Agroclimatic assessment of watersheds for crop planning and water harvesting

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ABSTRACT

Agroclimatic analysis of two nucleus-watersheds viz., Malleboinpally (Alfisols) in Jadcherla mandal of Mahabubnagar district and Nandavaram (Vertisols) in Banaganapalle mandal of Kurnool district, Andhra Pradesh (India) was carried out using agromet data for the period 1971-2006. Water balance analysis indicated moderate water surplus at Malleboinpally (179 mm) and at Nandavaram it is low at 40 mm. Both watersheds have similar water deficits of 1050-1100 mm per year. Runoff analyses indicated that about 0.3 to 0.5 million m³ water is available for storage during normal years at the watershed area of 500 ha. In the wet years, Malleboinpally has a potential of about 1.25 million m³. Nandavaram has the lowest potential even in wet years. Though both the locations have Semi-Arid type of climate, there is a tendency for the climate to temporarily shift towards drier side. Malleboinpally has the most stable climate (Semi-Arid) climate. In contrast, Nandavaram showed higher tendency towards and type of climate.

Nandavaram provides greater opportunity for double cropping as the LGP here ranges from 120 to 195 days. Malleboinpally has LGP ranging from 100 to 160 days and provides greater potential for sole cropping during rainy season and intercropping with short to medium-duration crops. Early and mid-season droughts occur at Nandavaram and this watershed would require crop/ varieties tolerant to early or mid-season droughts depending upon the location. Malleboinpally has greater potential for water harvesting and offers opportunity for supplemental irrigation. These results help in arriving at efficient and sustainable management of natural resources and thereby sustaining rural livelihoods at watershed level.

Key words : Water shed, water balance, runoff, LGP, water harvesting.

An agroclimatological approach of predicting kharif rice yield using daily rainfall data: A case study for Purulia district of West Bengal

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ABSTRACT

Total seasonal rainfall being mostly sufficient during the rainfed kharif rice-growing period in the Purulia district of West Bengal, the crop is subjected to frequent water stress due to its uneven distribution. To assess the effective part of the total rainfall for kharif rice a daily rainwater balance approach has been followed to estimate effective rainfall (ER) against a given total rainfall (TR) during July, August and September and its contribution to rice yield in the Purulia district. Twenty years of historical rainfall database across 8 different locations along with 13 years of historical rice yield data were analysed. ER for rice varied from 63-66% during these three rice-growing months. Coefficient of variability of monthly TR was much higher than the ER.
for the same period. ER during August showed maximum degree of association with rice yield ($r = 0.78^*$). Degree of association between ER and yield has been higher than that with TR and thus ER is a better predictor of rice yield than TR. Three different multiple regression equations were tried using components of this rainwater balance to predict rice yield; one equation involving ER corresponding to July, August and September is recommended for its maximum goodness of fit.

**Key words**: Effective rainfall, rainwater balance, rice yield.

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*Journal of Agrometeorology 10(1) : 13-18 (June 2008)*

**Soil climatic analogues of rapeseed and mustard, potato and lentil in Assam**

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**ABSTRACT**

Analogous areas for rapeseed and mustard, potato and lentil have been traced out in Assam by superimposing monthly rainfall and mean temperature maps on soil suitability maps of the respective crops. The analogous zones for the crops have been categorized as ‘most suitable’, ‘suitable’, ‘fairly suitable’, ‘moderately suitable’, ‘marginally suitable’ and ‘unsuitable’ according to the degree of suitability of the classes for the crops. It is found that almost the entire North Bank of the Brahmaputra is suitable for rapeseed & mustard whereas in the South Bank suitable agroclimatic environments for the crop are comparatively few. Potato can be grown in most parts of the state excepting the major part of Hill zone, Barak Valley zone and southern parts of Kamrup and Goalpara districts. Lentil can be grown within a selected region of the state particularly the districts of LBVZ, NBPZ, CBVZ and parts of UBVZ. These analogous maps will help to select a more profitable crop for a given locality thereby enhancing the productivity of the crops.

