



*Supplement of*

## Return levels of temperature extremes in southern Pakistan

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Table 1. 1980-2010 monthly mean temperature climatology for the considered meteorological stations.

Stations	Mean Temperature (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Jacobabad	15.2	18.2	24	30.5	35.6	37	34.8	33	31.4	27.8	22.3	16.7	27
Mohenjo-daro	13.9	16.7	23	29.1	34.1	35	33.9	32.9	30.9	26.7	21.1	15.9	25.9
Rohri	15.6	18.2	23.6	29.8	34.5	35.6	33.9	32.3	31.2	27.6	22.1	16.9	26.4
Padidan	14.8	17.7	23.5	29.9	34.4	35.5	33.7	32.1	31	27.5	22.4	16.4	26.5
Nawabshah	15.4	18	24	29.8	34.5	35.6	34	32.3	31.5	28	22.4	16.9	26.7
Hyderabad	18	21	26.2	30.9	33.3	34	32.4	31.1	31	29.6	24.8	19.6	27.6
Chhor	16.5	19.5	25	30.1	33.5	33.7	31.6	30.1	30.1	28.2	22.6	17.9	26.3
Karachi	18.6	21.2	25.4	28.9	31.1	31.9	30.5	29.2	29.5	28.9	24.6	20.4	26.4
Badin	17.5	20.5	25.8	30.1	32.6	32.8	31	29.6	29.6	28.7	24	19	26.6

Stations	Minimum Temperature (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Jacobabad	7.9	10.9	16.6	22.4	27.4	29.8	29.3	28.4	26.3	20.5	14.3	8.9	19.9
Mohenjo-daro	4.7	7.9	13.3	18.9	24	27.4	27.9	27	24.7	18.2	11.8	7.3	17.3
Rohri	8.3	10.8	15.9	21.7	26.1	27.7	27.1	26	24.4	19.9	14.2	9.6	18.7
Padidan	6.5	8.9	14.5	20.2	24.7	27	26.9	25.8	23.7	18.3	12.4	7.6	17.8
Nawabshah	6.3	8.7	14.2	19.4	24.6	27.3	27.2	25.9	23.8	18.4	12.4	7.8	17.9
Hyderabad	11.4	13.9	18.8	22.8	26.1	27.9	27.6	26.5	25.4	22.5	17.4	13	21.1
Chhor	5.9	8.9	14.8	20.3	24.8	26.9	26.5	25.3	23.9	18.7	11.8	7	17.6
Karachi	11.5	14	18.6	23	26.6	28.3	27.6	26.3	25.6	21.9	16.8	12.7	20.7
Badin	9.9	12.6	17.9	22.3	25.7	27.6	27.1	26	25	22.1	16.5	11.4	20.2

Stations	Maximum Temperature (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Jacobabad	22.6	25.6	31.4	38.6	43.9	44.4	40.2	37.6	36.8	35.1	30.3	24.4	34.1
Mohenjo-daro	23.1	26.2	32.1	38.7	43.8	44.2	40.9	38.7	37.5	35.2	30.5	24.8	34.5
Rohri	22.6	25.6	31.2	38.1	43	43.5	40.5	38.3	37.8	35.2	30	24.3	34
Padidan	23.1	26.4	32.2	39.4	43.9	44.1	40.6	38.4	38.3	36.3	31.1	25.3	34.8
Nawabshah	24.5	27.9	33.8	40.2	44.2	43.9	40.7	38.8	39	37.7	32.3	26.1	35.5
Hyderabad	24.7	28.1	33.7	38.8	41.3	40	37.2	35.6	36.3	36.7	31.9	26.2	34.1
Chhor	26.9	29.9	35.2	40	42	40.6	36.8	34.9	36.3	37.6	33.5	28.7	35
Karachi	26.3	28.4	32.2	34.7	35.5	35.4	33.3	32.1	33.2	35.5	32.5	28.2	32
Badin	25.2	28.3	33.7	37.8	39.4	37.9	34.9	33.2	34.2	35.2	31.4	26.5	32.9

Table 2. Results of stationarity test for all the datasets.

