**Tables**

Table 1: Statistical analysis of Maximum temperature, Minimum temperature, rainfall and rainy days at Karnal (1972-2010)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Max T | Min T | Total | | Monsoon | | Summer | | Post Monsoon | |
| Rainfall | Rainy Days | Rainfall | Rainy Days | Rainfall | Rainy days | Rainfall | Rainy days |
| Mean | 29.9 | 16.9 | 757.6 | 47.6 | 595.9 | 32.0 | 67.7 | 6.9 | 94.0 | 8.7 |
| Standard Error | 0.1 | 0.1 | 41.6 | 2.2 | 38.2 | 1.6 | 9.0 | 0.8 | 8.8 | 0.6 |
| Median | 30.0 | 16.9 | 706.3 | 45.0 | 585.1 | 29.0 | 55.0 | 5.0 | 84.5 | 9.0 |
| Standard Deviation | 0.6 | 0.4 | 259.8 | 14.0 | 238.8 | 10.3 | 56.2 | 5.0 | 55.0 | 3.7 |
| Minimum | 28.2 | 16.1 | 340.7 | 24.0 | 215.3 | 11.0 | 0.2 | 0.0 | 14.9 | 1.0 |
| Maximum | 31.3 | 18.3 | 1399.9 | 81.0 | 1271.3 | 51.0 | 252.9 | 20.0 | 233.0 | 16.0 |
| CV | 1.9 | 2.6 | 34.3 | 29.5 | 40.1 | 32.1 | 83.0 | 72.3 | 58.5 | 42.4 |

Table 2: MK trend test for rainfall and rainy days (Karnal) 1972-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan | 0.07 | 0.17 | 0.53 | 0.10 |
| Feb | 0.08 | 0.20 | 0.47 | 0.10 |
| Mar | -0.10 | -0.11 | 0.40 | 0.10 |
| Apr | -0.03 | 0.00 | 0.81 | 0.10 |
| May | 0.13 | 0.34 | 0.26 | 0.10 |
| Jun | 0.10 | 0.77 | 0.36 | 0.10 |
| Jul | -0.19 | -2.17 | 0.09 | 0.10 |
| Aug | -0.14 | -2.41 | 0.23 | 0.10 |
| Sep\* | 0.24 | 2.64 | 0.03 | 0.10 |
| Oct\* | -0.21 | 0.00 | 0.08 | 0.10 |
| Nov | 0.01 | 0.00 | 0.98 | 0.10 |
| Dec | -0.10 | -0.03 | 0.37 | 0.10 |
| Total | -0.03 | -0.70 | 0.81 | 0.10 |
| Monsoon | -0.09 | -2.50 | 0.43 | 0.10 |
| Post monsoon | -0.16 | -0.45 | 0.15 | 0.10 |
| Winter | 0.12 | 0.73 | 0.30 | 0.10 |
| Summer | 0.02 | 0.11 | 0.84 | 0.10 |
| Rainy Days\* | -0.33 | -0.57 | 0.00 | 0.10 |

\*Significant trend observed

Table 3: MK trend test for Max temperature (Karnal) 1972-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan\* | -0.33 | -0.04 | 0.00 | 0.10 |
| Feb | 0.08 | 0.01 | 0.48 | 0.10 |
| Mar\* | 0.22 | 0.06 | 0.05 | 0.10 |
| Apr\* | 0.25 | 0.06 | 0.03 | 0.10 |
| May | -0.11 | -0.03 | 0.32 | 0.10 |
| Jun | -0.15 | -0.03 | 0.18 | 0.10 |
| Jul | 0.16 | 0.02 | 0.17 | 0.10 |
| Aug | 0.12 | 0.01 | 0.28 | 0.10 |
| Sep\* | -0.21 | -0.03 | 0.07 | 0.10 |
| Oct | 0.02 | 0.00 | 0.84 | 0.10 |
| Nov\* | 0.21 | 0.02 | 0.06 | 0.10 |
| Dec | -0.11 | -0.02 | 0.31 | 0.10 |
| Average | 0.10 | 0.01 | 0.39 | 0.10 |

\*Significant trend observed

Table 4: MK trend test for Min temperature (Karnal) 1972-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan | -0.02 | 0.00 | 0.86 | 0.10 |
| Feb\* | 0.20 | 0.04 | 0.08 | 0.10 |
| Mar\* | 0.19 | 0.03 | 0.09 | 0.10 |
| Apr | 0.10 | 0.01 | 0.39 | 0.10 |
| May | 0.12 | 0.02 | 0.29 | 0.10 |
| Jun | -0.04 | 0.00 | 0.72 | 0.10 |
| Jul\* | 0.25 | 0.02 | 0.03 | 0.10 |
| Aug\* | 0.27 | 0.01 | 0.02 | 0.10 |
| Sep | 0.15 | 0.01 | 0.20 | 0.10 |
| Oct | 0.09 | 0.02 | 0.40 | 0.10 |
| Nov | 0.09 | 0.02 | 0.40 | 0.10 |
| Dec | 0.17 | 0.03 | 0.14 | 0.10 |
| Average\* | 0.33 | 0.02 | 0.00 | 0.10 |

