Name of the Tool: Drought Assessment

Introduction

Drought, an unavoidable part of Earth's climate, commonly develops with no clear warning and without identifiable borders and leads to agriculture losses of billions of dollars annually (Kogan 2000). Drought affects virtually all climatic regions (Wilhite 2000), and more than one-half of the earth is susceptible to drought each year (Kogan 1997). Hewitt (1997) reported that, throughout the world, drought ranks first among the natural disasters in numbers of persons directly affected. Droughts occur in both high and low rainfall areas, and virtually all climate regimes and its impacts are critical and costly affecting more people than any other type of natural disaster universally (Keyantash and Dracup 2002). The impacts of droughts vary depending on the state of development and coping capabilities of regions and countries in a manner that it affects the livelihoods and economy of the developing countries, whereas in developing countries commerce and trade of private and public enterprises are affected. In India, apart from the other major disasters including floods and cyclones, droughts are considered to be impact the Indian economy as some or the other region suffers from regular droughts.

Droughts can be classified according to its physical aspects into, Meteorological, Hydrological and Agricultural. **In this assessment we have quantified the meteorological drought.**

Meteorological drought is the earliest and the most explicit event in the process of occurrence and progression of drought conditions. Rainfall is the primary driver of meteorological drought. There are numerous indicators based on rainfall that are being used for drought monitoring. Deviation of rainfall from normal i.e. long term mean, is the most commonly used indicator for drought monitoring and has been used for our assessment.

Such a tool can be useful in providing information to decision makers in business, government and the public stakeholders.

Objectives of tool

Drought Assessment tool helps us in understanding and quantifying meteorological drought vulnerability which is one of the prominent climate extremes. It helps in detecting the probability of occurrence and anticipated severity of drought, in the selected districts under the Neeranchal National Watershed Project.

Definitions and Concepts

- **Drought**
  Drought is the consequence of a natural reduction in the amount of precipitation over an extended period of time, usually a season or more in length, often associated with other climatic factors (viz. high temperatures, high winds and low relative humidity) that can aggravate the severity of the drought event.

- **Meteorological Drought**
  Meteorological and climatological drought is defined in terms of the magnitude of a precipitation shortfall and the duration of this shortfall event. In India, according to India Meteorological Department, meteorological drought over an area is defined as a situation when the seasonal rainfall received over the area is less than 75% of its long term average value.

- **Rainfall Departure**
  The difference between the actual value for the day and the normal is the departure. The cumulative rainfall departure from normal rainfall is a concept sometimes utilized to evaluate the temporal correlation of rainfall with surface water or groundwater levels.

Method Used

The meteorological drought analysis is carried out using **Rainfall Departure Analysis**. Steps adopted for the calculation of rainfall departure are as follows:

1. Take the annual rainfall of the 30 years' data and calculate mean (normal) of annual rainfall data.
2. Find out the 75% of mean rainfall and calculate the drought year. For calculating the drought year, compare the annual rainfall. According to Indian Meteorological Department (IMD), if the value of annual rainfall of year is less than 75% of mean rainfall, then it is called Drought year but if the value of annual rainfall of year is greater than 75% of mean rainfall then it is called the NO drought year.

If annual rainfall > 75% of mean annual rainfall	No Drought
If annual rainfall < 75% of mean annual rainfall	Drought

3. After calculating the drought year, calculate rainfall departure using the following formula:

$$\text{Rainfall Departure (\%)} = \left(\frac{\text{Total Annual Rainfall} - \text{Mean of Annual Rainfall}}{\textit{Mean of Annual Rainfall}}\right) * 100$$

4. Finally classify the drought year as per severity following the given criteria.

Table 1: List of indices and indicators selected for the study

Rainfall Departure Criteria	Values
–50% to –75% of Rainfall Departure	Severe Drought
–25% to –50 % of Rainfall Departure	Moderate Drought
– 20 to –25% of Rainfall Departure	Mild Drought
Source: Indian Meteorological Department	

5. Further rainfall departure calculations, bar plots are plotted to identify the class of severity and the drought year of the particular block according to the Table 1.
6. Lastly, the probability and frequency of the drought events are calculated using the following formulae:

$$\text{Probability of drought events} = \frac{\text{Number of Drought Years}}{(\text{Total number of years selected} + 1)}$$

$$\text{Frequency of drought events} = \left(\frac{1}{\text{Probability of drought events}}\right) \text{years}$$

Expected Inputs and Outputs

Expected Input:

- Daily/Monthly rainfall data for minimum 30 years.

Expected Output:

- To understand the trend of rainfall
- To identify drought years
- To identify the severity of droughts
- To identify the average frequency of the drought recurrence in the area on the basis of the annual departure

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Suggested Readings

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