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Supplement of

Ability of the 4-D-Var analysis of the GOSAT BESD XCO_2 retrievals to characterize atmospheric CO_2 at large and synoptic scales

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Table 1: Coefficient for the fitting of the free run bias against the data of each TCCON station. See appendix A for more details. a is in ppm per year, b, α and β are in ppm and φ in fraction of π. RMSE is the root mean square error of the difference beetween the raw bias and the smoothed bias. r is the correlation coefficient beetween the raw bias and the smoothed bias. Stations in italic are not used for the fitting.

Station	a	b	α	β	φ	RMSE	r
Sodankylä	1.573	-2.721	0.000	1.630	1.688	0.470	0.930
Białystok	-0.919	-1.580	1.716	-1.047	0.735	0.926	0.841
Bremen	-1.290	-1.225	1.341	-1.542	0.756	0.793	0.878
Karlsruhe	-0.144	-1.171	1.241	-1.184	0.831	0.620	0.891
Orléans	0.148	-1.490	1.527	-0.912	0.859	0.476	0.880
Garmisch	2.837	-2.311	0.463	-0.986	0.801	0.817	0.785
Park Falls	-0.338	-1.372	0.912	-1.398	0.863	0.660	0.880
Four Corners	0.651	0.601	0.000	-1.365	1.151	0.493	0.866
Lamont	-1.405	0.254	1.600	-0.906	1.074	0.912	0.783
Tsukuba	*-1.401*	*1.947*	*0.584*	*-0.939*	*1.002*	*0.649*	*0.781*
Edwards	*-6.699*	*6.888*	*-1.024*	*-0.319*	*0.895*	*0.644*	*0.894*
Pasadena	*-1.600*	*3.411*	*1.783*	*-0.080*	*1.231*	*1.032*	*0.722*
JPL	*14.786*	*-0.281*	*2.565*	*-0.491*	*0.618*	*1.067*	*0.363*
Saga	-0.560	-1.052	1.154	-1.058	0.975	0.638	0.861
Izaña	-0.510	0.553	0.281	-0.463	0.678	0.450	0.654
Ascension	1.684	1.269	0.000	-0.610	0.623	0.508	0.727
Darwin	0.258	1.485	1.048	0.361	1.022	0.534	0.846
Réunion	-1.546	1.295	1.219	0.583	1.002	0.290	0.898
Wollongong	0.895	-0.245	0.780	0.081	1.160	0.390	0.888
Lauder	2.081	-0.888	-0.289	-0.129	0.675	0.273	0.897

Table 2: Same as tab. 1 but for the analysis.

Station	a	b	α	β	φ	RMSE	r
Sodankylä	3.393	-2.345	0.000	-1.094	0.850	0.535	0.888
Białystok	0.038	-1.286	1.107	-1.043	0.842	0.935	0.768
Bremen	0.858	-1.396	0.563	-1.431	0.821	0.694	0.850
Karlsruhe	1.349	-1.264	0.693	-1.243	0.890	0.576	0.889
Orléans	1.008	-1.380	1.269	-0.930	0.954	0.364	0.920
Garmisch	3.966	-2.379	0.037	-1.080	0.822	0.821	0.789
Park Falls	1.672	-1.512	0.059	-1.172	0.908	0.457	0.876
Four Corners	-0.968	1.075	0.000	-0.294	1.000	0.352	0.501
Lamont	-1.257	0.559	0.860	0.098	1.081	0.668	0.512
Tsukuba	*-1.821*	*2.857*	*0.250*	*-0.368*	*1.136*	*0.860*	*0.497*
Edwards	*-7.394*	*6.754*	*-0.448*	*-0.033*	*1.206*	*0.499*	*0.852*
Pasadena	*-0.951*	*3.446*	*1.370*	*0.314*	*1.330*	*0.932*	*0.705*
JPL	*11.119*	*0.973*	*1.322*	*-0.279*	*0.608*	*1.083*	*0.500*
Saga	1.516	-1.673	-0.065	-1.115	0.785	0.752	0.669
Izaña	0.081	0.372	0.092	-0.431	0.693	0.336	0.665
Ascension Island	0.921	0.197	0.000	-0.617	0.702	0.549	0.644
Darwin	-1.481	0.846	1.340	0.334	0.977	0.415	0.849
Réunion Island	-2.226	0.421	1.019	0.370	0.965	0.271	0.781
Wollongong	-0.028	-1.084	0.447	0.424	0.914	0.468	0.674
Lauder	0.472	-1.220	-0.151	0.118	1.312	0.254	0.545

Table 3: Same as tab. 1 but for the standard deviation.

