The Pharma Innovation Journal 2022; SP-11(12): 1220-1230

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; SP-11(12): 1220-1230

www.thepharmajournal.com
Received: 08-10-2022
Accepted: 14-11-2022

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# Study on verification of weather forecast in different agro-climatic zones of Chhattisgarh

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**Abstract**
In this context, attempts were made to verify the weather forecast received on every Tuesday and Friday from NCMRWF/IMD. The verification analysis was carried out for six important weather parameters on seasonal and annual basis through various verification techniques *viz.*, Ratio score, Critical success index, Heidke skill score, Hansen and Kuiper score, Root Mean Square Error, Usability Analysis and Correlation Analysis for the year 2021-22, analysis was done on block basis. We have selected 3 blocks (i.e., Dhamtari, Ambikapur and Jagdalpur) which represent the three Agro-climatic Zones of Chhattisgarh (Dhamtari-Chhattisgarh plateau, Ambikapur- Northern hill and Jagdalpur – Bastar plateau). All parameters *viz.*, rainfall, maximum temperature, minimum temperature and wind speed showed highest success percentage at all 3 blocks. Usability analysis gave best performance in Jagdalpur block.

**Keywords:** Weather forecast, usability, RMSE, Skill score

## 1. Introduction
The success or failure of farming is intimately related to the prevailing weather conditions, if weather is favorable, yield would be high and vice-versa. It is nevertheless possible to optimize farm production by adjusting cropping patterns and agronomic practices to suit the climate of a locality. Weather forecast plays an important role in agriculture as agriculture production is highly dependent on variability in weather condition. An accurate weather forecast not only helps in increasing agriculture production and quality of produce but helps in efficient use of limited resources. Forecast of onset of monsoon is therefore important for sowing and different crop management practices during kharif season and the prediction of winter season rainfall is important for the rabi crops in the northern and central part of the country. The weather forecasting helps farmers in capitalizing benevolent weather conditions in order to optimize the resource use and to minimize the loss due to aberrant weather conditions (Rathod *et al.*, 2003) [3]. In arid to semiarid climate, rainfall is the major influencing climatic factor which determines the crop production in *kharif* season in India. Rainfall in south west monsoon season is the most important weather elements as the country's agricultural production is dependent on its amount and distribution. An accurate weather forecast not only helps in increasing agriculture production and quality of produce but helps in efficient use of limited resources. Forecast of onset of monsoon is therefore important for sowing and different crop management practices during.

## 2. Material and Methods
### 2.1 Collection of weather data
The medium range forecast weather parameters Rainfall (mm), temperature maximum and minimum (Gridded data), relative humidity (I, II), wind speed were collected from the Department of Agrometeorology, IGKV Raipur.

### 2.2 Input
#### 2.2.1 Observed weather data
Daily weather data were collected from Agro-meteorological observatory records of Indira Gandhi Agricultural University, Raipur (C.G.). In year 2021-2022. Daily weather data includes parameters of (Weightage gridded data) maximum temperature, minimum temperature (ºC), rainfall (mm), for relative humidity (%) and wind speed (kmph) it was available weather data was found collected from the Department of Agrometeorology IGKV Raipur

### 2.3 Qualitative analysis of different weather parameter

The contingency table approach offers simple and easily understood picture of forecast successes and failures, which can serve as the starting point for examination of the strength and weakness of the forecasts (Murphy *et al.*, 1989) [4]. The extent to which the table is diagonally dominant is a crude measure of what is going right in the forecasts, or more importantly the off -diagonal cells represents forecasts gone wrong to various degrees. This knowledge can point one in the proper directions for improving the predictions.

#### 2.3.1 Rain/no rainfall events

Consider a set of rainfall forecasts that can have only two alternatives *i.e.* Rain or no rain

| Forecast/observation | Rain | No Rain |
|---|---|---|
| Rain | A(YY) | B(YN) |
| No Rain | C(NY) | D(NN) |

Where,
(YY)A= No. of Hits (predicted and observed),
(YN)B = No. Of Alarms (predicted but not observed)
(NY)C = No. Of misses (observed but not predicted),
(NN)D = No. of correct predictions of no. rain. (Neither predicted nor observed)

#### 2.3.2 Ratio score (RS)

Ratio score is the ratio of correct forecast to total number of forecast for rainfall events. It was worked out on Yes/No basis for pre- monsoon, monsoon, post monsoon and winter season. Ratio score was calculated as follows:

$$\text{Ratio score} = \frac{(YY+NN)}{(YY+NN+YN+NY)}$$

It range between 0 to 1, 0 indicates no skill and 1 indicate perfect score.

Where,
YY= No. of Hits (predicted and observed)
YN = No. of Alarms (predicted but not observed)
NY = No. of misses (observed but not predicted)
NN = No. of correct predictions of no. rain. (Neither predicted nor observed)

#### 2.3.3 Hanssen and Kuipers score (HK score)

The HK score is the ratio of economic saving over climatology due to the forecast to that of a set of perfect forecasts.

$$\text{H.K. Score} = \frac{YYNN-YNNY}{(YY+NN)\,(YN+NY)}$$

Where,
YY= No of days when rain was forecasted and also observed,
YN= No of gays when rain was forecasted but not observed,
NY= No of days when rain was not forecasted but observed,
NN= No of days when rain was not forecasted and also not observed.

The value of H.K. Score ranges between -1 to 1, 0 indicates no skill and 1 indicate perfect score. It explains how well the forecast separated the yes event from the no event.

#### 2.3.4 Critical success index (threat score)

Measures relative forecast accuracy (e.g., rain or no rain). It also varies from 0 to 1 with indicating perfect forecast and is defined as the ratio of the number of hits (i.e., correct event forecasts) to the number of events which occurred plus the number of false alarms (incorrect event forecast).

$$\text{Critical Success index (CSI)} = \frac{Hits}{Hits+False\ alarm}$$

$$= \frac{A}{A+B+C}$$

#### 2.3.5 Probability of detection (POD)

$$\text{Probability of detection (POD)} = \frac{Correct\ rain\ forecast}{Rain\ observation} = \frac{A}{A+C}$$

POD uses only the observed event A and C, it is sensitive only to missed events and not false alarms. Therefore POD can generally be improved by systematically over – forecasting the occurrence of the event. The POD is incomplete by itself and should be used in conjunction with either the false alarm ratio (FAR) below

#### 2.3.6 False alarm ratio (FAR)

$$\text{False alarm ratio (FAR)} = \frac{False\ alarm}{Hits+False\ alarms}$$

FAR is dependent on A and B only and does not include C, and therefore, is not sensitive to missed events. FAR can be improved by systematically by under forecasting the events. It also is an incomplete score and should be used in connection with the POD above.

#### 2.3.7 Heidke skill score (HSS)

$$\text{Heidke skill score (HSS)} = \frac{Correct forecast - (Correct\ Forecast)\ random}{N-(\ Correct\ Forecst) random}$$

$$\text{HSS} = \frac{2(AD-BC)}{(A+C)(C+D)+(A+B)(B+D)}$$

The HSS ranges from negative value to +1, negative values indicate that the standard forecast is more accurate than the forecast; skill is negative. The HSS represents the fraction by which the forecast improves on the standard forecast. A perfect forecast gives a HSS of 1, no matter how good the standard forecast is.

