Supplement of Atmos. Chem. Phys., 16, 5043–5062, 2016
http://www.atmos-chem-phys.net/16/5043/2016/
doi:10.5194/acp-16-5043-2016-supplement

Atmospheric Chemistry and Physics Open Access EGU

Supplement of

Inverse modeling of GOSAT-retrieved ratios of total column CH_4 and CO_2 for 2009 and 2010

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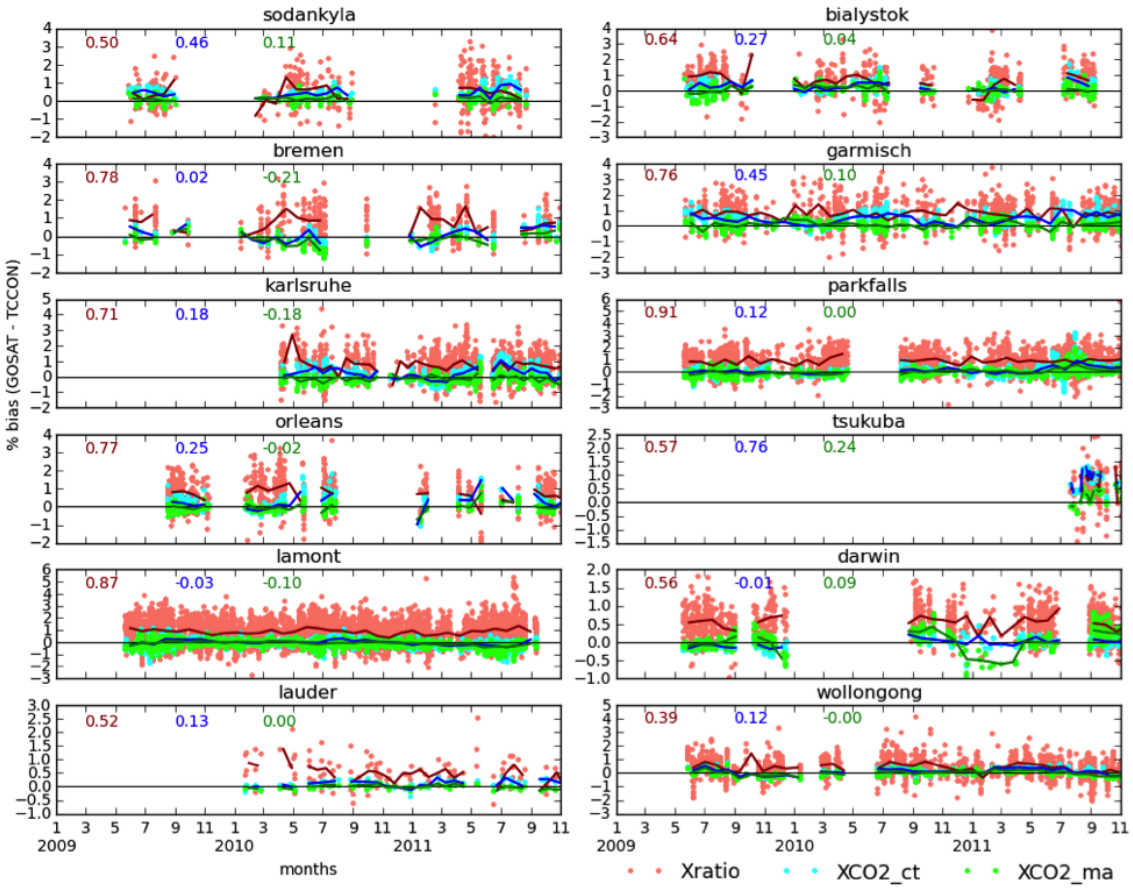

Figure 1: Percentage error relative to TCCON measurements in the terms used to calculate XCH_4^{proxy} (X_{ratio}: red, XCO_2^{ma} : green, XCO_2^{ct}: blue). The lines in darker color represent a running average of the corresponding points in lighter color. At the top left of each panel we show the mean of these errors. Note that the values shown in table 1 of main article are different from mean bias values shown in this table as they are weighted with the errors in GOSAT and TCCON measurements.

