



## Supplement of

## Carbon dioxide retrieval from OCO-2 satellite observations using the RemoTeC algorithm and validation with TCCON measurements

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## **1** Overview

- 5 Here, we provide additional information about: Fig.S1: Error on XCO2 retrievals as a function of six parameters: air mass, water column, blended albedo, mean signal in O2 A-band, aerosol ratio and aerosol size parameter (reff); Fig.S2: same as Fig. S1 but after bias correction; Fig.S3:Validation of individual XCO2 retrieved from OCO-2 measurements after bias correction; Fig.S4-Fig.S6: Validation of overpass averaged retrievals with TCCON before bias correction for targer, land and ocean soundings, respectively; Fig.S7-Fig.S9: The dependence of the bias on latitude before bias correction for targer, land
- 10 and ocean soundings, respectively.

## 2 Content of this file

(1). Figures S1 to S9.

(2). Table S1

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Figure S1. Error on XCO2 retrievals as a function of six parameters: air mass, water column, blended albedo, mean signal in 5 O2 A-band, aerosol ratio and aerosol size parameter (reff). Different colors represent the frequency of point occurrence.



Figure S2.Same as Figure S1 after bias correction.



5 Figure S3. Validation of individual XCO2 retrieved from OCO-2 measurements with collocated TCCON data after bias correction.



Figure S4. Validation of averaged XCO2 retrieved from OCO-2 target measurements with collocated TCCON data before bias correction. The standard deviation of individual TCCON data and that of RemoTeC/OCO-2 retrievals are presented with error bars. The bias ( $b_a$ ), standard deviation ( $\sigma_a$ ), number of points (N), the Pearson correlation coefficient (cor) and one-to-one line are included.



Figure S5. Same as Fig. S4, but for OCO-2 land type measurements obtained under nadir and glint modes.



Figure S6. Same as Fig. S4, but for OCO-2 ocean type measurements obtained under glint mode.



Figure S7. The dependence of the bias between RemoTeC/OCO-2 target XCO<sub>2</sub> retrievals coincident with TCCON data on the latitude of each station. Shown are the averaged results before bias correction. Stations with less than 5 collocation points (marked with red pentagon) should be interpreted with care and are therefore excluded from the calculation of the derived parameters including mean bias ( $b_a$ ) and the station-to-station variability ( $\sigma_s$ ). The size of each dot represents the standard deviation of the difference at each station.



Figure S8. Same as Fig. S7, but for OCO-2 land type measurements obtained under nadir and glint modes.



Figure S9. Same as Fig. S7, but for OCO-2 ocean type measurements obtained under glint mode.

Table S1. Correlation coefficients between XCO2 difference between TCCON and OCO-2 retrievals with filtering parameters listed in Table 2 in the paper.

parameters	Correlation before bias correction	Correlation after bias correction
sza	-0.19	-0.05
vza	-0.07	-0.04
χ <sup>2</sup>	0.20	0.00
$\chi^2_{NIR}$	0.18	0.09
X <sup>2</sup> <sub>SWIR1</sub>	0.20	-0.04
$\chi^2_{SWIR2}$	0.15	-0.05
Blended albedo	0.16	0.18
sev	0.07	0.10
α <sup>s</sup>	0.04	0.01
τ <sub>0.765</sub>	-0.05	-0.02
Aerosol ratio parameter	-0.02	-0.05
water column	0.20	0.06
Ioff1	-0.21	-0.15
Ioff2	0.05	0.10
Ioff3	-0.11	-0.09