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Greenhouse gas (GHG) column average mole fraction data delivered by the Total Carbon Column Observing Network (a global network of high resolution, solar-viewing Fourier transform infrared spectrometers) is highly valuable for carbon cycle science. It is also a key link in the validation strategy for space-based GHG observations, as it serves as the essential transfer standard between in situ GHG measurements and the space-based retrievals. The GGG2020 product, released in April 2022, represents a significant improvement on the previous GGG2014 data product.

However, it has been recognized that there remain some biases in the GGG2020 column average GHG products. In particular, as seen in comparisons with in situ profiles, XCO2 can be biased by +/-0.5 ppm. This bias is correlated with a diagnostic quantity, termed “Xluft”, which is a proxy for issues such as non-ideal instrument line shape, solar pointing errors, zero-level offsets, and errors in the O2 spectroscopy used in the forward model. There is also bias in XN2O, compared to pseudo-profiles derived from surface in situ measurements, that is correlated with temperature at 700 hPa. This suggests an error in the temperature dependence of the N2O spectroscopy.

To mitigate these biases, plan to release a minor update to the TCCON data product, termed “GGG2020.1”. Ideally, these biases will be corrected by updates to the forward model that address the underlying error. This work is in progress but not yet complete, and will require all TCCON sites to redo retrievals on all of their spectra, which is a significant time investment. The GGG2020.1 product is currently planned to include two main updates:

- Empirically-derived bias corrections to the XCO2 products (XCO2, XwCO2, and XlCO2) and the XN2O product.
- Small corrections for all Xgas products to account for changes in the atmospheric average O2 mole fraction over time.

Additionally, the TCCON data product will switch from using the GEOS FP-IT meteorology product for a priori information to the new GEOS IT product in 2024. We will show that this has minimal impact on most of our Xgas product, with XCO being the sole exception.
Presentation file
Laughner-Joshua.pdf
Meeting homepage
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