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Addendum to

"Validation of remotely sensed profiles of atmospheric state variables: strategies and terminology" published in Atmos. Chem. Phys., 6, 4311–4320, 2006

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In Eq. (33) of the original paper, of which the terminology is used here and to which all following equation and section numbers refer, a χ^2 test is suggested to test the significance of a bias $\breve{\boldsymbol{b}}$, i.e. the mean difference of K co-incident profiles. This approach assumes a perfectly known covariance matrix $\breve{\mathbf{S}}_{\mathrm{bias}}$, i.e. a large size of the sample this covariance matrix is estimated from. However, it turns out that in real applications the sample size K often is too small to justify this approach. In such cases the T^2 statistics (Hotelling, 1951) is the method of choice for profile validation. The quantity to be tested is

$$T^2 = \breve{\boldsymbol{b}}_{\mathrm{diff}}^T \breve{\mathbf{S}}_{\mathrm{bias}}^{-1} \breve{\boldsymbol{b}}_{\mathrm{diff}} = \chi^2_{\mathrm{bias}} \quad (1)$$

but the probability function applicable to this test is the Hotelling's T^2 distribution instead of the χ^2 distribution. For univariate applications as discussed in Sect. 7, the Student's t-test (Gosset, 1908) is the natural choice for assessment of the significance of a scalar bias in the case of small sample sizes.

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