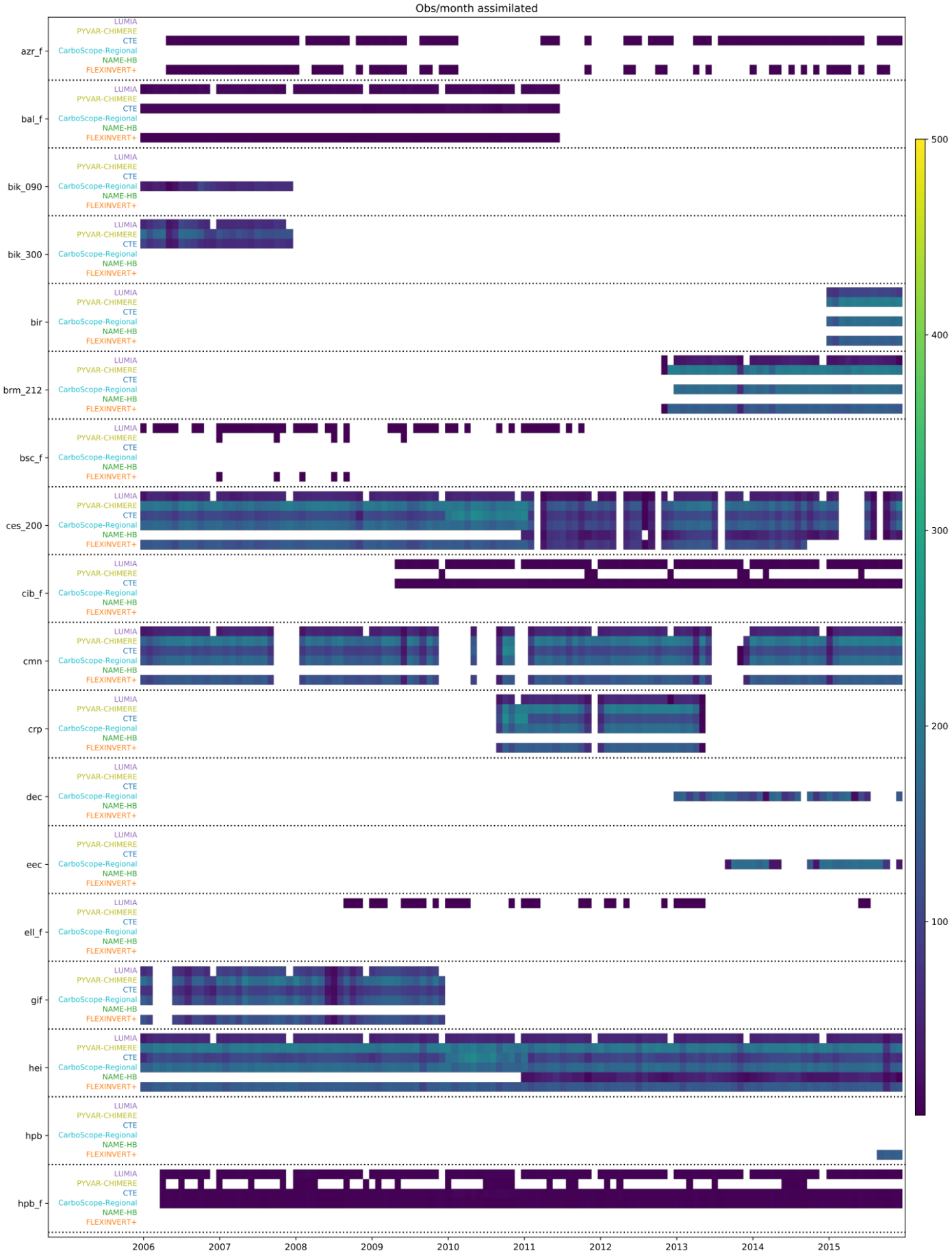

Figure SI1: Number of observations assimilated every month, at each site, by the inversions (1/3)

Figure SI1: Number of observations assimilated every month, at each site, by the inversions (2/3)

