

Supplementary Materials: Evaluation of Hybrid Wavelet Models for Regional Drought Forecasting

Gilbert Hinge, Jay Piplodiya, Ashutosh Sharma, Mohamed A. Hamouda and Mohamed M. Mohamed

Table S1. Geographical and rainfall statistics of IMD stations in the study area.

Station no.	Latitude (degree)	Longitude (degree)	Monthly Rainfall (mm)				Coefficient of variation
			Maximum	Mean	Standard Deviation	Skewness	
1	27	70	789.66	14.21	39.05	8.35	2.75
2	27.5	70	412.06	13.51	34.88	5.10	2.58
3	26	70.5	533.48	19.90	46.82	4.65	2.35
4	26.5	70.5	842.92	15.78	40.61	8.32	2.57
5	27	70.5	715.52	14.74	37.93	7.24	2.57
6	27.5	70.5	340.72	13.71	34.25	4.63	2.50
7	28	70.5	344.35	13.59	34.82	4.65	2.56
8	25	71	781.29	27.59	64.25	4.13	2.33
9	25.5	71	882.07	22.88	56.49	5.61	2.47
10	26	71	486.14	20.49	46.59	4.15	2.27
11	26.5	71	405.01	16.13	37.31	4.29	2.31
12	27	71	370.03	15.62	35.98	4.19	2.30
13	27.5	71	331.42	14.82	34.40	4.20	2.32
14	25	71.5	619.04	30.86	72.52	3.75	2.35
15	25.5	71.5	678.16	24.05	55.96	4.50	2.33
16	26	71.5	532.98	21.32	48.13	4.42	2.26
17	26.5	71.5	349.34	17.61	37.81	3.51	2.15
18	27	71.5	402.01	16.58	35.90	3.76	2.17
19	27.5	71.5	367.73	16.90	35.54	3.63	2.10
20	25	72	701.64	35.66	80.27	3.55	2.25
21	25.5	72	536.68	27.07	59.32	3.60	2.19
22	26	72	452.32	22.61	48.52	3.67	2.15
23	26.5	72	296.73	20.64	41.06	2.94	1.99
24	27	72	415.23	18.76	38.86	3.67	2.07
25	27.5	72	359.01	18.01	39.33	3.93	2.18
26	28	72	394.44	17.91	39.55	4.07	2.21
27	24.5	72.5	1099	67.80	145.50	3.27	2.15
28	25	72.5	737.38	45.41	96.19	3.27	2.12
29	25.5	72.5	585.81	31.93	68.44	3.40	2.14
30	26	72.5	491.99	26.19	53.62	3.26	2.05
31	26.5	72.5	404.45	24.29	47.44	2.87	1.95
32	27	72.5	319.13	20.87	41.30	3.10	1.98
33	27.5	72.5	353.27	18.95	39.41	3.66	2.08
34	28	72.5	415.05	19.88	39.87	3.67	2.01
35	28.5	72.5	355.84	19.73	37.35	3.21	1.89
36	24.5	73	975.27	67.16	134.36	2.93	2.00
37	25	73	803.86	49.36	99.88	3.17	2.02
38	25.5	73	714.55	38.06	79.08	3.20	2.08
39	26	73	628.21	31.80	65.36	3.17	2.06
40	26.5	73	554.51	28.96	58.48	3.15	2.02
41	27	73	326.67	25.33	48.47	2.93	1.91

