



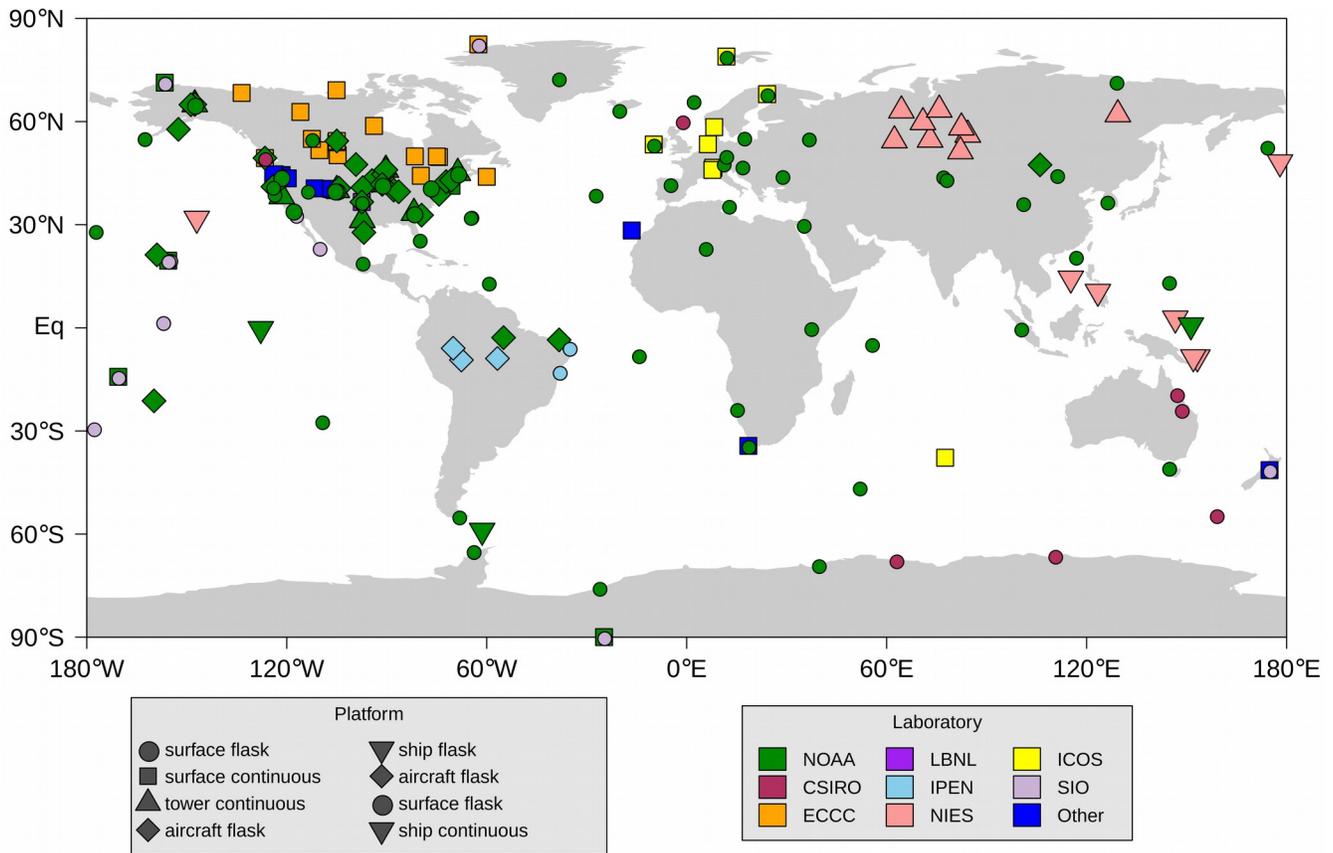
*Supplement of*

## **Optimizing 4 years of CO<sub>2</sub> biospheric fluxes from OCO-2 and in situ data in TM5: fire emissions from GFED and inferred from MOPITT CO data**