## 3. Result and Discussion

### 3.1 To compare medium range weather forecast of one representative block of each agro-climatic zone of Chhattisgarh state

#### 3.1.2 Simple success probability of weather forecast for different seasons were compared between three blocks *viz*., Dhamtari, Ambikapur and Jagdalpur which is described as follows

Simple success probability of weather forecast for rainfall was analysed (Table 4.70) during pre monsoon season of the year 2021-22. It indicated that the pre monsoon season rainfall success percentage was observed highest (88%) in Ambikapur block whereas, lowest (76%) in Jagdalpur block.

During monsoon season the success percentage of rainfall forecast was higher in Ambikapur block (98%) and almost similar success percentage was observed in Dhamtari and Jagdalpur block (93%). The success percentage of rainfall during monsoon season is more important since it has direct impact on crop production.

In post monsoon season, the success percentage of rainfall forecast was comparatively higher in Ambikapur (93%) than in Jagdalpur and Dhamtari block it was 86% and 88%, respectively. Rainfall success percentage in winter season was observed to be highest in Jagdalpur (93%) followed by Dhamtari block (92%).while in lowest in Ambikapur block (86%). Annual rainfall success percentage was maximum in Ambikapur block with 90% as compared to other two representative blocks. Dhamtari and Jagdalpur blocks given similar percentage (89%) in annual rainfall.

Simple success probability of weather forecast for maximum temperature was analysed during pre monsoon season (Table 1) of the year 2021-22. This analysis indicates that the pre monsoon season rainfall success percentage was observed highest (40%) in Ambikapur and Jagdalpur block whereas comparatively observed lower (38%) in Dhamtari block. During monsoon season the success percentage of maximum temperature forecast was higher in Ambikapur block (43%). while, lower success percentage was observed in Dhamtari and Jagdalpur blocks (37% and 35%). In post monsoon season, the success percentage of maximum temperature forecast was found in Ambikapur block (59%). which was comparatively higher and lower in Dhamtari and Jagdalpur blocks (50% and 45%) respectively. Success percentage in winter season for maximum temperature was observed to be highest in Jagdalpur block (53%) while was lower for Dhamtari and Ambikapur blocks (49% and 42%).

Annual maximum temperature success percentage was maximum in Ambikapur block 46% as compared to other blocks *viz*; Dhamtari and Jagdalpur blocks (42%).

Simple success probability of weather forecast for minimum temperature was analysed during pre monsoon season of the year 2021-22 (Table 1). This Indicates that the pre monsoon season minimum temperature success percentage was observed highest (42%) in Dhamtari block whereas, lowest in Ambikapur (39%) followed by Jagdalpur block (38%). During monsoon season the success percentage of minimum temperature forecast was higher in Dhamtari block (46%) and almost similar success percentage was observed in Ambikapur and Jagdalpur blocks (45%). In post monsoon season, the success percentage of minimum temperature forecast was found higher in Ambikapur and Jagdalpur blocks (59%) respectively. While, lowest in Dhamtari block with 53%. Minimum temperature success percentage was in winter season was observed to be highest in Dhamtari block (49%) while, lowest in Ambikapur and Jagdalpur blocks it was (47%) respectively.

In case of annual temperature, minimum temperature success percentage was observed the almost similar in different blocks *i.e.*, Dhamtari, Ambikapur and Jagdalpur respectively.

Simple success probability of weather forecast for wind speed was analysed during pre monsoon season of the year 2021-22 (Table 1). This indicates that the pre monsoon season wind speed success percentage was observed to be negligible for all three blocks. During monsoon season the success percentage of wind speed forecast was higher in Jagdalpur block (3%) and almost similar success percentage was observed in Dhamtari and Ambikapur blocks (1%). In post monsoon season, the success percentage of wind speed forecast was comparatively higher in Ambikapur block (61%) than lowest in Dhamtari (48%) and Jagdalpur blocks (51%).

Wind speed success percentage in winter season was observed to be highest in Ambikapur block (97%) while, lowest percent was observed in Dhamtari and Jagdalpur block (93%). In case of annual basis, success percentage of wind speed in Ambikapur block (31%) with comparatively higher than blocks Jagdalpur and Dhamtari (29% and 27%, respectively).

**Table 1:** Simple success probability of different parameters and seasons compare with three blocks

| Rainfall (mm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Blocks** | **Premonsoon (March-May)** | | **SW-Monsoon (June-Sep)** | | **Postmonsoon (Oct-Dec)** | | **Winter (Jan-Feb)** | | **Annual 2021-22** | |
| | **S** | **%** | **S** | **%** | **S** | **%** | **S** | **%** | **S** | **%** |
| Dhamtari | 78 | 85 | 113 | 93 | 81 | 88 | 54 | 92 | 326 | 89 |
| Ambikapur | 81 | 88 | 119 | 98 | 79 | 86 | 51 | 86 | 330 | 90 |
| Jagdalpur | 70 | 76 | 114 | 93 | 86 | 93 | 55 | 93 | 325 | 89 |
| | **Maximum temperature (ºC)** | | | | | | | | | |
| Dhamtari | 35 | 38 | 45 | 37 | 46 | 50 | 29 | 49 | 155 | 42 |
| Ambikapur | 37 | 40 | 53 | 43 | 54 | 59 | 25 | 42 | 169 | 46 |
| Jagdalpur | 37 | 40 | 43 | 35 | 41 | 45 | 31 | 53 | 152 | 42 |
| | **Minimum temperature (ºC)** | | | | | | | | | |
| Dhamtari | 39 | 42 | 56 | 46 | 49 | 53 | 29 | 49 | 173 | 47 |
| Ambikapur | 36 | 39 | 55 | 45 | 54 | 59 | 28 | 47 | 173 | 47 |
| Jagdalpur | 35 | 38 | 55 | 45 | 54 | 59 | 28 | 47 | 172 | 47 |
| | **Wind speed (Km/h)** | | | | | | | | | |
| Dhamtari | 0 | 0 | 1 | 1 | 44 | 48 | 55 | 93 | 100 | 27 |
| Ambikapur | 0 | 0 | 1 | 1 | 56 | 61 | 57 | 97 | 114 | 31 |
| Jagdalpur | 0 | 0 | 4 | 3 | 47 | 51 | 55 | 93 | 106 | 29 |

### 3.2 Skill Scores of weather forecast for different seasons were compared between three blocks *viz*., Dhamtari, Ambikapur and Jagdalpur which is described as follows

The ratio score analysed during pre-monsoon season was found comparatively higher in Ambikapur block 88 and lower in Dhamtari and Jagdalpur block 85 and 76. H.K. Scores analysis was found to be highest 0.58 in Ambikapur block while, lowest (0.51) in Jagdalpur block. The probability of detection (POD) during pre-monsoon season was found to be highest 0.69 in Ambikapur block whereas, lowest value of 0.62 was observed in Jagdalpur block. The Heidke Skill Score (HSS) analyzed during pre-monsoon season varied between 0.49 to 0.59. It was found to be highest in Ambikapur (0.59) and lowest in Dhamtari and Jagdalpur blocks (0.57 and 0.49), respectively. False Alarm Ratio (FAR)value was around 0.26 to 0.35.It was found to be highest in Ambikapur block (0.35) whereas, lowest in Dhamtari and Jagdalpur blocks it was 0.33 to 0.26, respectively. The critical success index (CSI) value varies between 0.50 in (Dhamtari and Ambikapur blocks) to 0.51 (Jagdalpur block).

The ratio score was analysed during monsoon season was found comparatively higher in Ambikapur block with value of 98 and lowest and similar value observed was in Dhamtari and Jagdalpur blocks 93.