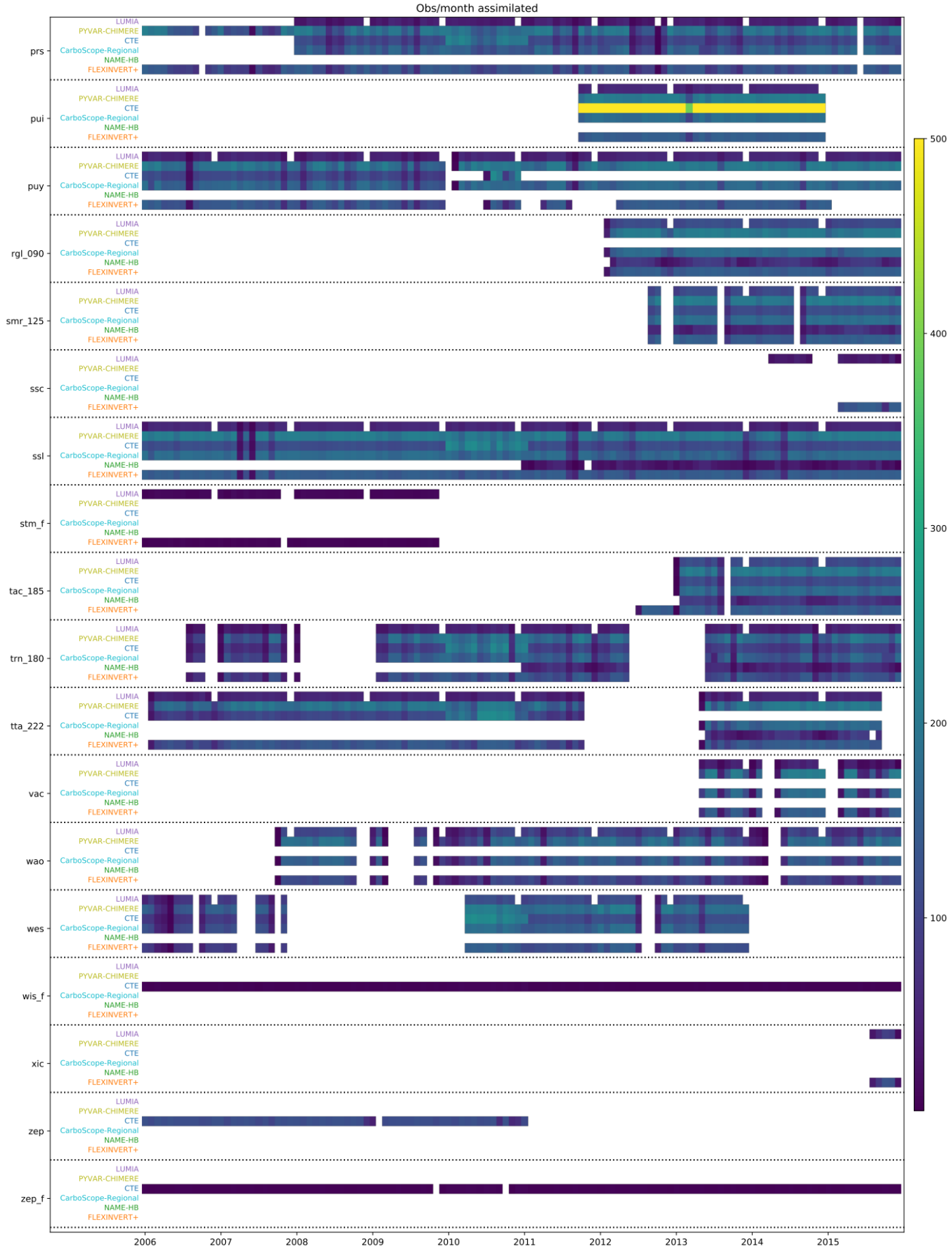

Figure SI1: Number of observations assimilated every month, at each site, by the inversions (3/3)