Stations	Augmented Dickey-Fuller (ADF) test					
	Observations $T_{max}$	ERA Interim $T_{max}$	Bias corrected ERA Interim $T_{max}$	Observations $TW_{max}$	ERA Interim $TW_{max}$	Bias corrected ERA Interim $TW_{max}$
Jacobabad	0.01	0.04	0.01	0.02	0.005	0.0043
Mohenjo-daro	0.02	0.015	0.02	0.013	0.026	0.031
Rohri	0.003	0.01	0.04	0.04	0.006	0.005
Padidan	0.011	0.025	0.013	0.001	0.012	0.014
Nawabshah	0.01	0.03	0.045	0.03	0.029	0.041
Hyderabad	0.034	0.004	0.021	0.011	0.04	0.002
Chhor	0.045	0.018	0.033	0.01	0.015	0.013
Karachi	0.02	0.01	0.019	0.002	0.007	0.006
Badin	0.04	0.034	0.028	0.033	0.021	0.024

Table 3. Results of Trend test of all the datasets.

Stations	Mann-Kendall (MK) test					
	Observations $T_{max}$	ERA Interim $T_{max}$	Bias corrected ERA Interim $T_{max}$	Observations $TW_{max}$	ERA Interim $TW_{max}$	Bias corrected ERA Interim $TW_{max}$
Jacobabad	0.115	0.825	0.756	0.854	0.068	0.071
Mohenjo-daro	0.487	0.366	0.333	0.174	0.403	0.537
Rohri	0.962	0.479	0.456	0.430	0.290	0.429
Padidan	0.313	0.497	0.67	0.867	0.643	0.844
Nawabshah	0.779	0.372	0.082	0.146	0.095	0.603
Hyderabad	0.477	0.136	0.111	0.410	0.084	0.545
Chhor	0.481	0.288	0.307	0.771	0.519	0.681
Karachi	0.281	0.233	0.172	0.103	0.113	0.13
Badin	0.766	0.323	0.423	0.073	0.111	0.115

