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Estimation of temperature error structure for temperature under Gramin Krishi Mausam Sewa project for Tehri region of Garhwal Himalayas

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Abstract

Growth and development of crops are dependent on prevailing weather/climatic conditions. To achieve higher yield, congenial environmental/weather condition is important. The AMFU, Ranichauri is involved in providing weather based agro advisories to the farmers of hilly region of Uttarakhand through various means. The present work was carried out at AMFU, Ranichauri to estimate the error structure for minimum and maximum temperature for Tehri region of Garhwal Himalayas. The study revealed that success probability for both minimum and maximum temperature was maximum for post monsoon season (October-December) and minimum for summer season (March-May). The principle crops of the study site are millets, Amaranth, Pulses, Wheat, Vegetables etc.

Keywords: Weather, agro advisories. AMFU, probability

Introduction

The agricultural crops cultivated in Uttarakhand state are clearly distinguished at alpine, subalpine, temperate and subtropical regions. The principle farm products comprises of Rice, wheat, sugarcane, Lentil etc, rapeseed mustard, mango, guava, litchi etc in *tarai* and *bhabhar* regions; rice, wheat, potato, finger millet, cole crops, plum, peaches etc in mid hills (1000-1500 m amsl); Amaranth, finger millet, cole crops, potatoes, apple, peach, plum, stone fruits etc in high hills (1500-2400 m amsl) and Amaranth, buckwheat, peas, cole crops, apple, potato in very high hills (> 2400 m amsl). Weather not only effects the yield of field/horticulture crops but also influence the yield of livestock. The major livestock's for Tarai & Bhabhar region are Buffalo and cattle and for mid & high hills are cattle, sheep and goat. For very high hills major livestock are sheep and goat (Anonymous 2012) ^[1]. The principle crops of the study site includes Finger millet, Barnyard millet, Amaranth, Arhar, Ricebean, Lentil, Wheat, Tomato, capsicum, cauliflower, cabbage, Broccoli, Potato, onion etc. The India Meteorological Department (IMD) in the year 1932 established Agriculture Meteorology division to meet out the demands of farmers. Later in the year 1945 IMD started Farmers Weather Bulletin to cater the needs of farmers. In the year 1988, Department of Science and Technology (DST) established National Centre for Medium Range Weather Forecasting (NCMRWF) at New Delhi to provide agro advisories to the farmers (Reddy, 2011) ^[3]. In the year 2008, District Agrometeorological Advisory Service (DAAS) was started (Now known as Gramin Krishi Mausam Sewa (GKMS)) to provide agro advisories to the farmers at district/block level through Agro Met Field Units (AMFU's). Presently, there are three AMFU's in Uttarakhand located at Ranichauri, Tehri Garhwal (Covering eight hilly districts namely Tehri Garhwal, Uttarkashi, Chamoli, Rudrapur, Pithoragarh, Almora, Bageshwar and Champawat districts), Pantnagar, U.S. Nagar (Covering U.S. Nagar and Nainital districts) and Roorkee (covering Haridwar, Dehradun and Pauri Garhwal districts). The agro-advisories prepared by AMFU's after incorporating the forecasted data is provided to the beneficiaries. Also, comparison is made between the forecasted data and actual data for different weather parameters like rainfall, minimum temperature, maximum temperature, Minimum Relative humidity. Maximum relative humidity, Wind speed, wind direction and cloud cover. Here an attempt has been taken to compare forecasted data and actual data for minimum and maximum temperature of Tehri District and also some of the successful forecast that benefitted the farming community is also reported.

