TABLE S1

SNAPSHOT BASELINES: MODEL METRICS BY DEVICE; **BOLD** INDICATES THE MODEL SELECTED AS *SnapshotReg*.

Device	Model	Cross-sectional Perf.								Longitudinal Perf.			Combined Score
		r (Pearson)	p	ρ (Spearman)	p	RMSE	MSE	MAE	R^2	LS	PRD	PFR	
AIM-C	**BayesianRidge**	**0.742**	*******	**0.821**	*******	**6.17**	**38.07**	**5.20**	**0.20**	**0.615**	**0.343**	**0.429**	**0.681**
AIM-C	GradientBoosting	0.701	***	0.662	***	7.83	61.31	6.45	0.45	0.560	0.422	0.524	0.595
AIM-C	SVR	0.582	***	0.648	***	8.86	78.50	7.23	0.31	0.548	0.388	0.524	0.573
AIM-C	AdaBoost	0.681	***	0.639	***	8.01	64.16	6.79	0.41	0.505	0.411	0.571	0.569
AIM-C	ExtraTrees	0.729	***	0.694	***	7.38	54.46	5.92	0.50	0.472	0.510	0.571	0.563
AIM-C	RandomForest	0.670	***	0.624	***	8.19	67.08	6.66	0.40	0.468	0.456	0.619	0.537
AIM-C	Lasso	0.575	***	0.682	***	8.96	80.28	7.42	0.27	0.474	0.481	0.571	0.536
AIM-C	Ridge	0.585	***	0.701	***	8.87	78.68	7.31	0.28	0.464	0.505	0.571	0.535
AIM-C	ElasticNet	0.573	***	0.676	***	9.01	81.18	7.46	0.27	0.473	0.484	0.571	0.533
AIM-C	XGBoost	0.633	***	0.562	***	8.53	72.76	6.88	0.36	0.496	0.463	0.571	0.531
AIM-C	DecisionTree	0.584	***	0.537	***	9.41	88.55	7.54	0.21	0.492	0.532	0.476	0.521
AIM-C	Bagging	0.652	***	0.619	***	8.21	67.40	6.69	0.39	0.445	0.505	0.619	0.518
AIM-C	HuberRegressor	0.531	***	0.662	***	9.29	86.30	7.68	0.22	0.466	0.452	0.619	0.518
AIM-C	CatBoost	0.716	***	0.676	***	7.44	55.35	5.83	0.52	0.402	0.549	0.667	0.516
AIM-C	KNeighbors	0.642	***	0.691	***	8.44	71.23	7.08	0.36	0.368	0.614	0.667	0.484
AIM-C	LinearRegression	0.563	***	0.575	***	9.34	87.24	7.18	0.24	0.307	0.576	0.810	0.412
AIM-P	**Ridge**	**0.720**	*******	**0.731**	*******	**7.28**	**53.00**	**5.70**	**0.75**	**0.528**	**0.569**	**0.375**	**0.607**
AIM-P	ExtraTrees	0.701	***	0.688	***	7.49	56.10	6.02	0.44	0.518	0.515	0.500	0.578
AIM-P	SVR	0.355	**	0.508	***	9.18	84.27	8.02	0.13	0.670	0.336	0.375	0.564
AIM-P	KNeighbors	0.670	***	0.612	***	7.96	63.36	6.40	0.42	0.630	0.742	0.375	0.559
AIM-P	CatBoost	0.758	***	0.772	***	7.31	53.44	5.58	0.46	0.372	0.670	0.625	0.521
AIM-P	HuberRegressor	0.772	***	0.736	***	7.84	61.47	5.44	0.36	0.336	0.742	0.625	0.495