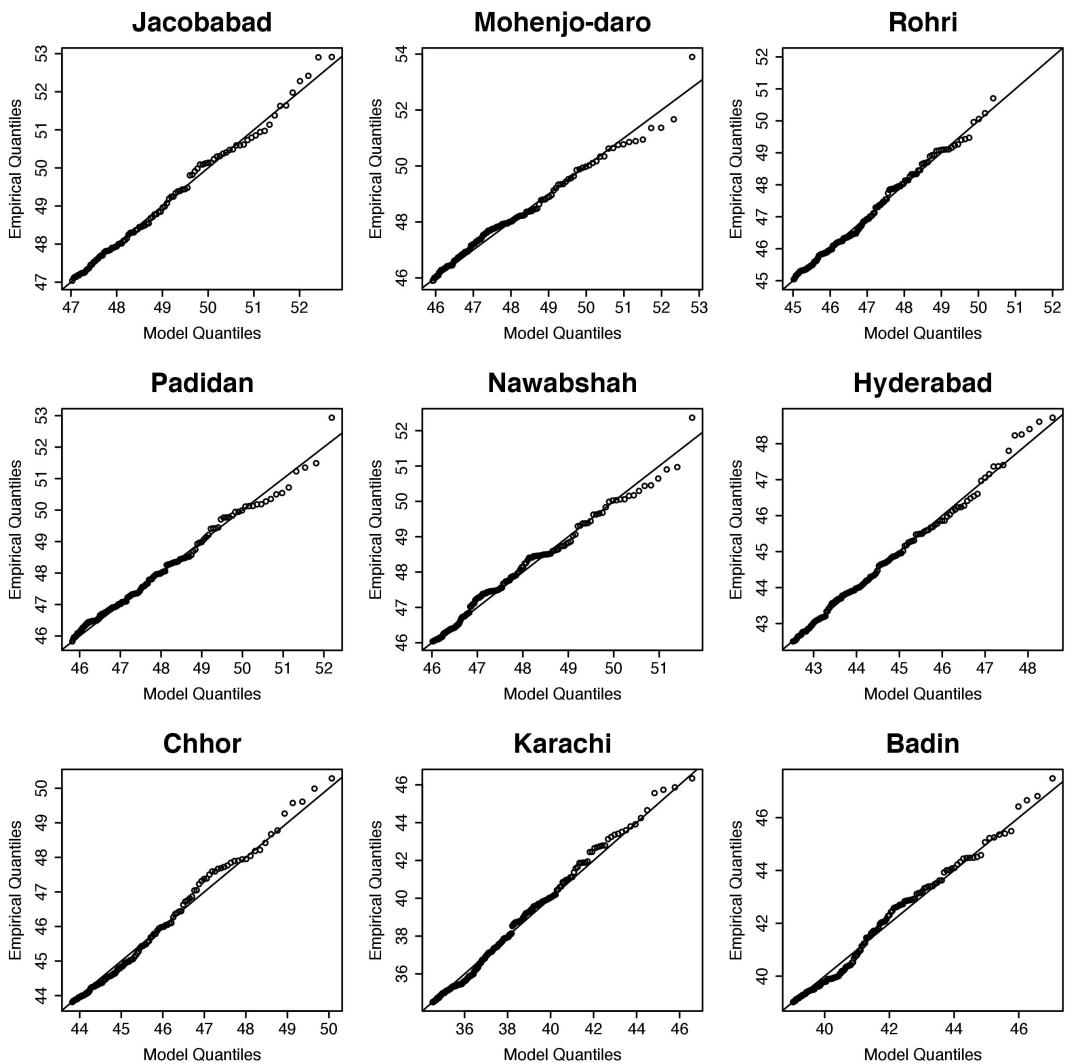


Figure 1. Quantile-Quantile plots of station observed  $T_{max}$  ( $^{\circ}\text{C}$ ),  $u = 90\%$  for 9 stations of southern Pakistan (Sindh).