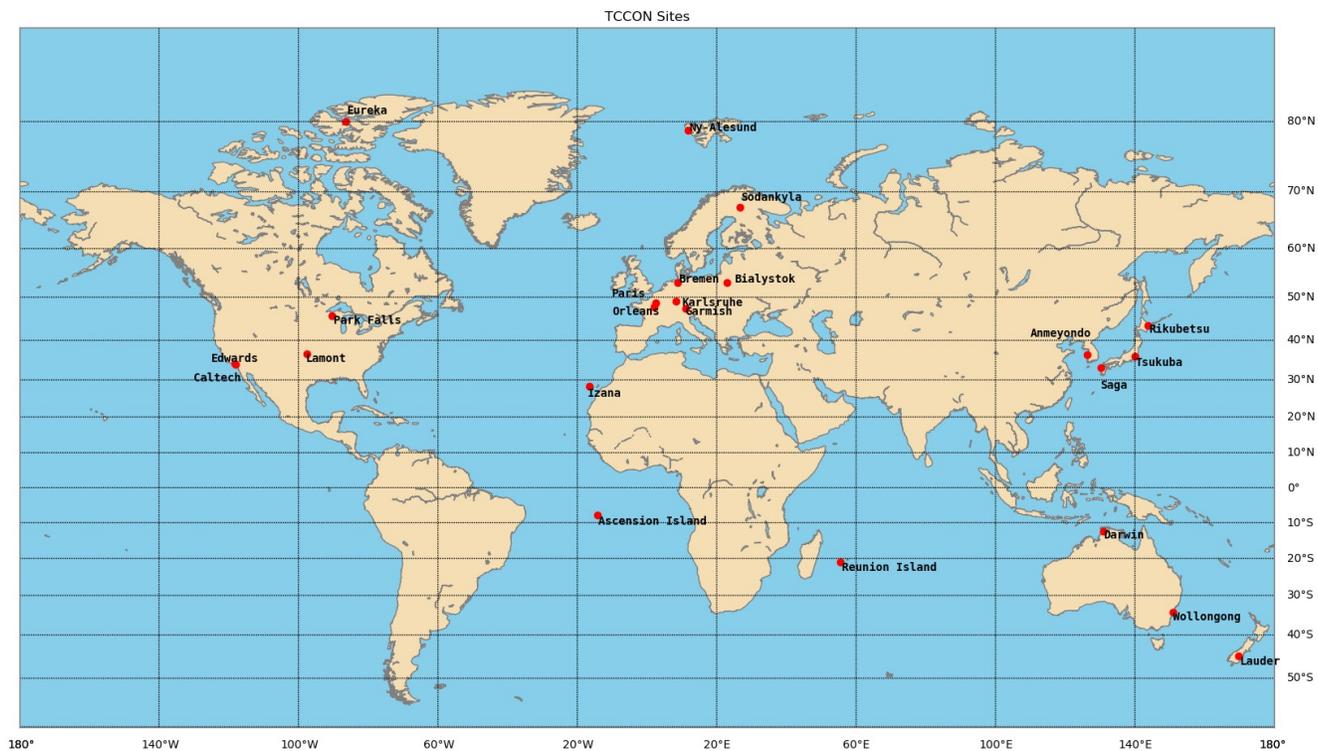
**Hélène Peiro et al.**

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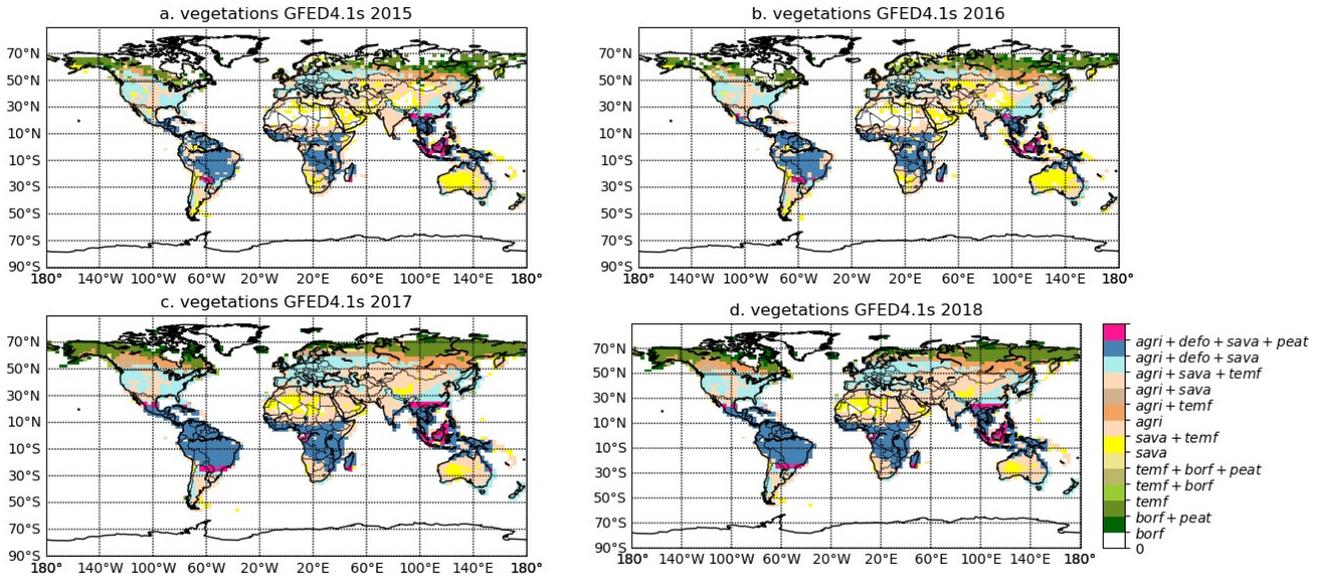
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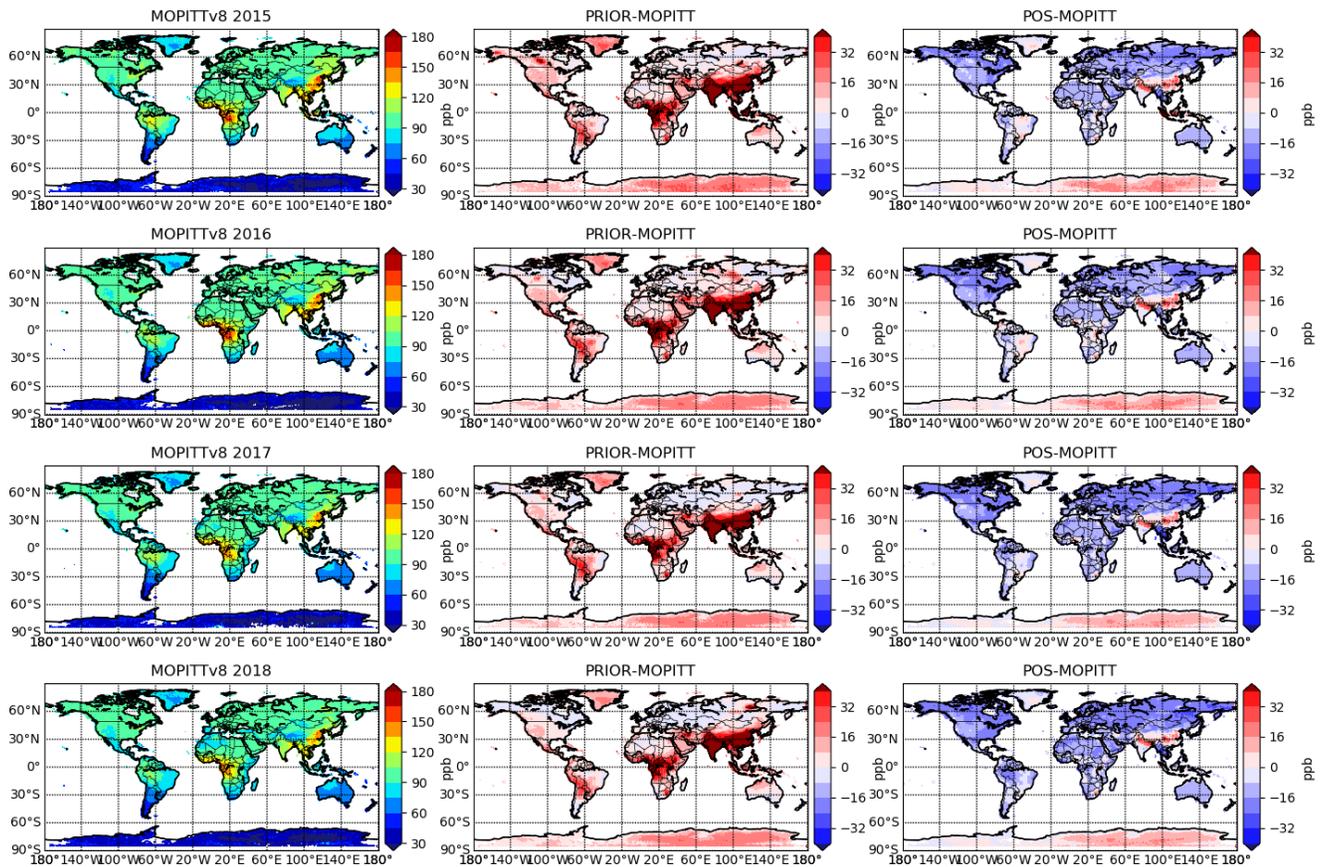
**Figure S1.** Distribution of assimilated in situ measurements around the world. The instrument platform is indicated by marker shape, whereas the color represents the laboratory collecting the data. NOAA is the United States National Oceanic and Atmospheric Administration, CSIRO is the Australian Commonwealth Scientific and Industrial Research Organisation, ECCC is Environment and Climate Change Canada, LBNL is the Lawrence Berkeley National Laboratory, IPEN is the Brazilian Instituto de Pesquisas Energeticas e Nucleares, NIES in the Japanese National Institute for Environmental Studies, ICOS is the European Union Integrated Carbon Observation System, and SIO is the Scripps Institute of Oceanography. Mobile shipboard programs are shown with a single marker at the mean location of the measurements. Figure from Jacobson et al. (2020a).



