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Validation of agro-meteorological rainfall forecasted to twelve blocks of Guntur district of South Coastal Andhra Pradesh

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Abstract
In this article an attempt has been made to validate the month and season wise rainfall forecast issued to the 12 blocks of the Guntur district of South Coastal Andhra Pradesh for 2021-2022 by using skill score analysis. The skill score of the different blocks during south west monsoon (June-September) period indicated that the highest skill was observed with Krosuru block (86.9%) followed by Guntur block (86.2%) but lowest was noticed with Tenali (78.7%) followed by Macharla (81.2%) respectively. Percent skill of North East monsoon (October-December) indicated that the Macharla, Krosuru and Narsaraopet (95.6%) recorded highest skill score followed by Vinukonda and Piduguralla (93.4%) while lowest was observed in Tenali (83.4%) followed by Ponnuru block (83.6%) respectively. During entire monsoon period Krosuru (91.3%) followed by Narsaraopet (89.7%) and Vinukonda (88.9%) recorded highest skill score while lowest was noticed with Tenali block (81.1%) followed by Ponnuru block & Repalle block (84.4%) respectively and the percent deviation of forecasted rainfall from actual during south west monsoon was highest in Vinukoda block (192%), during north east monsoon was highest in Tenali block (-49%) and entre period was highest in Vinukonda block (109%). The skill score of entire district of Guntur during south west monsoon, north east monsoon and entire monsoon period indicated that 73.9%, 72.6% and 73.2 % respectively and that the percent departure of forecasted rain from actual of entire Guntur district indicated that -56%, -73% and -62% respectively.

Keywords: Blocks, validation, skill sore, percent departure, actual and normal rainfall

Introduction
The tropical country like India is completely depending on monsoon rains for agricultural production and productivity of different crops in their specific agro-climatic situations of the country. The crops, cropping pattern and cropping systems are decided by the monsoon arrival and its distribution in their respective agro-climatic region. Not only monsoon rain but also its timely onset, distribution intensity, with drawl and spread over the country or the region are very important factors in deciding the production and productivity of agricultural crops during the *kharif* and *rabi*. The unfavorable weather conditions such as untimely rains, floods and drought drastically affect the agricultural production in the region and in turn create a distress in farmer's economy. Andhra Pradesh receives annual rainfall of 940 mm, out of which 66% is received through south west monsoon (June-September) and 24% by north east monsoon (October-December) respectively. 12 blocks of Guntur district of Coastal Andhra Pradesh comes under the Krishna agro-climatic zone of Andhra Pradesh, and that the production and productivity of crops in this region also influenced by the monsoon system. These blocks of Guntur district also experienced with the south west and north east monsoons during entire crop growing season. In this context, the India metrological department providing the medium range weather forecast on biweekly basis from regional met center Amaravathi i.e. on every Tuesday and Friday. Keeping in view an attempt has been made to validate month wise, season wise rainfall forecast issued to 12 blocks of Guntur district (District as whole) of south coastal Andhra Pradesh by adopting skill score analysis.

Materials and Methods
Guntur is a large city and the administrative headquarters of the district, located in the northeastern part of Andhra Pradesh, India. Situated about 60 kilometers west of the Bay of Bengal and is a very important economic center of the country famous for cotton, tobacco,

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chilly and other industries. It lies between 16^018^1 N latitude and 80^029^1 E longitude with MSL of above 33m. Regional met center, IMD located at VIT-University, Amaravathi in association with CWC, Vizag providing the medium range weather forecast to the 12 blocks of Guntur district of south coastal Andhra Pradesh viz., Guntur, Tenali, Vinikonda, Pidugurall, Krosuru, Macharla, Mangalagiri, Narasaraopet, Ponnuru, Repalle, Sattenapalle and Bapatla in addition to the district forecast on biweekly basis i.e. on every Tuesday and Friday. The rainfall forecast issued to the above blocks and district were analyzed for skill percentage and validation of quantitative forecasted rainfall (mm) by using actual and normal rainfall data collected from respective met centers of the 12 blocks under Gramin Krishi Mausam Sewa (GKMS) scheme, Regional Agril. Research Station, Lam, Guntur. Skill score was calculated for the forecasted rain by using the formula presented below

Skill score (%) = YY+NN//YY+YN+NY+NN

Where,
YY= Rainfall Predicted/forecasted and actually observed.
YN=Rainfall Predicted /forecasted but actually not observed.
NY= Rainfall not Predicted/forecasted but actually observed.
NN=Rainfall not Predicted/forecasted nor observed.

