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Supplement of

A biogenic CO_2 flux adjustment scheme for the mitigation of large-scale biases in global atmospheric CO_2 analyses and forecasts

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Table 1: Root mean square error [ppm] of different forecast (FC) experiments with observations at three NOAA/ESRL tall towers for daily mean dry molar fraction of atmospheric CO_2 in March 2010. The dash symbol means the correlation is not significant.

NOAA/ESRL Tower site (ID)	Latitude, Longitude, Altitude	Sampling level [m]	BFAS FC	CTRL FC	OPT FC	OPT-CLIM FC
Park Falls, Wisconsin (LEF)	45.95^{o}N, 90.27^{o}W, 472 m	30	6.12	4.97	3.04	3.31
		122	4.05	5.44	2.09	3.06
		396	2.93	5.10	1.37	1.99
West Branch, Iowa (WBI)	41.72^{o}N, 91.35^{o}W, 242 m	31	3.79	10.39	5.06	6.96
		99	2.91	9.94	2.95	3.92
		379	2.46	8.91	3.20	2.43
Argyle, Maine (AMT)	45.03^{o}N, 68.68^{o}W, 50 m	12	3.72	3.76	2.35	1.30
		30	3.55	3.36	1.66	0.82
		107	2.86	3.37	1.06	0.76

