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Interactive comment on "A refined statistical cloud closure using double-Gaussian probability density functions" *by* A. K. Naumann et al.

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In view of a puzzling statement in the author's reply (see my Editorial comment) I asked one of the reviewers for an opinion whether the necessary distinction between training and testing data was regarded in the revised manuscript. Here I present the reviewer's new comments.

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Interactive Discussion

Discussion Paper

Review of the 1st revised manuscript by Naumann et al.
"A refined statistical cloud closure using double-Gaussian probability density functions"

Referee 1

Comment on Reply to Referees:

p. 1: One reason for using cross-validation in this case is that the manuscript does model selection. That is, the manuscript attempts to compare the errors in several parametrisations. Therefore, the errors reported should be comparable between parametrisations, i.e. they both should be out-of-sample (generalisation) errors.

p. 2: When the authors tune the closure equations of Larson et al. (2001, L01, Eq. 3 in the GMDD manuscript), they have tuned only one of two parameters. Namely, they have tuned gamma but they have kept alpha=2. Furthermore, negative variances can be avoided by insisting that gamma<1 and alpha>0, as can be seen by inspection of Eq. 3.

The authors have not attempted to tune the parametrisation of Cuijpers and Bechtold (1995), even though a parameter could be introduced as a prefactor to the exponent and another within the argument of exponent.

p. 2: Table 2 of the revised manuscript lumps together the errors from the training datasets (RICO and DYCOMS) and the generalisation datasets (ASTEX and ARM) for the new parametrisation. It also includes the data from L01, CB95, and the new parametrisation. This is misleading, because the errors from the training datasets are not comparable with generalisation error. Either the RICO and DYCOMS errors should be omitted from the table, or else the data from those two cases should be presented

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separately in a way that does not compare training and generalisation errors.

p. 5: The authors' response here conflates inputs and tunable parameters. The inputs are the mean, variance, and skewness, and those cannot be tuned. The tunable parameters are coefficients like gamma and alpha that can be tuned. The new parametrisation has more tunable parameters than the older ones. More tunable parameters can sometimes lead to less robust behaviour when tested in very different data (e.g. congestus clouds). However, there are statistical methods to fairly compare formulas with different numbers of tunable parameters, such as the Akaike Information Criterion and the Bayesian Information Criterion.

p. 7: The revised manuscript should list the number of iterations required for convergence of the equation involving the relative weight, a.

In the revised manuscript, the following passages make comparisons based on training data, whereas the comparisons should be made for the generalisation data:

"In Fig. 6, the new parameterization and the parameterization of Larson et al. (2001a) are shown compared to the LES data of the RICO case. We focus on the RICO case because the main differences between these two parameterizations are found for the cumulus regime. For stratocumulus the two parameterizations differ only marginally."

"For comparison the parameterization by Cuijpers and Bechtold (1995) using an exponential fit of F that only depends on Q1 is also shown in Fig. 7c" (where Fig. 7c shows the RICO case).

"Comparing the two parameterizations based on double-Gaussian distributions, the new parameterization is superior to the parameterization by Larson et al. (2001a) for RICO and ASTEX, but not for ARM and DYCOMS. For the latter two cases the new parameterization and the parameterization by Larson et al. (2001a) seem to have comparable error magnitudes. This is reasonable, because the closure equations have most notably been changed for high positive skewness which correspond to the cumu-

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lus cloud regime. Because the new parameterization is better able to reproduce the highly skewed distributions occurring mostly in RICO and ASTEX compared to the parameterization by Larson et al. (2001a), the new parameterization is superior for these cases but not remarkably different for small positive or negative skewness."

Interactive comment on Geosci. Model Dev. Discuss., 6, 1085, 2013.