Results and Discussion
Skill score analysis of different blocks and entire district
The skill score of the different blocks of the Guntur district of south coastal Andhra Pradesh analyzed by using skill score analysis method and that the results were presented in the table-1 & Fig.1 and that the skill of south west monsoon (June-September) period indicated that the highest skill was observed with Krosuru block (86.9%) followed by Guntur block (86.2%) but lowest was noticed with Tenali (78.7%) followed by Macharla (81.2%) respectively. Percent skill of north east monsoon (October-December) indicated that the Macharla, Krosuru and Narsaraopet (95.6%) recorded highest followed by Vinukonda and Piduguralla (93.4%) while lowest was observed in Tenali (83.4%) followed by Ponnuru block (83.6%) respectively. During entire monsoon period Krosuru (91.3%) followed by Narsaraopet (89.7%) and Vinukonda (88.9%) recorded highest skill score while lowest was noticed with Tenali block (81.1%) followed by Ponnuru block & Repalle block (84.4%) respectively. The percent variation in the skill score of the different blocks might be due to the temporal and special variation in the distribution of rainfall and that these results are similar to that of Ratnam *et al.*, (2018) [4].
Skill score analysis of entire Guntur district of south coastal Andhra Pradesh was also validated by using skill score analysis developed by Rana *et al.*, (2013) [1] and that the skill of south west monsoon, north east monsoon and entire monsoon period indicated 73.9%, 72.6% and 73.2% respectively and that the results were depicted in Table.1 & Fig.1.

Table 1: Month and season wise Skill Score (%) of rainfall forecasted to 12 blocks of Guntur district of south coastal Andhra Pradesh

| Name of the block & district	Jun	Jul	Aug	Sept	SW Monsoon	Oct	Nov	Dec	NE Monsoon	Monsoon Period
Guntur District	86.7	58.1	83.9	66.7	73.9	64.5	73.3	80.0	72.6	73.2
Guntur Block	90.0	83.9	77.4	93.3	86.2	90.3	80.0	93.5	87.9	87.0
Tenali Block	80.0	77.4	83.9	73.3	78.7	90.3	66.7	93.5	83.5	81.1
Vinukonda Block	96.7	74.2	83.9	83.3	84.5	100.0	83.3	96.8	93.4	88.9
Piduguralla Block	86.7	83.9	83.9	76.7	82.8	90.3	90.0	100.0	93.4	88.1
Krosuru Block	86.7	83.9	87.1	90.0	86.9	96.8	90.0	100.0	95.6	91.3
Macherla Block	86.7	80.6	77.4	80.0	81.2	100.0	86.7	100.0	95.6	88.4
Mangalgiri Block	93.3	74.2	80.6	80.0	82.0	90.3	86.7	96.8	91.3	86.6
Narasarao Peta Block	93.3	77.4	77.4	86.7	83.7	93.5	93.3	100.0	95.6	89.7
Ponnuru Block	86.7	80.6	87.1	86.7	85.3	83.9	73.3	93.5	83.6	84.4
Repalle Block	86.7	74.2	87.1	80.0	82.0	93.5	70.0	96.8	86.8	84.4
Sattenapalle Block	86.7	74.2	83.9	86.7	82.9	83.9	80.0	96.8	86.9	84.9
Bapatla Block	90.0	80.6	80.6	86.7	84.5	93.5	63.3	96.8	84.5	84.5
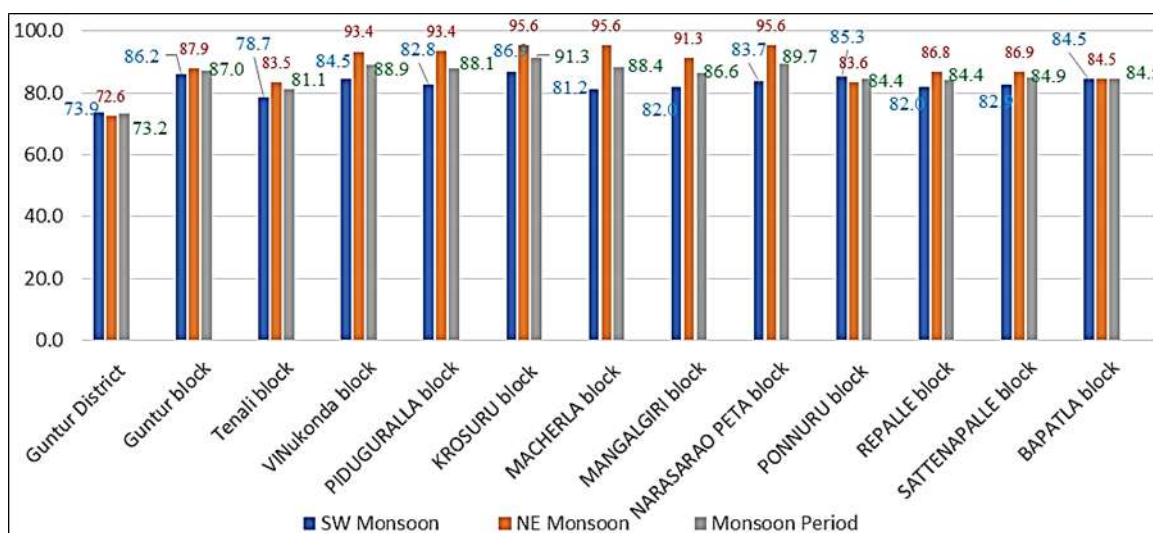
Fig 1: Monsoon wise Skill Score (%) of rainfall forecasted to 12 blocks

