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Improvements in XCO_2 accuracy from OCO-2 with the latest ACOS v10 product

Christopher ODell[1], Annmarie Eldering[2], Michael Gunson[2], David Crisp[2], Brendan Fisher[2], Matthäus Kiel[2], Le Kuai[2], Josh Laughner[3], Aronne Merrelli[4], Robert Nelson[2], Gregory Osterman[2], Vivienne Payne[2], Robert Rosenberg[2], Thomas Taylor[1], Paul Wennberg[3], Susan Kulawik[5], Hannakaisa Lindqvist[6], Scot Miller[7], and Ray Nassar[8]

[1]Colorado State University, Cooperative Institute for Research in the Atmosphere, Fort Collins, United States of America (odell@atmos.colostate.edu)

[2]The Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

[3]California Institute of Technology, Pasadena, CA, USA

[4]Space Science and Engineering Center, University of Wisconsin-Madison, Madison, WI, USA

[5]Bay Area Environmental Research Institute, Moffett Field, CA, USA

[6]Finnish Meteorological Institute (FMI), Helsinki, Finland

[7]Johns Hopkins Whiting School of Engineering, Baltimore, MD, USA

[8]Environment and Climate Change Canada, Toronto, Ontario, Canada

While initial plans for measuring carbon dioxide from space hoped for 1-2 ppm levels of accuracy (bias) and precision in the CO_2 column mean dry air mole fraction (XCO_2), in the past few years it has become clear that accuracies better than 0.5 ppm are required for most current science applications. These include measuring continental (1000+ km) and regional scale (100s of km) surface fluxes of CO_2 at monthly-average timescales. Considering the 400+ ppm background, this translates to an accuracy of roughly 0.1%, an incredibly challenging target to hit.

Improvements in both instrument calibration and retrieval algorithms have led to significant improvements in satellite XCO_2 accuracies over the past decade. The Atmospheric Carbon Observations from Space (ACOS) retrieval algorithm, including post-retrieval filtering and bias correction, has demonstrated unprecedented accuracy with our latest algorithm version as applied to the Orbiting Carbon Observatory-2 (OCO-2) satellite sensor. This presentation will discuss the performance of the v10 XCO_2 product by comparisons to TCCON and models, and showcase its performance with some recent examples, from the potential to infer large-scale fluxes to its performance on individual power plants. The v10 product yields better agreement with TCCON over land and ocean, plus reduced biases over tropical oceans and desert areas as compared to a median of multiple global carbon inversion models, allowing better accuracy and faith in inferred regional-scale fluxes. More specifically, OCO-2 has single sounding precision of ~0.8 ppm over land and ~0.5 ppm over water, and RMS biases of 0.5-0.7 ppm over both land and water. Given the six-year and growing length of the OCO-2 data record, this also enables new studies on carbon interannual variability, while at the same time allowing identification of more

subtle and temporally-dependent errors. Finally, we will discuss the prospects of future improvements in the next planned version (v11), and the long-term prospects of greenhouse gas retrievals in the coming years.