Materials and Methods

The present study was carried out at AMFU, Ranichauri located at College of Forestry, Ranichauri, VCSGUUHF, Tehri Garhwal, Uttarakhand. The AMFU, Ranichauri is providing weather based agro advisories to eight hilly districts of Uttarakhand on every Tuesday and Friday through various channels as depicted in Figure 1. Monitoring of farmers field is done to know about the crop status and feedback. The value added weather forecast is provided by the Meteorological Centre (MC), Dehradun on every Tuesday and

Friday. This data is used in preparation of weather based agro-advisories at district level. The bulletin (advisory) is then sent to the user through different means as shown in Figure 1. Also text message in regional language (Hindi) is sent to the registered farmers/users on every Tuesday and Friday. The feedback received from the users is taken care and problems faced by the farming community is tried to be resolved after discussing with the experts. For calculation of error structure for minimum and maximum temperature procedures provided by the funding agency is used.

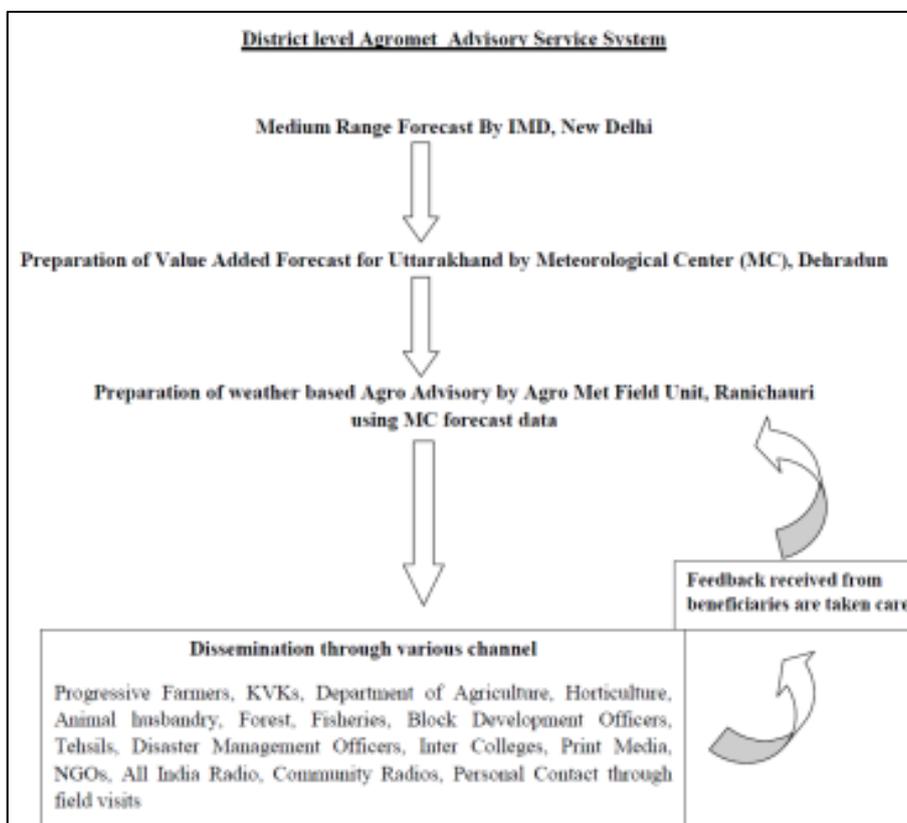


Fig 1: Channels for dissemination of weather based agro advisories.

Result and Discussion

The verification for some of the advisories issued by AMFU Ranichauri for the year 2018 is given in Table 1. It depicts that weather based agro advisory helped in conserving resources like irrigation water and chemicals. Also advanced forecasts/advisories helped in informing farmer about unseasonal rainfall, which in turn helped farmers in harvesting their mature produce at right time. Proper monitoring of fields was done to know about the crop stage and then advisories were made after consulting with the experts. The season wise error structures for Maximum and Minimum temperature are given in Table 1 and Table 2, respectively. The success probability of maximum temperature was highest during post monsoon (82%) and was lowest in winter & summer (67%). The Root Mean Square Error (RMSE) in the forecast varied between 1.751 and 2.244 throughout the year. The minimum temperatures prediction had a success probability of 85% during post monsoon season and 72 % in monsoon season. The RMSE value of minimum temperature varied between 1.833 to 2.610 and correlation coefficient between observed and predicted values lies

between 0.312 to 0.661 throughout the year.