\*Significant trend observed

Table 5: MK trend test for ET (Karnal) 1981-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan | -0.255 | -0.27 | 0.05 | 0.10 |
| Feb | 0.11 | 0.14 | 0.40 | 0.10 |
| Mar | 0.04 | 0.03 | 0.78 | 0.10 |
| Apr | 0.05 | 0.12 | 0.72 | 0.10 |
| May | 0.03 | 0.09 | 0.80 | 0.10 |
| Jun | -0.13 | -0.43 | 0.32 | 0.10 |
| Jul | -0.10 | -0.16 | 0.44 | 0.10 |
| Aug | -0.06 | -0.13 | 0.65 | 0.10 |
| Sep\* | -0.23 | -0.36 | 0.08 | 0.10 |
| Oct | 0.03 | 0.02 | 0.83 | 0.10 |
| Nov | 0.09 | 0.09 | 0.52 | 0.10 |
| Dec | 0.02 | 0.01 | 0.92 | 0.10 |
| Total | -0.07 | -0.76 | 0.62 | 0.10 |
| Monsoon | -0.14 | -1.02 | 0.30 | 0.10 |
| Post monsoon | 0.08 | 0.23 | 0.55 | 0.10 |
| Winter | -0.03 | -0.04 | 0.86 | 0.10 |
| Summer | 0.07 | 0.41 | 0.62 | 0.10 |

\*Significant trend observed

Table 6: Mann- Kendall trend test for ground water table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen’s slope | p-value (Two-tailed) | alpha |
| June\* | 0.779 | 0.228 | 0.000 | 0.05 |
| Oct\* | 0.730 | 0.267 | 0.000 | 0.05 |
| Fluctuation\* | 0.318 | 0.039 | 0.006 | 0.05 |

\*Significant trend observed

Table 7: Statistical analysis of Maximum temperature, Minimum temperature, rainfall and rainy days at Hisar (1981-2010)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Max T | Min T | Rainfall | | | | Rainy Days |
|  | Total | Monsoon | Post Monsoon | Summer |
| Mean | 31.4 | 16.2 | 464.8 | 359.1 | 48.4 | 57.3 | 26.9 |
| Standard Error | 0.1 | 0.1 | 31.0 | 28.1 | 7.3 | 8.9 | 1.2 |
| Median | 31.4 | 16.3 | 461.7 | 363.2 | 35.0 | 42.2 | 28.0 |
| Standard Deviation | 0.7 | 0.6 | 169.5 | 153.7 | 40.0 | 48.7 | 6.6 |
| Minimum | 29.6 | 15.3 | 145.2 | 63.5 | 6.0 | 0.0 | 16.0 |
| Maximum | 32.8 | 17.6 | 774.9 | 707.8 | 173.4 | 173.8 | 42.0 |
| CV | 2.3 | 3.7 | 36.5 | 42.8 | 82.6 | 85.0 | 24.6 |

Table 8: MK trend test for Max Temp (Hisar) 1981-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan\* | -0.24 | -0.06 | 0.06 | 0.10 |
| Feb | 0.13 | 0.05 | 0.32 | 0.10 |
| Mar | 0.16 | 0.07 | 0.21 | 0.10 |
| Apr\* | 0.26 | 0.09 | 0.05 | 0.10 |
| May | 0.03 | 0.01 | 0.83 | 0.10 |
| Jun | -0.20 | -0.06 | 0.13 | 0.10 |
| Jul | 0.05 | 0.01 | 0.70 | 0.10 |
| Aug | 0.01 | 0.00 | 0.94 | 0.10 |
| Sep | -0.18 | -0.04 | 0.17 | 0.10 |
| Oct | 0.01 | 0.00 | 0.94 | 0.10 |
| Nov | 0.08 | 0.01 | 0.55 | 0.10 |
| Dec | -0.01 | 0.00 | 0.94 | 0.10 |
| Average | 0.08 | 0.01 | 0.57 | 0.10 |

\*Significant trend observed

Table 9: MK trend test for Min Temp (Hisar) 1981-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan | -0.12 | -0.03 | 0.36 | 0.10 |
| Feb | 0.02 | 0.01 | 0.90 | 0.10 |
| Mar | -0.10 | -0.02 | 0.46 | 0.10 |
| Apr | 0.13 | 0.03 | 0.32 | 0.10 |
| May | 0.20 | 0.06 | 0.14 | 0.10 |
| Jun | -0.20 | -0.04 | 0.13 | 0.10 |
| Jul | 0.03 | 0.00 | 0.86 | 0.10 |
| Aug | 0.02 | 0.00 | 0.90 | 0.10 |
| Sep | 0.07 | 0.01 | 0.62 | 0.10 |
| Oct | 0.09 | 0.03 | 0.52 | 0.10 |
| Nov | 0.01 | 0.00 | 0.94 | 0.10 |
| Dec | -0.02 | 0.00 | 0.92 | 0.10 |
| Average | 0.05 | 0.00 | 0.72 | 0.10 |