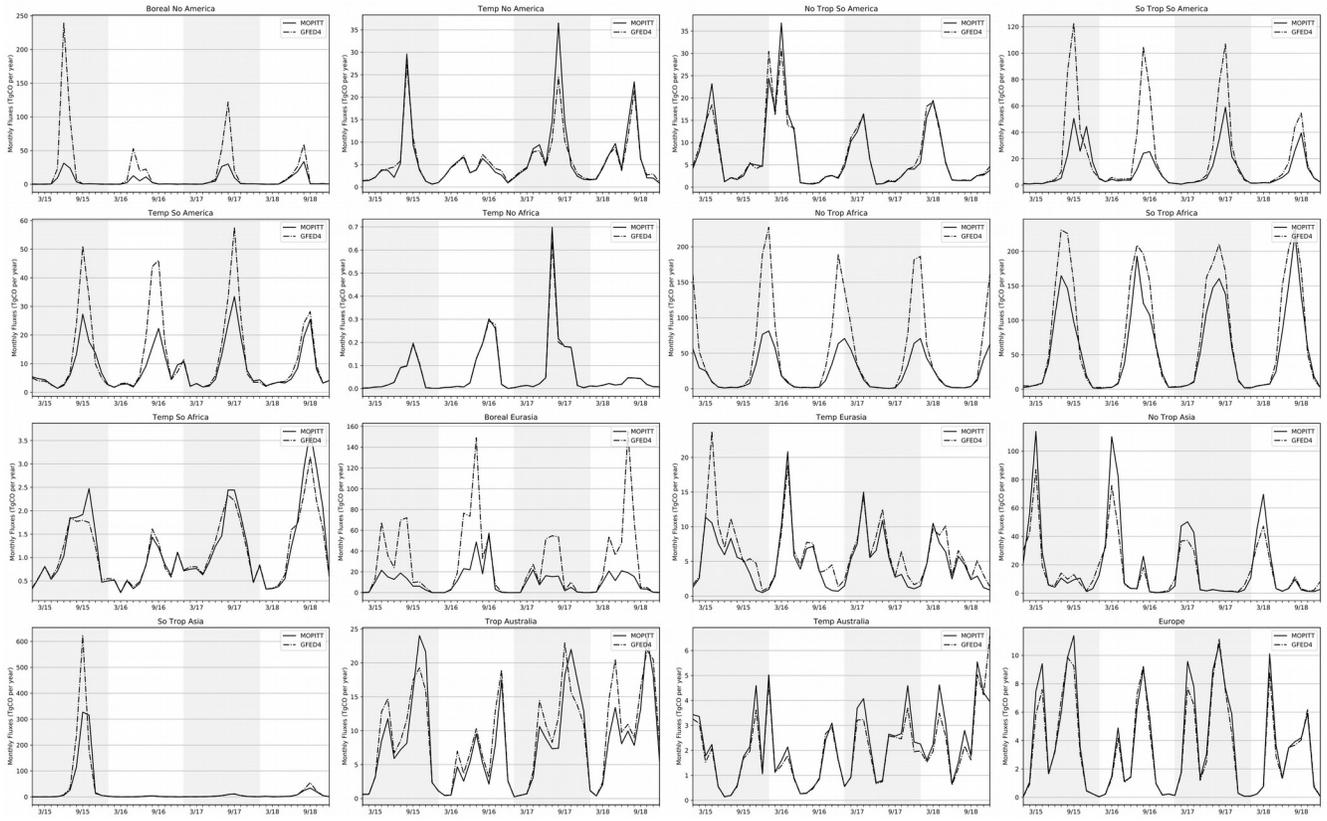
**Figure S2.** Location of the TCCON site used in this study over the globe.



**Figure S3.** GFED vegetation types by pixel on a  $3^{\circ} \times 2^{\circ}$  grid for a) 2015, b) 2016, c) 2017, and d) 2018. Each color represents each pixel with one or several vegetation types.