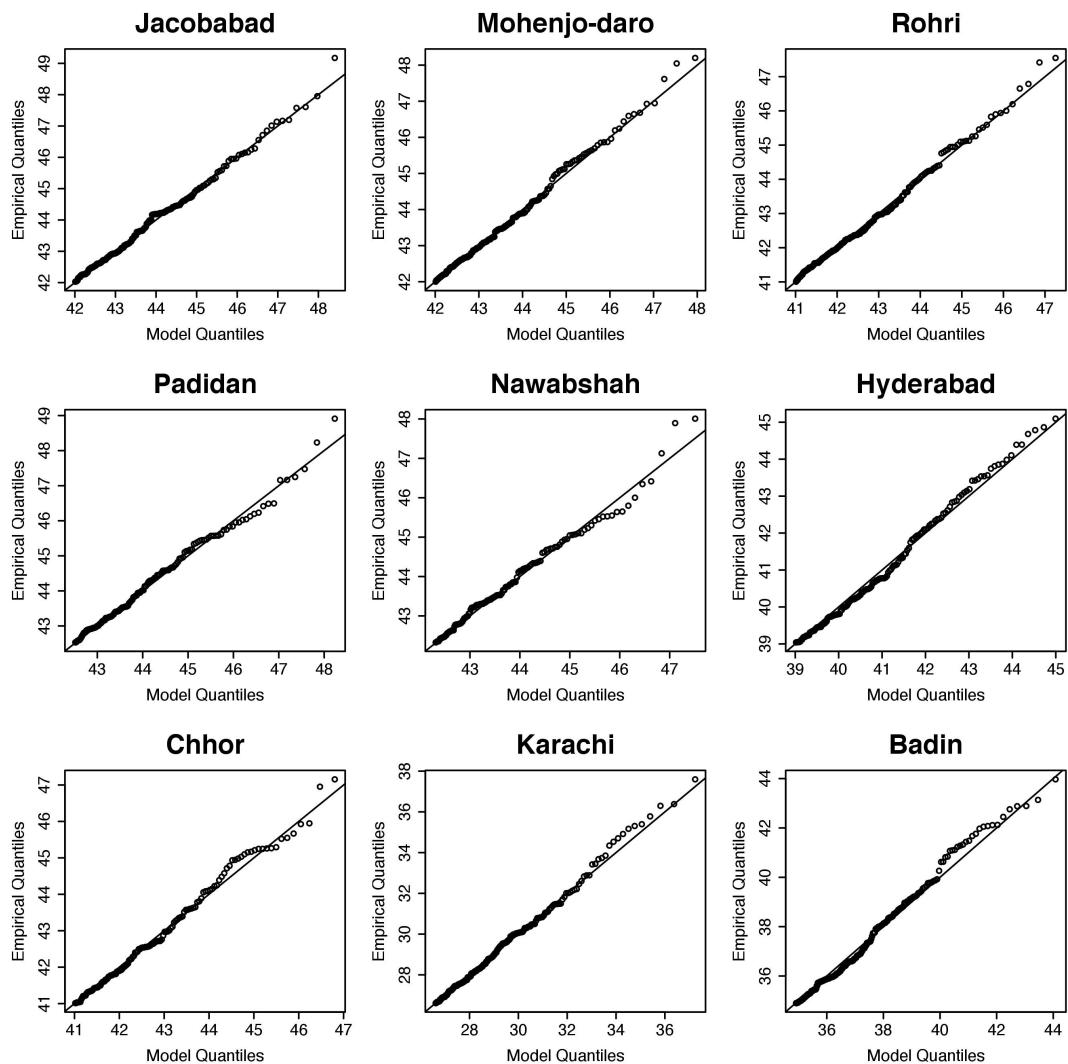


Figure 2. Quantile-Quantile plots of ERA Interim  $T_{max}$  ( $^{\circ}C$ ),  $u = 90\%$  for 9 stations of southern Pakistan (Sindh).