Quantitative validation of rainfall forecasted to different blocks of Guntur district and District as a whole
Quantitative forecasted rainfall validation was calculated in accordance with the Varshenya *et al.*, (2008) [3]. For the year 2021-2022, the Percent deviation of forecasted rainfall from actual and normal rainfall of 12 blocks of Guntur district and district as whole during south west monsoon (June-September), north east monsoon and entire monsoon period of Krishna agro-climatic zone of south coastal Andhra Pradesh were worked out and were furnished in the tables and Figures.

Percent departure of forecasted rainfall from actual and normal during South West, North east and entire monsoon period
Percent deviation of forecasted rainfall of different blocks and district as a whole from actual and normal was discussed in this para and that the results were presented in the table 2&3 & Fig.2. Among the blocks the percent deviation of forecasted rainfall from actual during south west monsoon was highest in Vinukoda block (192%) followed by Krosuru block (97%). While the deviation from normal it was highest for Vinukoda block (90%) followed by Bapatla (79%) and that the entire district indicated that -56% & -66% respectively.

The percent deviation of forecasted rainfall from the actual and its normal during North East monsoon (June-September) period indicated that for Guntur district it was 73.4% & -71.1% respectively (Table 2 and Fig.3). Among the blocks the percent deviation from actual was highest with Tenali (-49%) followed by Krosuru (-46%). While the deviation from normal it was highest for Tenali (-37%) followed by Vinukonda (36%) Table 3 & Fig.3).

The percent deviation of forecasted rainfall from the actual and its normal of Guntur district and its blocks during the entire monsoon period (i.e., from June-December) indicated that for Guntur district it was -62% and -67% respectively (Table 2 & Fig 4) and among the blocks the percent deviation from actual was highest with Vinukonda (109%) followed by Sattenapalle (-59%). While the deviation from normal it was highest for Vinukonda (65%) followed by Sattenapallae (-60%) and these results were presented in Table 3 & Fig.4.

The percent deviation of forecasted rainfall from the actual and its normal of the different blocks and Guntur district might be due to the temporal and special variation in the distribution of rainfall and that these results are in conformation with that of Shinde *et al.*, (2017) [2] and Ratnam *et al.*, (2018) [4].