Station	a	b	α	β	φ	RMSE	r
Sodankylä	-0.025	0.690	0.000	0.289	0.614	0.186	0.737
Białystok	0.355	0.494	0.457	-0.001	1.613	0.398	0.628
Bremen	0.789	0.126	-0.145	-0.291	1.212	0.212	0.600
Karlsruhe	0.201	0.525	-0.260	-0.079	0.551	0.278	0.528
Orléans	-0.108	0.570	0.197	0.093	1.327	0.213	0.581
Garmisch	0.123	0.535	-0.202	0.120	0.479	0.320	0.482
Park Falls	-0.101	0.826	0.622	-0.265	1.424	0.395	0.774
Four Corners	1.042	0.945	0.000	0.745	0.532	0.408	0.762
Lamont	-0.224	0.974	0.628	-0.137	1.463	0.321	0.819
Tsukuba	*-0.145*	*0.840*	*-0.149*	*0.064*	*0.573*	*0.256*	*0.442*
Edwards	*0.239*	*0.158*	*0.530*	*-0.158*	*1.035*	*0.243*	*0.619*
Pasadena	*0.115*	*1.393*	*-0.024*	*0.373*	*1.153*	*0.458*	*0.514*
JPL	*4.183*	*0.160*	*-0.633*	*0.031*	*1.256*	*0.314*	*0.646*
Saga	-0.129	0.504	0.131	0.012	1.075	0.230	0.298
Izaña	0.277	0.175	-0.150	0.072	0.823	0.174	0.536
Ascension	0.310	0.502	0.000	-0.201	0.999	0.188	0.547
Darwin	-0.055	0.573	0.158	0.083	1.062	0.175	0.544
Réunion	0.148	0.277	0.080	0.095	1.520	0.115	0.482
Wollongong	-0.008	0.529	0.138	-0.029	0.683	0.150	0.550
Lauder	0.014	0.338	-0.052	0.071	1.191	0.121	0.459

Table 4: Same as tab. 2 but for the standard deviation.

Station	a	b	α	β	φ	RMSE	r
Sodankylä	-0.163	0.705	0.000	0.253	0.656	0.231	0.615
Białystok	0.207	0.571	0.412	0.074	1.537	0.382	0.624
Bremen	0.491	0.269	-0.070	-0.172	1.270	0.180	0.508
Karlsruhe	0.106	0.522	0.167	0.110	1.440	0.239	0.470
Orléans	-0.187	0.522	0.136	0.092	1.271	0.144	0.564
Garmisch	0.147	0.526	-0.229	0.118	0.536	0.353	0.468
Park Falls	-0.101	0.679	0.305	-0.030	1.415	0.268	0.605
Four Corners	0.969	1.014	0.000	0.643	0.482	0.426	0.696
Lamont	-0.014	0.845	0.385	-0.030	1.530	0.247	0.746
Tsukuba	*-0.261*	*0.913*	*-0.192*	*0.005*	*0.631*	*0.321*	*0.467*
Edwards	*0.698*	*-0.122*	*0.590*	*-0.086*	*1.134*	*0.206*	*0.690*
Pasadena	*-0.159*	*1.709*	*0.095*	*0.427*	*1.188*	*0.584*	*0.447*
JPL	*17.986*	*-2.350*	*3.014*	*-0.455*	*0.569*	*0.520*	*0.676*
Saga	0.105	0.424	-0.029	-0.048	0.637	0.220	0.160
Izaña	0.144	0.191	-0.068	0.062	0.728	0.127	0.474
Ascension Island	0.154	0.579	0.000	-0.231	1.074	0.185	0.503
Darwin	0.089	0.524	0.071	0.107	1.132	0.178	0.527
Réunion Island	0.041	0.325	0.072	0.063	1.526	0.114	0.432
Wollongong	0.067	0.648	0.015	0.052	0.679	0.231	0.204
Lauder	0.263	0.225	-0.121	0.033	1.228	0.138	0.508