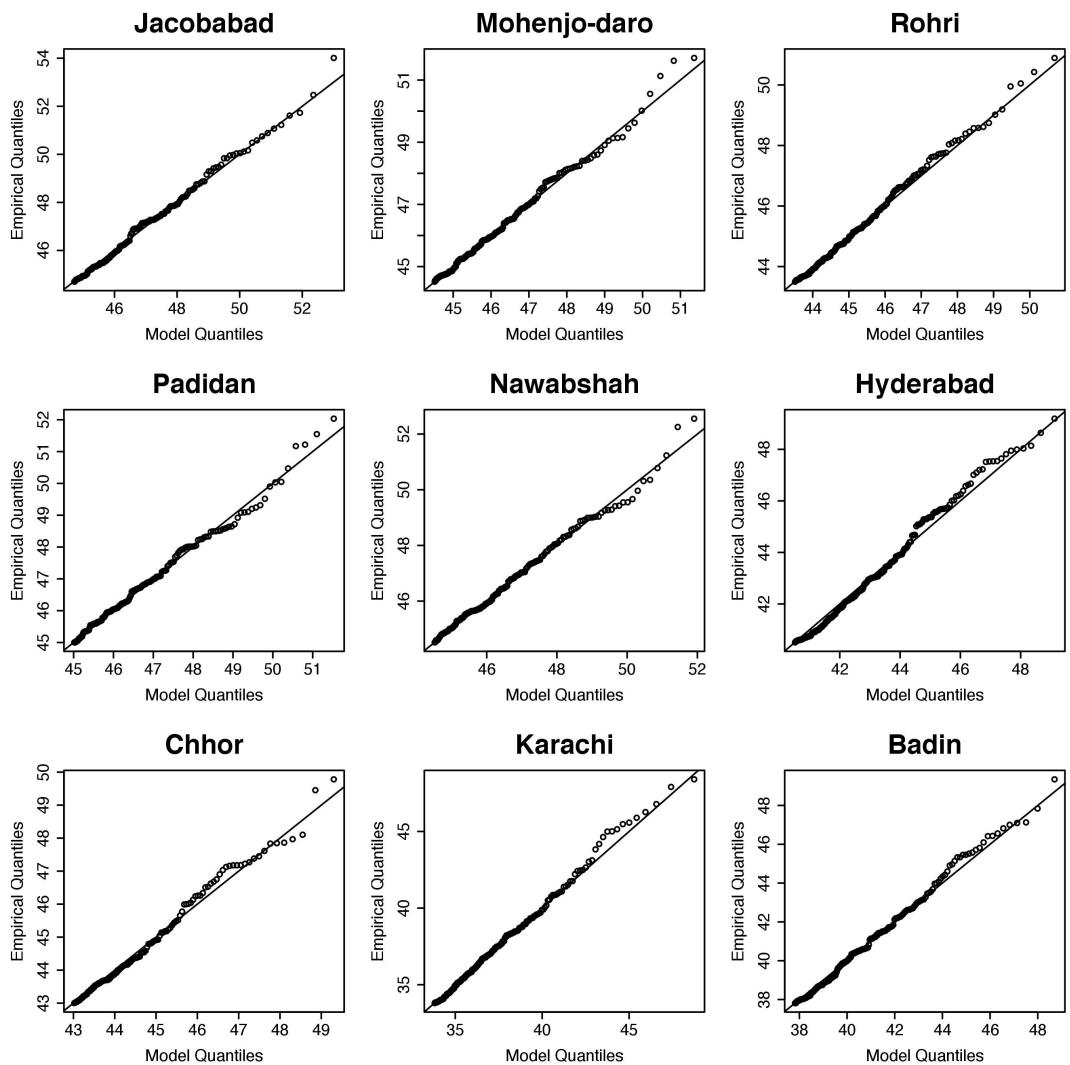


Figure 3. Quantile-Quantile plots of bias corrected ERA Interim  $T_{max}$  ( $^{\circ}C$ ),  $u = 90\%$  for 9 stations of southern Pakistan (Sindh).

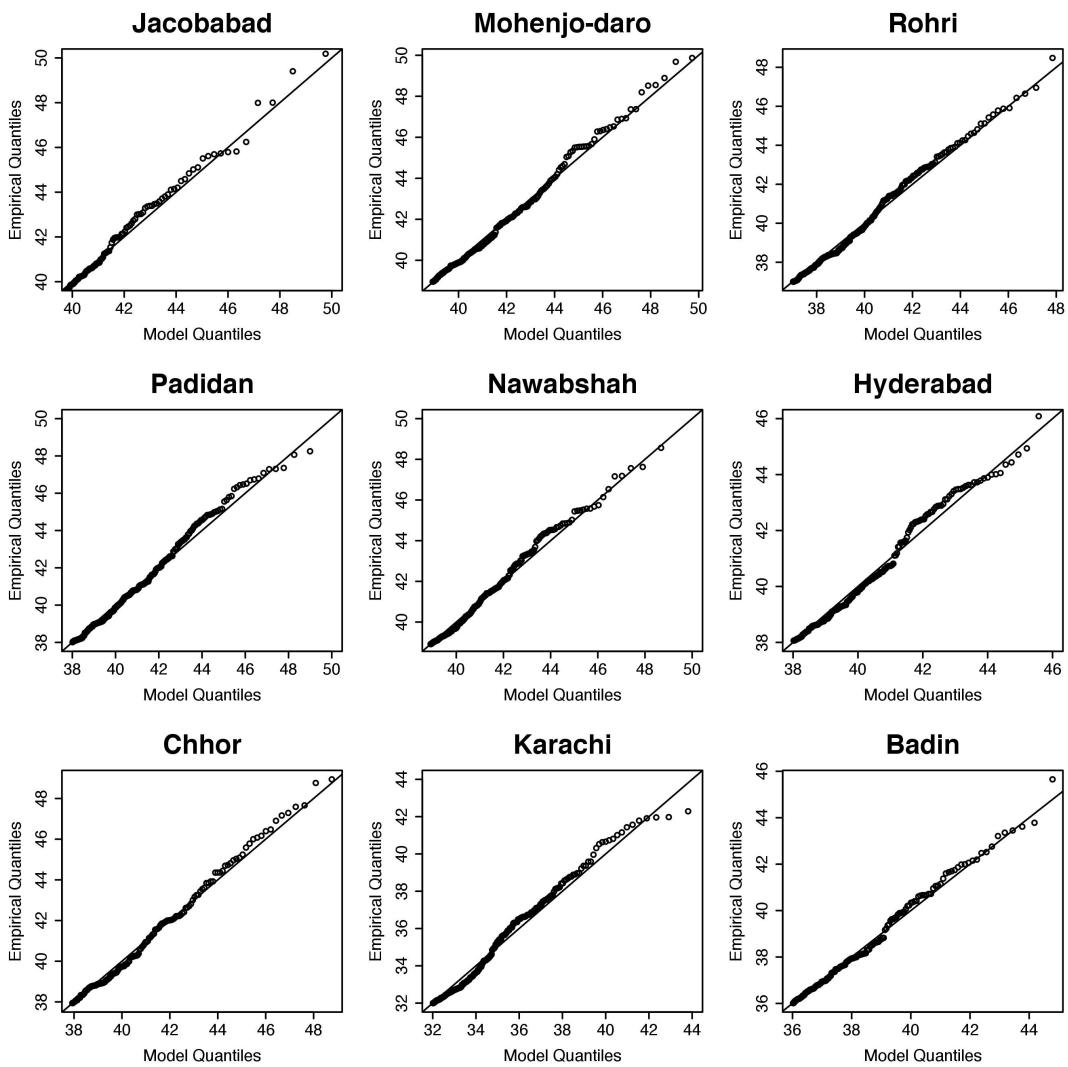


Figure 4. Quantile-Quantile plots of station observed  $TW_{max}$  ( $^{\circ}\text{C}$ ),  $u = 90\%$  for 9 stations of southern Pakistan (Sindh).