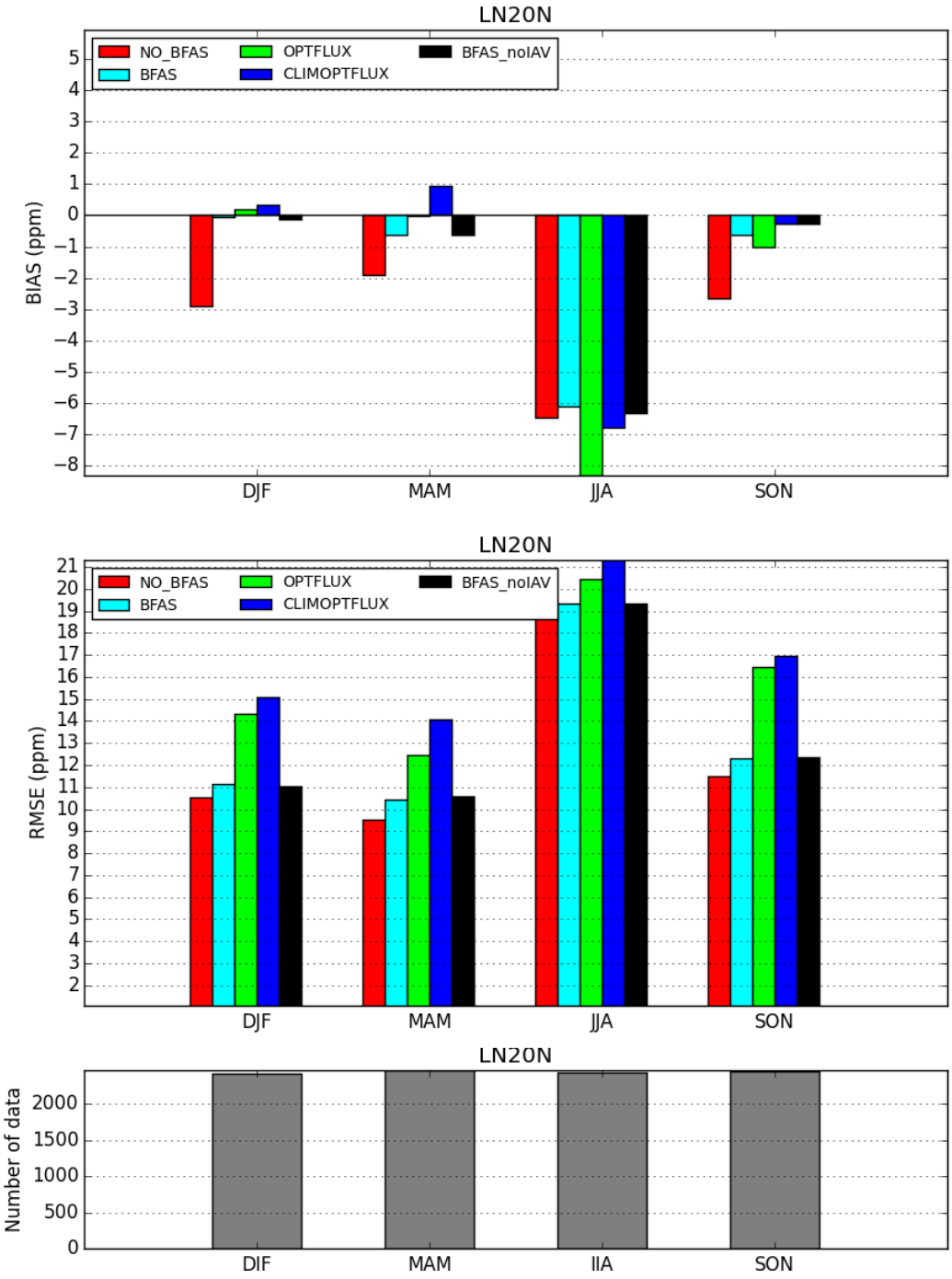

Figure 1: Evaluation of diurnal cycle amplitude of CO_2 dry molar mixing ratio [ppm] for the different forecast experiments (see legend) in the northern hemisphere land (north of 20^oN) based on hourly data from all the in situ stations compiled in the NOAA Obspack (2015) dataset for 2010. Top panel: mean error; middle panel: root mean square error; and lower panel: number of observations.