42	27.5	73	406.4	22.58	44.08	3.39	1.95
43	28	73	439.26	22.12	42.31	3.41	1.91
44	28.5	73	308.09	20.80	37.41	2.84	1.80
45	29	73	253.12	17.08	32.95	3.18	1.93
46	24	73.5	712.7	57.74	104.84	2.27	1.82
47	24.5	73.5	671.2	54.77	96.87	2.26	1.77
48	25	73.5	714.98	50.63	92.68	2.65	1.83
49	25.5	73.5	738.58	44.28	87.75	3.01	1.98
50	26	73.5	691.17	36.15	73.55	3.22	2.03
51	26.5	73.5	505.85	32.33	63.72	3.02	1.97
52	27	73.5	542.58	29.00	56.99	3.41	1.97
53	27.5	73.5	408.01	25.68	49.90	3.33	1.94
54	28	73.5	334.8	23.23	42.18	2.94	1.82
55	28.5	73.5	318.39	21.77	39.44	2.85	1.81
56	29	73.5	249.79	18.73	33.64	2.91	1.80
57	29.5	73.5	311.44	18.28	34.07	3.25	1.86
58	23.5	74	802.45	69.76	128.19	2.36	1.84
59	24	74	718.34	60.00	109.39	2.35	1.82
60	24.5	74	650.49	55.72	98.74	2.28	1.77
61	25	74	648.03	50.08	88.72	2.32	1.77
62	25.5	74	635.01	45.80	84.53	2.64	1.85
63	26	74	515.16	39.21	74.99	2.73	1.91
64	26.5	74	523.88	34.58	67.10	2.85	1.94
65	27	74	577.2	32.11	61.97	3.17	1.93
66	27.5	74	476.02	29.60	55.85	3.19	1.89
67	28	74	475.57	26.44	48.53	3.10	1.84
68	28.5	74	435.59	24.66	44.81	3.04	1.82
69	29	74	248.62	21.04	37.42	2.81	1.78
70	29.5	74	337.73	19.76	36.06	3.10	1.82
71	23.5	74.5	823.8	77.74	141.29	2.32	1.82
72	24	74.5	781.25	69.11	123.99	2.27	1.79
73	24.5	74.5	735.56	64.62	114.63	2.28	1.77
74	25	74.5	745.05	57.13	103.12	2.38	1.81
75	25.5	74.5	575.23	49.60	91.35	2.44	1.84
76	26	74.5	503.69	40.58	74.54	2.45	1.84
77	26.5	74.5	402.23	38.53	71.45	2.53	1.85
78	27	74.5	540.71	34.87	66.12	2.90	1.90
79	27.5	74.5	457.81	32.57	60.52	2.94	1.86
80	28	74.5	512.73	31.33	56.33	2.77	1.80
81	28.5	74.5	520.37	28.56	51.53	2.96	1.80
82	29	74.5	395.23	25.58	45.41	2.85	1.78
83	29.5	74.5	447.64	24.21	42.39	3.05	1.75
84	25	75	675.62	62.91	112.94	2.32	1.80
85	25.5	75	694.99	54.52	101.44	2.47	1.86
86	26	75	563.11	45.58	84.11	2.46	1.85
87	26.5	75	506.04	40.68	74.37	2.53	1.83
88	27	75	556.03	39.11	73.10	2.84	1.87
89	27.5	75	483.1	38.01	68.01	2.75	1.79
90	28	75	539.26	34.58	59.39	2.67	1.72
91	28.5	75	610.08	30.82	53.62	3.06	1.74
92	29	75	533.37	28.44	49.41	3.17	1.74
93	24	75.5	777.21	71.13	125.50	2.37	1.76
94	25	75.5	730.84	65.29	116.84	2.30	1.79

95	25.5	75.5	683.31	59.06	108.66	2.41	1.84
96	26	75.5	646.29	51.43	94.03	2.39	1.83
97	26.5	75.5	713.03	47.20	86.41	2.65	1.83
98	27	75.5	598.79	45.36	82.13	2.60	1.81
99	27.5	75.5	457.68	42.25	72.94	2.36	1.73
100	28	75.5	498.17	39.46	65.13	2.40	1.65
101	28.5	75.5	490	33.57	55.34	2.65	1.65
102	29	75.5	570.27	32.74	54.96	3.18	1.68
103	24.5	76	847.67	76.48	136.43	2.38	1.78
104	25	76	743.31	68.66	123.19	2.32	1.79
105	25.5	76	653.3	60.71	111.35	2.38	1.83
106	26	76	725.39	57.53	107.34	2.48	1.87
107	26.5	76	898.19	52.62	96.82	2.64	1.84
108	27	76	764.84	50.20	88.35	2.54	1.76
109	27.5	76	490.72	48.24	80.60	2.21	1.67
110	24.5	76.5	948.75	80.05	142.41	2.32	1.78
111	25	76.5	933.22	73.11	133.05	2.40	1.82
112	25.5	76.5	706.25	66.44	119.21	2.31	1.79
113	26	76.5	686.38	62.54	113.28	2.38	1.81
114	26.5	76.5	824.45	56.08	101.48	2.50	1.81
115	27	76.5	586.21	51.50	88.77	2.36	1.72
116	27.5	76.5	494.43	51.36	84.39	2.08	1.64
117	28	76.5	582.4	47.56	79.43	2.33	1.67
118	24.5	77	959.69	85.35	147.96	2.24	1.73
119	26.5	77	672.05	56.41	100.12	2.32	1.77
120	27	77	543.53	51.71	89.70	2.28	1.73
121	27.5	77	490.92	50.00	84.32	2.22	1.69
122	26.5	77.5	584.56	58.08	101.82	2.22	1.75
123	27	77.5	521.53	53.17	91.17	2.18	1.71

Table S2. Optimal number of inputs and neurons chosen for the ANN model for 1 month lead time.

