} (y - F(x_i)) \quad (1)$$

while Eq 10–11 would only hold if the Levenberg-Marquardt method was (erroneously) coded as follows:

$$x_{i+1} = x_i + (K_i^T S_y^{-1} K_i + \alpha M)^{-1} (K_i^T S_y^{-1} (y - F x_i) - \alpha M (x_i - x_a)) \quad (2)$$

ACPD

6, S6530–S6532, 2007

Interactive Comment

Eq. 9 in a linear context (as written in the paper) rather is a kind of zero order Tikhonov regularization.

ACPD

6, S6530–S6532, 2007