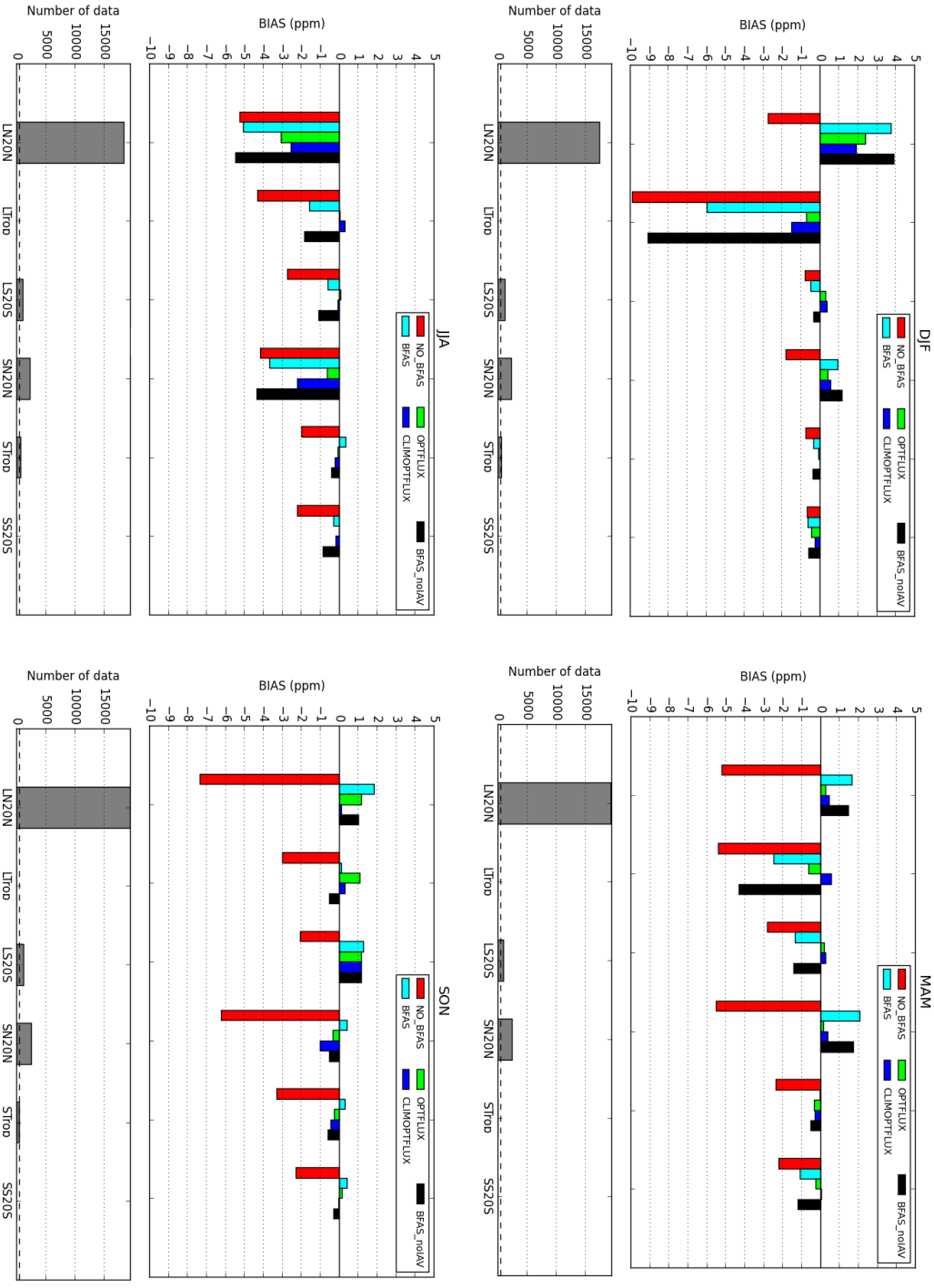

Figure 2: Mean error of atmospheric CO_2 dry molar mixing ratio [ppm] for different forecast experiments (see legend) with respect to insitu and flask observations for different seasons and regions (N20N: north of 20^oN; Trop: between 20^oS and 20^oN; S20S : south of 20^oS) with a separation between land and sea points denoted by a preceeding "L" and "S" in the region name respectively. The observations were extracted from the NOAA Obspack (2015) dataset in 2010. The number of observations used for the statistics are shown as grey bars in the panel below each plot.