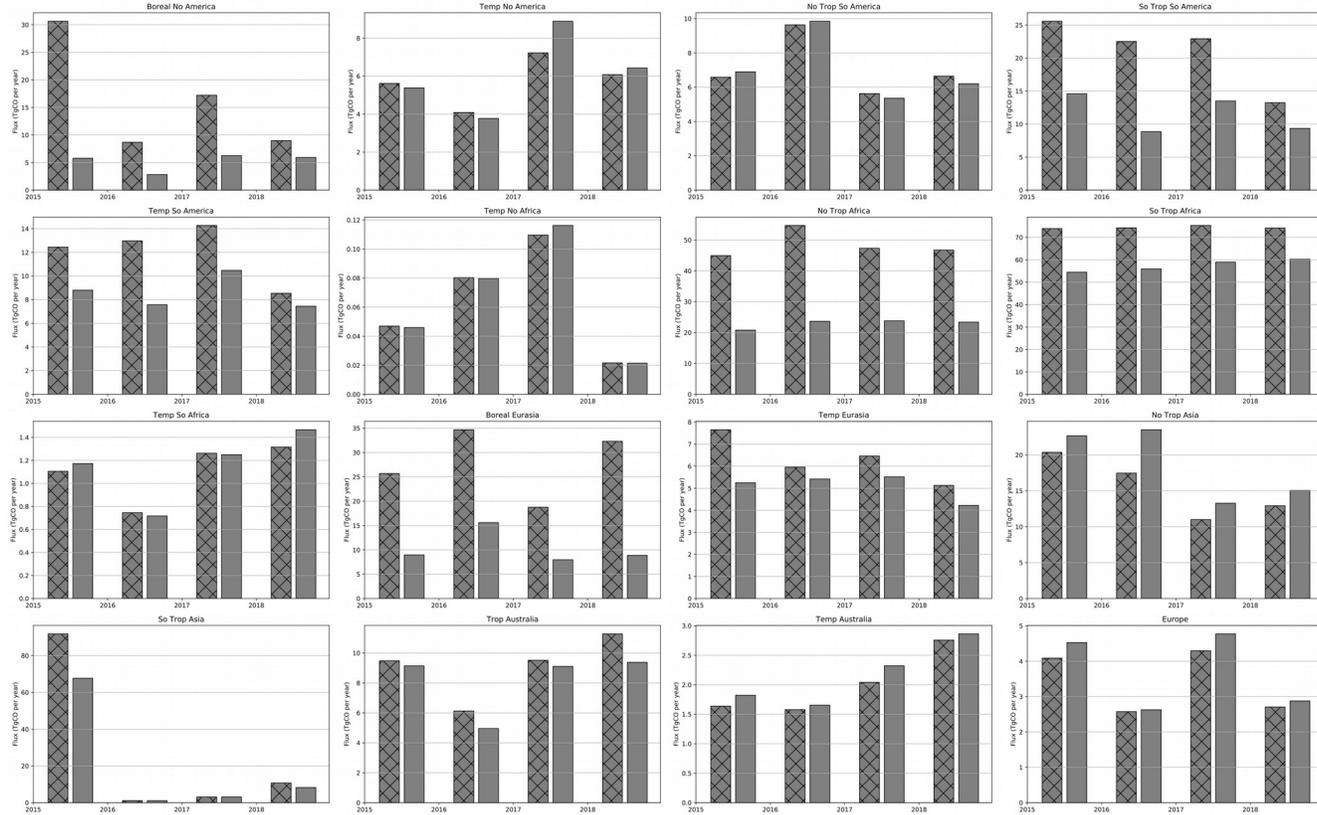


**Figure S4.** Spatial distributions of the CO total column (XCO). Left column : distribution of annual mean XCO of MOPITTv8 retrieval. Center column : Mean annual difference between the prior simulation and MOPITT. Right column : Mean annual difference between the posterior simulation and MOPITT. From top to bottom are the annual mean from 2015 through 2018. Results are in ppb.