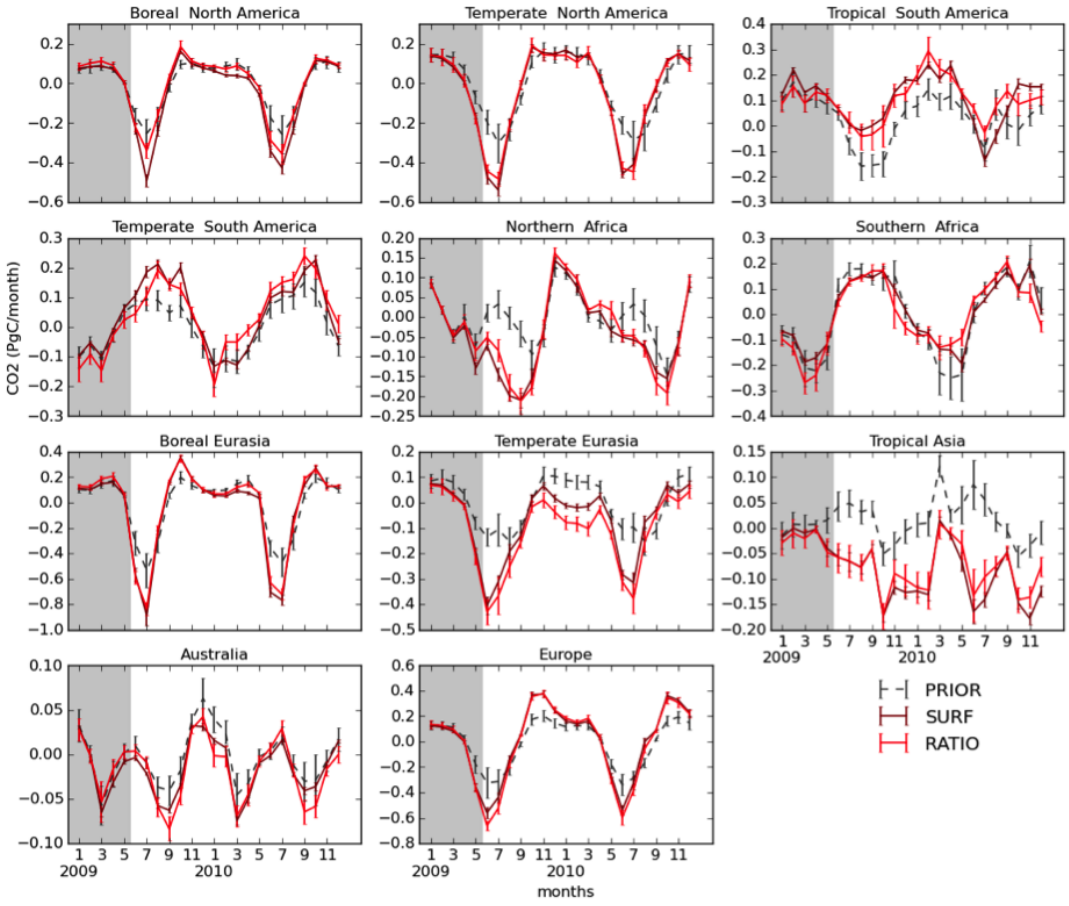

Figure 2: Net monthly fluxes of CO_2 (excluding fossil fuel emissions) integrated over TRANSCOM regions. The vertical lines represent 1 σ uncertainty of the monthly fluxes estimated with the Monte-Carlo method. The gray regions in each plot represent the time period for which no measurements are assimilated.