The H.K scores value lowest as compared to other blocks, value it was -0.02 in Jagdalpur block during monsoon season whereas, the highest value of 0.48 in Ambikapur block and 0.18 in Dhamtari block. The seasonal probability of detection (POD) during monsoon season was found to be highest 0.99 in Ambikapur block. While, it was observed lowest with value of 0.95 in Jagdalpur and 0.93 in Dhamtari block. The Heidke skill score (HSS) was analyzed. Lowest value was

observed in Jagdalpur compared to other blocks. Value was -0.03 in Jagdalpur block and highest in Ambikapur and Dhamtari blocks (0.39 to 0.29) respectively. False Alarm Ratio (FAR) value was around 0.00 to 0.02. It was observed highest same value in Ambikapur and Jagdalpur block 0.02 and lowest in Dhamtari block it was 0.00.

Moreover, critical success index (CSI), the index varied between 0.93 to 0.98 among seasons. CSI highest value as compared to other block in Ambikapur. And lowest same value was observed in Dhamtari and Jagdalpur block it was 0.93.

The ratio score analysed during post monsoon season was found comparatively higher in Jagdalpur block 93 and lowest in Dhamtari and Ambikapur block with value of 88 and 86. H.K. Score analysis was found to be lowest (0.75) in Ambikapur block while, highest in 0.88 in Jagdalpur block. The probability of detection (POD) during post monsoon season was found to be highest 0.88 in Jagdalpur block whereas, lowest value 0.65 in Ambikapur block.

The Heidke skill score (HSS) analyzed during post monsoon season varied between 0.66 to 0.87. Highest value was found in Jagdalpur (0.87) and lowest in Dhamtari and Ambikapur blocks with value of 0.71 and 0.66, respectively. False Alarm Ratio (FAR) value was around 0.03 to 0.09. Highest value was found in Ambikapur block (0.09) whereas, lowest in Dhamtari and Jagdalpur block with value of 0.05 to 0.03 respectively.The critical success index (CSI) analysed during post monsoon season was found comparatively higher in Jagdalpur block 86 and lowest in Dhamtari and Ambikapur blocks with value of 0.65 and 0.61, respectively.

The ratio score analysed during winter season was found comparatively higher in Jagdalpur block 93 and lowest in Dhamtari and Ambikapur block with value of 92 and 86.

H.K. Score analysis was found to be highest in 0.65 in Jagdalpur block while lowest (0.61) in Ambikapur and (0.63) in Dhamtati block. The probability of detection (POD) during winter season was found comparatively highest 0.86 in Jagdalpur block whereas, lowest value 0.75 in Dhamtari and 0.69 in Ambikapur block. The Heidke skill score (HSS) analyzed during winter season varied between 0.61 to 0.71. It was found to be highest in Jagdalpur (0.71) and lowest in Dhamtari and Ambikapur blocks with value of 0.66 and 0.61, respectively.

False Alarm Ratio (FAR) value was found to be highest in Dhamtari block (0.33) followed by Jagdalpur (0.33) and lowest in Ambikapur block 0.31. The critical success index (CSI) analysed during winter season was found comparatively higher in Jagdalpur blocks with value of 60 and lowest in Dhamtari and Ambikapur blocks, it was 0.55 and 0.53.

The ratio score analysed during annual basis was found comparatively higher in Ambikapur block with value of 90% and lower in Dhamtari and Jagdalpur block with value of 89% respectively.

H.K. Scores analysis was found to be lowest (0.78) in Jagdalpur block and while, highest in 0.81 in Ambikapur block. The probability of detection (POD) during was found to be highest 0.88 in Ambikapur block whereas, lowest value of 0.84 in Dhamtari block. The Heidke Skill Score (HSS) analyzed during annual basis

varied between 0.78 to 0.81. It was found highest in Ambikapur (0.81) whereas lowest was found in Dhamtari and Jagdalpur blocks it was 0.79 and 0.78, respectively. False Alarm Ratio (FAR) value was around 0.07 to 0.08. It was highest in Ambikapur block (0.08) whereas, lowest in Dhamtari and Jagdalpur blocks it was 0.07 respectively. The critical success index (CSI) value varies between 0.79 in Dhamtari and Ambikapur and Jagdalpur block 0.82.

**Table 2:** Skill score of rainfall forecast for different season compare with three blocks

| S. No. | | Blocks | YY | YN | NY | NN | Ratio score | H.K. Score | POD | HSS | FAR | CSI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Premonsoon (March-May) | Dhamtari | 14 | 7 | 7 | 64 | 85 | 0.57 | 0.67 | 0.57 | 0.33 | 0.50 |
| 2. | | Ambikapur | 11 | 6 | 5 | 70 | 88 | 0.58 | 0.69 | 0.59 | 0.35 | 0.50 |
| 3. | | Jagdalpur | 23 | 8 | 14 | 47 | 76 | 0.51 | 0.62 | 0.49 | 0.26 | 0.51 |
| | | Total event=92 | | | | | | | | | | |
| 1. | SW-Monsoon (June-Sep) | Dhamtari | 111 | 0 | 9 | 2 | 93 | 0.18 | 0.93 | 0.29 | 0.00 | 0.93 |
| 2. | | Ambikapur | 118 | 2 | 1 | 1 | 98 | 0.48 | 0.99 | 0.39 | 0.02 | 0.98 |
| 3. | | Jagdalpur | 114 | 2 | 6 | 0 | 93 | -0.02 | 0.95 | -0.03 | 0.02 | 0.93 |
| | | Total event=122 | | | | | | | | | | |
| 1. | Post monsoon (Oct-Dec) | Dhamtari | 20 | 1 | 10 | 61 | 88 | 0.81 | 0.67 | 0.71 | 0.05 | 0.65 |
| 2. | | Ambikapur | 20 | 2 | 11 | 59 | 86 | 0.75 | 0.65 | 0.66 | 0.09 | 0.61 |
| 3. | | Jagdalpur | 38 | 1 | 5 | 48 | 93 | 0.88 | 0.88 | 0.87 | 0.03 | 0.86 |
| | | Total event= 92 | | | | | | | | | | |
| 1. | Winter (Jan-Feb) | Dhamtari | 6 | 3 | 2 | 48 | 92 | 0.63 | 0.75 | 0.66 | 0.33 | 0.55 |
| 2. | | Ambikapur | 9 | 4 | 4 | 42 | 86 | 0.61 | 0.69 | 0.61 | 0.31 | 0.53 |
| 3. | | Jagdalpur | 6 | 3 | 1 | 49 | 93 | 0.65 | 0.86 | 0.71 | 0.33 | 0.60 |
| | | Total event=59 | | | | | | | | | | |
| 1. | Annual (2021-22) | Dhamtari | 151 | 11 | 28 | 175 | 89 | 0.79 | 0.84 | 0.79 | 0.07 | 0.79 |
| 2. | | Ambikapur | 158 | 14 | 21 | 172 | 90 | 0.81 | 0.88 | 0.81 | 0.08 | 0.82 |
| 3. | | Jagdalpur | 181 | 14 | 26 | 144 | 89 | 0.78 | 0.87 | 0.78 | 0.07 | 0.82 |
| | | Total event =365 | | | | | | | | | | |

### 3.3 Usability analysis of maximum temperature for different seasons were compared between three blocks *viz*., Dhamtari, Ambikapur and Jagdalpur which is described as follows

The analysis for the maximum temperature reveals that the forecast was 51% correct in highest Ambikapur block and lowest percentage was observed in Dhamtari and Jagdalpur blocks 48 and 49 respectively. Usable percentage was found 30%. Highest percentage was found Ambikapur block while, lowest percentage was found in Dhamtari and Jagdalpur with value of 29% and 26%, respectively. The results indicated the performance of maximum temperature was found 25% unusable percentage in Jagdalpur block and lowest percentage was found in Dhamtari (23%) and Ambikapur block (19%). In

case of correct+usable percentage was found comparatively highest in Ambikapur block were 81%and lowest percentage was observed in Dhamtari and Jagdalpur blocks, it was found with value of 77% and 75%, respectively.