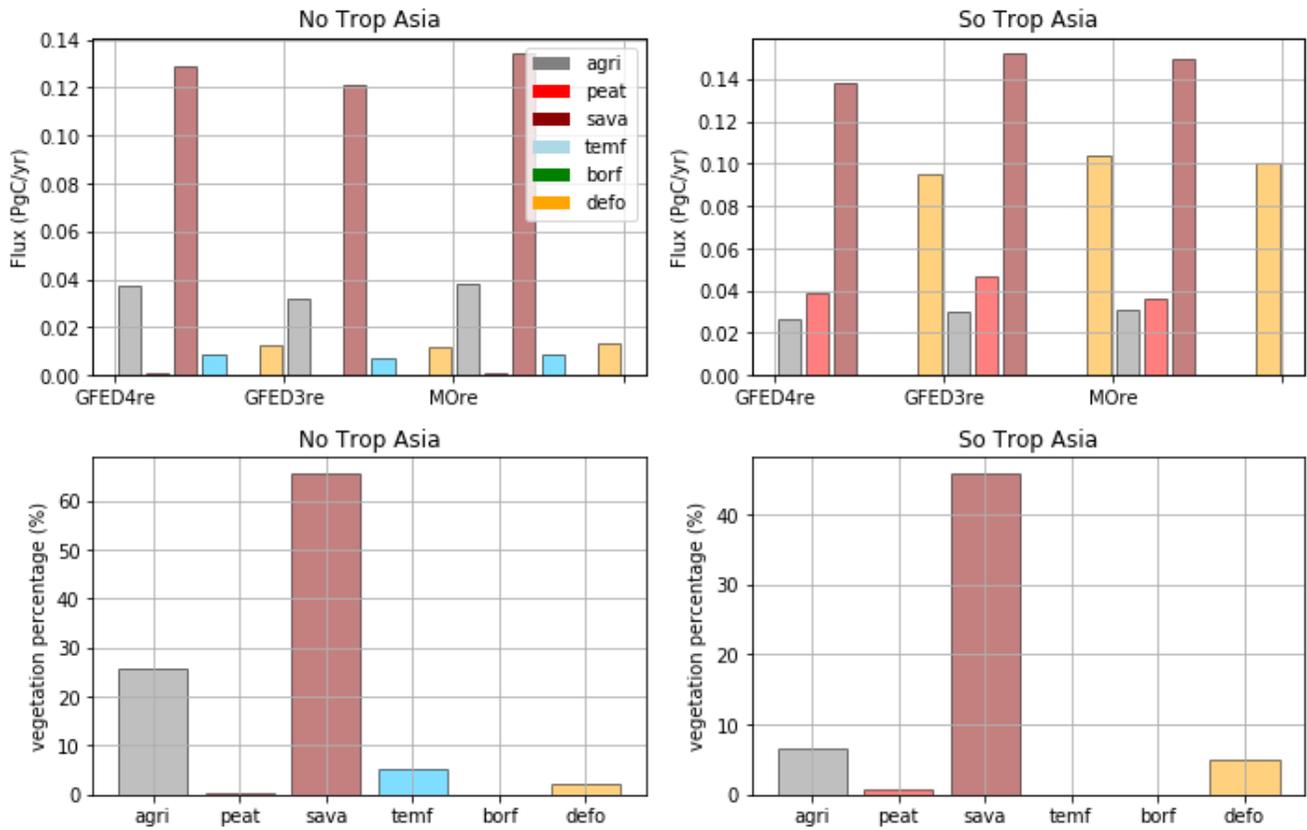
**Figure S5.** Time series of CO fire emissions over the OCO-2 MIP region between fire priors (dot lines) and posteriors (solid lines) emissions. Emissions are in TgCO/yr.

Annual Fluxes (TgCO per year)