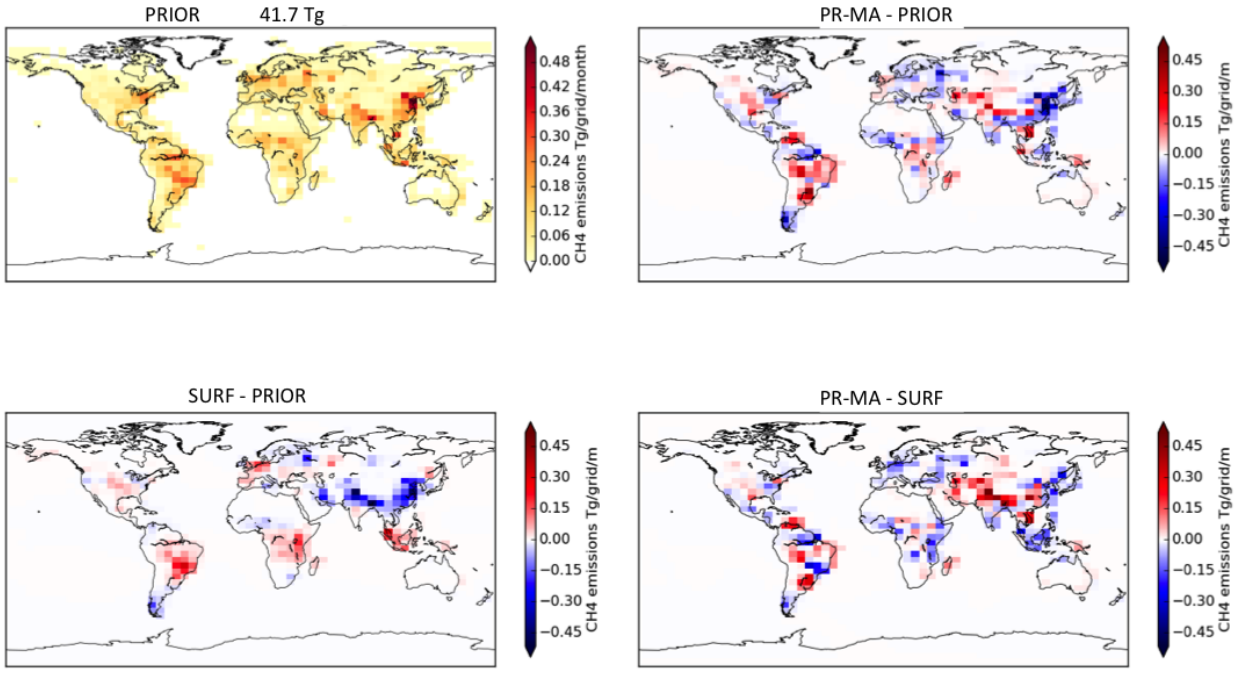

Figure 3: CH_4 fluxes in January 2010.