The correct percentage analysed during SW-monsoon season was found comparatively higher in Ambikapur block 55 and lower in Jagdalpur and Dhamtari block 39 and 34.

Usable percentage was found to be lowest (25%) in Ambikapur block and while, highest with value of 28% was observed in Dhamtari and Jagdalpur block. In unusable percentage was found comparatively high value in Dhamtari bock (38%) and lowest in Jagdalpur and Ambikapur blocks. It was found 33% and 20% respectively. In case of correct+usable percentage was observed comparatively high percentage in (80%) Ambikapur block and lowest percentage was observed in Jagdalpur and Dhamtari blocks 67% and 62%, respectively.

The correct percentage analysed during post monsoon season was found in almost comparative similar results was found in Dhamtari, Ambikapur and Jagdalpur blocks and there were 67%, 66% and 65%, respectively. Usable percentage was found (Table 3) to be high (25%) in Dhamtari block while, lower percentage in Jagdalpur and Ambikapur blocks were observed with value of 23% and 20%, respectively.

Unusable percentage was found (Table 3) comparatively high in Ambikapur bock (14%) and lowest in Jagdalpur and Dhamtari blocks (12% and 8%), respectively. In case of correct+usable percentage was observed comparatively high percentage in Dhamtari block (92%) and lower in Jagdalpur and Ambikapur blocks it was 88% and 86% respectively.

It can be seen from (Table 3) during winter season high percentage (75%) of maximum temperature correctness was recorded in Jagdalpur while, lowest percentage was observed in Dhamtari and Ambikapur block with value of 70% and 54%, respectively. Usable percentage was found to be high (22%) in Dhamtari block and while, lowest percentage in Jagdalpur and Ambikapur blocks (17%), respectively.

In unusable percentage was found comparatively high in Ambikapur block (29%) while, lowest in Dhamtari and Jagdalpur blocks 8%. In case of correct+usable percentage was observed comparatively lowest percentage in (71%) Ambikapur block and highest in Dhamtari and Jagdalpur blocks (92%), each.

In case of annual basis the comparatively high correct percentage was recorded in Ambikapur block (57%) while, lowest percentage was found in Dhamtari and Jagdalpur blocks it was 52% and 54% respectively. In usable percentage higher percentage was found to be high in Dhamtari block (27%) than lowest percentage was recorded in Ambikapur and Jagdalpur blocks with value of 23% and 24% respectively.

In unusable percentage was respectively almost similar recorded in Ambikapur, Dhamtari and Jagdalpur blocks it ranged 20%, 21% and 22% respectively. There was not much difference in unusable percentage. In case of correct+ usable percentage was respectively almost similar recorded in Jagdalpur, Dhamtari and Ambikapur blocks it ranged 78%, 79% and 80% respectively. Which was not much difference among different blocks.

**Table 3:** Usability analysis of maximum temperature for different season compare with three blocks.

| S. No. | Blocks | Correct (%) | Usable (%) | Unusable (%) | Correct+usable (%) |
|---|---|---|---|---|---|
| | **Pre-monsoon season (March-May)** | | | | |
| 1. | Dhamtari | 44(48) | 27(29) | 21(23) | 71(77) |
| 2. | Ambikapur | 47(51) | 28(30) | 17(19) | 75(81) |
| 3. | Jagdalpur | 45(49) | 24(26) | 23(25) | 69(75) |
| | **SW-monsoon season (June-Sep)** | | | | |
| 1. | Dhamtari | 42(34) | 34(28) | 46(38) | 76(62) |
| 2. | Ambikapur | 67(55) | 30(25) | 25(20) | 97(80) |
| 3. | Jagdalpur | 48(39) | 34(28) | 40(33) | 82(67) |
| | **Post monsoon season(Oct- Dec)** | | | | |
| 1. | Dhamtari | 62(67) | 23(25) | 7(08) | 85(92) |
| 2. | Ambikapur | 61(66) | 18(20) | 13(14) | 79(86) |
| 3. | Jagdalpur | 60(65) | 21(23) | 11(12) | 81(88) |
| | **Winter season (Jan-Feb)** | | | | |
| 1. | Dhamtari | 41(70) | 13(22) | 5(08) | 54(92) |
| 2. | Ambikapur | 32(54) | 10(17) | 17(29) | 42(71) |
| 3. | Jagdalpur | 44(75) | 10(17) | 5(08) | 54(92) |
| | **Annual (2021-22)** | | | | |
| 1. | Dhamtari | 189(52) | 97(27) | 79(21) | 286(79) |
| 2. | Ambikapur | 207(57) | 86(23) | 72(20) | 293(80) |
| 3. | Jagdalpur | 197(54) | 89(24) | 79(22) | 286(78) |

### 3.4 Usability analysis of minimum temperature for different seasons were compared between three blocks *viz.*, Dhamtari, Ambikapur and Jagdalpur which is described as follows

Result shown (Table 4) that the comparatively high correct percentage was recorded in Jagdalpur block (61%) while, lowest percentage was found in Ambikapur and Dhamtari blocks with value of 50% and 42% respectively. In usable percentage was found to be high in (33%) Dhamtari block whereas lowest percentage was recorded in Ambikapur and Jagdalpur block. It was observed to be 32% and 28%, respectively.

Unusable percentage was recorded to be high in Dhamtari block as it was ranged 25%. While lowest was recorded in Ambikapur and Jagdalpur blocks and it renged 18% and 11% respectively. In case of correct+ usable percentage was recorded as comparatively high in Jagdalpur block as it was ranged 89% while lowest was found in Ambikapur and Dhamtari blocks as it was 82% and 75%, respectively.

Results showed (Table 4) that the comparatively lowest correct percentage was recorded in Dhamtari block (66%) while, high percentage was found in Ambikapur and Jagdalpur blocks 75%. In usable percentage was high in Dhamtari block where (23%) was observed while lowest percentage was recorded in Ambikapur and Jagdalpur block it was 18% and 20%, respectively.

In unusable percentage was recorded high in Dhamtari block where 11% was recorded. While lowest was recorded in Ambikapur and Jagdalpur blocks it was 7% and 5% respectively. In case of correct+ usable percentage was recorded as comparatively high in Jagdalpur block where 95% was observed while lowest was found in Ambikapur and Dhamtari blocks with value of 93% and 75%, respectively.

It can be seen from Table 4, than result interpreted that the comparatively high correct percentage was recorded in Ambikapur block (69%) whereas lowest percentage was found in Jagdalpur and Dhamtari blocks with values of 67% and 59%. In usable percentage was high in Dhamtari block where (25%) was observed while lowest percentage was recorded in Ambikapur and Jagdalpur blocks it with value of 16% and 11% respectively.

In unusable percentage was recorded high in Jagdalpur block where 22% was recorded. While lowest percentage was recorded in Ambikapur and Dhamtari block and values were 15% and 16% respectively. In case of correct+ usable percentage was recorded as comparatively high in Ambikapur block where 85% was observed while lowest was found in Dhamtari and Jagdalpur blocks with values of 84% and 78%.