Table 1: Error Structure for Maximum Temperature (°C)

	Winter	Summer	Monsoon	Post monsoon
Correct %	40	39	50	54
Usable %	27	28	26	28
Success Probability %	67	67	76	82
Unusable/Failure %	33	33	24	18
RMSE	2.2443	2.4098	1.7511	2.0341
Corr. Coefft.	0.6608	0.7087	0.5628	0.6957

Table 2: Error Structure for Minimum Temperature (°C)

TMIN	Winter	Summer	Monsoon	Post monsoon
Correct %	45	41	43	57
Usable %	29	20	29	28
Success Probability %	74	61	72	85
Unusable/Failure %	26	39	28	15
RMSE	2.4076	2.4886	1.8338	2.6106
Corr. Coefft.	0.6178	0.6599	0.3122	0.6614

Table 3: Verification of advisory issued for Tehri region of Uttarakhand

Date of issuing AAS	Forecasted weather	Observed weather	Crop	Crop stage	Advisory given	Remarks
19.01.2018 Valid to 20 – 24 Jan	Mainly clear sky to partly cloudy weather with moderate rainfall (15 mm); temperatures gradually decreases around 1-2 ^o C	Mainly clear sky to overcast sky with 26.4 mm rainfall, temperatures gradually decreased about 1-3 ^o C	Wheat	CRI/ Tillering	Postpone irrigation, Avoid spraying of pesticides.	Saved irrigation cost
06.04.2018 Valid to 07 – 11 April	Mostly generally cloudy weather with Light to moderate rainfall (total 41mm); Temperatures gradually decreases around 3-4 ^o C.	Partly to generally cloudy with 29.5mm rainfall observed. Temperature gradually decreased about 1-3 ^o C.	Mustard	Physiological maturity/Maturity	Harvest mature crops and kept in safer place	Saved crop/ produce
			Wheat, Barley	Booting/Heading	Postpone irrigation and chemical spray	Saved irrigation and chemical cost
05.06.2018 Valid to 06 – 10 June	Mostly cloudy weather with Light to moderate rainfall (total 50mm); Temperatures may decreases about 4-5 ^o C.	Mostly generally cloudy weather with light to rather heavy rainfall (69.6mm) observed. Temperatures decreased 2-3 ^o C.	Finger millet, amaranth, pulse	Field preparation and sowing	Prepare fields and start sowing	Timely sowing
10.07.2018 Valid to 11 – 15 July	Generally cloudy weather with moderate rainfall (total 130mm); Maximum Temperatures would be ranges 23-25 ^o C; minimum temperature may ranges around 13-16 ^o C.	Generally cloudy weather with light to rather heavy rainfall (total 108.8mm) observed. Maximum temperature ranged 22.0 –24.5 ^o C; Minimum temperature ranged 16.2-17.0 ^o C.	Vegetables (Tomato, Capsicum etc)	Flowering/Fruiting	Harvest mature fruits	Saved crop/produce
			Paddy (Irrigated)	Seedling	Postpone herbicide application	Saved chemical cost
			Vegetables	Fruting	Postpone irrigation and chemical spray	
20.09.2018 Valid to 21 – 25 September	Partly to generally cloudy weather with moderate rainfall (total 80mm); Temperatures may gradually decrease 1 ^o C.	Partly cloudy to overcast sky with 89.1mm rainfall observed. Temperatures gradually decreased 1-6 ^o C.	Kharif crops	Physiological maturity/ Maturity	Harvest mature crops and kept in safer place	Saved crop/ produce

Conclusion

From the above study, it can be concluded that weather based agro advisory helps the farmers and other users in doing their agricultural operations in a better way. Also it helps in conserving natural resources like irrigation water and energy. However, strengthening of the network for dissemination of weather based agro advisory to cover more number of beneficiary is need of the hour.

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