

Agroclimatic assessment of watersheds for crop planning and water harvesting

**A.V.R. KESAVA RAO, S.P. WANI, PIARA SINGH, G.G.S.N. RAO¹, L.S. RATHORE²
and T.K. SREEDEVI**

*International Research Institute for the Semi-Arid Tropics (ICRISAT),
Patancheru 502 324, Andhra Pradesh, India*

¹ *Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad*

² *India Meteorological Department, New Delhi*

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 arid 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

ABHIJIT SAHA and SIBAMOY DE

Department of Agricultural Meteorology & Physics, B. C. K. V., Mohanpur, WB.

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

P. GOGOI KHANIKAR and K. K. NATH

Department of Agrometeorology, Assam Agricultural University, Jorhat-785013, Assam

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

C. S. MURTHY, M.V.R. SESA SAI, V. BHANUJA KUMARI, V. S. PRAKASH¹ and P. S. ROY

RS & GIS Applications Area

National Remote Sensing Agency, Hyderabad 500 037, India

¹*Drought Monitoring Cell, Government of Karnataka, Bangalore*

E-mail : murthy_cs@nrta.gov.in

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

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

D.T. MESHAM , V.V.APPA RAO , A.K.SINGH, B.G. BAGLE and D.G.DHANDHAR

Central Horticultural Experiment Station, (CIAH-ICAR)

Godhra – Baroda Highway Vejalpur-389 340(Gujarat)

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 severe erosion classes were observed.

The total volume of water storage is 61,200 m³ at cost of 6.75/1000 liters, which also be estimated to protect 1607 m³ 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.

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Modeling of evaporation using M5 model tree algorithm

S. DESWAL

Civil Engineering Department, National Institute of Technology, Kurukshetra-136119, Haryana

Email: deswal.leo@gmail.com

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 $\pm 15\%$, 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

S.K.BAL¹, B.U.CHOUDHURY², ANIL SOOD², S.K.JALOTA³ and H. SINGH²

¹*Department of Agrometeorology, ²Punjab Remote Sensing Centre*

³*Department of Soils, Punjab Agricultural University, Ludhiana 141004*

ABSTRACT

In the present study, *ClimGen* (weather generator) generated data was compared to the observed weather data of Ballawal, 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 (R^2), 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 $d > 0.95$) 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

S. R. BHAKAR and R. V. SINGH

Department of Soil and Water Engineering, College of Technology and Engineering, MPUAT, Udaipur-313001, Rajasthan. Email: srbhakar@rediffmail.com

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

S. R. BHAKAR, RAJ VIR SINGH, NEERAJ CHHAJED and ANIL KUMAR BANSAL

Deptt. of SWE, CTAE, Udaipur – 313 001 Rajasthan

E-mail : srbhakar@rediffmail.com

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.

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Climate change at selected locations in the Kerala state, India

K.N. KRISHNAKUMAR, G.S.L.H.V. PRASADA RAO and C.S. GOPAKUMAR

Dept. of Agricultural Meteorology, College of Horticulture,

Kerala Agricultural University, Vellanikkara, Thrissur-680 656, Kerala, India

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. Amabalavayal 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

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Probability analysis of rainfall for Udhagamandalam

D.C. SAHOO, M. MADHU and R. MOHANRAJ

Central Soil and Water Conservation Research and training Institute,

Research Center, Udhagamandalam-643 004, Tamil Nadu, India.

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

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

HARPREET SINGH, S. S. HUNDAL and PRABHJYOT- KAUR

Department of Agricultural Meteorology, Punjab Agricultural University, Ludhiana

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

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A simple weather based forewarning model for white rust in *Brassica*

GOPAL KUMAR and N.V.K.CHAKRAVARTY

Division of Agricultural Physics,

Indian Agricultural Research Institute, New Delhi – 110 012

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

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

M. V. GEDIA, H. J. VYAS and M. F. ACHARYA¹

National Research Centre for Groundnut (ICAR), P.Box No. 5, Ivanagar Road, Junagadh-362 001.

¹*Junagadh Agricultural University, Junagadh-362 001.*

E mail : gedia@nreg.res.in

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

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

B. AJITHKUMAR*, M.B. SAVANI and K.K.DAKHORE

Department of Agricultural Meteorology, Anand Agricultural University, Anand

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.

Key words: Stomatal conductance, leaf temperature, cauliflower

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Variability of climatic elements at Jorhat

R.L DEKA and K.K. NATH

Department of Agrometeorology, Assam Agricultural University, Jorhat-785 013

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