It can be seen from table 4 than result interpreted that the comparatively highest correct percentage was recorded in Jagdalpur block (60%) while, lowest percentage was found in Dhamtari and Ambikapur block where values of 54% and 51% was recorded. In usable percentage was high in Ambikapur block where (29%) was observed while lowest percentage was recorded in Dhamtari and Jagdalpur blocks with values of 27% and 20% respectively.

In unusable percentage was found high in Ambikapur and Jagdalpur block where 20% value recorded. While lowest percentage was recorded in Dhamtari block 19%. In case of correct+ usable percentage was recorded as comparatively lowest in Ambikapur and Jagdalpur block where value of 80% was observed. While highest value was found in Dhamtari with value of 81%.

The analysis for minimum temperature (Table 4) revealed that the forecast was 67% correct percentage for entire year comparatively high in Jagdalpur block while lowest values observed percentage was found in Ambikapur and Dhamtari blocks where 63% and 56% respectively. Usable percentage was found to be high (27%) in Dhamtari block while, lowest percentage of forecast was in Jagdalpur block (23%) followed by Ambikapur block (20%).

In unusable percentage was found comparatively high in Dhamtari bock (17%) and lowest in Ambikapur and Jagdalpur blocks. It was 14% and 13% respectively. In case of correct+usable percentage was observed comparatively high percentage in (87%) Jagdalpur block and lowest in Ambikapur and Dhamtari blocks with value of 86% and 83% respectively.

**Table 4:** Usability analysis of minimum temperature for different seasons compare with three blocks.

| S. No. | Pre monsoon (March-May) | | | | |
|---|---|---|---|---|---|
| | **Blocks** | **Correct (%)** | **Usable (%)** | **Unusable (%)** | **Correct+usable (%)** |
| 1. | Dhamtari | 39(42) | 30(33) | 23(25) | 69(75) |
| 2. | Ambikapur | 46(50) | 29(32) | 17(18) | 75(82) |
| 3. | Jagdalpur | 56(61) | 26(28) | 10(11) | 82(89) |
| | Total event = 92 | | | | |
| | **SW-monsoon (June-Sep)** | | | | |
| 1. | Dhamtari | 81(66) | 28(23) | 13(11) | 109(89) |
| 2. | Ambikapur | 91(75) | 22(18) | 9(07) | 113(93) |
| 3. | Jagdalpur | 91(75) | 25(20) | 6(05) | 116(95) |
| | Total events= 122 | | | | |
| | **Post monsoon (Oct-Dec)** | | | | |
| 1. | Dhamtari | 54(59) | 23(25) | 15(16) | 77(84) |
| 2. | Ambikapur | 63(69) | 15(16) | 14(15) | 78(85) |
| 3. | Jagdalpur | 62(67) | 10(11) | 20(22) | 72(78) |
| | Total events = 92 | | | | |
| | **Winter (Jan-Feb)** | | | | |
| 1. | Dhamtari | 32(54) | 16(27) | 11(19) | 48(81) |
| 2. | Ambikapur | 30(51) | 17(29) | 12(20) | 47(80) |
| 3. | Jagdalpur | 35(60) | 12(20) | 12(20) | 47(80) |
| | Total events = 59 | | | | |
| | **Annual (2021-22)** | | | | |
| 1. | Dhamtari | 206(56) | 97(27) | 62(17) | 303(83) |
| 2. | Ambikapur | 230(63) | 83(23) | 52(14) | 313(86) |
| 3. | Jagdalpur | 244(67) | 73(20) | 48(13) | 317(87) |
| | Total events = 365 | | | | |

### 3.5 Usability analysis of morning relative humidity for different seasons were compared between three blocks *viz*., Dhamtari, Ambikapur and Jagdalpur which is described as follows

The analysis for the morning relative humidity revealed that the forecast was 25% correct in highest Jagdalpur block and lowest percentage in Dhamtari and Ambikapur blocks was observed with value of 11% and 6% respectively.

From (Table 5) usable percentage was found highest with value of 27% in Jagdalpur block while, lowest percentage were found in Dhamtari and Ambikapur where the value observed were 26% and 16%, respectively. The results indicated the performance of morning relative humidity was high percentage with percentage of 78% in Ambikapur block in unusable category and lowest percentage was found in Dhamtari (63%) and Jagdalpur blocks (48%).

In case of (correct+usable) success percentage were found comparatively highest in Jagdalpur block where 52% value was recorded and lowest observed percentage was in Dhamtari and Ambikapur blocks with value of i.e., 37% and 22% respectively.

Study of usability analysis (Table 5) of morning relative humidity for comparatively basis was found in high correct percentage from Jagdalpur block (80%) while lowest success percentage was recorded in Dhamtari and Ambikapur blocks with value of 72% and 67%. In usable sole-category higher

percentage was found in Ambikapur block (21%) while lowest percentage was found in Dhamtari and Jagdalpur blocks (16%).

In case of unusable percentage was found high in Dhamtari and Ambikapur blocks while was (12%), while relatively lowest percentage found was in Jagdalpur (4%). Moreover, (Table 5) in correct+usable percentage sole-category highest percentage was found in Jagdalpur block value of 96% was observed while 88% lowest percentage of morning relative humidity was found in Dhamtari and Ambikapur blocks.

Study of table 5 usability analysis of morning relative humidity for comparatively basis was found in high correct percentage from Jagdalpur block (92%) while lowest success percentage was recorded in Dhamtari and Ambikapur blocks with value of 73% and 85%. In usable sole-category, highest percentage was found in Dhamtari block (13%) while relatively lowest percentage found was in Ambikapur and Jagdalpur block with value of 3% and 4% respectively.

In case of unusable percentage was found comparatively high percentage in Dhamtari block while was 14%, while lowest percentage was found in Ambikapur and Jagdalpur block with value of 12% and 4%. Moreover, in case of correct+usable percentage was high in Jagdalpur block where 96% value was observed while lowest percentage of morning relative humidity was found in Dhamtari block (86%) and Ambikapur block (88%).

It can be seen from Table 5 as comparatively correct percentage was high in (98%) Ambikapur block while lowest percentage was found recorded in Jagdalpur and Dhamtari blocks (97% and 93%). Relatively lowest percentage was observed during winter season for usable percentage in Ambikapur and Jagdalpur blocks where was 0% and 3%.while high percentage was observed in Dhamtari block (7%).

Moreover, comparatively unusable percentage was found high in Ambikapur block 2% and relatively lowest percentage was recorded in Dhamtari and Jagdalpur block was 0%. In case of (correct + usable) success percentage was found that the comparatively high value was found in Dhamtari and Jagdalpur blocks with value of 100% while lowest percentage found was (98%) in Ambikapur block.

It can be seen from Table 5, as comparatively correct percentage was high in (71%) Jagdalpur block while lowest percentage found was recorded in Dhamtari and Ambikapur blocks with value of 60% and 61%, respectively. In usable percentage found highest percentage observed was during entire year in Dhamtari block was 17%.While lowest percentage recorded was in Ambikapur and Jagdalpur blocks was 12% and 14%. Moreover, comparatively unusable percentage found was high in Ambikapur block with value of 27% and lowest percentage was recorded in Dhamtari and Jagdalpur blocks with value of 23% and 15%, respectively.

In case of morning relative humidity (correct + usable) success percentage was found with comparatively high value in Jagdalpur block 85% while lowest percentage found was in Ambikapur (73%) and Dhamtari blocks (77%).