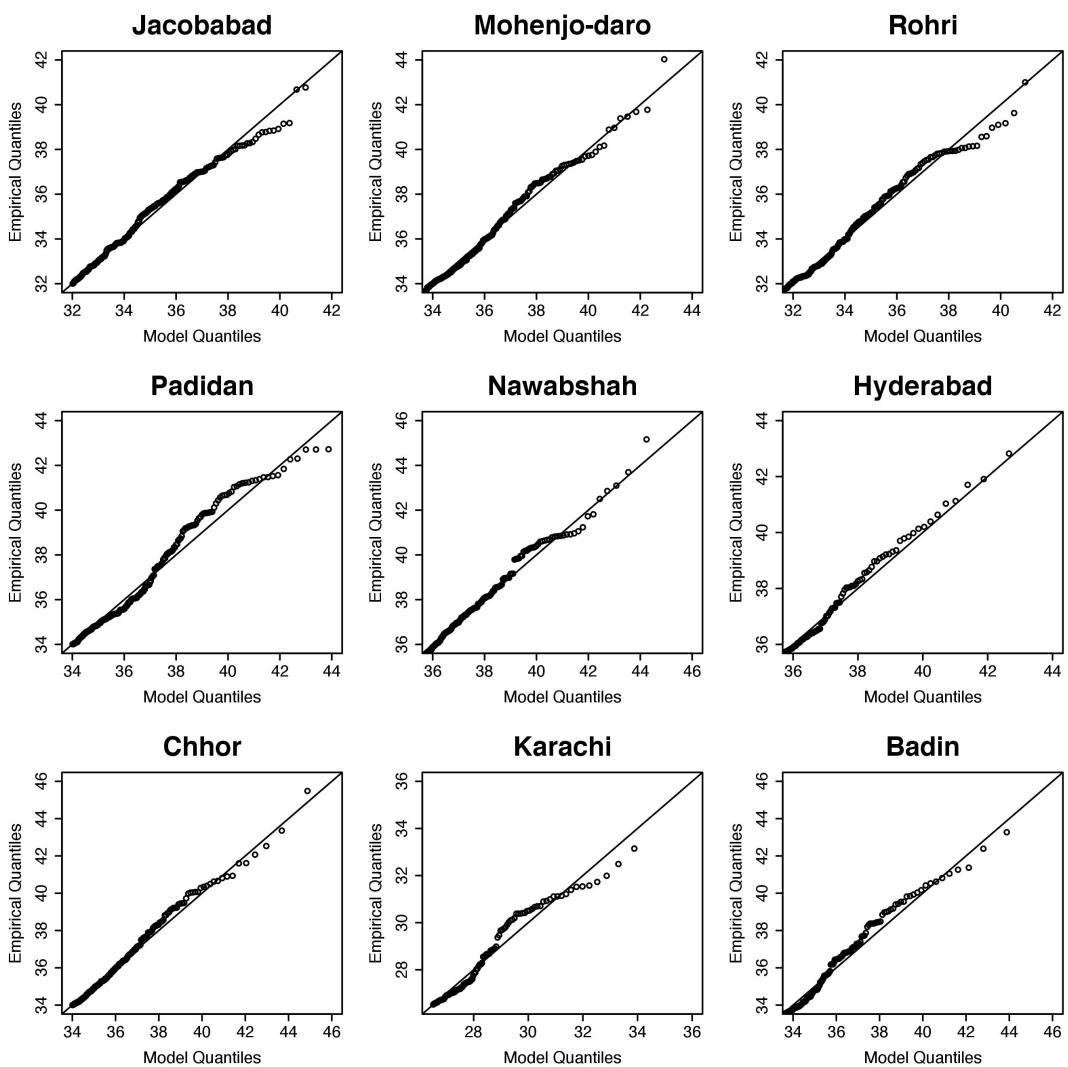


Figure 5. Quantile-Quantile plots of ERA Interim  $TW_{max}$  ( $^{\circ}C$ ),  $u = 90\%$  for 9 stations of southern Pakistan (Sindh).

