

STable 1 Comparison of model performance under 1-s prediction

Model	MAE	RMSE	MAPE	R2	MAE _norm	RMS E_norm	MAP E_norm	R2_norm	Overall Score
GRU	0.191± 0.066	0.258± 0.081	90.161± 70.573	0.821± 0.214	0.611	0.664	0.487	0.452	0.553
Bi-LS	0.273±	0.371±	94.476±	0.695±	0.425	0.446	0.462	0.407	0.435
TM	0.119	0.142	57.267	0.275					
CNN-	0.257±	0.361±	110.315±	0.698±	0.462	0.466	0.371	0.408	0.427
LSTM	0.083	0.123	49.641	0.267					
LSTM	0.296± 0.081	0.407± 0.131	91.656± 32.922	0.665± 0.239	0.374	0.378	0.478	0.397	0.406
CNN	0.276± 0.071	0.394± 0.134	115.234± 59.745	0.689± 0.230	0.418	0.402	0.342	0.405	0.392
Transf	0.374±	0.519±	134.132±	0.330±	0.196	0.163	0.234	0.278	0.218
ormer	0.144	0.215	84.533	0.670					
TCN	0.487± 0.401	0.661± 0.574	161.415± 94.134	-0.138± 1.845	-0.061	-0.110	0.077	0.112	0.005
XGBo	1.529±	1.857±	600.865±	-7.399±	-2.424	-2.408	-2.451	-2.460	-2.436
ost	0.291	0.371	284.178	8.665					

STable 2 Comparison of model performance under 30-s prediction

Model	MAE	RMSE	MAPE	R2	MAE_ norm	RMSE _norm	MAPE _norm	R2_n orm	Overa ll Score
GRU	0.304 ± 0.101	0.423± 0.136	137.535± 65.204	0.607± 0.312	0.907	0.976	0.514	0.741	0.784
Bi-LS TM	0.363 ± 0.129	0.504± 0.209	120.154± 40.609	0.479± 0.363	0.733	0.764	0.642	0.662	0.700
CNN- LSTM	0.437 ± 0.145	0.595± 0.220	157.043± 55.751	0.294± 0.454	0.512	0.527	0.371	0.547	0.489
LSTM	0.483 ± 0.135	0.648± 0.142	137.215± 42.097	0.151± 0.505	0.373	0.390	0.516	0.458	0.434
CNN	0.573 ± 0.361	0.762± 0.429	171.120± 72.065	-0.272± 1.456	0.106	0.092	0.267	0.196	0.165
Transf ormer	0.636 ± 0.464	0.828± 0.529	179.721± 89.455	-0.587± 2.293	-0.084	-0.080	0.204	0.000	0.010
TCN	0.701 ± 0.439	0.982± 0.599	221.884± 87.319	-1.042± 1.906	-0.278	-0.481	-0.106	-0.282	-0.287
XGBo ost	1.369 ± 0.172	1.638± 0.155	535.076± 203.886	-4.328± 3.092	-2.268	-2.188	-2.408	-2.321	-2.296

STable 3 Comparison of model performance under 60-s prediction

Model	MAE	RMSE	MAPE	R2	MAE_ norm	RMSE _norm	MAPE _norm	R2_n orm	Overa ll Score
GRU	0.383 ± 0.150	0.510± 0.166	158.586± 66.613	0.474± 0.363	0.935	0.987	0.617	0.739	0.820
Bi-LS TM	0.439 ± 0.172	0.578± 0.194	151.961± 49.314	0.291± 0.511	0.750	0.797	0.670	0.634	0.713
CNN- LSTM	0.537 ± 0.129	0.701± 0.161	154.464± 29.879	0.094± 0.372	0.429	0.449	0.650	0.521	0.512
LSTM	0.551 ± 0.088	0.728± 0.145	217.827± 108.846	-0.355± 1.637	0.383	0.375	0.142	0.265	0.291
CNN	0.606 ± 0.300	0.789± 0.338	190.994± 54.977	-0.148± 0.761	0.204	0.201	0.357	0.383	0.286
Transf ormer	0.687 ± 0.403	0.889± 0.461	228.129± 115.587	-0.673± 1.603	-0.062	-0.080	0.060	0.082	0.000
TCN	0.789 ± 0.525	1.061± 0.672	252.341± 129.103	-1.315± 2.390	-0.396	-0.565	-0.135	-0.285	-0.345
XGBo ost	1.352 ± 0.218	1.628± 0.164	530.148± 231.659	-4.906± 5.150	-2.243	-2.164	-2.362	-2.340	-2.277

STable 4 Prediction performance under fixed baseline mode

Variable	False Alert Rate	False Negative Rate	False Positive Rate	MAE	RMSE
systolic_blood_pressure	0.0205 ± 0.0603	0.0969 ± 0.2699	0.0218 ± 0.0640	1.7379 ± 1.5240	2.2111 ± 1.9578
diastolic_blood_pressure	0.0265 ± 0.0489	0.0647 ± 0.1876	0.0203 ± 0.0531	1.8107 ± 1.7646	2.3583 ± 2.4438
pulse_rate	0.0222 ± 0.0355	0.0374 ± 0.0608	0.0171 ± 0.0632	4.8960 ± 4.3179	5.8486 ± 4.9162

