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Preliminary validation and inter-comparison of XCO_2 retrieved from GOSAT and OCO-2 using the University of Leicester retrieval algorithm

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Reliable observations of atmospheric CO_2 concentrations are essential to our understanding anthropogenic carbon emissions and their impact on the global climate system. Satellite measurements of the column-averaged concentration (XCO_2) are useful in constraining flux estimations, but require robust validation to ensure their quality.

Currently, XCO_2 is measured from space using the JAXA Greenhouse Gases Observing Satellite (GOSAT, launched 2009) and Orbiting Carbon Observatory-2 (OCO-2, launched 2014) instruments. Both instruments observe radiation from the near infrared (NIR) and short-wave infrared (SWIR) bands, but differ significantly in their mission design; GOSAT observes global XCO_2 distributions using a nadir 10.5 km footprint, while OCO-2 is capable of resolving emission sources at $\sim$1 km resolution, albeit without global coverage. Despite their differences in coverage, both satellites could be combined to provide a global time series. However, combining both datasets first requires robust validation against a common standard.

For this work, the University of Leicester (UoL) full physics retrieval algorithm has been adapted to retrieve XCO_2 from both satellite missions allowing consistent inter-comparisons of both datasets against models and ground-based Total Carbon Column Observing Network (TCCON). Comparisons are also made against retrievals performed by the operational NASA algorithm for OCO-2.