

AMT-2014-14, “A method for colocating satellite XCO₂ data to ground-based data and its application to ACOS-GOSAT and TCCON”

Responses to Reviewer 2

1. The authors choose not to apply the recommended bias correction to the ACOS data and justify the reasons for this decision. However, this results in some of the large difference observed in Fig. 4. It would be interesting for the authors to discuss in more detail what effect these large biases have on the approach taken and whether the conclusions are potentially sensitive to these biases (i.e. are some of the techniques more sensitive than others).

The recommended bias correction for the ACOS data are derived by comparing ACOS observations with TCCON data, and therefore we think that it is best that we avoid any possible ‘feedback’ issue that we would incur when applying the bias-correction to the ACOS data before applying the colocation methodologies.

In this paper, we are interested in minimizing the expected interpolation error (prediction variance). Any systematic bias described in Wunch et al. [2011] should affect the three colocation methodologies equally. The expected error can be decomposed as

$$\text{Expected error} = \text{Variance} + \text{Bias}^2 + \text{Noise}^2,$$

As seen above, the lack of bias correction would inflate the term ‘Bias’ equally for all three colocation methodologies that we considered. Since we are concerned with the relative magnitude of the expected prediction error across the three methodologies, the effect of the constant ‘Bias’ term can be ignored.

2. There is currently some uncertainty regarding the TCCON XCO₂ data due to errors introduced by a laser sampling issue. Consequently, the recommended corrections to the TCCON data have changed several times. Clarification of exactly which TCCON data have been used with which corrections applied should be stated. This also has implications for the statement that TCCON has a precision/accuracy of 0.8 ppm. Currently the uncertainty on the TCCON data is +/- 1 ppm for many stations.

We used the GGG2012 version of TCCON data, and we did not correct for systematic error introduced by the laser sampling issue. We have revised the manuscript to correct the error at affected sites over the time range in our manuscript. The recommended corrections that we used are listed at https://tcccon-wiki.caltech.edu/Network_Policy/Data_Use_Policy/Data_DescriptionLaser_Sampling_Errors

We added a note in the paper in the 7th paragraph of section 2 describing this error correction. We have found that the error correction tends to be fairly small (typical corrections range between 0.1 and .4 ppm). We re-computed the the relevant figures and graphics, and the effect of the bias corrections on the results is minimal. There are some very minor differences to Figure 5 due to this TCCON correction, and the overall observations and conclusions in the previous manuscript are still applicable. The methodology is unaffected, of course.

We believe that this correction should make the estimate of the TCCON *average* precision/accuracy of +/- .8ppm [Wunch et al., 2010] a good conservative estimate.

3. Similarly to 2, clarification of exactly which CarbonTracker version has been used would be helpful. CT2011 initially had an issue, resulting in its re-release as CT2011oi.

We apologize for not mentioning the version of CartronTracker in the previous draft. We used the CT2001_loi version, and we made the corresponding note to the manuscript in the 3rd paragraph of Section 3.1.

4. Figure 5 is perhaps the most interesting one but its quite difficult to read. Id recommend making the figure larger and substantially increasing the front size.

We stretched Figure 5 and increased the font size. The legend on the lowest panel has also been adjusted to avoid blocking results for Ny Alesund. The new figure is attached below.

Minor corrections: Page 1515 Line 14: remove "of"

Fixed. Thank you.

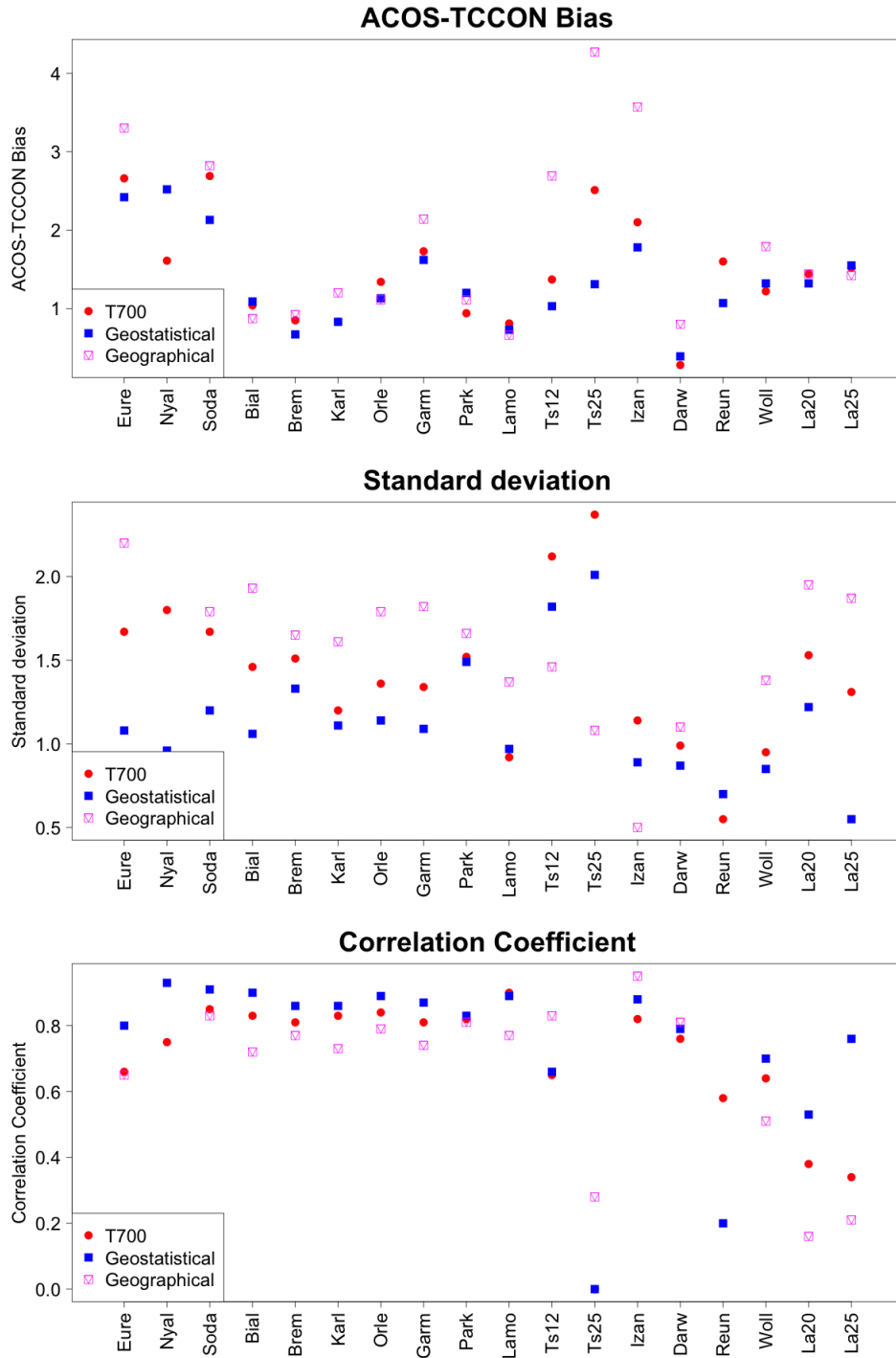


Figure 1: Summary statistics for the comparison between ACOS and TCCON using 3 colocation methodologies

References

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