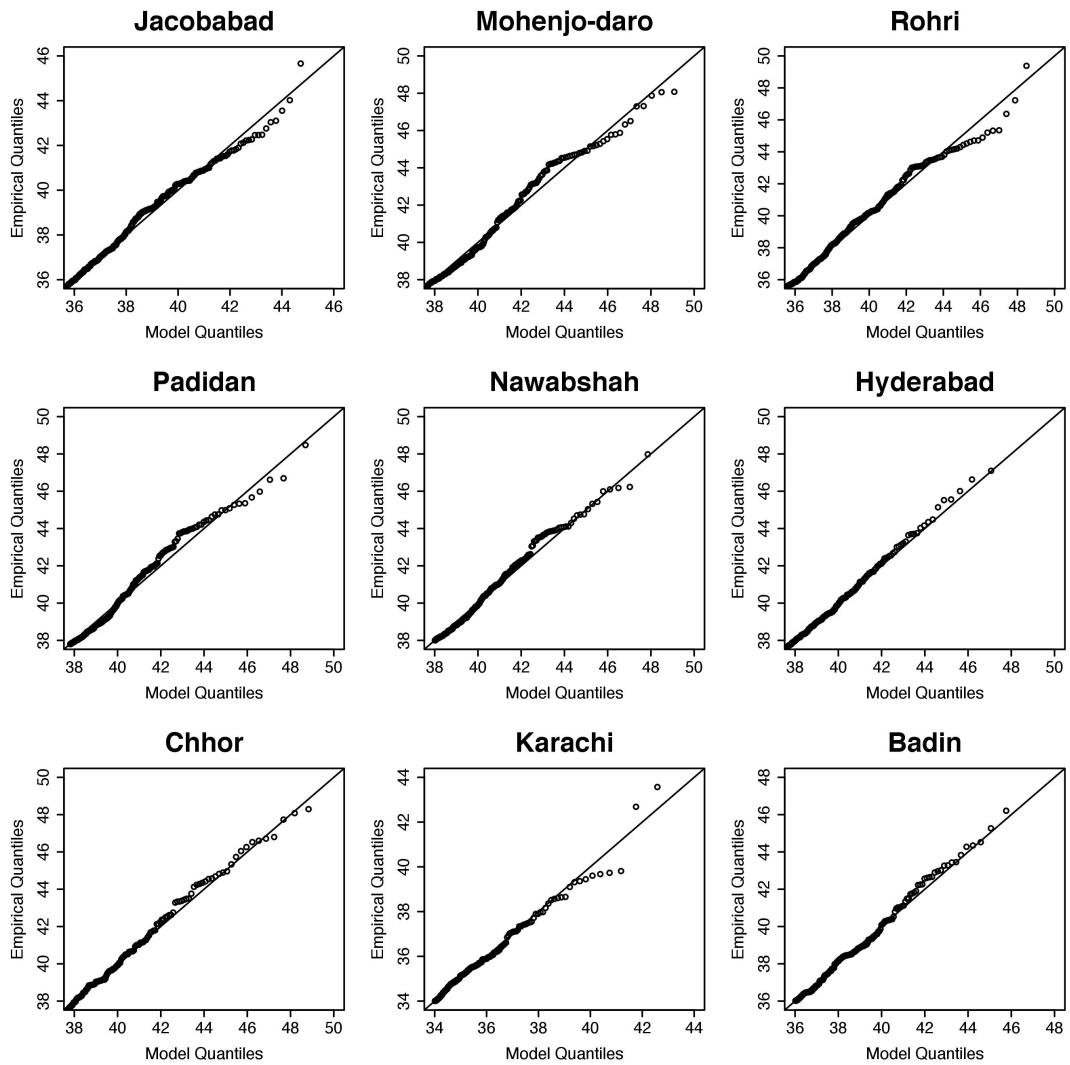


Figure 6. Quantile-Quantile plots of bias corrected ERA Interim  $TW_{max}$  ( $^{\circ}C$ ),  $u = 90\%$  for 9 stations of southern Pakistan (Sindh).