Thank you for this critical review and also for the summary and emphasizing the core issues.

General comment

We want to point out and specify more precisely our motivation! The aim was a fast and lightweight algorithm but with sufficient precision for atmospheric conditions (with a minimum assumptions). However, this framework is with extended functionality and a larger output (e.g. error propagation). Therefore we've changed the title and try to emphasize this more in the text.

This algorithm is not a competitor to the solution of sets of Fredholm integral equations, due to total different priorities!

Specific comments

Though the title suggests that the manuscript presents a novel data inversion algorithm, it is almost entirely focused only on calculation of the response matrix. The approach used to invert the data is to simply calculate the inverse of that response matrix and multiply it by the measurement array.

See general comment

This is a simple and efficient approach, but one that is rarely used because it can amplify noise in the distributions and can lead to physically unrealistic negative concentrations. These complications are evident in the "conventional inversion" distribution shown in Figure 3. The well behaved distribution determined using the "enhanced inversion" is certainly not proof that such problems will necessarily be absent when accounting for larger multiply charged particles.

Indusputable, in this example it isn't due to noise. Even the raw plain counts did not show a noisy structure. It is just due to the massive coarse mode!

In this case, an algorithm with constraints, like enforcing positive values, would also fail (just positive functional values are no guarantee for correctness). But such algorithms would not suggest that there is something substantial wrong, which is rather counterproductive.

Apart from that, you are right!

[...] Specifically, these are calculated assuming the transfer function is narrower than the bin width and can be effectively approximated as a rectangle spanning the bin and having an area equivalent to the actual triangle or Gaussian profile. The authors do not presume this to be true, but rather that the error introduced by doing so will be small for typical ambient distributions that possess only broad

features. No support for this is provided.

It is based on the "first mean value theorem for integrals". And it is not a new approximation/assumption (see e.g. Stratmann, 1997), but consistently applied for non spherical and larger multiple charged particle, consequently as a fully single matrix operation, with resulting analytical expressions for error propagation.

The calculated "efficiency" values, E, that contain most of the terms used to calculate the response matrix elements are quite simplistic.

and

The term A is defined in section 2.1 as a dimensionless area and then in section 2.3 as an efficiency. The brief mention of using a CCNC in place of a CPC will probably lead to confusion for some readers and doesn't seem to add much to this description. Why not just comment on inclusion of the CPC efficiency?

The CPC efficiency is now explicitly given, consequently also in the table 2 (see reply to other referees). Therefore, we've deleted the second naming of A. The CCNC in the appendix is just an "unusual" example for the easy expandability, in case one wants to determined number size distribution of activated particle.

I don't see the delta term introduced in Equation 5 defined.

The dirac delta function is now explicitly mentioned in the text, as well as added to table 2.

More clearly state that Equation 6a is the Wiedensohler approximation and 6b is the Gunn distribution.

You are right, we have rearranged this section (see reply to Referee 1).

The transfer function area, A, is left out of Equation 7.

This is correct and wanted! We wanted to split the problem into both effects, particle passing the DMA (neglect multiple charges and charge probability) to introduce the approximation due to relative narrow DMA TF and the effect of multiple charges.

It might be helpful for some readers to show the result of Equation 7 graphically.

We don't think so, it would do more to confuse the reader, which is not skilled in distributions/dirac delta function.
It would be a plot with single lines, the probabilities can't be displayed!.

The repeated mention of coarse particles outside of the mobility spectrometer size range is overly specific and could be misleading. An SMPS configured to measure up to 200 nm would be impacted by multiply charged particles just beyond that, which are far from being considered coarse by most readers.

This is right! What about "outside the detection range"? We have considered this, also for the new title (see general comment). In the text, especially for the specific example, it is left unchanged.

Starting at the top of page 4746 it is implied that agreement of the mobility spectrometer and complementary instrument (e.g., APS) provides evidence of the accuracy of the measurements and inversion. Maybe, but for more typical size distributions in which the concentration is falling with size the impact of multiply charged particles outside of the size range is probably in the noise (literally) and, consequently, agreement or lack thereof won't say much about the inversion.

This is absolutely right! But it is characteristic for dust storm events, especially close to the measuring location! Independently, for "typical size distributions" the effect on the resulting PNSD is lower. Improving the counting statistics is first a technical issue. Moreover, reducing the noise in the algorithm would lead to the well know but unwanted minimization problem. (see replies to other referees)

Line 10 on page 4754: Calculating the inverse of a matrix with entries on both sides of the diagonal wouldn't be too computationally demanding, as asserted in the manuscript.

We wish to apologize for the bad wording. You are right! Calculating the inverse of band matrix wouldn't be too computationally demanding! But the solution is more sensitive to noise! Reducing the noise is a minimization problem. Therefore it is written *"numerical more demanding algorithms"*. It has been reformulated! (see reply to Referee 2)

- Replacing or deleting minor words according to the referee is not explicitly listed.