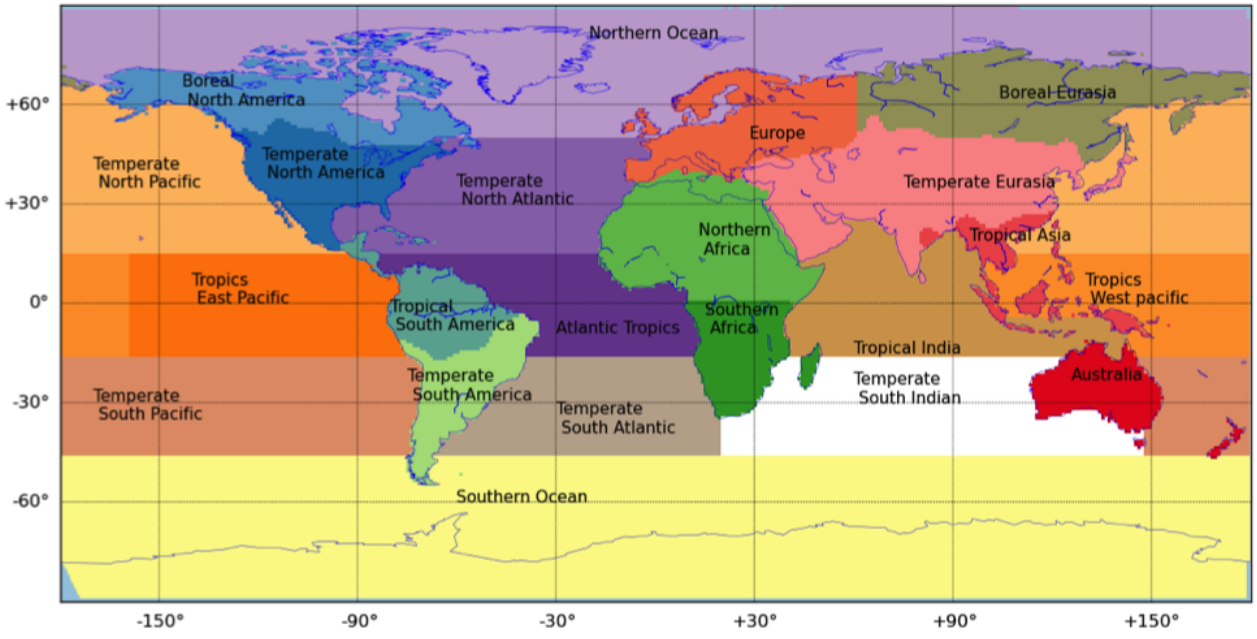

Figure 4: TRANSCOM region map [*Gurney et al.*, 2002] used for integrating the surface fluxes.