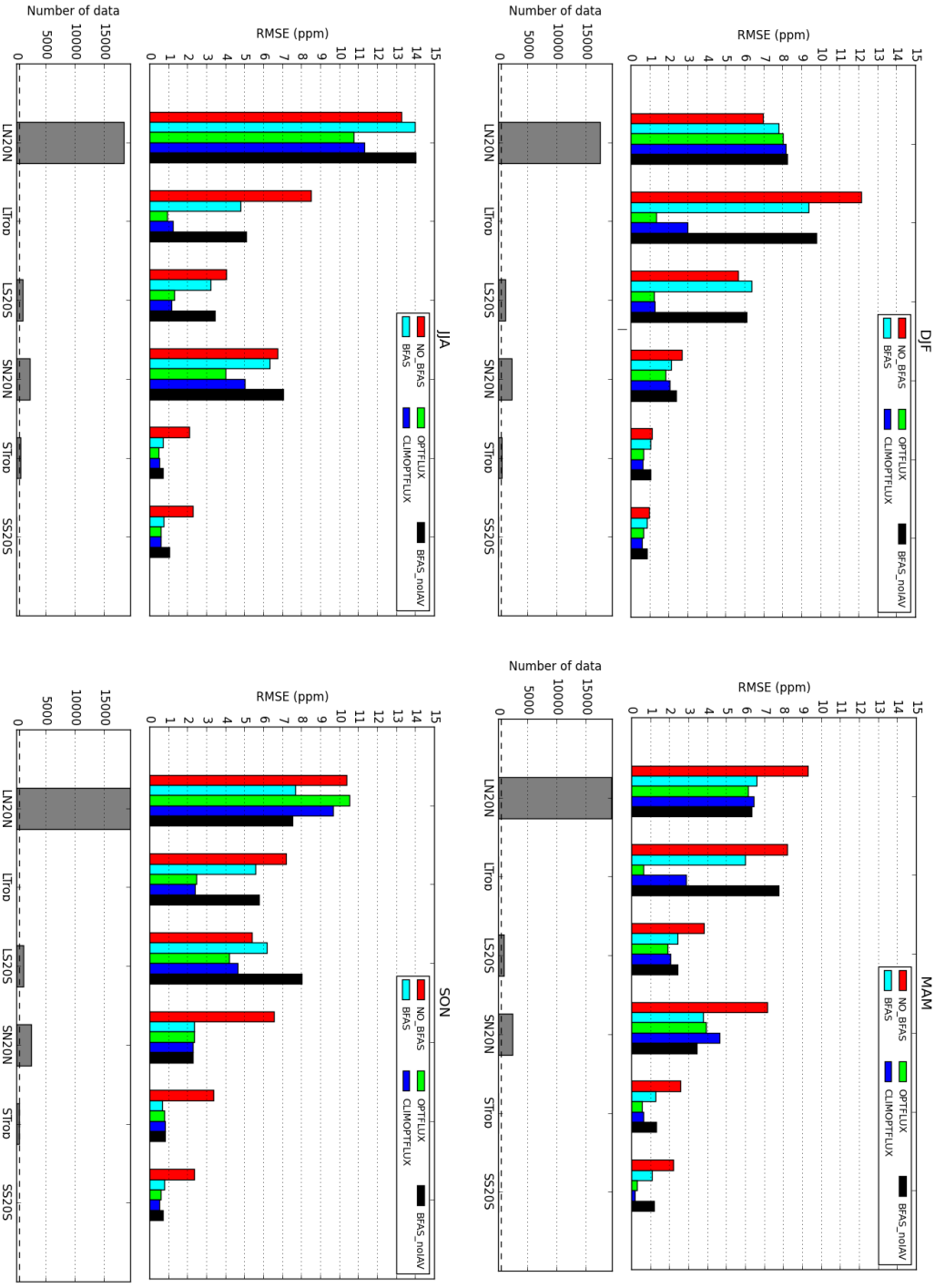

Figure 3: Root mean square error of atmospheric CO_2 dry molar mixing ratio [ppm] for different experiments (see legend) with respect to insitu and flask observations for different seasons and regions as described in Fig. **??**. The observations were extracted from the NOAA Obspack (2015) dataset in 2010. The number of observations used for the statistics are shown as grey bars in the panel below each plot.