**Table 5:** Usability analysis of morning relative humidity for different seasons compare with three blocks

| S. No. | Blocks | Correct (%) | Usable (%) | Unusable (%) | Correct+usable (%) |
|---|---|---|---|---|---|
| | | **Pre monsoon (March-May)** | | | |
| 1. | Dhamtari | 10(11) | 24(26) | 58(63) | 34(37) |
| 2. | Ambikapur | 5(06) | 15(16) | 72(78) | 20(22) |
| 3. | Jagdalpur | 23(25) | 25(27) | 44(48) | 48(52) |
| | | Total Event=92 | | | |
| | | **SW-monsoon (June- Sep)** | | | |
| 1. | Dhamtari | 88(72) | 20(16) | 14(12) | 108(88) |
| 2. | Ambikapur | 81(67) | 26(21) | 15(12) | 107(88) |
| 3. | Jagdalpur | 97(80) | 20(16) | 5(04) | 117(96) |
| | | Total Events= 122 | | | |
| | | **Post monsoon (Oct-Dec)** | | | |
| 1. | Dhamtari | 67(73) | 12(13) | 13(14) | 79(86) |
| 2. | Ambikapur | 78(85) | 3(03) | 11(12) | 81(88) |
| 3. | Jagdalpur | 84(92) | 4(04) | 4)04) | 88(96) |
| | | Total Events= 92 | | | |
| | | **Winter (Jan-Feb)** | | | |
| 1. | Dhamtari | 55(93) | 4(07) | 0(0) | 59(100) |
| 2. | Ambikapur | 58(98) | 0(0) | 1(02) | 58(98) |
| 3. | Jagdalpur | 57(97) | 2(03) | 0(0) | 59(100) |
| | | Total Events= 59 | | | |
| | | **Annual (2021-22)** | | | |
| 1. | Dhamtari | 220(60) | 60(17) | 85(23) | 280(77) |
| 2. | Ambikapur | 222(61) | 44(12) | 99(27) | 266(73) |
| 3. | Jagdalpur | 261(71) | 51(14) | 53(15) | 312(85) |
| | | Total Events= 365 | | | |

### 3.6 Usability analysis of evening relative humidity for different seasons were compared between three blocks *viz*., Dhamtari, Ambikapur and Jagdalpur which is described as follows

It can be seen from Table 6 as comparatively correct percentage was high in (56%) Ambikapur block while lowest percentage found was recorded in Jagdalpur and Dhamtari blocks with value of 40% and 38% respectively. In usable category highest percentage was observed during entire year in Jagdalpur block was 53%. While lowest percentage was recorded in Dhamtari and Ambikapur blocks with value of 48% and 36%, respectively.

Moreover, comparatively unusable percentage was found with high value in Dhamtari block 14% and lowest percentage was recorded in Ambikapur and Jagdalpur blocks was 8% and 7%, respectively. In case of Evening relative humidity (correct + usable) success percentage was found with comparatively high value in Jagdalpur block 93% while lowest percentage found was in Ambikapur block (92%) and Dhamtari blocks (86%).

Study of usability analysis (Table 6) has done of evening relative humidity for comparative basis. High correct percentage was found from Dhamtari block (44%) while lowest success percentage was recorded in Jagdalpur and Ambikapur blocks with value of 42% and 30%, respectively. In usable sole-category, percentage was high in Ambikapur block (47%) while lowest percentage was found in Jagdalpur and Dhamtari blocks where percentage found was 38% and

39% respectively. In case of unusable sole-category, percentage was found comparatively high in Ambikapur block which was 23% while lowest percentage found was in Jagdalpur and Dhamtari block with value of 20% and 17%.
Moreover, in correct+usable percentage category, percentage was high in Dhamtari block where 83% value was observed while lowest percentage was found in Jagdalpur and Ambikapur blocks where value were 80% and 77%.
Study of usability analysis of (Table 6) evening relative humidity for comparative basis was found in high correct percentage from Jagdalpur block (90%) while lowest success percentage was recorded in Ambikapur and Dhamtari blocks where percentage was 87% and 84%. In usable sole-category percentage found was high in Dhamtari block (13%) while lowest percentage was found in Jagdalpur and Ambikapur block with value of 8% and 9%, respectively.
In unusable sole-category percentage was found comparatively high in Jagdalpur block which was 7%, while lowest percentage found was in Dhamtari and Ambikapur blocks with value of 3% and 4% respectively. Moreover, correct+usable percentage was comparatively high in Ambikapur, Dhamtari and Jagdalpur block where values observed were 96%.97% and 98% for comparatively basis with not much difference.
The correct percentage analysed (Table 6) during winter season was found comparatively higher in Jagdalpur block 85% and lower in Ambikapur and Dhamtari block with value of 70% and 83%. Usable percentage was found to be lowest in Jagdalpur and Dhamtari block where was 8% and 10% while, highest percentage was 20% in Ambikapur block.
Unusable percentage was found comparatively high in Ambikapur block (10%) and lowest in Dhamtari and Jagdalpur block with value of 7% was observed with similar percentage. In case of correct+usable percentage was observed comparatively high percentage in Dhamtari and Jagdalpur blocks (93%) respectively and lowest in Ambikapur block 90%.
In entire year 2021-22 (Table 6) correct percentage analysed was found comparatively high in Jagdalpur block (61%) while lowest percentage was recorded in Ambikapur and Dhamtari block (58% and 59%), respectively. Usable percentage was found to be lowest in Jagdalpur block which was 29% while, high 30% was observed Dhamtari and Ambikapur blocks.
However, unusable percentage was in Jagdalpur, Dhamtari and Ambikapur blocks. It was found to have value of 10%, 11% and 12% respectively found comparative basis which was having not much difference. Analysed was (Table 6) the correct+usable percentage 88%, 89% and 90%, respectively. It observed shown that the comparatively have value of high percentage was found in Jagdalpur followed by Dhamtari and Ambikapur blocks.

**Table 6:** Usability analysis of evening relative humidity for different seasons compare with three blocks

| S. No. | Pre monsoon(March-May) | | | | |
|---|---|---|---|---|---|
| | **Blocks** | **Correct (%)** | **Usable (%)** | **Unusable (%)** | **Correct+usable (%)** |
| 1. | Dhamtari | 35(38) | 44(48) | 13(14) | 79(86) |
| 2. | Ambikapur | 52(56) | 33(36) | 7(08) | 85(92) |
| 3. | Jagdalpur | 37(40) | 49(53) | 6(07) | 86(93) |
| | | Total event=92 | | | |
| | **SW-monsoon(June- Sep)** | | | | |
| 1. | Dhamtari | 54(44) | 47(39) | 21(17) | 101(83) |
| 2. | Ambikapur | 37(30) | 57(47) | 28(23) | 94(77) |
| 3. | Jagdalpur | 51(42) | 46(38) | 25(20) | 97(80) |
| | | Total events=122 | | | |
| | **Post monsoon(Oct-Dec)** | | | | |
| 1. | Dhamtari | 77(84) | 12(13) | 3(03) | 89(97) |
| 2. | Ambikapur | 80(87) | 8(09) | 4(04) | 88(96) |
| 3. | Jagdalpur | 83(90) | 7(08) | 2(07) | 90(98) |
| | | Total events= 92 | | | |
| | **Winter(Jan-Feb)** | | | | |
| 1. | Dhamtari | 49(83) | 6(10) | 4(07) | 55(93) |
| 2. | Ambikapur | 41(70) | 12(20) | 6(10) | 53(90) |
| 3. | Jagdalpur | 50(85) | 5(08) | 4(07) | 55(93) |
| | | Total events= 59 | | | |
| | **Annual(2021-22)** | | | | |
| 1. | Dhamtari | 215(59) | 109(30) | 41(11) | 324(89) |
| 2. | Ambikapur | 210(58) | 110(30) | 45(12) | 320(88) |
| 3. | Jagdalpur | 221(61) | 107(29) | 37(10) | 328(90) |
| | | Total events= 365 | | | |