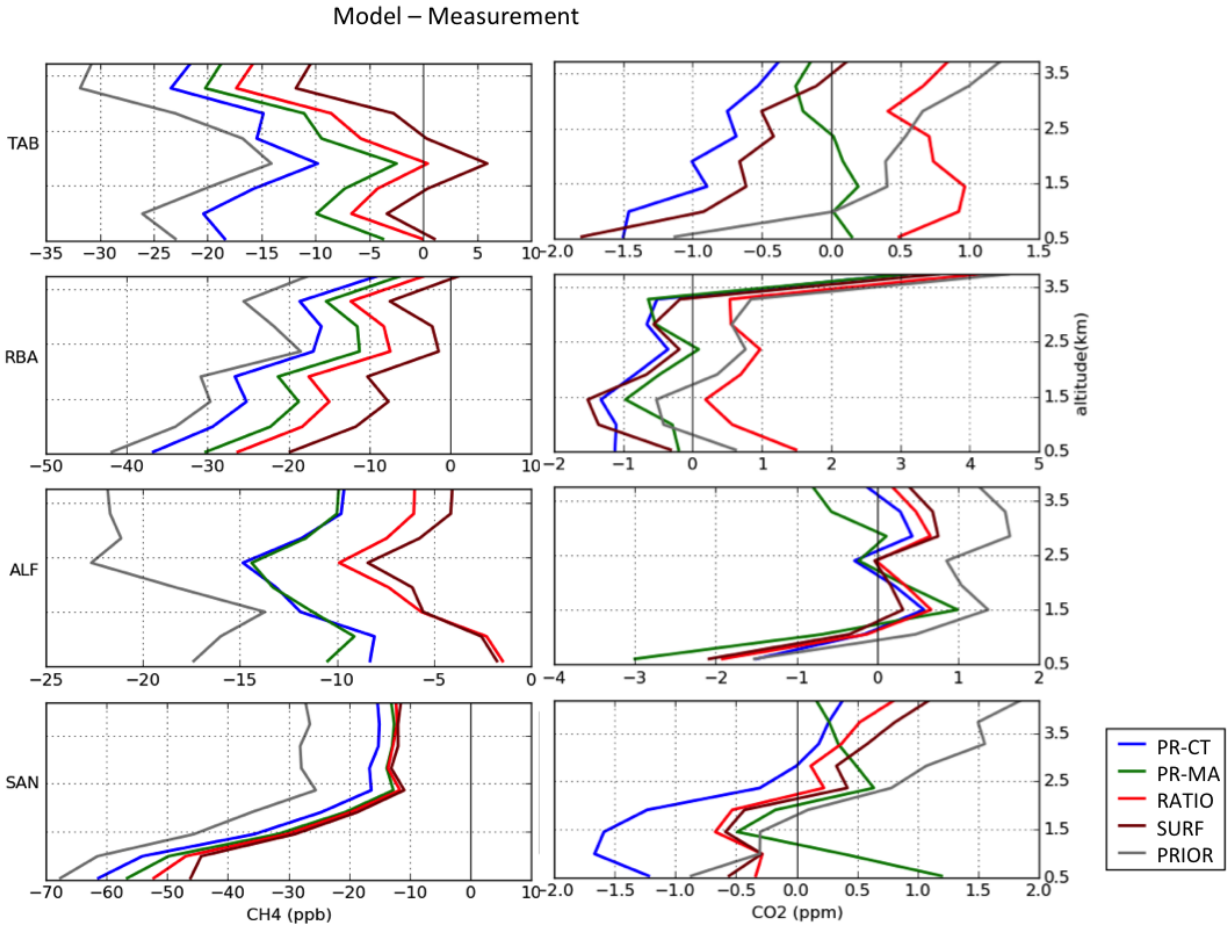

Figure 5: Mean modeled - measured profiles at the four sites of the AMAZONICA campaign. We grouped the measurements in 10 vertical bins and the plotted values represent the mean of each bin. All models have difficulties in reproducing the large CH_4 mixing ratios measured at Santarem (SAN) below 2 km altitude, likely due to local variations that cannot be reproduced by the coarse grid model.

Table 1: Statistics of the aircraft validation.

Tracer	Campain	Project	μ	σ	$RMSD$	κ
		PRIOR	-32.02	35.33	47.68	16.77
		SURF	-14.06	30.15	33.27	3.48
	AMAZONICA	RATIO	-17.18	28.81	33.55	4.35
		PR-CT	-24.11	28.64	37.44	8.43
		PR-LM	-20.3	28.74	35.19	5.4
		PRIOR	13.49	33.11	35.75	6.14
		SURF	5.56	27.79	28.35	1.67
CH_4	HIPPO	RATIO	6.68	27.95	28.74	1.79
		PR-CT	6.03	28.17	28.8	1.94
		PR-LM	6.95	28.02	28.87	1.83
		PRIOR	13.99	21.59	25.73	6.99
		SURF	0.92	19.66	19.69	5.33
	CONTRAIL	RATIO	2.99	19.07	19.31	5.47
		PR-CT	4.43	19.16	19.67	4.56
		PR-LM	3.87	18.73	19.12	4.71

Tracer	Campain	Project	μ	σ	$RMSD$
		PRIOR	0.46	3.35	3.38
		SURF	-0.23	3.3	3.31
	AMAZONICA	RATIO	0.27	3.22	3.23
		CarbonTracker	-0.67	3.11	3.18
		LMDZ	-0.03	3.13	3.13
		PRIOR	1.55	1.44	2.12
		SURF	-0.09	1.26	1.26
CO_2	HIPPO	RATIO	-0.12	1.28	1.29
		CarbonTracker	-0.17	1.08	1.09
		LMDZ	-0.16	1.06	1.08
		PRIOR	2.23	1.69	2.8
		SURF	-0.41	1.6	1.65
	CONTRAIL	RATIO	-0.43	1.59	1.64
		CarbonTracker	0.11	1.41	1.41
		LMDZ	-0.2	1.45	1.46

References

Gurney, K., et al., Towards robust regional estimates of CO2 sources and sinks using atmospheric transport models, *Nature*, *415*, 626– 630, doi:doi:10.1038/415626a,2002., 2002.