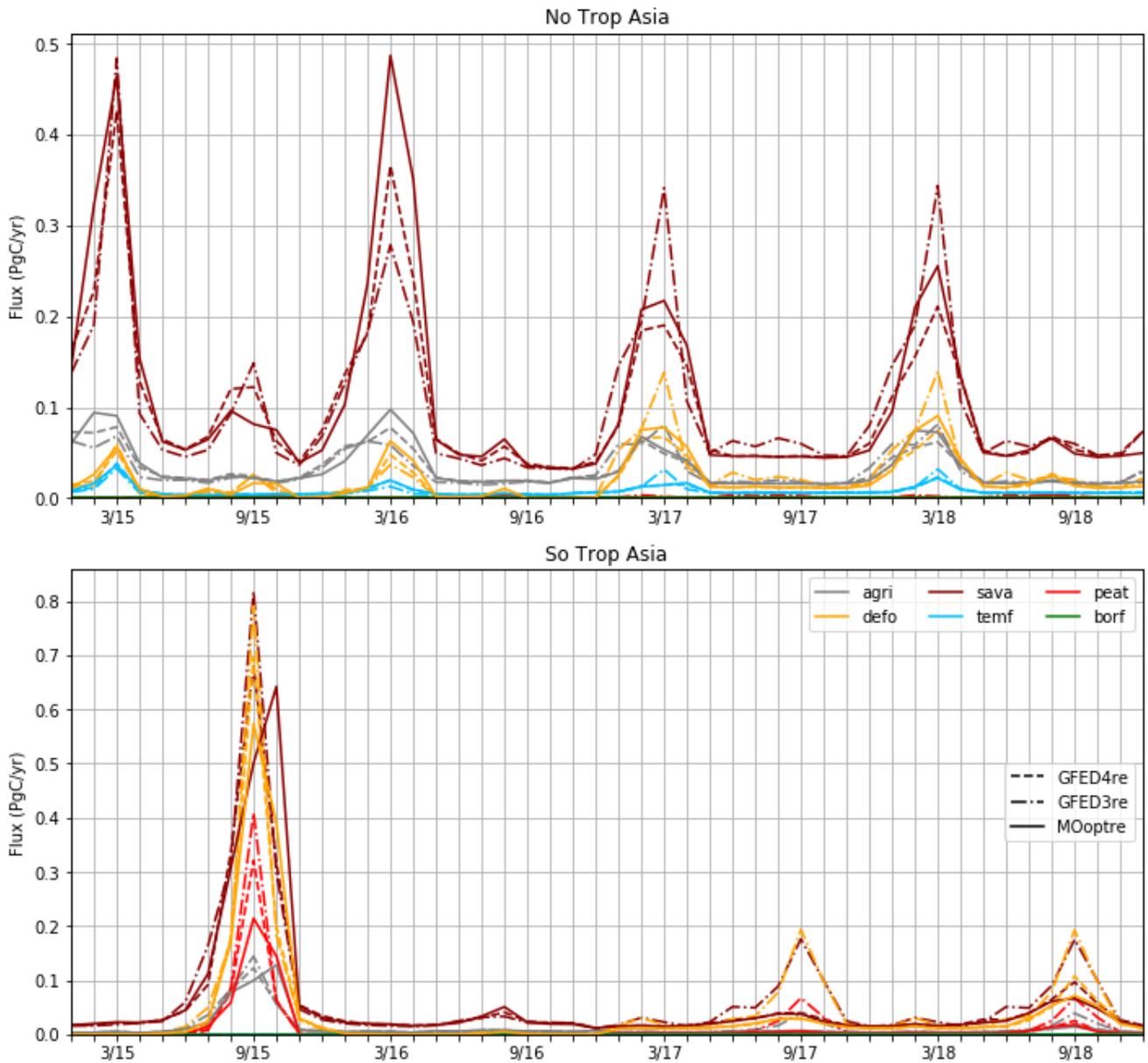


**Figure S6.** Annual CO emissions for posterior and prior (hatched bars) over all OCO-2 MIP regions. Emissions are in TgCO/yr.

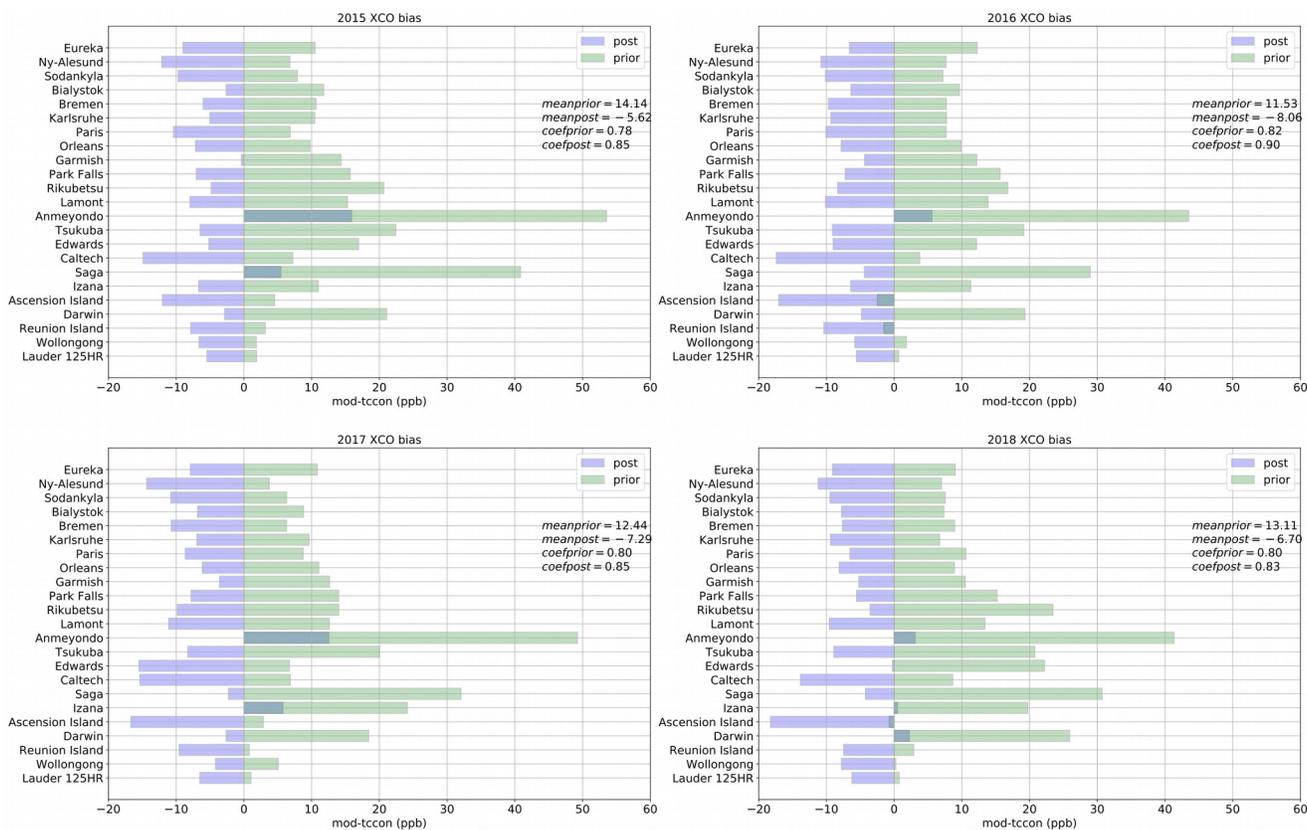
### 2015 Annual Prior Flux (PgC/yr)



