

Inputs

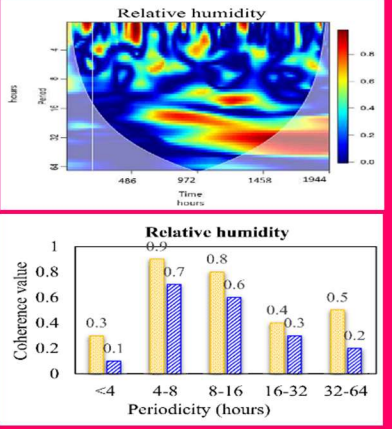
Mean air temperature

Relative humidity

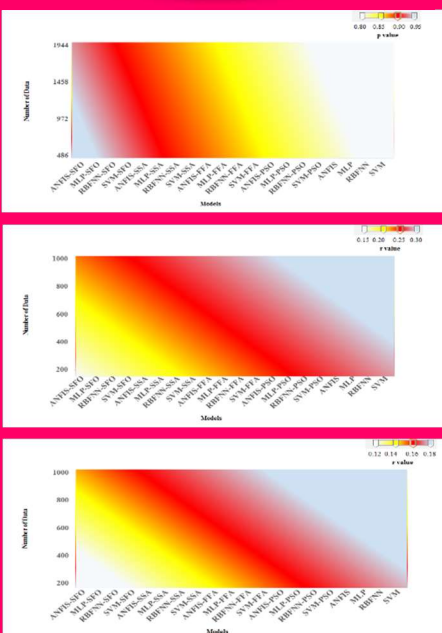
Solar radiation

Wind speed

Wavelet coherence analysis



GLUE uncertainty analysis



FFA

SFO

ANFIS

MLP

SVM

RBFN

PSO

SSA

Output: soil temperature (°C)

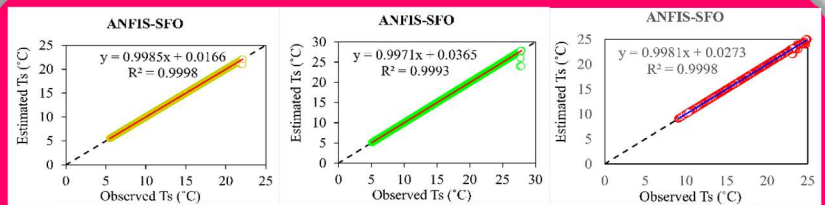


Table 4 Statistical results of models performance in testing phase.

Model	5 cm				10 cm				30 cm			
	RMSE (°C)	MAE (°C)	NSE (%)	PBIAS (%)	RMSE (°C)	MAE (°C)	NSE (%)	PBIAS (%)	RMSE (°C)	MAE (°C)	NSE (%)	PBIAS (%)
ANFIS-SFO	1.18	1.05	0.93	7	0.824	0.822	0.98	1	0.911	0.905	0.97	2
MLP-SFO	1.23	1.12	0.92	9	0.835	0.832	0.97	3	0.914	0.909	0.96	4
RBFNN-SFO	1.25	1.18	0.89	11	0.845	0.843	0.95	5	0.915	0.912	0.94	6
SVM-SFO	1.35	1.20	0.87	14	0.856	0.854	0.94	6	0.917	0.914	0.93	7
ANFIS-SSA	1.17	1.12	0.92	16	0.832	0.828	0.97	2	0.914	0.911	0.96	9
MLP-SSA	1.29	1.19	0.90	18	0.839	0.837	0.95	5	0.919	0.918	0.94	10
RBFNN-SSA	1.30	1.22	0.86	20	0.849	0.842	0.94	8	0.933	0.932	0.91	12
SVM-SSA	1.42	1.39	0.85	22	0.860	0.857	0.93	9	0.935	0.931	0.90	14
ANFIS-FFA	1.19	1.16	0.82	23	0.878	0.876	0.93	3	0.955	0.951	0.92	4
MLP-FFA	1.37	1.22	0.81	24	0.882	0.880	0.91	5	0.962	0.958	0.90	6
RBFNN-FFA	1.44	1.27	0.84	26	0.893	0.891	0.90	7	0.969	0.967	0.89	8
SVM-FFA	1.47	1.42	0.83	28	0.896	0.892	0.88	10	0.976	0.972	0.87	15
ANFIS-PSO	1.22	1.26	0.88	29	0.901	0.899	0.92	5	0.980	0.976	0.91	7
MLP-PSO	1.39	1.35	0.87	30	0.923	0.912	0.89	8	0.983	0.981	0.88	9
RBFNN-PSO	1.48	1.43	0.84	32	0.935	0.932	0.88	9	0.985	0.983	0.86	11
SVM-PSO	1.51	1.45	0.82	33	0.945	0.935	0.86	11	0.990	0.986	0.84	12
ANFIS	1.25	1.23	0.81	35	0.934	0.931	0.90	6	1.002	1.001	0.89	8
MLP	1.50	1.45	0.83	37	0.932	0.930	0.88	9	1.040	1.030	0.87	10
RBFNN	1.53	1.47	0.80	39	0.945	0.941	0.87	12	1.063	1.055	0.86	15
SVM	1.65	1.52	0.80	40	0.978	0.971	0.85	14	1.069	1.054	0.83	17