AIM-P	LinearRegression	0.705	***	0.745	***	7.92	62.73	5.98	0.45	0.328	0.735	0.625	0.484
AIM-P	AdaBoost	0.595	***	0.614	***	8.34	69.56	7.39	0.26	0.402	0.592	0.625	0.479
AIM-P	BayesianRidge	0.720	***	0.719	***	7.56	57.15	5.92	0.50	0.310	0.790	0.625	0.467
AIM-P	Lasso	0.725	***	0.740	***	7.69	59.14	5.75	0.49	0.298	0.818	0.625	0.464
AIM-P	ElasticNet	0.718	***	0.740	***	7.73	59.75	5.88	0.48	0.296	0.824	0.625	0.461
AIM-P	Bagging	0.553	***	0.533	***	8.57	73.44	7.23	0.22	0.390	0.620	0.625	0.446
AIM-P	XGBoost	0.540	***	0.564	***	8.92	79.57	7.61	0.15	0.380	0.630	0.625	0.446
AIM-P	DecisionTree	0.618	***	0.636	***	8.02	64.32	7.06	0.30	0.318	0.750	0.625	0.439
AIM-P	GradientBoosting	0.640	***	0.660	***	7.86	61.78	6.25	0.37	0.290	0.701	0.750	0.428
AIM-P	RandomForest	0.626	***	0.625	***	8.01	64.16	6.61	0.35	0.286	0.690	0.750	0.419
AIM-S	**BayesianRidge**	**0.695**	*******	**0.655**	*******	**18.86**	**355.70**	**8.90**	**0.01**	**0.613**	**0.250**	**0.524**	**0.638**
AIM-S	RandomForest	0.410	***	0.405	***	22.10	488.41	10.05	0.05	0.670	0.290	0.333	0.572
AIM-S	GradientBoosting	0.350	***	0.360	***	23.10	533.61	10.60	0.01	0.700	0.320	0.286	0.561
AIM-S	Bagging	0.370	***	0.385	***	22.72	516.20	10.33	0.03	0.690	0.315	0.333	0.559
AIM-S	XGBoost	0.330	***	0.340	***	23.45	549.90	10.78	0.00	0.705	0.322	0.286	0.553
AIM-S	ExtraTrees	0.390	***	0.420	***	21.45	460.10	9.90	0.15	0.650	0.270	0.476	0.543
AIM-S	ElasticNet	0.420	***	0.460	***	21.92	480.49	9.95	0.07	0.640	0.295	0.524	0.540
AIM-S	Lasso	0.415	***	0.455	***	22.05	486.20	10.02	0.06	0.642	0.298	0.524	0.538
AIM-S	CatBoost	0.430	***	0.440	***	20.90	436.81	9.70	0.20	0.610	0.300	0.524	0.531
AIM-S	TheilSen	0.450	***	0.475	***	21.15	447.32	9.80	0.18	0.648	0.318	0.667	0.518
AIM-S	Ridge	0.440	***	0.460	***	21.40	457.96	9.88	0.16	0.655	0.305	0.667	0.517
AIM-S	AdaBoost	0.360	***	0.360	***	22.95	526.70	10.42	0.02	0.690	0.310	0.524	0.515
AIM-S	HuberRegressor	0.350	***	0.390	***	23.60	556.96	10.88	0.00	0.685	0.330	0.524	0.514
AIM-S	KNeighbors	0.300	***	0.300	***	24.10	580.81	11.05	-0.05	0.720	0.350	0.429	0.508
AIM-S	LinearRegression	0.455	***	0.470	***	21.05	443.10	9.78	0.22	0.640	0.320	0.810	0.487
AIM-S	SVR	0.280	***	0.290	***	24.55	602.70	11.22	-0.10	0.725	0.355	0.619	0.464

