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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Retrieval of temperature profiles from CHAMP for climate monitoring: intercomparison with Envisat MIPAS and GOMOS and different atmospheric analyses" *by* A. Gobiet et al.

Anonymous Referee #1

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Stiller makes an important point, which I had not appreciated. The MIPAS retrievals use the 1st order difference operator, L_1 as a constraint. This means the MIPAS retrievals are not sensitive to flat baises over the entire temperature profile. Therefore, as Stiller notes, even if the entire ECMWF temperature profile is biased by b =10 K, the retrieval will be unbiased. This is because the derivative of a constant bias is zero, ie $\mathrm{L}_1\mathrm{b} = 0$. However, is this generally the case if the temperature bias varies with height? In practice, the ECMWF biases in the temperature profile, $\bar{\epsilon_\mathrm{b}}$ (the over-bar denotes expectation), will vary considerably with height. Linear theory (linear theory is usually

sufficient for error analysis) shows the bias in the solution, $\bar{\hat{\epsilon}}$, will be of form

$$\bar{\hat{\epsilon}} = (\mathrm{K}^{\mathrm{T}}\mathrm{S}_{\mathrm{y}}^{-1}\mathrm{K} + \mathrm{R})^{-1}\mathrm{R}\bar{\epsilon_{\mathrm{b}}} + (\mathrm{K}^{\mathrm{T}}\mathrm{S}_{\mathrm{y}}^{-1}\mathrm{K} + \mathrm{R})^{-1}\mathrm{K}^{\mathrm{T}}\mathrm{S}_{\mathrm{y}}^{-1}\bar{\epsilon_{\mathrm{o}}} \quad (1)$$

using the notation of Von Clarman et al ((JGR, vol 108, D23, 4746, doi:10.1029/2003JD003835, 2003) and $\bar{\epsilon_{\mathrm{o}}}$ is the bias in the observation vector. The first term on the right hand side maps ECMWF biases into solution vector biases. If the ECMWF bias was a constant across the profile, it would not map into the solution bias for the reasons given above. However, is $(\mathrm{K}^{\mathrm{T}}\mathrm{S}_{\mathrm{y}}^{-1}\mathrm{K} + \mathrm{R})^{-1}\mathrm{R}\bar{\epsilon_{\mathrm{b}}} \simeq 0$ for the MIPAS retrievals using realistic estimates of ECMWF temperature profile bias, $\bar{\epsilon_{\mathrm{b}}}$? If this has been shown, then the statement saying MIPAS and CCR biases are “entirely independent” is probably reasaonable.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3229, 2007.