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Influence of several a priori CO_2 concentration profile covariance matrices on XCO_2 total column retrieval

Matthieu Dogniaux, Cyril Crevoisier, Thibaud Thonat, Virginie Capelle, Raymond Armante, Thibault Delahaye, and Vincent Casse

Laboratoire de Météorologie Dynamique / IPSL, CNRS, Ecole polytechnique, 91128 Palaiseau Cedex, France (matthieu.dogniaux@lmd.polytechnique.fr)

A better understanding of greenhouse gas surface sources and sinks is required in order to adress the global challenge of climate change. Spaceborne remote estimations of their atmospheric concentration can offer the global coverage that is necessary to improve the constraints on those fluxes, thus enabling a better monitoring of anthropogenic emissions. Consequently, striving for this goal, several satellite missions have been designed during the past decade, and the TCCON ground-based network provides an essential validation resource for their estimations. Most of these results are obtained thanks to Bayesian optimal estimation, an inverse method that is well-know for its sensitivity to the a priori choice. This work proposes to quantify the influence of a priori CO_2 concentration profile covariance choice in term of total column retrieval bias. Several a priori covariance matrices will be compared and used in a Bayesian optimal estimation inversion scheme based on 4A/OP radiative transfer model and GEISA spectroscopic database, evaluated thanks to calc-obs spectral residuals computed for hundreds of observations for which atmospheric situations are known. The matrices will be taken from regular TCCON a priori profile databases, CAMS analyses or derived from a profile climatology of profiles measured by balloon-borne AirCores. The performance of the retrieval procedure will then be assessed against atmospheric profiles of CO_2 acquired at several stations as well as during the 2018 Monitoring of Atmospheric composition and Greenhouse gases through multi-Instruments Campaign (MAGIC).