Table 2: Month and season wise validation of quantitative rainfall (mm) forecast for the Guntur district of south coastal Andhra Pradesh

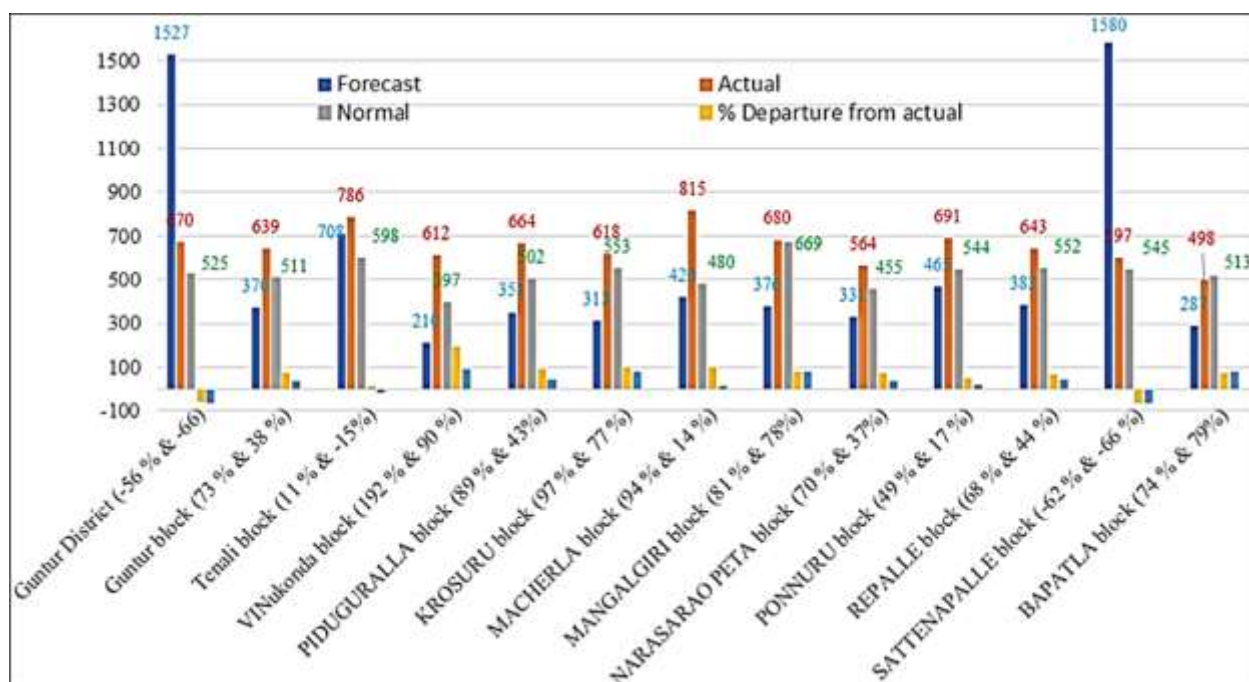| Season/Month	Forecast RF	Actual RF	Normal RF	% Departure from actual	% Departure from normal
June	240	85	86	-65	-64
July	623	214	142	-66	-77
August	279	222	152	-21	-46
Sept	385	150	145	-61	-62
SW Monsoon	1527	670	525	-56	-66
October	347	60	131	-83	-62
November	410	150	82	-64	-80
December	35	1	16	-97	-53
NE Monsoon	792	210	229	-73	-71
Monsoon Period	2319	881	754	-62	-67

Fig 2: Season wise validation of quantitative rainfall (mm) forecast for the 12 blocks of the Guntur district and district as a whole for during South West monsoon

Table 3: Month and season wise validation of quantitative rainfall (mm) forecast for the 12 blocks of the Guntur district of south coastal Andhra Pradesh