**Key words**: Climatic analogues, soil suitability, rapeseed & mustard, potato, lentil.

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*Journal of Agrometeorology 10(1) : 19-26 (June 2008)*

**Study of crop condition and assessment of agricultural drought in rabi season using IRS – AWiFS images**

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**ABSTRACT**

Although kharif season crops are more vulnerable to agricultural droughts due to uncertainty in monsoon rains, crops of rabi season grown under residual soil moisture and rainfed minor irrigation tanks are equally vulnerable to drought hazard. The present study was undertaken in Bagalkot district of north interior Karnataka to assess the extent of crop area affected by agricultural drought during rabi 2005-06, using Advanced Wide Field Sensor (AWiFS) images of Indian Remote Sensing Satellite, Resourcesat-1. Normalised Difference Vegetation Index (NDVI) images which represent density, health and vigour of crops were generated from satellite images and analyzed in association with cropping pattern, crop calendar, rainfall pattern and soil
depth. The area affected by agricultural drought was delineated in each taluk. The study indicated the feasibility for detailed assessment of agricultural drought during rabi season on near real-time basis using the indigenously available AWiFS images.

**Key words:** Agricultural drought, crop condition, AWiFS, IRS, NDVI

**Journal of Agrometeorology 10(1) : 27 - 32 (June 2008)**

**Planning, designing and construction of series of check dams for soil and water conservation in micro-watershed**

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**ABSTRACT**

Planning, design and construction parameters of series of water harvesting structures were presented for 66.75 hectares in micro-watershed. Thematic maps were prepared for planning, design of various types of water harvesting structures in 1:5,000 scale on land use/land cover, soil with drainage status. The slope of the land varies from 0-5 per cent and slight, moderate and serve erosion classes were observed.

The total volume of water storage is 61,200 m$^3$ at cost of 6.75/1000 liters, which also be estimated to protect 1607 m$^3$ of productive soil from flowing out of the area. The series of check dam is found suitable for retaining productive soil and also to help in conservation of moisture for horticulture land.

**Key word:** Micro-watershed, thematic maps, water harvesting structures and conservation of soil and water.

**Journal of Agrometeorology 10(1) : 33- 38 (June 2008)**

**Modeling of evaporation using M5 model tree algorithm**

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**ABSTRACT**

This paper investigates the prediction of pan evaporation using M5 Model Tree technique, evaluated for its applicability for predicting evaporation from meteorological data. Different combinations of input data were considered and the resulting values of evaporation were analysed and compared with those of existing techniques. The results suggest that the M5 Model could be successfully employed in estimating the evaporation from the available meteorological data set, within a scatter of ±15%, using the combination of air temperature, wind speed, sunshine hours and relative humidity) using M5 Model Tree algorithm. This study suggests the usefulness of M5 Model Tree technique with all the meteorological parameters considered together in predicting the pan evaporation from reservoirs.

**Keywords:** pan evaporation, M5 model tree.
Evaluation of climgen model to generate weather parameters under different climatic situations in Punjab

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ABSTRACT

In the present study, Climgen (weather generator) generated data was compared to the observed weather data of Ballowal, Ludhiana and Bathinda weather stations representing different type of climatic situations in Punjab. Several years of daily data of solar radiation, maximum and minimum temperature, morning and evening relative humidity, rainfall and wind speed were used as input and five years data were used for validation purpose. Evaluation was done on the basis of coefficient of determination (R²), Residual Mean Square Error (RMSE), General Standard Deviation (GSD) and Wilmott's index (d) of agreement between generated and observed data. The Climgen generated data for maximum and minimum temperature showed good performance (GSD d° 0.10 and d e° 0.95) and the data generated for morning relative humidity was acceptable (GSD > 0.10 but d° 0.20 and d < 0.95 but e° 0.90) while evening relative humidity and wind speed were poor except for Ludhiana station. However, the generated rainfall data was poor for all the stations and hence, cannot be accepted. Overall, results indicated Climgen a good performer as a weather generator for certain parameters.

Key words: Climgen, weather generation, solar radiation, temperature Punjab.

Forecasting monthly wind speed for Udaipur region

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ABSTRACT

Stochastic modelling for mean monthly wind speed of Udaipur (Rajasthan) was done using 26 years (1978–2003) data. The performed statistical tests indicated that the series of the monthly wind speed data is trend free. The periodic component can be represented by third harmonic expression. The stochastic components of the mean monthly wind speed follow fourth order Markov model. The correlation coefficient between generated and measured mean monthly wind speed series was 0.9995 and found to be highly significant 1 per cent level. The standard error (5.57 mm) is quite low. The regression equation is very near to 1:1 line. Therefore, developed model can be used for future prediction of monthly wind speed at Udaipur.