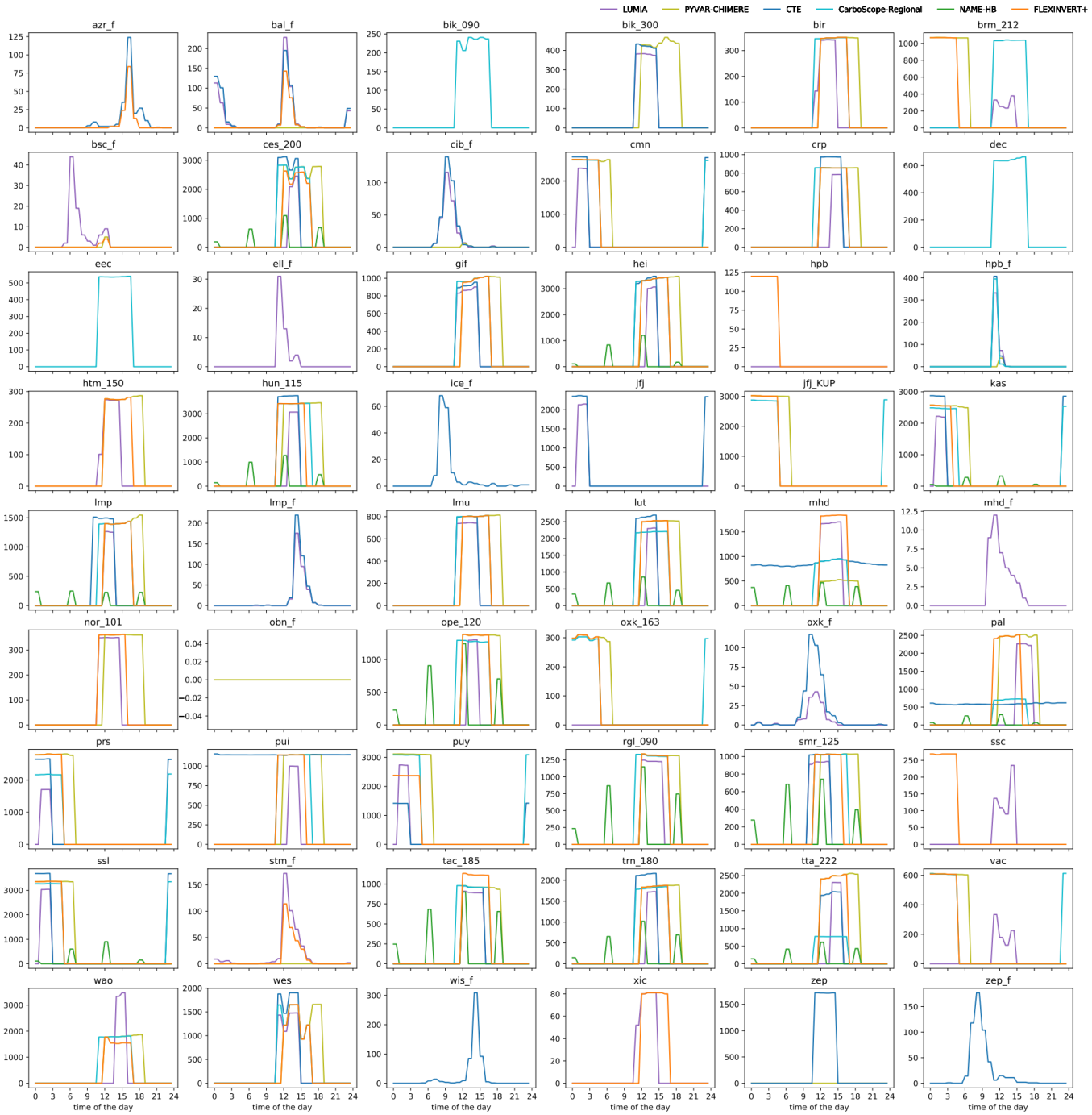

Figure SI2: Number of observations assimilated by each inversion at each site and each hour of the day.

Averaging	Error (RMSE)	LUMIA	PYVAR-CHIMERE	CTE	CarboScope-Regional	NAME-HB	FLEXINVERT+
Hourly	Prior (ppm)	3.11	3.19	2.53	3.11	5.67	3.66
	Posterior (ppm)	2.67	2.75	2.11	2.87	4.54	2.75
	Reduc (%)	14	14	17	8	20	25
Daily	Prior (ppm)	2.98	3.02	2.40	2.79	4.57	3.45
	Posterior (ppm)	2.58	2.55	1.98	2.49	3.49	2.51
	Reduc (%)	13	16	17	11	**24**	27
Monthly	Prior (ppm)	2.00	2.07	1.45	1.73	4.16	2.30
	Posterior (ppm)	1.50	1.58	1.15	1.39	3.50	1.34
	Reduc (%)	**25**	**24**	**21**	20	16	**42**
Annual	Prior (ppm)	1.54	1.48	0.90	1.21	5.31	1.47
	Posterior (ppm)	1.34	1.35	0.75	0.95	4.34	0.98
	Reduc (%)	13	9	17	**21**	18	33

Table SI1: Error statistics (RMSE) of the model-data mismatches, calculated on hourly, daily, monthly and annual averaged observations. The green bold values indicate for each model the temporal scale at which the representation of the concentrations is the most improved (relatively to the prior misfit).

Figure SI3: Posterior flux maps for the six inversions, in 3-monthly intervals (2006)

Figure SI3: Posterior flux maps for the six inversions, in 3-monthly intervals (2011)

Figure SI3: Posterior flux maps for the six inversions, in 3-monthly intervals (2015)