\*Significant trend observed

Table 10: MK trend test for Rainfall and Rainy Days (Hisar) 1981-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan | -0.06 | -0.05 | 0.68 | 0.10 |
| Feb | -0.02 | -0.01 | 0.90 | 0.10 |
| Mar | -0.13 | -0.06 | 0.35 | 0.10 |
| Apr | -0.01 | 0.00 | 0.96 | 0.10 |
| May\* | 0.23 | 0.67 | 0.07 | 0.10 |
| Jun | 0.15 | 0.93 | 0.26 | 0.10 |
| Jul | 0.02 | 0.15 | 0.87 | 0.10 |
| Aug | -0.13 | -1.68 | 0.34 | 0.10 |
| Sep\* | 0.25 | 1.92 | 0.06 | 0.10 |
| Oct | -0.05 | 0.00 | 0.76 | 0.10 |
| Nov | -0.02 | 0.00 | 0.93 | 0.10 |
| Dec | 0.01 | 0.00 | 0.98 | 0.10 |
| Total | 0.11 | 3.78 | 0.40 | 0.10 |
| Monsoon | 0.14 | 3.33 | 0.30 | 0.10 |
| Post monsoon | -0.04 | 0.00 | 0.79 | 0.10 |
| Winter | -0.02 | -0.03 | 0.90 | 0.10 |
| Summer | 0.14 | 1.47 | 0.29 | 0.10 |
| Rainy Days Total | 0.11 | 0.11 | 0.41 | 0.10 |
| RDMonsoon | 0.11 | 0.11 | 0.43 | 0.10 |
| RDSummer | -0.05 | 0.00 | 0.70 | 0.10 |
| RDWinter | 0.03 | 0.00 | 0.87 | 0.10 |
| RDPost Monsoon | -0.13 | 0.00 | 0.34 | 0.10 |

\*Significant trend observed

Table 11: MK trend test for Evapotranspiration (Hisar) 1981-2010

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Kendall's tau | Sen' slope | p-value (Two-tailed) | alpha |
| Jan\* | -0.40 | -0.39 | 0.00 | 0.10 |
| Feb\* | -0.28 | -0.40 | 0.03 | 0.10 |
| Mar | -0.15 | -0.35 | 0.24 | 0.10 |
| Apr | -0.07 | -0.17 | 0.60 | 0.10 |
| May | -0.19 | -0.69 | 0.14 | 0.10 |
| Jun\* | -0.48 | -1.58 | 0.00 | 0.10 |
| Jul | -0.10 | -0.53 | 0.44 | 0.10 |
| Aug | -0.03 | -0.10 | 0.83 | 0.10 |
| Sep\* | -0.35 | -0.90 | 0.01 | 0.10 |
| Oct\* | -0.34 | -0.48 | 0.01 | 0.10 |
| Nov\* | -0.34 | -0.43 | 0.01 | 0.10 |
| Dec\* | -0.42 | -0.37 | 0.00 | 0.10 |
| Total\* | -0.37 | -6.60 | 0.00 | 0.10 |
| Monsoon\* | -0.27 | -3.03 | 0.03 | 0.10 |
| Post monsoon\* | -0.46 | -1.24 | 0.00 | 0.10 |
| Winter\* | -0.46 | -0.83 | 0.00 | 0.10 |
| Summer | -0.18 | -1.13 | 0.17 | 0.10 |

\*Significant trend observed

**Figures**

Fig. 1:Monsoon rainfall categorization as deficient, normal and Excess at Karnal, Haryana

Fig. 2:Frequency of one day maximum rainfall in monsoon months at Karnal, Haryana**.**

Fig. 3: Trend analysis of BSS during 1981- 2010 at Karnal, Haryana.

Fig. 4: Decadal means of monsoon months rainfall at Karnal, Haryana.

Fig 5: decadal means of reference evapotranspiration (1981- 2010) at Karnal, Haryana

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| Fig. 6: Trends of ground water level in pre and post monsoon months in Karnal | |

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| --- | --- |
|  |  |
| Fig. 7: Relationship between fluctuation of water table depth and monsoon rainfall | |

Fig. 8:Monsoon rainfall categorization as deficient, normal and Excess at Hisar, Haryana

Fig. 9: Trends of ground water level in pre and post monsoon months in Hisar

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| --- | --- |
|  |  |
| Fig 10: Total energy consumption in Karnal (1980-2005) | Fig11: Total energy consumption in Hisar (1980-2005) |