Latitude	Longitude	SPI-3		SPI-6		SPI-12	
		No. of Neu- rons	No. of input	No. of Neu- rons	No. of input	No. of Neu- rons	No. of input
27	70	3	4	3	7	3	13
27.5	70	15	4	3	10	11	14
26	70.5	9	6	5	6	12	15
26.5	70.5	9	3	11	10	4	15
27	70.5	3	3	3	9	11	13
27.5	70.5	3	4	3	10	3	14
28	70.5	3	3	8	9	4	14
25	71	3	5	4	9	5	13
25.5	71	12	6	6	6	6	14
26	71	5	4	5	6	10	15
26.5	71	3	4	8	9	11	13
27	71	3	6	3	10	15	14
27.5	71	9	6	3	6	4	13
25	71.5	3	4	4	9	6	14
25.5	71.5	5	5	5	10	7	13
26	71.5	5	3	5	10	6	14
26.5	71.5	3	4	5	8	6	15
27	71.5	13	3	11	6	3	15
27.5	71.5	6	4	3	7	8	15
25	72	8	5	7	8	10	14
25.5	72	5	4	3	6	8	15
26	72	3	5	4	8	10	15
26.5	72	6	5	3	10	4	14
27	72	3	5	3	10	11	13
27.5	72	3	5	4	10	4	14
28	72	5	5	5	7	3	14
24.5	72.5	5	6	3	8	8	15
25	72.5	3	4	3	6	10	13
25.5	72.5	5	4	4	6	4	15
26	72.5	3	4	11	7	3	14
26.5	72.5	4	3	3	9	8	14
27	72.5	3	6	11	8	5	15
27.5	72.5	11	6	3	9	6	14
28	72.5	3	6	3	7	5	13
28.5	72.5	3	5	4	7	5	13
24.5	73	3	6	9	10	6	15
25	73	3	4	5	7	8	15
25.5	73	5	4	13	6	10	14
26	73	3	4	3	10	6	14
26.5	73	3	5	5	10	12	14
27	73	4	6	6	9	10	15
27.5	73	3	6	3	9	3	15
28	73	4	4	11	9	6	14
28.5	73	5	6	3	7	3	14
29	73	9	4	3	10	4	13
24	73.5	4	5	5	8	6	15
24.5	73.5	3	4	6	10	3	14
25	73.5	3	3	3	10	8	15

25.5	73.5	3	4	3	10	3	15
26	73.5	3	5	3	10	5	13
26.5	73.5	3	4	3	8	3	13
27	73.5	15	6	3	9	3	14
27.5	73.5	6	5	4	9	3	13
28	73.5	8	6	4	9	5	15
28.5	73.5	4	5	3	10	5	15
29	73.5	13	4	5	7	3	13
29.5	73.5	5	4	4	9	8	15
23.5	74	3	5	7	7	8	15
24	74	3	5	10	9	3	15
24.5	74	4	5	10	10	10	14
25	74	4	6	13	8	15	14
25.5	74	4	6	6	7	3	15
26	74	3	4	5	8	3	13
26.5	74	4	4	8	8	12	14
27	74	3	6	12	8	3	13
27.5	74	3	3	5	6	5	13
28	74	5	4	5	7	3	14
28.5	74	12	6	3	8	4	13
29	74	8	4	3	10	3	15
29.5	74	8	5	5	9	6	15
23.5	74.5	3	5	3	9	6	15
24	74.5	3	6	9	10	8	14
24.5	74.5	3	6	3	8	3	14
25	74.5	4	4	11	10	4	15
25.5	74.5	3	6	3	9	3	13
26	74.5	3	4	3	9	4	15
26.5	74.5	4	5	5	8	11	13
27	74.5	5	5	3	9	4	15
27.5	74.5	9	6	11	7	3	13
28	74.5	3	5	5	10	3	13
28.5	74.5	3	5	3	10	9	13
29	74.5	4	6	3	10	3	15
29.5	74.5	5	6	3	8	3	13
25	75	5	4	3	10	5	14
25.5	75	5	5	4	7	3	14
26	75	14	5	3	8	5	13
26.5	75	3	5	5	9	14	14
27	75	3	6	3	8	3	13
27.5	75	3	3	3	7	5	15
28	75	5	5	3	7	3	14
28.5	75	4	6	3	10	4	13
29	75	7	6	3	10	11	15
24	75.5	3	6	3	9	9	15
25	75.5	4	5	3	10	7	15
25.5	75.5	4	5	3	9	9	13
26	75.5	3	6	5	9	3	14
26.5	75.5	6	5	3	10	4	13
27	75.5	3	4	3	10	10	15
27.5	75.5	3	6	6	7	5	13
28	75.5	8	6	6	7	3	13
28.5	75.5	4	5	5	6	3	13

29	75.5	3	6	3	6	5	14
24.5	76	3	3	4	10	6	15
25	76	3	6	4	9	4	13
25.5	76	4	4	4	7	6	13
26	76	3	4	5	8	4	13
26.5	76	3	5	11	10	7	13
27	76	3	4	6	10	3	14
27.5	76	10	4	10	8	3	15
24.5	76.5	3	5	3	8	3	14
25	76.5	3	4	5	7	3	14
25.5	76.5	4	6	8	10	6	13
26	76.5	4	6	4	7	3	14
26.5	76.5	4	5	9	6	7	13
27	76.5	11	4	3	10	3	13
27.5	76.5	6	5	3	7	3	13
28	76.5	4	3	3	8	3	14
24.5	77	3	6	9	10	11	15
26.5	77	4	6	6	7	3	14
27	77	7	4	3	9	5	14
27.5	77	6	4	4	10	13	14
26.5	77.5	4	4	8	8	5	15
27	77.5	3	6	3	10	6	15
