



Assessing 5 years of GOSAT Proxy XCH₄ data and associated uncertainties

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We present 5 years of GOSAT XCH₄ retrieved using the "proxy" approach. The Proxy XCH₄ data is validated against ground-based TCCON observations and is found to be of high-quality with a small bias of 4.8 ppb (~0.27%) and a single-sounding precision of 13.4 ppb (~0.74%). For the first time the XCH₄/XCO₂ ratio component of the Proxy retrieval is validated (bias of 0.014 ppb/ppm (~0.3%), single-sounding precision of 0.033 ppb/ppm (~0.72%).

The uncertainty relating to the model XCO₂ component of the Proxy XCH₄ is assessed through the use of an ensemble of XCO₂ models. While each individual XCO₂ model is found to agree well with the TCCON validation data ($r = 0.94-0.97$), it is not possible to select one model as the best based on these comparisons. The median XCO₂ value of the ensemble has a smaller scatter against TCCON than any of the individual models (0.92 ppm) whilst maintaining a small bias (0.15 ppm). This model median XCO₂ is used to calculate the Proxy XCH₄ with the maximum deviation from the median used as an estimate of the uncertainty.

We compare this uncertainty to the a posteriori retrieval error and find typically that the model XCO₂ uncertainty becomes significant during summer months where the a posteriori error is at its lowest.

We assess the significance of these uncertainties on flux inversion by comparing against the GOSAT-MACC XCH₄ differences. We find that for the majority of regions the differences are much larger than the estimated uncertainties. Our findings show that useful information will be provided to the inversions for the majority of regions in addition to that already provided by the assimilated in-situ measurements.