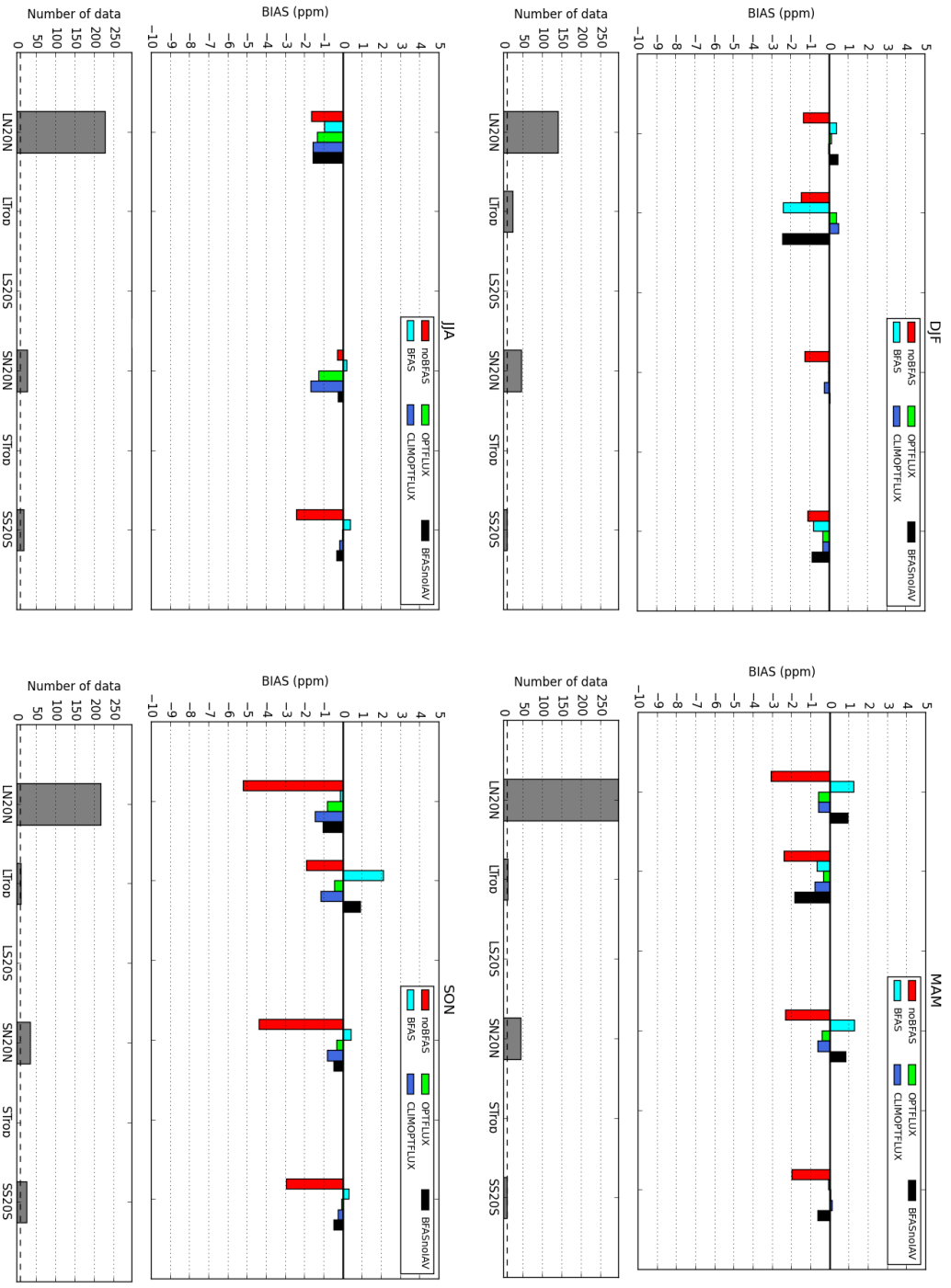

Figure 4: Mean error of atmospheric CO_2 dry molar mixing ratio [ppm] for different experiments (see legend) with respect to NOAA aircraft vertical profiles (Sweeney et al. 2015) in the free troposphere (1000 m above surface) for different seasons and regions as described in Fig. **??**. The observations were extracted from the NOAA Obspack (2015) dataset in 2010. The number of observations used for the statistics are shown as grey bars in the panel below each plot.