Keywords: Stochastic, auto correlation function, auto regression, wind speed.
Stochastic modelling of relative humidity at Banswara

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ABSTRACT

Study was conducted to develop stochastic model for monthly minimum and maximum relative humidity using 12 years (1992-2003) data of Banswara. The performed statistical test indicates that the series of monthly minimum and maximum relative humidity data are trend free. Their periodic components can be presented satisfactorily by the second harmonics. The stochastic components of both monthly minimum and maximum relative humidity follow second order Markov model. Validation of generated was made with measured series. A high correlation coefficient of 0.9980 and 0.9976 for mean monthly minimum and maximum relative humidity respectively was observed. The correlation was tested by t-test and found to be highly significant at 1 per cent level. The standard error is quite low. The regression equation was very close to 1:1 line. Therefore, the developed model could be used for future prediction of mean monthly minimum and maximum relative humidity, at Banswara.

Key words: Stochastic, auto correlation function, auto regression, relative humidity.

Climate change at selected locations in the Kerala state, India

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ABSTRACT

Rainfall and number of rainy days showed declining trend during the southwest monsoon (June-September) at four selected locations viz., Pilicode, Vellanikkara Amabalavayal and Pampadumpara across Kerala State, India with a maximum rate of 22.0 mm/year at Vellanikkara in the case of rainfall. Significant decline in rainfall from 2000 to 2005 was reflected in the above trend at Vellanikkara, Ambalavayal and Pampadumpara showed a rise in maximum temperature at the rate of 0.006°C/year and 0.04°C/year, respectively on annual basis. At Pampadumpara, the difference between maximum and minimum temperatures is likely to rise as maximum temperature was increasing while minimum temperature is declining. Cooler summers are expected at all the locations and may be significant at Vellanikkara (-0.05°C/year) due to pre - monsoon showers.

Key words: Climate variability, rainfall trends, warming and cooling

Probability analysis of rainfall for Udhagamandalam

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ABSTRACT

Rainfall and number of rainy days showed declining trend during the southwest monsoon (June-September) at four selected locations viz., Pilicode, Vellanikkara Amabalavayal and Pampadumpara across Kerala State, India with a maximum rate of 22.0 mm/year at Vellanikkara in the case of rainfall. Significant decline in rainfall from 2000 to 2005 was reflected in the above trend at Vellanikkara, Ambalavayal and Pampadumpara showed a rise in maximum temperature at the rate of 0.006°C/year and 0.04°C/year, respectively on annual basis. At Pampadumpara, the difference between maximum and minimum temperatures is likely to rise as maximum temperature was increasing while minimum temperature is declining. Cooler summers are expected at all the locations and may be significant at Vellanikkara (-0.05°C/year) due to pre - monsoon showers.

Key words: Climate variability, rainfall trends, warming and cooling

Probability analysis of rainfall for Udhagamandalam

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ABSTRACT
Daily rainfall data of 43 years (1960-2002) of Udhagamandalam were used for annual, seasonal and monthly analysis at different probability levels to obtain the rainfall distribution pattern. At 80 per cent probability level, the rainfall available in the first (May to August) and second (September to November) season are more than the water requirement of the crops which are grown in this region. In the third season (December to April) the rainfall availability is not enough to support any crop without irrigation. Annual maximum daily rainfall was estimated at different return period which will be useful for design of any water harvesting and soil conservation structures. The annual one day maximum rainfall at 50 and 100 years return period was found to be 238.8 and 293.6 mm, respectively. The depth-duration-frequency relationship was developed for duration of 1 to 6 days maximum rainfall for different frequency.