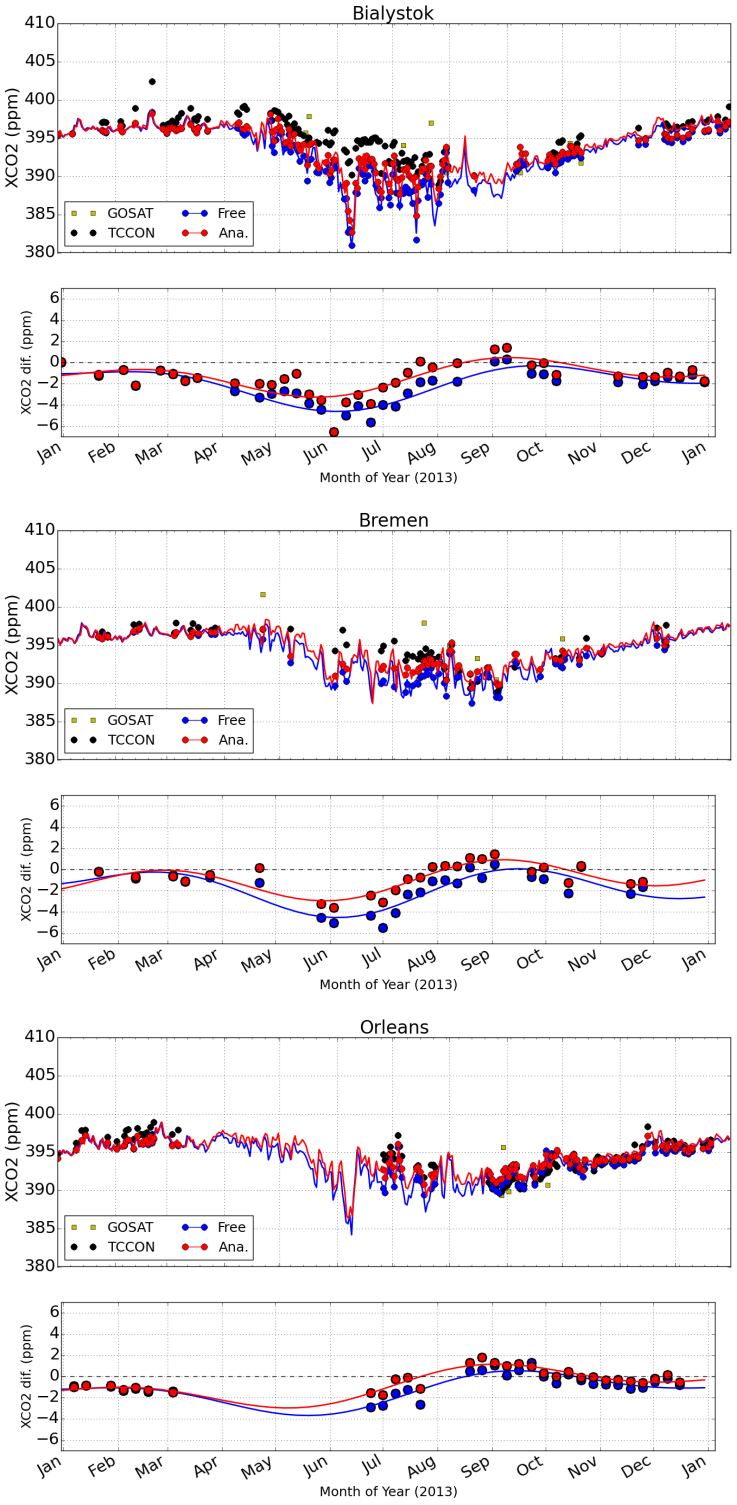

Figure 1: Same as Fig. 4 of the article for Białystok, Bremen and Orléans (from top to bottom).

