An editor's review on the version 3 manuscript submitted to "Geoscientific Instrumentation, Methods and Data System"

Title: **Response time correction of slow response sensor data by deconvolution of the growth-law equation**

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Reviewed by Takehiko Satoh (the handling editor)

Thank you very much for your intensive effort in addressing all the issues arisen by two anonymous reviewers through the peer-review period. I'm grateful to find out that this version 3 manuscript is indeed approaching the state of publication. In this report, as the handling editor, I'm going to make several minor comments plus one major comment. They are mostly related to the ways handling uncertainties of the measurements and/or the restored results. No more reviewers will be needed other than me (the handling editor) in subsequent refinement of the manuscript. In the below, indicated line numbers are of the version 3 manuscript.

L. 107: in the in-line equation of γ, one representative σ is used but how it is obtained from σ_j is not explained (although I would guess the largest of σ_j).

L. 145: Eq. (13) is identical with Eq. (3). Avoid repeating the same equation to appear in different places with different numbers (this is not a lengthy paper) but just mention here "The simulated measurements m_j are obtained according to Eq. (3)" or alike.

L. 182-183: "The error estimate is obtained from Eq. 11" needs to be explained more explicitly. My understanding is that the diagonal elements of the upper left quadrant (N x N) of Σ_{MAP} (the covariance matrix) are used, right? Explain in the text.

L. 184: add "except an offset σ_0" after "proportional to $u_m(t)$"

L. 232: not very clear why re-definition of σ_j is needed instead of using that in Eq. (14). Please clarify.

L. 232: I believe this (equation about μ) reduces to

$$\mu = \frac{1}{M-1}(m_M - m_1)$$

L. 246: "with process 2 inverted" may not be appropriate as processes 2 and 3 are no longer discernible (or, in other word, the second derivative of the curve never becomes null) in the step decrease phases after ~2 x 10^4 s (Fig. 4c). Better rewording this.

L. 313-326 and Figure 6: I have one *major* concern here about the uncertainties estimated for $u_a(t)$ displayed in Fig. 6d. As the authors noted that "lower for increasing concentrations … at ~00:15", the behavior of uncertainties in Fig. 6d (almost proportional to instantaneous values of "already convolved" measurements, m_j, in Fig. 6a) is far from one would expect. Since the response time of the EB sensor is longer than 2000 s (as in L. 265-266, for the temperature range of field experiment), reconstruction of $u_a(t)$ at a time actually refers all subsequent measurements in next thousands of seconds (wouldn't this appear in the covariance matrix?). How come UPs and DOWNs of $u_a(t)$ in last 10 or so minutes (after ~07:15) be reconstructed this good as in Fig. 6a? This also implies that uncertainties of the reconstructed signals should behave like weighted integrals of the measurement uncertainties in the same length of time.

In addition, the RT-corrected EB data deviate from the DRB sensor measurements by the order of tens of ppm at many occasions while the estimated errors of the former are mostly smaller than 3 ppm except 00:15 – 00:45 after the largest peaks of methane concentrations. To my eyes, attributing ALL of these discrepancies to the different characteristics of the EB sensor and the DRB sensor would not be appropriate but (at least) some should be to suspected under-estimate of the uncertainties of $u_a(t)$.

Although I'm not 100 % sure how this could happen, one possible area may be the authors' choice of numerically large weighting constant (γ) for the growth-law equation, the upper part in Eq. (6). It seems that a factor 10^5 in γ has rather arbitrarily been chosen. What if this factor is much smaller, say 10^3, 10^2 or even unity? I'm very curious whether or not smaller factors could yield "more understandable" behavior of uncertainties for $u_a(t)$ which may make me (and readers) feel probably more comfortable.