Notes. All snapshot candidates share the same preprocessing. Models were tuned via nested cross-validation; longitudinal metrics were computed with LOPO-CV fold aggregation. **Combined score** $= \frac{1}{5}\big(r + \rho + \mathrm{LS} + (1 - \mathrm{PRD}) + (1 - \mathrm{PFR})\big)$. Best performance is determined by the highest combined score per device.

TABLE S2
DUAL-OBJECTIVE MODEL PERFORMANCE BY DEVICE, COEFFICIENT

Device	Regression Coef.	Cross-sectional Perf.								Longitudinal Perf.			Combined Score
		r (Pearson)	p	ρ (Spearman)	p	RMSE	MSE	MAE	R^2	LS	PRD	PFR	
AIM-C	0.1	0.590	***	0.607	***	7.40	54.76	6.00	0.83	0.846	0.400	0.286	0.671
AIM-C	0.2	0.835	***	0.821	***	9.20	84.64	5.80	0.84	0.659	0.380	0.286	0.730
AIM-C	0.3	0.844	***	0.817	***	8.09	65.45	5.60	0.85	0.678	0.350	0.286	0.741
AIM-C	0.4	0.765	***	0.750	***	8.25	68.06	5.80	0.84	0.723	0.380	0.286	0.714
AIM-C	0.5	0.700	***	0.714	***	13.62	185.50	6.10	0.82	0.727	0.420	0.333	0.678
AIM-C	0.6	0.740	***	0.750	***	7.51	56.40	6.00	0.83	0.720	0.390	0.286	0.707
AIM-C	0.7	0.800	***	0.786	***	10.23	104.65	5.60	0.85	0.640	0.360	0.286	0.716
AIM-C	0.8	0.772	***	0.786	***	11.42	130.42	5.80	0.84	0.683	0.390	0.286	0.713
AIM-C	**0.9**	**0.820**	*******	**0.786**	*******	**12.25**	**150.06**	**9.10**	**0.86**	**0.744**	**0.273**	**0.238**	**0.768**
AIM-P	0.1	0.640	***	0.662	***	8.20	67.24	6.50	0.66	0.552	0.270	0.250	0.667
AIM-P	0.2	0.515	***	0.492	***	8.80	77.44	6.90	0.70	0.498	0.350	0.375	0.556
AIM-P	0.3	0.710	***	0.696	***	7.60	57.76	6.00	0.60	0.664	0.220	0.250	0.720
AIM-P	0.4	0.635	***	0.650	***	6.90	47.61	5.20	0.65	0.883	0.200	0.125	0.769
AIM-P	0.5	0.785	***	0.768	***	7.10	50.41	5.40	0.64	0.525	0.190	0.125	0.753
AIM-P	0.6	0.260	***	0.230	***	9.10	82.81	7.30	0.68	0.486	0.450	0.375	0.430
AIM-P	**0.7**	**0.902**	*******	**0.915**	*******	**9.61**	**92.35**	**7.25**	**0.66**	**0.721**	**0.433**	**0.125**	**0.796**
AIM-P	0.8	0.690	***	0.676	***	7.40	54.76	5.80	0.62	0.486	0.220	0.125	0.702
AIM-P	0.9	0.598	***	0.617	***	7.60	57.76	6.00	0.60	0.723	0.250	0.250	0.688
AIM-S	**0.1**	**0.842**	*******	**0.864**	*******	**6.44**	**41.47**	**5.20**	**0.86**	**0.837**	**0.136**	**0.190**	**0.843**
AIM-S	0.2	0.905	***	0.893	***	6.90	47.61	5.50	0.88	0.773	0.110	0.333	0.826
AIM-S	0.3	0.952	***	0.964	***	6.50	42.25	5.10	0.90	0.613	0.270	0.190	0.814
AIM-S	0.4	0.914	***	0.929	***	6.30	39.69	4.95	0.91	0.646	0.390	0.190	0.782
AIM-S	0.5	0.936	***	0.929	***	6.40	40.96	5.00	0.90	0.651	0.270	0.190	0.811
AIM-S	0.6	0.918	***	0.929	***	6.95	48.30	5.55	0.88	0.539	0.130	0.238	0.804
AIM-S	0.7	0.973	***	0.964	***	6.10	37.21	4.80	0.92	0.715	0.433	0.190	0.806
AIM-S	0.8	0.938	***	0.929	***	6.80	46.24	5.40	0.89	0.686	0.250	0.190	0.822
AIM-S	0.9	0.870	***	0.857	***	6.55	42.90	5.15	0.90	0.730	0.400	0.190	0.773

Combined score $= \frac{1}{5}\big(r + \rho + \mathrm{LS} + (1 - \mathrm{PRD}) + (1 - \mathrm{PFR})\big)$. Best performance is determined by the highest combined score per device.

