**Dear Editor,**

We write you about our accepted manuscript: “Inverse modelling of carbonyl sulfide: implementation, evaluation and implications for the global budget”, MS No.: acp-2020-603.

In our follow-on research we discovered some mistakes in the manuscript. Fortunately, these mistakes do not influence the main message of the manuscript. However, we would like to correct them before the final version appears online.

In checking the manuscript carefully, we found three main issues, which we briefly point out below:

1. TES averaging kernel

We found that we applied the TES averaging kernel in the wrong way (i.e. the AK matrix should have been transposed). This has consequences for the validation of our results with TES (Figure 12). In general, the comparison with the TES satellite data is now less favorable. Also, we had to apply a bias correction, similar to Kuai et al. (2015). Therefore, we modified also Equation 1. Below, we have listed all changes in detail.

1. Wrong prior information was used in some figures

We carefully checked the figures, and found that the wrong prior information was used in Figures 4, 8, 10, and 12. Also, in Figure 4 the prior information was cut off at the beginning of 2010 and at the end of 2012.

We are very sorry for these mistakes, but also think that the main message of the paper is unchanged. Currently, the satellite data are only used to evaluate the model. We also would like to ask advice on how to inform the readers about these changes, e.g. by writing an additional Author Comment outlining the mistake.

Sincerely,

Jin Ma & Maarten Krol

Detailed list of changes made to the manuscript:

Relevant changes are marked on a pdf file. The following is a list of changes made in the revised manuscript and figures:

* The footnote on Page 2 was modified from:

In convention, the unit of COS sources or sinks is written as Gg S a-1 to account for mass of sulfur. To avoid misunderstanding and keep clarity of physical unit, we use Gg a-1 throughout the paper, but only account for mass of sulfur in COS, CS2 or DMS.

to:

By convention, the unit of COS sources and sinks is normally written as Gg S a-1 to account for the mass of sulfur. To keep clarity of the physical unit, we use Gg a-1 throughout the paper, but account only for mass of sulfur in COS, CS2, and DMS.

* The satellite TES description was added on Page 4 Lines 106-109 as:

β is a global constant bias correction term. In (Kuai et al., 2015) a β value of 0.2 was derived using inverse modelling, partly to account for the missing stratospheric decay in that study.

And a bias correction parameter β was added in Eq. 1.

* On Page 5 Line 127 Eq. was modified to Equation, because it is at the beginning of a sentence.
* On Page 14 Lines 413-414, the modification was made from:

Prior TM5 profiles (black) show highest values around the tropopause.

To:

Compared to the other TM5 runs, Prior TM5 profiles (black) show the lowest values around the tropopause.

Because after using the correct data the prior profile is now the lowest amongst TM5 model profiles.

* On Page 15 Lines 431-437, the description was modified to in order to reflect the impact of applying correct AK application and prior information:

We applied an arbitrary bias correction β = 0.1 in Equation 1 to obtain a reasonable fit to TES observations. After assimilation, the agreement with TES improves compared to the prior, but the latitudinal gradients remain generally smaller in the model. The inversion in which also the HIPPO observations are assimilated increases the simulated mole fractions, confirming our findings based on the airborne observation.

* The conclusion on Page 17 Line 508 was modified from:

Comparison between TM5 inversions and satellite data shows that COS in the model is systematically lower than MIPAS or TES, …

To:

Comparison between TM5 inversions and satellite data shows that COS in the model is systematically lower than MIPAS, …

* On Page 18 Lines 535-536 the acknowledgement was modified by adding:

"This work was carried out on the Dutch national e-infrastructure with the support of SURF Cooperative."

* Figure 4 was replaced (prior information (black dots) changed).
* Figure 8 was replaced (prior information (black lines) in the top panels changed).
* Figure 10 was replaced. The prior profile in panel (d) is now smaller.
* Figure 12 was replaced. Also, the Figure caption was modified by adding:

A bias correction of β = 0.1 was applied when applying the TES AK in Eq. 1.