**3.7 Usability analysis of Wind Speed for different seasons were compared between three blocks *viz*., Dhamtari, Ambikapur and Jagdalpur which is described as follows**
Study of usability analysis (Table 7) of wind speed for comparatively basis was found in high correct percentage from Dhamtari block (75%) while lowest success percentage was recorded in Jagdalpur and Ambikapur blocks with value of was 74% and 60%.
In usable percentage found was high in Ambikapur block (38%) while lowest percentage was found in Dhamtari and Jagdalpur blocks which was 25% and 26%, respectively.
In unusable percentage was found comparatively high value in Ambikapur block which was 2%, while relatively lowest percentage was found in Dhamtari and Jagdalpur block (0%). Moreover, correct+usable percentage sole-category was comparative in Dhamtari and Jagdalpur blocks (100%). While lowest percentage was recorded in Ambikapur block (98%).
The analysis for the wind speed revealed that the forecast was 61% correct in highest Jagdalpur block while lowest percentage was obtained in Ambikapur and Dhamtari block (46% and 47%). From table 7 usable sole-category percentage found was 48% in Ambikapur block while, lowest percentage block was observed in Dhamtari and Jagdalpur was with value of 46% and 36%, respectively.

The results indicated the performance of wind speed. High percentage was found 7% unusable in Dhamtari block and lowest percentage was found in Ambikapur (6%) and Jagdalpur block (3%) respectively. In case of (correct+usable) sole-category success percentage was found comparatively highest in Jagdalpur block with value of 97% and lowest observed percentage was in Dhamtari and Ambikapur blocks (93% and 94%), respectively.

The correct percentage analysed during post monsoon season was found comparatively higher in Dhamtari block 100% and found has lower in Jagdalpur and Ambikapur blocks (98% and 99%). Usable percentage found was 2% in Jagdalpur block while, lowest percentage was observed in Dhamtari and Ambikapur blocks where observed value was 0% and 1%.

The results indicated the performance of wind speed unusable percentage was found in all blocks were was negligibal percentage, so not comparatively difference among all blocks. It can be seen from table 7 (correct+usable) success percentage was found comparatively similarly percentage in Dhamtari, Ambikapur and Jagdalpur blocks where was recorded 100% blocks respectively.

The correct percentage analysed table 7 during winter season was found comparatively higher in Dhamtari, Ambikapur and Jagdalpur blocks 100%. Usable percentage found was 0% in all blocks Dhamtari, Ambikapur and Jagdalpur.

The results indicated the performance of wind speed unusable percentage was found in all blocks negligible percentage, so not comparatively difference among all block. It can be seen from table 7 (correct+usable) that success percentage was found comparatively similarly percentage in all blocks *viz*; Dhamtari, Ambikapur and Jagdalpur block which was recorded 100%, respectively.

The correct percentage analysed (Table 7) during entire year was found comparatively higher in Jagdalpur block which 80% where as lowest percentage was found in Dhamtari (76%) and Ambikapur blocks (72%). Usable percentage found was high in Ambikapur block (26%) while in Dhamtari and Jagdalpur blocks (22% and 19%), lower percentage were recorded.

The results indicated the performance of wind speed unusable percentage was found to be high in (2%) Dhamtari and Ambikapur blocks while lowest percentage found (1%) in Jagdalpur. It can be seen from table 7 (correct+usable) that success percentage was found comparatively high percentage in Ambikapur block with value of 99% and lowest was recorded in Dhamtari and Ambikapur blocks (98%).

**Table 7:** Usability analysis of wind speed for different season compare with three blocks.

| S. No. | Pre monsoon (March- May) | | | | |
|---|---|---|---|---|---|
| | **Blocks** | **Correct (%)** | **Usable (%)** | **Unusable (%)** | **Correct+usable (%)** |
| 1. | Dhamtari | 69(75) | 23(25) | 0(0) | 92(100) |
| 2. | Ambikapur | 55(60) | 35(38) | 2(02) | 90(98) |
| 3. | Jagdalpur | 68(74) | 24(26) | 0(0) | 92(100) |
| | Total Event=92 | | | | |
| | **SW-monsoon (June-Sep)** | | | | |
| 1. | Dhamtari | 58(47) | 56(46) | 8(07) | 114(93) |
| 2. | Ambikapur | 56(46) | 59(48) | 7(06) | 115(94) |
| 3. | Jagdalpur | 74(61) | 44(36) | 4(03) | 118(97) |
| | Total Events= 122 | | | | |
| | **Post monsoon (Oct-Dec)** | | | | |
| 1. | Dhamtari | 92(100) | 0(0) | 0(0) | 92(100) |
| 2. | Ambikapur | 91(99) | 1(01) | 0(0) | 92(100) |
| 3. | Jagdalpur | 90(98) | 2(02) | 0(0) | 92(100) |
| | Total Events= 92 | | | | |
| | **Winter (Jan-Feb)** | | | | |
| 1. | Dhamtari | 59(100) | 0(0) | 0(0) | 59(100) |
| 2. | Ambikapur | 59(100) | 0(0) | 0(0) | 59(100) |
| 3. | Jagdalpur | 59(100) | 0(0) | 0(0) | 59(100) |
| | Total Events= 59 | | | | |
| | **Annual (2021-22)** | | | | |
| 1. | Dhamtari | 278(76) | 79(22) | 8(02) | 357(98) |
| 2. | Ambikapur | 261(72) | 95(26) | 9(02) | 356(98) |
| 3. | Jagdalpur | 291(80) | 70(19) | 4(01) | 361(99) |
| | Total Events= 365 | | | | |

**3.8 Usability analysis of Rainfall for different seasons were compared between three blocks *viz.*, Dhamtari, Ambikapur and Jagdalpur which is described as follows**

It can be seen from Table 8 that for Ambikapur block that out of 100% of rainfall forecast of less than 10 mm during premonsoon season, comparatively high in 93% were found correct while 78% and 91% were found *i.e.*, Jagdalpur and Dhamtari block. Usability analysis of rainfall forecast was maximum in Jagdalpur block which there was 14% while minimum event was found in Dhamtari and Ambikapur blocks 6% each. In case of unusable percent there were high 8% Jagdalpur block while lowest in Dhamtari and Ambikapur blocks 3 and 1%, respectively. Moreover, in correct+usable of rainfall forecast was high in Ambikapur block (99%) while lowest in Jagdalpur and Dhamtari blocks were 92% and 12%.

In case of rainfall greater than 10 mm, correct was found none percent. All blocks and usable percent was found in 100% high for Ambikapur block while Dhamtari and Jagdalpur block was recorded none percent. Unusable percent was maximum recorded in Jagdalpur block 100% while Dhamtari and Ambikapur block was found none percent. In correct + usable percent in high 100% in Ambikapur block than Dhamtari and Jagdalpur blocks none percent.

From (Table 8) Dhamtari block that out of 100 percent of rainfall forecast of less than 10 mm during monsoon season, comparatively high 19% were found correct while 15% and 10% were found for recorded Ambikapur and Jagdalpur blocks, respectively. Usability analysis of rainfall forecast was maximum in Ambikapur and Jagdalpur block where 14% were recorded while minimum percent was found in Dhamtari

block with 13%.