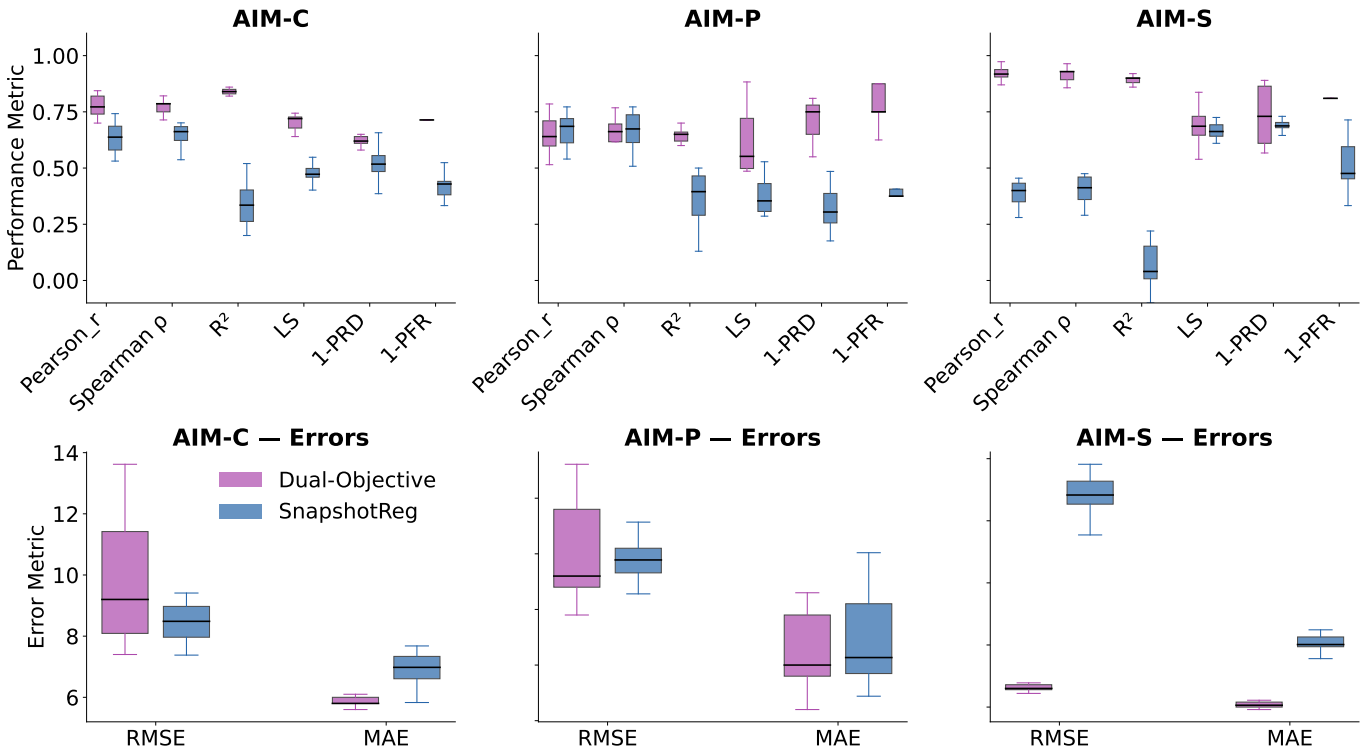

Fig. S1. Boxplots comparing *Dual-Objective* (purple) and *SnapshotReg* (blue) across devices (AIM-C, AIM-P, AIM-S). Top row: performance metrics (Pearson r, Spearman ρ, R^2, LS, $\mathbf{1-PRD}$, $\mathbf{1-PFR}$). Bottom row: error metrics (RMSE, MAE). Boxes show the interquartile range across LOPO-CV folds (SnapshotReg selected via nested CV, then evaluated comparably); center lines are medians, whiskers denote 1.5×IQR. *Dual-Objective* yields higher longitudinal metrics (LS, $\mathbf{1-PRD}$, $\mathbf{1-PFR}$) while maintaining strong cross-sectional correlations, with device-dependent error trade-offs.