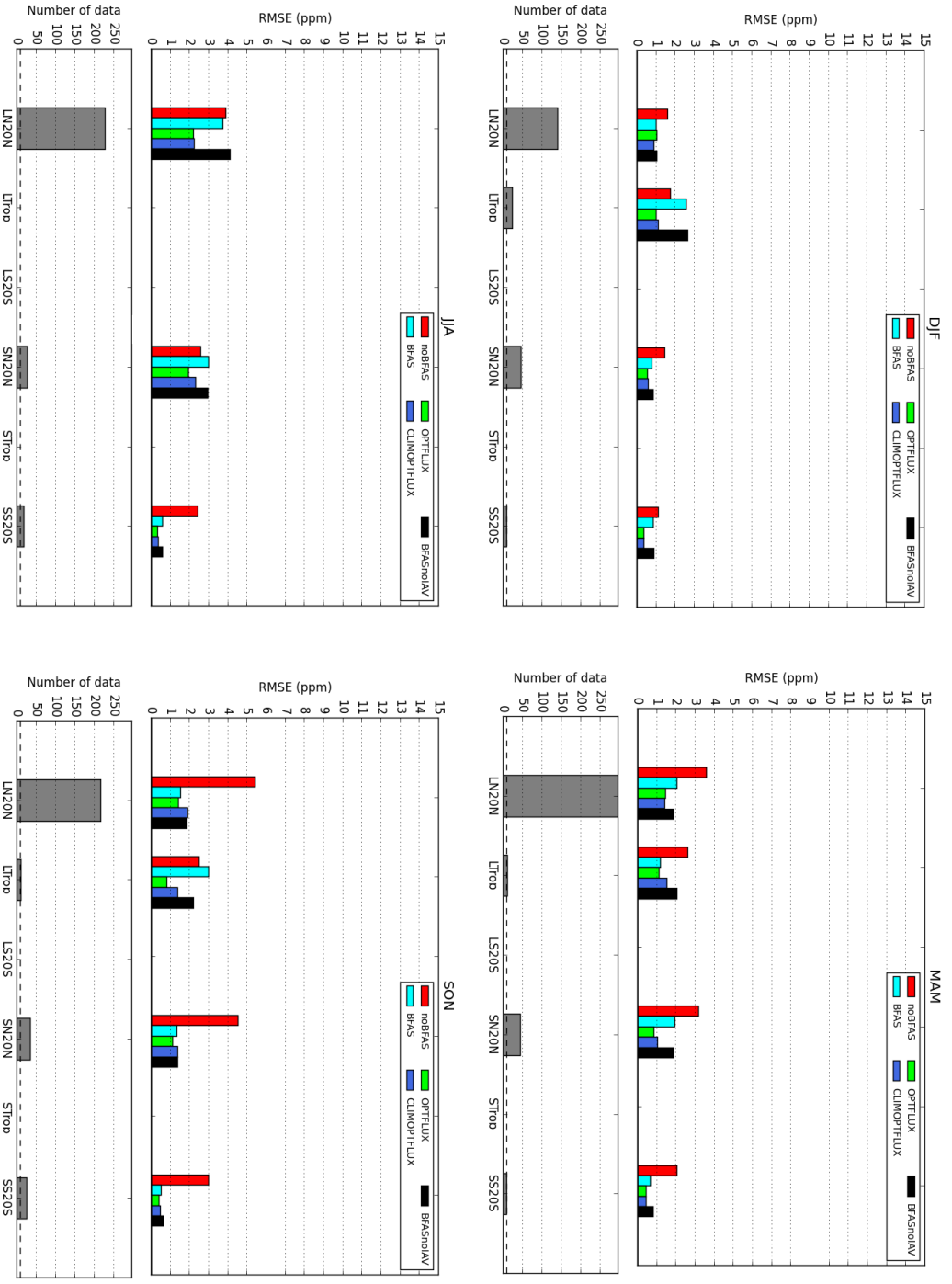

Figure 5: Root mean square error of atmospheric CO_2 dry molar mixing ratio [ppm] for different experiments (see legend) with respect to NOAA aircraft vertical profiles (Sweeney et al. 2015) in the free troposphere (1000 m above surface) for different seasons and regions as described in Fig. **??**. The observations were extracted from the NOAA Obspack (2015) dataset in 2010. The number of observations used for the statistics are shown as grey bars.

Table 2: Annual budget of CO_2 fluxes [PgC/yr] for the different Trascom regions for the different experiments.

TransCom regions	CTRL	BFAS	CLIM-OPT	OPT
North American Boreal	-0.41	-0.55	-0.18	-0.56
North American Temperate	1.87	1.91	1.47	1.08
South American Tropical	-0.66	0.84	0.50	0.92
South American Temperate	-0.91	-0.31	-0.65	-0.51
Northern Africa	1.86	1.04	0.83	0.09
Southern Africa	-0.89	-0.45	-0.20	0.03
Eurasia Boreal	-0.77	-0.34	-0.31	-0.21
Eurasia Temperate	2.69	4.04	2.73	2.97
Tropical Asia	0.41	0.88	0.48	0.65
Australia	-0.10	0.06	0.09	0.07
Europe	-0.86	1.16	1.11	0.87
North Pacific Temperate	-0.18	-0.11	-0.00	0.04
West Pacific Tropical	-0.03	0.03	0.11	0.04
East Pacific Tropical	0.43	0.43	0.57	0.52
South Pacific Temperate	-0.33	-0.31	-0.31	-0.32
Northern Ocean	-0.30	-0.25	-0.10	-0.08
North Atlantic Temperate	-0.13	-0.06	-0.02	0.12
Atlantic Tropical	0.07	0.14	0.27	0.35
South Atlantic Temperate	-0.16	-0.15	-0.14	-0.13
Southern Ocean	-0.27	-0.27	-0.40	-0.40
Indian Tropical	0.05	0.17	-0.08	-0.29
South Indian Temperate	-0.42	-0.41	-0.51	-0.49
TOTAL	0.95	7.49	5.25	4.76