International Journal of Agricultural Engineering, Vol. 2 No. 1 : 50-57 (April to September 2009)

Remote sensing satellite (NOAA AVHRR) based drought assessment and monitoring in Southern Rajasthan

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Accepted : *January, 2009*

ABSTRACT

Drought is the major natural hazard affecting large area and millions of people every year. Monitoring drought is of considerable important for water resource planning and management. This study was carried out to monitor drought condition in southern part of Rajasthan using satellite data. The Advanced Very High Resolution Radiometer (AVHRR) onboard the National Oceanic and Atmospheric Administration (NOAA) series of satellite was used for the duration of four year (2002-2005) to derive Normalized Difference Vegetation Index (NDVI) and the Brightness Temperature (BT). Water Supplying Vegetation Index (WSVI) was derived using the NDVI and fourth channel Brightness Temperature to detect drought conditions. On the basis of WSVI the study area was classified in to five categories of drought *viz.*, extreme, severe, moderate, slight and normal. The result showed that the 2002 was the year worst affected by the greater severity of drought, while the year 2005 was about normal. Years 2003 and 2004 were also affected by drought, but of a lesser intensity as compared to the year 2002. The zone wise analysis showed that the area under zone 1 (Transitional plain of Luni basin) was affected by the greater intensity of drought in all the years followed by the zone 4 (humid south eastern plain). Zone 2 (sub humid southern plain) and zone 3 (humid southern plain) were least affected by drought condition next to the zone 4.

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Key words : Drought, NOAA AVHRR, NDVI, WSVI

Drought is a creeping natural hazard, which is caused by short raining and humidity deficit. Drought is defined as a deficiency of precipitation over an extended period of time resulting in water shortage that causes extensive damages to crops. When a drought occurs dramatic social, economic and environmental effects are inevitable. The latest drought in south Asia in 2000-2003 affected more than 100 million people, the impacts of which were felt in Gujarat and Rajasthan states in western India, in Pakistan's Sindh and Baluchistan provinces, as well as in part of Iran and Afghanistan (Tenkbail *et al.*, 2004). Drought reduces agriculture production and considerably affects the balance between food supply and demand. 68 % of the total net sown area (144 Mha) is prone to drought out of which 50 % is severely drought prone. The magnitude of droughts well understood since India is an agricultural country with 65 % of its population directly dependent on agriculture for their livelihood.

Numerous drought indices based on meteorological data have been used to monitor drought conditions. The calculations of these indices mostly rely on meteorological parameters mainly precipitation, which is limited in the region, often inaccurate and most importantly difficult to obtain in real time. Satellite Remote Sensing (SRS) can provide the large amounts of data quickly and inexpensively, relative to other means of data collection. Geographical Information System (GIS) can bring together vast amounts of information from a wide variety of sources and make the information quickly visible and applicable in a situation of emergency (Verstappeen, 1995). During the last decades coarse spatial resolution, high temporal frequency satellite data such as National Oceanic Atmospheric Administration (NOAA) Advanced Very High Resolution Radiometer (AVHRR) were extensively used to monitor vegetation cover and climatic variability over the globe (Bayarjargal *et al.*, 2001). The NOAA AVHRR derived Normalized Difference Vegetative Index (NDVI) have been widely used for drought monitoring (Kogan, 1997; Ji and Pater, 2003; Mcvicar and Bierwirth, 2001; Prathumchai *et al.*, 2001; Rabab, 2002; Song *et al.*, 2004; Vicente-serrano *et al.*, 2006).

Temperature along with rainfall determines the availability of the moisture for physical, biological and chemical activities in plants that ultimately leads to the healthy plants. Hence, with the seasonal change of rainfall and temperature, it is possible to observe the change in vegetation growth. This depends on the level of water and heat stress to which the vegetation is exposed. The Water Supplying Vegetation Index (WSVI) detects drought by combining vegetation with temperature retrieved from NOAA satellite data (Xiao *et al.*, 1995).