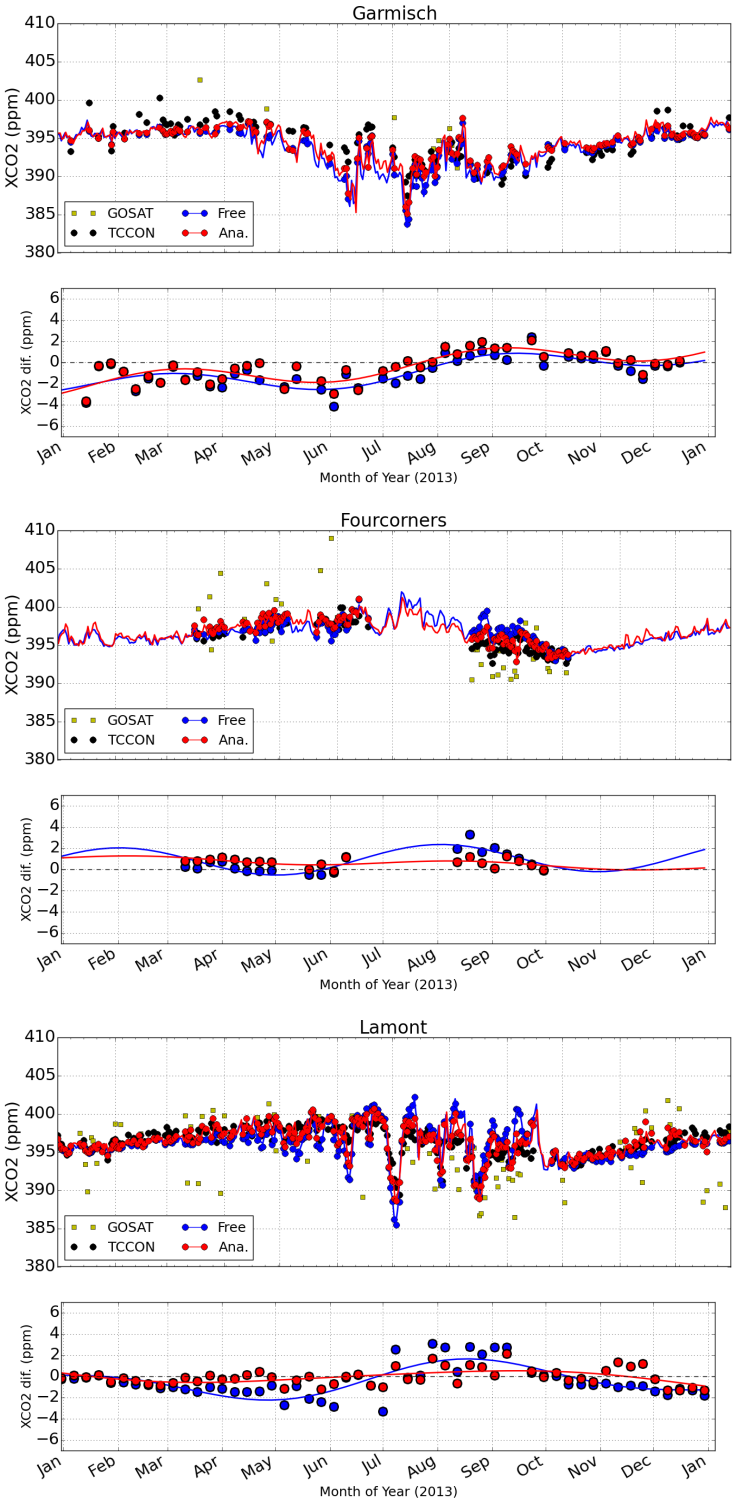

Figure 2: Same as Fig. 4 of the article for Garmisch, Four Corners and Lamont (from top to bottom).

