# DROUGHT DEFINITION: A HYDROLOGICAL PERSPECTIVE

E.L. TATE and A. GUSTARD
*Institute of Hydrology*
*Wallingford, Oxon, OX10 8BB, UK*

**Abstract.** This paper summarises different techniques for defining a drought. Hydrologists as distinct from economists or social scientists define drought according to water deficits in some component of the hydrological cycle (precipitation, soil moisture, river flow and groundwater) or the impact on the level of service provided to public water supply, irrigation or hydropower demands. Generic features of droughts are their severity, frequency, duration and spatial extent. For operational purposes it is essential that a wide range of analytical procedures are used according to the response characteristics of the resource system. However, for comparisons of drought severity over time and between countries, there may be merit in applying simple procedures for drought frequency assessment.

## 1. INTRODUCTION

There is no universally accepted definition of drought. Ideally, definitions should be related to the region under study and be specific to the particular application. Drought indicators can be either qualitative (usually descriptive, linguistic definitions of drought severity) or quantitative (requiring the use of statistical analysis). McMahon and Diaz Arenas (1982) define drought as a period of abnormally dry weather sufficiently prolonged for the lack of precipitation to cause a serious hydrological imbalance, carrying connotations of a moisture deficiency with respect to man's usage of water. Several general definitions have been proposed by hydrological authors, perhaps most succinctly by Beran and Rodier (1985):

> *'The chief characteristic of a drought is a decrease of water availability in a particular period and over a particular area.'*

A comprehensive classification of drought considers its type, intensity, duration and spatial extent in conjunction with its perceived impact, since only through such a broad description can a fully objective picture be obtained.

Moreover, drought definitions are continually being updated, particularly to take account of impacts on, and complex interactions with, the environment and society; for example, the relationship between rainfall variability and impacts can depend upon the specifics of a particular agro-ecological zone or the economy. An issue for investigation is, therefore, an economically useful definition of drought (Benson and Clay, 1994). Furthermore, hydrological definitions require further development to include the impact



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of drought on ecosystems; for example, the resilience of in-stream ecology to river flow deficiencies. Despite the difficulties with finding a suitable definition of drought for a particular application, it provides a practical way to assess a drought situation and to give a relative picture of its severity.

The following categories of drought are reviewed from a hydrological perspective in this paper:

1) Climatological drought
2) Agro-meteorological drought
3) River flow drought
4) Ground-water drought
5) Operational drought

The aim is to provide a concise presentation of each drought type, as a quick reference for hydrologists and those interested in assessing drought from a hydrological viewpoint. It is not intended to be comprehensive, rather to act as a summary, with key definitions and indices referenced for the benefits of further research. A simple description of each drought category is given here, followed by a summary of the most common drought indices and descriptors falling into each category.

## 2. CLIMATOLOGICAL DROUGHT

Climatological drought can be simply expressed in terms of a rainfall deficit, in relation to some average amount, and the duration of the dry period. One of rainfall's main merits for assessing drought severity is that long-term records are often available. However, rainfall has limitations as a measure of water availability in droughts: measurements over short periods take no account of initial ground conditions nor seasonal evaporation variations. Effective rainfall may be a more useful drought indicator, but requires estimates of actual evapotranspiration. The indirect nature of evapotranspiration and lack of readily available data on the subject mean it is not in widespread use as a drought severity indicator (DSI).

The most widely accepted definition of drought, amplifying the notion of a prolonged and abnormal moisture deficiency, is Palmer's (1965): '*an interval of time, generally of the order of months or years in duration, during which the actual moisture supply at a given place rather consistently falls short of the climatically expected or climatically appropriate moisture supply.*'

However, Marsh and Lees (1985) comment that simple definitions requiring a fixed number of dry days in sequence, although still enshrined in certain official definitions, have generally been abandoned in favour of methods depending on accumulated departures from the mean value linked to some criterion for determining that the drought has ended. This approach was used by Foley (1957) and the procedure has been used by