Season/Month	FRF	ARF	NRF	% Departure from ARF	% Departure from NRF	FRF	ARF	NRF	% Departure from ARF	% Departure from NRF	FRF	ARF	NRF	% Departure from ARF	% Departure from NRF	FRF	ARF	NRF	% Departure from ARF	% Departure from NRF	FRF	ARF	NRF	% Departure from ARF	% Departure from NRF	FRF	ARF	NRF	% Departure from ARF	% Departure from NRF
	1. Guntur					**2. Tenali**					**3. Vinukonda**					**4. Piduguralla**					**5. Krosuru**					**6. Macherla**				
Jun	96	99	89	3	-8	152	124	91	-18	-40	61	45	71	-26	17	72	104	75	44	4	91	87	92	-4	1	86	132	76	53	-12
Jul	111	210	145	89	31	180	258	168	43	-7	65	219	91	235	40	134	183	136	36	1	118	177	155	50	31	157	212	126	35	-20
Aug	48	244	143	407	198	102	290	180	185	78	21	189	100	816	386	41	184	149	348	264	34	200	170	488	401	53	301	131	471	149
Sept	115	86	134	-25	17	274	115	159	-58	-42	63	159	135	153	114	103	194	142	88	37	70	153	137	119	95	124	170	147	37	19
SWM	370	639	511	73	38	708	786	598	11	-15	210	612	397	192	90	351	664	502	89	43	313	618	553	97	77	420	815	480	94	14
Oct	81	64	122	-21	50	75	52	131	-31	76	39	41	136	5	249	63	38	112	-40	78	54	26	123	-51	130	35	29	112	-19	217
Nov	192	148	77	-23	-60	228	137	84	-40	-63	110	150	83	36	-25	160	129	53	-19	-67	137	84	56	-39	-59	161	136	55	-15	-66
Dec	45	1	17	-97	-62	64	0	16	-100	-75	26	2	18	-93	-29	12	1	7	-96	-36	12	0	5	-100	-55	10	0	11	-100	3
NEM	318	213	216	-33	-32	366	189	232	-49	-37	175	192	237	10	36	234	167	172	-29	-26	202	110	185	-46	-8	206	165	178	-20	-14
MP	688	852	727	24	6	1074	975	830	-9	-23	384	804	635	109	65	584	831	674	42	15	515	728	738	41	43	626	979	658	56	5
	7. Mangalagiri					**8. Narasaraopeta**					**9. Ponnuru**					**10. Repalle**					**11. Sattenapalle**					**12. Bapatla**				
Jun	83	66	115	-21	38	66	42	80	-36	22	106	61	95	-42	-10	79	103	87	30	10	90	79	92	-12	2	47	74	77	57	62
Jul	153	204	196	34	28	95	257	118	172	25	115	191	152	65	32	77	177	138	129	80	1317	204	165	-85	-88	75	26	116	-66	54
Aug	43	233	201	443	369	48	170	126	255	164	72	272	151	276	109	87	171	155	97	78	53	185	162	250	205	55	223	159	306	190
Sept	97	177	157	82	62	123	95	130	-23	6	172	168	145	-3	-16	139	192	171	38	23	120	130	127	8	6	109	174	162	60	48
SWM	376	680	669	81	78	331	564	455	70	37	465	691	544	49	17	382	643	552	68	44	1580	597	545	-62	-66	287	498	513	74	79
Oct	65	73	128	12	98	58	70	123	21	112	71	86	123	22	75	67	76	184	13	174	71	67	120	-6	71	57	104	152	83	168
Nov	161	66	63	-59	-61	121	148	96	22	-21	223	205	95	-8	-58	299	241	128	-19	-57	158	87	66	-45	-58	263	291	134	11	-49
Dec	34	0	13	-100	-62	33	3	18	-91	-45	49	0	22	-100	-55	29	0	29	-99	-1	35	1	11	-98	-68	47	0	31	-100	-34
NEM	240	138	204	-42	-15	212	221	237	4	12	342	292	240	-15	-30	395	318	340	-20	-14	264	154	198	-41	-25	366	395	316	8	-14
MP	616	818	873	33	42	543	785	691	44	27	807	983	783	22	-3	778	960	892	23	15	1843	752	743	-59	-60	653	892	829	37	27

