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Drought Monitoring Methodology Based on AVHRR Images and SPOT Vegetation Maps

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ABSTRACT

Many regions of the world are experiencing an increase in the frequency and intensity of droughts. The province of Fars, Iran, has faced particularly severe drought and ground water problems over the course of the last decade. However, previous research on the subject reveals a lack of useful information regarding droughts in this province. This paper presents a fast, efficient and reliable method that can be used to produce drought maps in which Advanced Very High Resolution Radiometer (AVHRR) images are processed and then compared with SPOT vegetation maps. Ten-day maximum Normalized Difference Vegetation Index (NDVI) maps were produced and vegetation drought indices such as the Vegetation Condition Index (VCI) were calculated. Furthermore, a Temperature Condition Index (TCI) was extracted from the thermal bands of AVHRR images in order to produce the Vegetation Health Index (VHI). Remotely sensed data was then compared with hydrological and meteorological data from 1998 to 2007. The Standardized Precipitation Index (SPI) was used to quantify the precipitation deficit while the Standard Water Level Index (SWI) was developed to assess the groundwater recharge deficit. Instead of correlation coefficients, spatial correlation through visual comparison was found to provide better and more meaningful pictures. The highest correlation values were obtained when VHI or Drought Severity Index (DSI) values were correlated with the current month's SWI data. DSI maps showed strong vegetation conditions existing for the majority of the study period. For most counties in Fars, strong Pearson correlations observed between the DSI and the SWI of the same month reflect high rates of ground water consumption. The results of this study indicate that the proposed method is a potentially promising method for early drought awareness which can be used for drought risk management in semi-arid climates such as in Fars, Iran. This study also recommends that the Iranian government develop programs to help decrease the consumption of ground water resources in the province of Fars to ensure the long term sustainability of the watersheds in this province.

KEYWORDS

Drought, Remote Sensing, Water Resources, VHI, DSI, SWI

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