STable 5 Prediction performance under dynamic baseline mode

Variable	False Alert Rate	Alarm Accuracy	MAE	RMSE
systolic_blood_pressure	0.0108±0.03 46	0.9892 ± 0.0346	1.8405 ± 1.6917	2.3252 ± 2.1025
diastolic_blood_pressure	0.0294±0.07 52	0.9706 ± 0.0752	1.8346 ± 2.0277	2.3629 ± 2.6468
pulse_rate	0.0228±0.09 18	0.9772 ± 0.0918	5.1957 ± 4.7271	6.1524 ± 5.3218

STable 6 Statistical comparison of key features between FP/FN groups

Feature		FP_mean	FN_mean	T-stat	p-value	Cohen's d
Prop	Out	0.277049819	0.692988835	-64.05771742	0	-1.23918033
Baseline						
Rel Error		0.043683831	0.057120539	-16.44353767	2.97E-59	-0.338990055
Coef Var		0.026925903	0.021557657	12.57048342	1.18E-35	0.271184344
Severity_nu		1.79794044	1.906728584	-10.94289358	1.50E-27	-0.22952382
m						

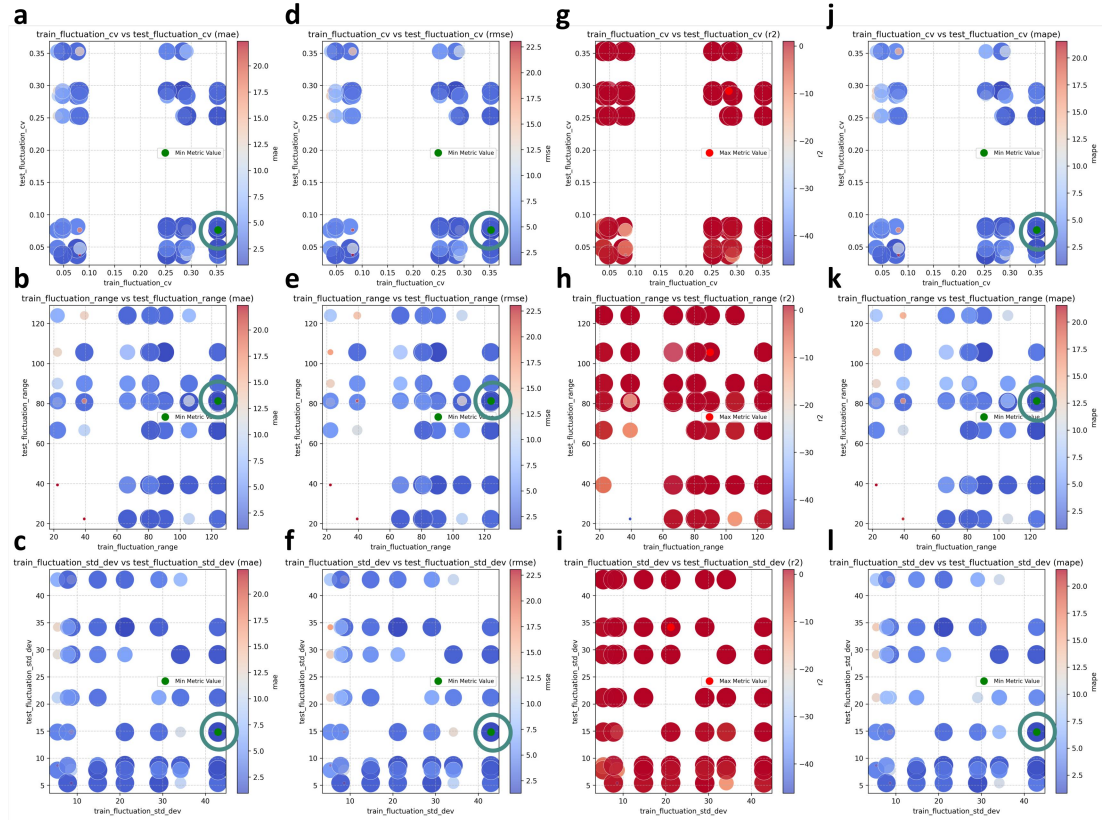


Fig. S1| Bubble plots for volatility matching and prediction error analysis. **a-c** Scatter plots showing the relationship between values of all data combinations under three volatility metrics (coefficient of variation (CV), standard deviation (SD), range (Range)) and mean absolute error (MAE). **d-f** Scatter plots illustrating the relationship between values of all data combinations under the three volatility metrics (CV, SD, Range) and root mean square error (RMSE). **g-i** Scatter plots depicting the relationship between values of all data combinations under the three volatility metrics (CV, SD, Range) and coefficient of determination (R^2). **j-l** Scatter plots presenting the relationship between values of all data combinations under the three volatility metrics (CV, SD, Range) and mean absolute percentage error (MAPE). In the figures, the horizontal and vertical coordinates represent the calculated values of the training set and test set under CV, SD, and Range, respectively. The color intensity and size of the bubbles intuitively reflect the levels of each evaluation metric. Green markers indicate the positions of the minimum values of the evaluation metrics, and red markers indicate the positions of the maximum values, with the minimum values highlighted by circles.