*FRF-Forecasred Rainfall *ARF-Actual Rainfall *NRF-Normal Rainfall *SWM-South West Monsoon *NEM-North East Monsoon *Monsoon Period
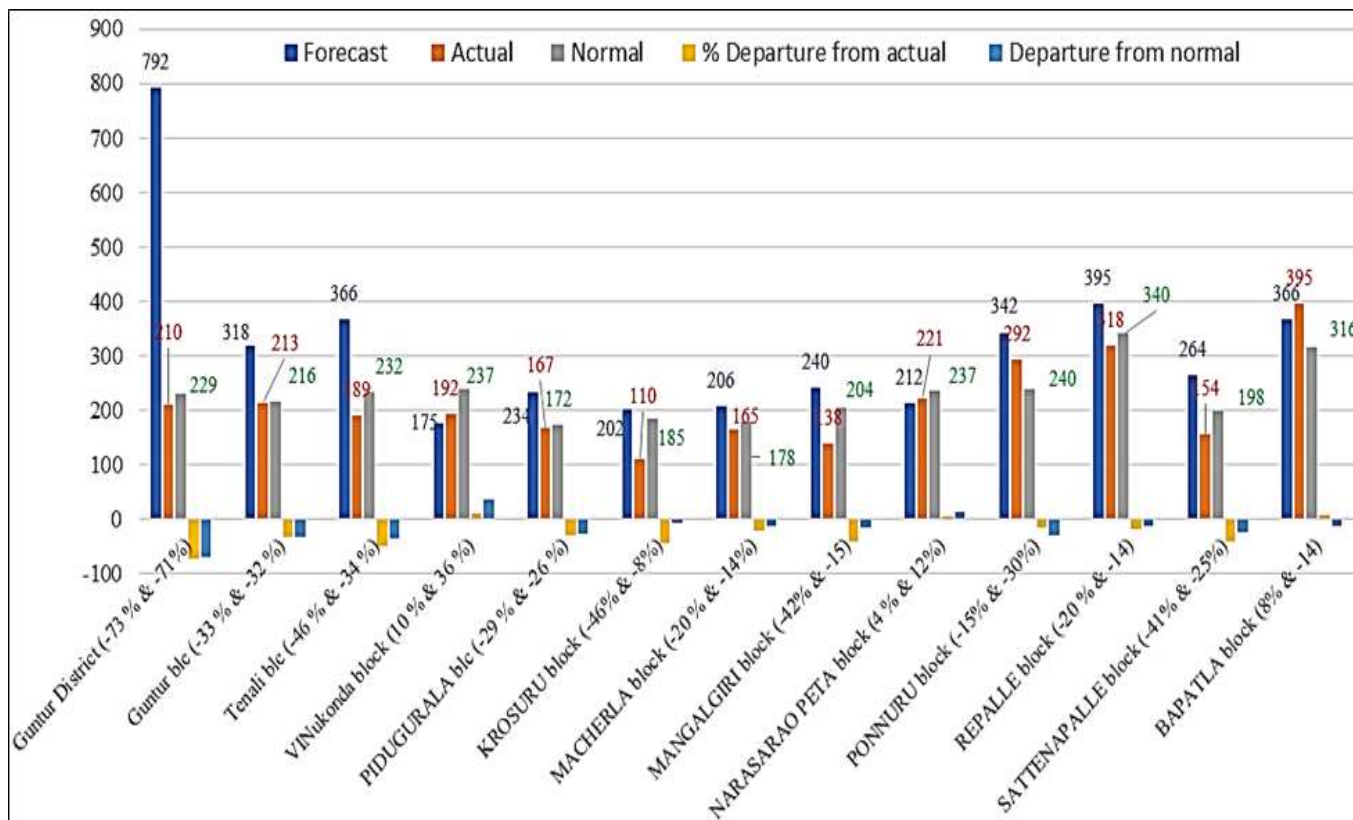
Fig 3: Season wise validation of quantitative rainfall (mm) forecast for the 12 blocks of the Guntur district and district as a whole for during North East monsoon
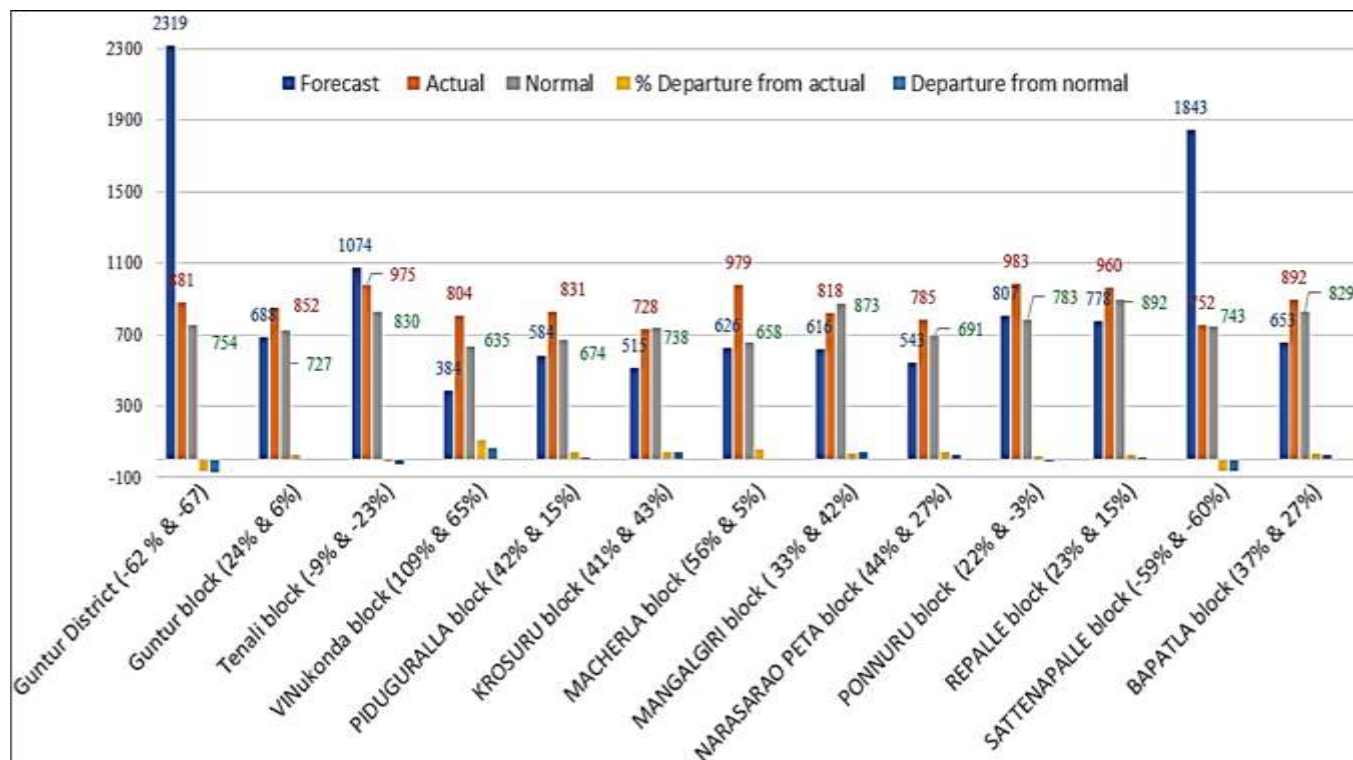

Fig 4: Season wise validation of quantitative rainfall (mm) forecast for the 12 blocks of the Guntur district and district as a whole for during Entire monsoon

Conclusion

References
1. Rana RS, Sood R, Adity, Shekhar J. Indian Journal of Agricultural Sciences. 2013;83(12):1357-1363.
2. Shinde PB, Dakhore KK, Warkar DP. Journal of Agricultural Research Technology. 2017;42(3):089-093.
3. Varshenya MC, Vaidya VB, Vyaspandey Shekh AM, Karande BI. Validation of astro-meteorological rainfall forecast for Gujarat. Journal of Agrometeorology. 2008;(Special-Issue-Part 2):345-348.
4. Ratnam M, Vindya S, Venkata Rao P. Validation of agro-meteorological rainfall forecast for Krishna agro-climatic zone of Andhra Pradesh. International Journal of Agriculture Sciences. 2018;10(22):7491-7492.