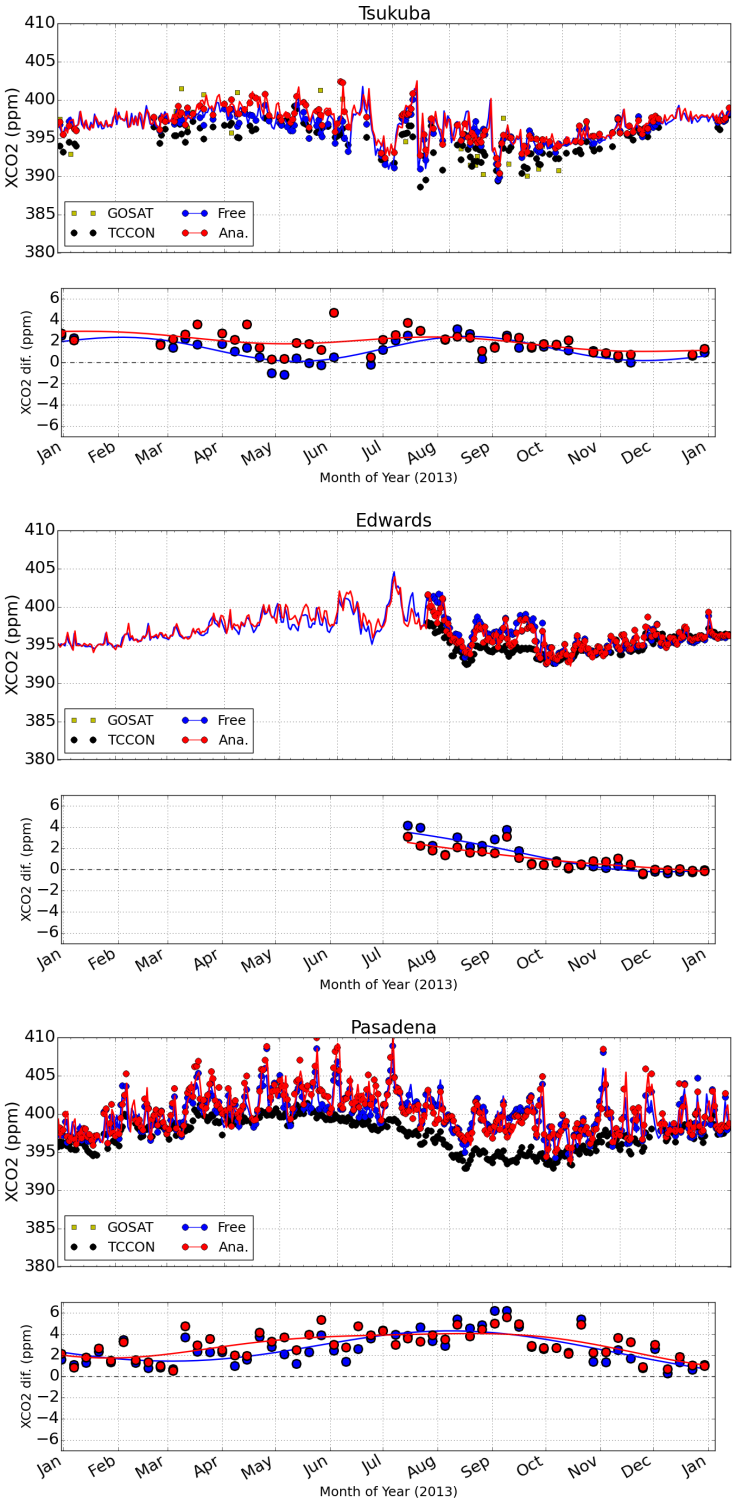

Figure 3: Same as Fig. 4 of the article for Tsukuba,Edwards and Pasadena.

