

## Prediction of water deficit by probability models for Varanasi region in Uttar Pradesh

YATNESH BIEN AND A.K.NEMA

Received : 12.01.2013; Revised : 15.03.2013; Accepted : 28.03.2013

See end of the Paper for authors' affiliation

Correspondence to:

**YATNESH BIEN**  
AICRP for Dryland, S.G.  
College of Agriculture and  
Research Station,  
Kumhrwand, JAGDALPUR,  
(C.G.) INDIA  
Email : yatnesh12@gmail.  
com

■ **ABSTRACT** : The water deficit of various frequencies is required for irrigation planning in rainfed areas. The value of water deficit is needed for computing the depth of irrigation for supplementary irrigation to rainfed crops during the dry spell periods. Prediction of annual maximum water deficit value for the same return periods were computed by Gumbel, Log normal, and Log Pearson Type -III distributions and also used as normal distribution. The probability distribution with lowest value of chi-square ( $X^2$ ) was selected as the best probability distribution. The statistical comparison by Chi-square test for goodness of fit clearly indicated that Gumbel distribution was the best probability model for predicting weekly maximum water deficit for Varanasi region.

■ **KEY WORDS** : Water balance, Probability models, Water deficit

■ **HOW TO CITE THIS PAPER** : Bisen, Yatnesh and Nema, A.K. (2013). Prediction of water deficit by probability models for Varanasi region in Uttar Pradesh. *Internat. J. Agric. Engg.*, 6(1) : 282-284.

Hydrologists consider maximum daily rainfall of different return periods important for safe and economical planning and designing of small and medium hydraulic structure. Similarly, maximum weekly water deficit of different return periods is important in crop planning in rainfed areas to apply supplementary irrigations or to predict the drought in terms of water deficit. There is no widely accepted procedure to predict the weekly water deficit. However, a hydrological frequency analysis has an application for predicting the future events on probability basis. Frequency analysis of one day rainfall has been attempted for different places (Sharda and Bhushan, 1985; Prakash and Rao, 1986; Bhatt *et al.*, 1996). An attempt has been made in the present analysis to estimate the weekly water deficit values for various return periods for Varanasi districts in Uttar Pradesh state by four distributions and to select the best one.

### METHODOLOGY

The daily meteorological data (Table A) were recorded at Agriculture Research Station, Banaras Hindu University (Varanasi) for a period of 32 years (1974-2005) were collected for study and also soil characteristics reference evapotranspiration (ET<sub>o</sub>) was computed on a weekly basis by Pen man-monteith (FAO-56) methods as suggested by Allen *et al.* (1998). Weekly water balance was computed by Thornthwaite and Mather (1955, 1957) methods.

Weekly water deficit (DEF) values were determined by the following expression:

$$DEF = ET_o - AET$$

where,

ET<sub>o</sub> = Weekly reference evapotranspiration, mm

AET = Weekly actual reference evapotranspiration, mm

The computing weekly water balance is described in Table A for Varanasi. By computing water balance, we can know the week in which soil moisture deficit or surplus water is available.

The Weibull's method (1939) was used for computation of observed weekly maximum water deficit amounts at the return period of 2, 5, 10, 25, 50 and 100 years, using below given equation

$$P = m/N + 1$$

where,

P is the return period (year), m is the rank number of water deficit events after arranging in descending order and N is the total number of years of record.

The predicted values of annual maximum water deficit for the same return periods were computed by Gumbel, Log normal and Log Pearson Type -III distributions (Chow *et al.*, 1988) and we also used as normal distribution. The probability distribution with lowest value of Chi-square ( $X^2$ ) is selected as the best probability distribution for predicting the weekly maximum water deficit.