In case of unusable 76% in Jagdalpur block while lowest was found in Dhamtari and Ambikapur block with 68% and 71%. Moreover, in correct+usable of rainfall forecast was high in Dhamtari block (32%) while lowest in Ambikapur and Jagdalpur block (29% and 24%). In case of rainfall greater than 10 mm, correct was found high with 31% in Dhamtari block while lowest was in recorded Jagdalpur and Ambikapur blocks with 10% and 11%, respectively. Usable percent was found in 23% high for Dhamtari block while Ambikapur and Jagdalpur blocks recorded 22% and 18%, respectively.

Unusable percent was recorded maximum in Jagdalpur block with 73% while Dhamtari and Ambikapur blocks observed 46% and 67%. In correct + usable percent high 46% were observed in Dhamtari block than Jagdalpur and Ambikapur blocks (28% and 33%), respectively.

It can be seen from table 8 comparatively basis of rainfall forecast of less than 10 mm during post monsoon season in maximum percent were found in (83%) Ambikapur block while minimum percent was recorded in Jagdalpur and Dhamtari block (71% and 79%). Usable percent were found in maximum 8% (Jagdalpur block) while minimum percent was recorded in 7% (Ambikapur block) and 5% (Dhamtari block). Unusable percent for maximum Jagdalpur block were 21% and rest minimum in Ambikapur and Dhamtari block with 10% and 16%. Moreover, correct + usable percent was high in Ambikapur blocks 9% and lowest percent was recorded in 84% (Dhamtari block) and 79% (Jagdalpur block).

In case of rainfall forecast of greater than 10 mm, correct was found with high 100% in Ambikapur and Jagdalpur blocks while none percent was recorded in Dhamtari block. Comparative usable percent was found in 67 high percentage for Dhamtari block while none percent was found in Ambikapur and Jagdalpur blocks. Unusable percent comparatively was maximum recorded in Dhamtari block 33% while Ambikapur and Jagdalpur block none forcast was observed. Moreover, correct + usable percent comparatively was found high in Ambikapur and Jagdalpur blocks 100% while lowest 67% was recorded in Dhamtari block.

Comparatively basis of rainfall forecast of less than 10 mm (Table 8) during winter season in maximum percent was found in (95%) block while minimum percent was recorded in Jagdalpur and Ambikapur blocks 88% and 81%. Usable was found in maximum 5% (Ambikapur and Jagdalpur blocks) while minimum was recorded in 2% (Dhamtari block). Unusable percent for maximum Ambikapur block in 14% and rest minimum in Jagdalpur block (7%) and Dhamtari block (3%). Moreover, correct +usable percent was high in Dhamtari block (97) and lowest percent was recorded in 93 (Jagdalpur block) and 86 (Ambikapur block). In case of rainfall forecast of greater than 10 mm, correct, usable, unusable and correct+usable was found none percent in all block Dhamtari, Ambikapur and Jagdalpur blocks.

Entire year (2021-22), table 8 from Dhamtari block that out of 100 percent of rainfall forecast of less than 10 mm, comparatively high 70% were found correct while, 68% and 63% were found lowest i.e., Ambikapur and Jagdalpur blocks. Usability analysis of rainfall forecast was high in Jagdalpur block where was 10% lowest percent was recorded in Dhamtari and Ambikapur block it was 7% and 8%, respectively. In case of unusable percent was high in 27 Jagdalpur block while lowest in Dhamtari and Ambikapur blocks where was 23% and 24%. Moreover, in correct+usable of rainfall forecast was high in Dhamtari block (77%) while lowest was in Ambikapur and Jagdalpur block 76% and 73%.

In case of rainfall greater than 10 mm, correct was found high 29% in Dhamtari block while lowest was recorded Jagdalpur block 11% and Ambikapur block 13% respectively and usable percent was found in 26 high percent for Dhamtari block while Ambikapur and Jagdalpur blocks was recorded in 23% and 16%. Unusable percent was maximum recorded in Jagdalpur block 73% while Dhamtari and Ambikapur block was observed 45% and 64%. Moreover, correct + usable percent in high 55% in Dhamtari and lowest Ambikapur and Jagdalpur block 36% and 27%.

**Table 8:** Usability analysis of rainfall for different season compare with three blocks

| **Pre monsoon season** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No.** | **Blocks** | **Correct (%)** | | **Usable (%)** | | **Unusable (%)** | | **Correct+usable (%)** | |
| | | **<10mm** | **>10mm** | **<10mm** | **>10mm** | **<10mm** | **>10mm** | **<10mm** | **>10mm** |
| 1. | Dhamtari | 84(91) | 0(0) | 5(06) | 0(0) | 3(03) | 0(0) | 89(97) | 0(0) |
| 2. | Ambikapur | 85(93) | 0(0) | 5(06) | 1(100) | 1(01) | 0(0) | 90(99) | 1(100) |
| 3. | Jagdalpur | 69(78) | 0(0) | 12(14) | 0(0) | 7(8) | 4(100) | 81(92) | 0(0) |
| | Total event = 92 | | | | | | | | |
| | **SW-monsoon season** | | | | | | | | |
| 1. | Dhamtari | 16(19) | 12(31) | 11(13) | 9(23) | 56(68) | 18(46) | 27(32) | 21(46) |
| 2. | Ambikapur | 13(15) | 4(11) | 12(14) | 8(22) | 60(71) | 25(67) | 25(29) | 12(33) |
| 3. | Jagdalpur | 7(10) | 5(10) | 10(14) | 9(18) | 54(76) | 37(73) | 27(24) | 14(28) |
| | Total event = 122 | | | | | | | | |
| | **Post monsoon season** | | | | | | | | |
| 1. | Dhamtari | 70(79) | 0(0) | 5(05) | 2(67) | 14(16) | 1(33) | 75(84) | 2(67) |
| 2. | Ambikapur | 76(83) | 1(100) | 6(07) | 0(0) | 9(10) | 0(0) | 82(90) | 1(100) |
| 3. | Jagdalpur | 65(71) | 1(100) | 7(08) | 0(0) | 19(21) | 0(0) | 72(79) | 1(100) |
| | Total Events =92 | | | | | | | | |
| | **Winter season** | | | | | | | | |
| 1. | Dhamtari | 56(95) | 0(0) | 1(2) | 0(0) | 2(03) | 0(0) | 57(97) | 0(0) |
| 2. | Ambikapur | 48(81) | 0(0) | 3(05) | 0(0) | 8(14) | 0(0) | 51(86) | 0(0) |
| 3. | Jagdalpur | 52(88) | 0(0) | 3(05) | 0(0) | 4(07) | 0(0) | 55(93) | 0(0) |
| | Total event = 59 | | | | | | | | |
| | **Annual season** | | | | | | | | |
| 1. | Dhamtari | 226(70) | 12(29) | 22(07) | 11(26) | 75(23) | 19(45) | 248(77) | 23(55) |
| 2. | Ambikapur | 222(68) | 5(13) | 26(08) | 9(23) | 78(24) | 25(64) | 248(76) | 14(36) |
| 3. | Jagdalpur | 193(63) | 6(11) | 32(10) | 9(16) | 84(27) | 41(73) | 225(73) | 15(27) |
| | Total event = 365 | | | | | | | | |

## 4. Conclusion

In all blocks, Skill score was found highest in Ambikapur block for rainfall, maximum temperature, minimum temperature and wind speed. Whereas, highest usability success percentage was found in Jagdalpur block i.e. 85% (RH-I), 87% (Tmix), 90% (RH-II) and 99% (wind speed) respectively for entire period. However, all parameters were reported relationship for the annual basis at all three blocks (i.e., D Dhamtari, Ambikapur and Jagdalpur) significant or highly significant.

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