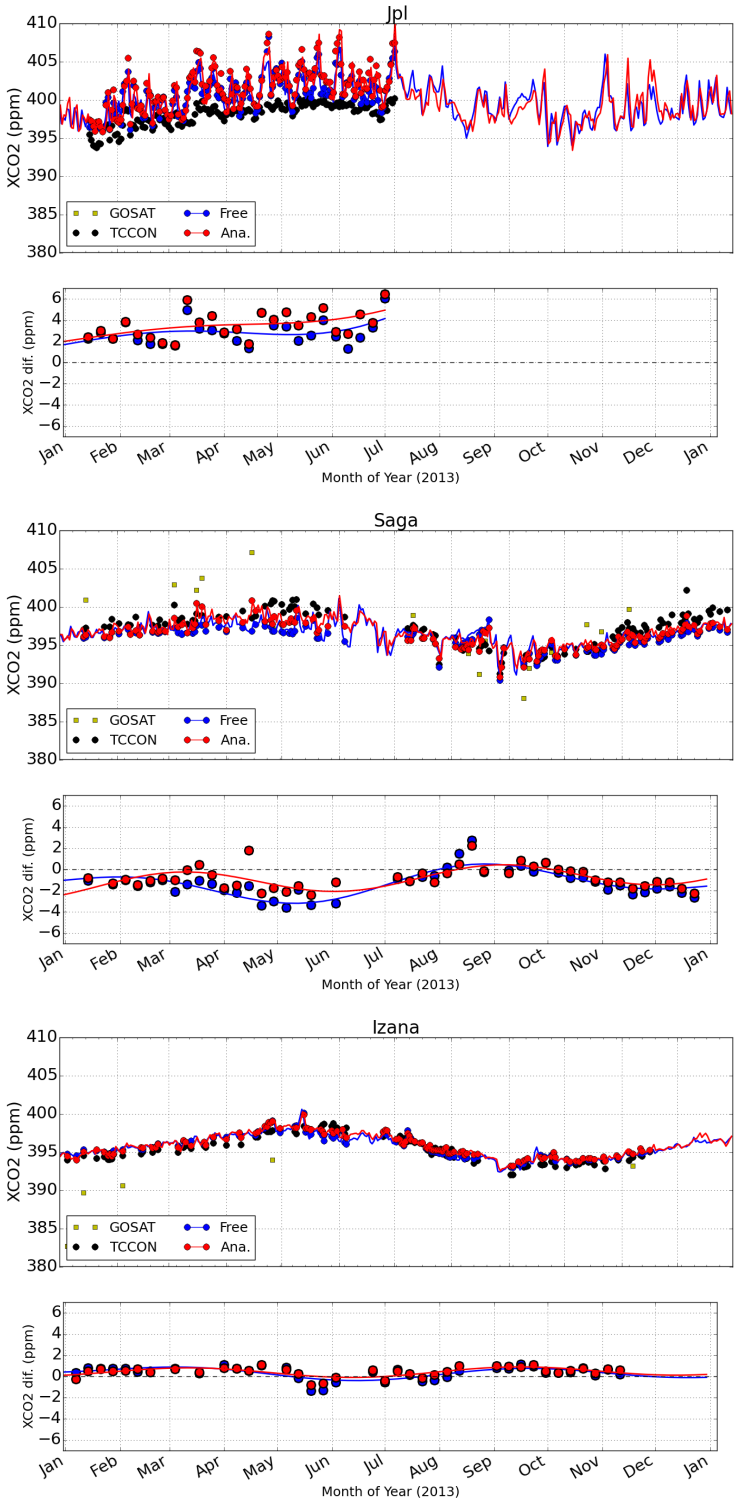

Figure 4: Same as Fig. 4 of the article for Jpl, Saga and Izaña.