Key words: Probability analysis; frequency analysis, Weibull’s formula, return period, probability density function, Depth-duration-frequency relationship

Journal of Agrometeorology 10(1) : 70- 74 (June 2008)

Effect of temperature and rainfall on wheat yield in south western region of Punjab

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ABSTRACT

A study was conducted to evaluate the effect of temperature and rainfall on historical wheat yields in south western region of Punjab. The technology trend at Bathinda indicated that over the past 25 years wheat yields have increased at the rate of 82.1 kg ha⁻¹ year⁻¹. Maximum, minimum temperature and rainfall from December to March for each pentad years 1977-81 to 1997-2001 were analyzed. Temperatures during February and March revealed significant effects on wheat yield. The maximum temperature of 25.6 °C and minimum temperature of 10.8 °C during grain filling period resulted in highest yield of wheat. Compared to first pentad, the percent increase in average yield during second, third, fourth and fifth pentad was 9.7, 20.3, 49.4 and 60.3 percent, respectively. The grain yield revealed positive correlation with minimum temperature but no trends were observed for other parameters. The regression models are in good agreement between the observed and predicted values of wheat yield.

Key words: Temperature, rainfall, wheat yield, technology trend, Punjab, regression model

Journal of Agrometeorology 10(1) : 75 - 80 (June 2008)

A simple weather based forewarning model for white rust in Brassica

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ABSTRACT

Field experiments were carried out with two Brassica varieties Pusa Jaikisan and Bio-169-96 (a genotype at the final stages of release) at the Indian Agricultural Research Institute farm during two rabi seasons of 2004-05 and 2005-06. The two varieties were sown on 15th and 30th October. Observations on incidence and spread of white rust were recorded to develop a suitable forewarning model. Incidentally, the 30th October sown plants were found to be infested more by white rust to the tune of 30 and 35 per cent in Bio-169-96 and Pusa Jaikisan respectively, as compared to about 16.
and 17 per cent in the 15th October sown plants. A thumb rule was developed to forewarn the incidence of white rust and model equations were developed using hourly weather data of the past to assess the disease severity quantitatively.

Keywords: Brassica, forewarning model, weather and white rust

Journal of Agrometeorology 10(1) : 81- 85 (June 2008)

Weather based monitoring of male moths in pheromone trap and oviposition of Spodoptera litura on cotton in Gujarat

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ABSTRACT

Field trials were conducted to study the effect of various weather factors on Spodoptera litura male moth catches in pheromone trap and their oviposition on cotton foliage during rainy and post rainy seasons of 2003-04 and 2004-05. The male moths were active from July to January and attained five peak levels with three oviposition peak with highest moth catch and oviposition in 44th standard week. Maximum temperature and bright sunshine hour had significant positive while wind speed and rainfall had significant negative association with male moth catches in pheromone trap and oviposition on cotton foliage during both the years. The values of coefficient of determination (R²) indicated that various weather parameters caused significant variation (45.22 and 47.15 per cent) in S. litura male moth catches and oviposition, respectively.

Keywords: Weather factors, pheromone trap, Spodoptera litura, male moth catches, oviposition, cotton

Journal of Agrometeorology 10(1) : 86- 88 (June 2008)

Periodical changes and diurnal variations of stomatal conductance and leaf temperature in cauliflower

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ABSTRACT

The experiment carried out at Anand revealed that stomatal conductance (SC) in cauliflower was the lowest in treatment having less number of irrigations. Diurnal variations revealed that the SC values were fairly high during the morning hours. Leaf temperatures (T_l) were higher by 1°C in treatments which had received less number of irrigations.

Keywords: Stomatal conductance, leaf temperature, cauliflower

Journal of Agrometeorology 10(1) : 89- 92 (June 2008)

Variability of climatic elements at Jorhat
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ABSTRACT

Major climatic elements of Jorhat, Assam for the period 1991-2000 have been compared with those of normal values. The total rainfall was lower than their normal values in all months except in February, September and October with significant decrease in the month of April. Pre-monsoon and monsoon rainfall decreased by 18.8 and 3.3 per cent, respectively. Monthly minimum temperature increased in all months with significant increase during June to September and in November. Monthly maximum temperature increased during April, July and from September to December but decreased during the remaining six months. The monthly temperature range was reduced. Seasonal minimum and seasonal average temperature also increased but seasonal maximum temperature slightly decreased except during post-monsoon season. Morning vapour pressure increased from May to September and decreased during the other months. Evening vapour pressure increased throughout the year. The increase in vapour content indicates intensification of Green House effect. Monthly evaporation also decreased significantly throughout the year. Decrease in bright sunshine hours was observed during January to June and August to October.

Key words: Variability, climatic elements, Jorhat