**Figure S7.** Prior fire flux (top row) for 2015 over Northern (left) and Southern (right) Tropical Asia of GFED4re, GFED3re and MOrE by vegetation types. The percentage of vegetation over these two regions is also represented in the bottom row. The colors represent the vegetation type : agriculture (gray), peat (red), savanna (brown), deforestation (yellow), and temperate forest (blue).



**Figure S8.** Prior fire flux from 2015 through 2018 over Northern (top) and Southern (bottom) Tropical Asia of GFED4re, GFED3re and MOre by vegetation types. The colors represent the vegetation type : agriculture (gray), peat (red), savanna (brown), deforestation (yellow), and temperate forest (blue).



**Figure S9.** Annual mean difference in ppb between the prior (in green) and posterior (in blue) against each TCCON site. Mean and coefficient of correlation are specified for each year. From top left through bottom right are the annual years 2015, 2016, 2017 and 2018.

Regions	OCO								IS							
	Prior CMS	prior3	prior4	Prior MO	CMS	GFED3 re	GFED4re	MORE	Prior CMS	prior3	prior4	Prior MO	ISCMS	IS3re	IS4re	ISMORE
North America	0.64	0.20	0.16	0.24	-0.071	-0.073	-0.074	-0.073	-90.94	-91.38	-91.42	-01.34	-91.61	-91.61	-91.61	-91.61
North T.S. America	0.15	0.033	0.043	0.050	-0.017	-0.016	-0.017	-0.017	6.18	6.07	6.08	6.09	6.03	6.03	6.03	6.03
South T.S. America	0.046	0.0045	0.015	0.014	-0.0078	-0.0073	-0.0078	-0.0074	5.99	5.95	5.96	5.96	5.93	5.93	5.93	5.93
Temp.S. America	0.30	0.078	0.14	0.13	-0.034	-0.033	-0.034	-0.033	19.91	19.69	19.75	19.74	19.59	19.59	19.59	19.59
Temp.N.Africa	0.068	0.020	0.017	0.024	-0.0078	-0.0078	-0.0079	-0.0078	-0.75	-0.80	-0.81	-0.80	-0.82	-0.82	-0.82	-0.82
North.T. Africa	0.14	0.029	0.045	0.048	-0.0097	-0.0097	-0.0095	-0.010	5.88	5.77	5.79	5.79	5.73	5.73	5.73	5.73
South.T. Africa	0.15	0.035	0.068	0.061	-0.0094	-0.0095	-0.010	-0.0098	13.08	12.97	13.00	13.00	12.92	12.92	12.92	12.92
Temp.S. Africa	0.21	0.056	0.10	0.094	-0.023	-0.022	-0.022	-0.022	27.09	26.94	26.98	26.98	26.87	26.87	26.87	26.87
North Asia	0.61	0.20	0.15	0.23	-0.060	-0.060	-0.062	-0.061	-13.99	-14.40	-14.44	-14.37	-14.64	-14.63	-14.63	-14.63
North.T. Asia	0.24	0.071	0.079	0.094	-0.011	-0.011	-0.012	-0.012	-10.67	-10.84	-10.83	-10.81	-10.91	-10.91	-10.91	-10.91
South.T. Asia	0.18	0.051	0.077	0.078	-0.015	-0.015	-0.016	-0.016	10.75	10.62	10.64	10.65	10.57	10.57	10.58	10.58
Trop Australia	0.082	0.022	0.037	0.036	-0.0073	-0.0074	-0.0073	-0.0073	3.42	3.36	3.38	3.38	3.34	3.34	3.34	3.34
Temp Australia	0.38	0.095	0.17	0.16	-0.048	-0.047	-0.047	-0.047	33.68	33.40	33.47	33.46	33.27	33.27	33.27	33.27
Europe	0.25	0.083	0.059	0.094	-0.032	-0.032	-0.032	-0.032	-10.13	-10.30	-10.33	-10.29	-10.40	-10.40	-10.40	-10.40

**Table S1.** Summary of CO2 model (prior or posterior) - data comparison against OCO-2 retrievals and IS data for each OCO-2 MIP regions. Values are in ppm.