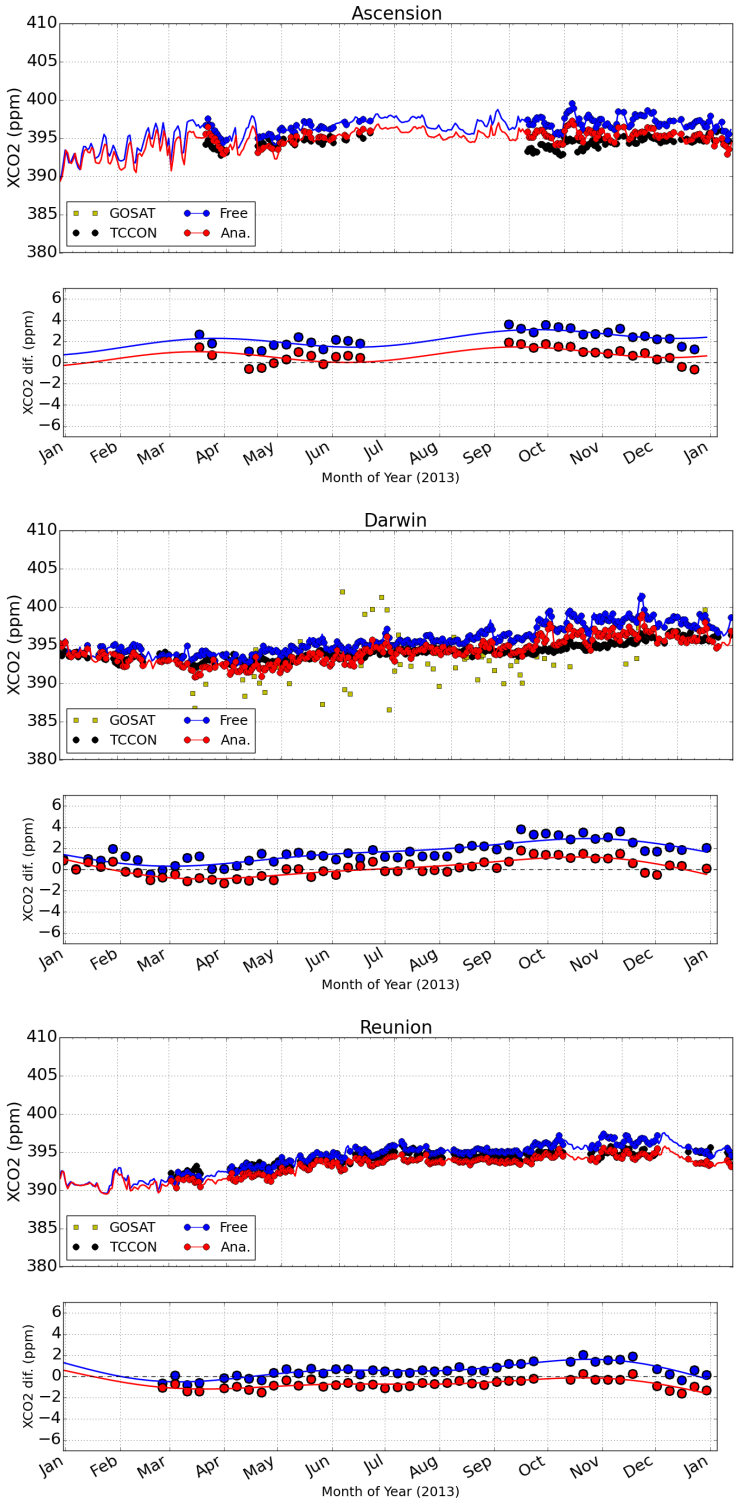

Figure 5: Same as Fig. 4 of the article for Ascension Island, Darwin and Réunion Island.

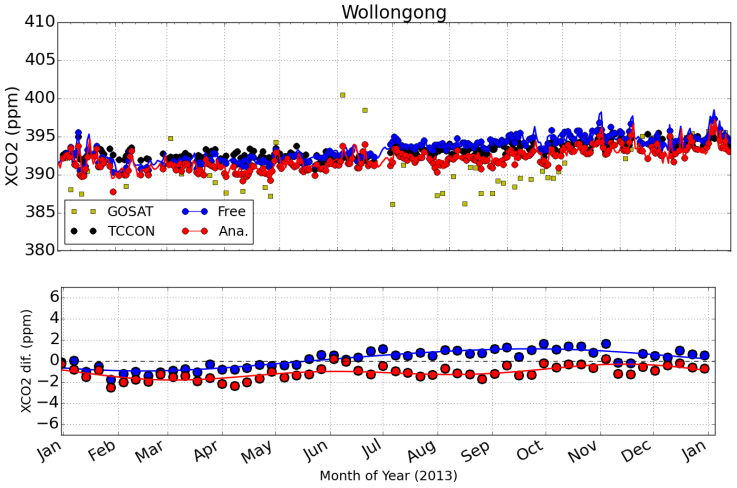

Figure 6: Same as Fig. 4 of the article for Wollongong.