Analysis of temporal and spatial variations of time series of droughts based on satellite images of terra and index (Spi) in the Zagros region with emphasis on the economic performance of rural communities

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Introduction

Drought is one of the environmental disasters that are very common in arid and semi-arid country regions. Rainfall defects have different effects on groundwater, soil moisture, and river flow. Meteorological drought indices are calculated directly from meteorological data such as rainfall and will not be useful in monitoring drought in the absence of data. Therefore, remote sensing techniques can be a useful tool in measuring drought. Drought is a known environmental disaster and has social, economic, and environmental impacts. Lack of rainfall in an area for long periods is known as drought. Drought and rainfall affect the water and agricultural resources of each region.

Materials & Methods

Due to the nature of the problem and the subject under study, the present study is descriptive-analytical with emphasis on quantitative methods. In this study, satellite images of Tera Sensor Modis in 2000 and 2017 were used to verify the existence of wet and drought phenomena. In the next step, by examining the rain gauge and synoptic data of the existing stations and using the standardized precipitation index model of three months (May, June, and April), the sample was selected. Next, we compared temperature status indices (TCI) and vegetation health indices (VHI) in these three months to determine the difference between these indices over the three months. Modira Terra satellite was used to study the vegetation status in the study area. Subsequently, vegetation-free areas were isolated from vegetation areas using the conditions set for the NDVI layer, the experimental method was used to determine the threshold value of this index. For this purpose, different thresholds were tested, with the optimum value of 1 being positive. NDVI is less than 1 free of positive plants and more than free of vegetation. MODIS spectral sensor images for surface temperature variables with a spatial resolution of 1 km, including 31 bands (1080/1180 bandwidth, central bandwidth / 11.017 spatial resolution of 1000 m) and 32 bands - 770/11Central Wavelength Band 032/12 Spatial Resolution Power (1000 m) Selected for months that are almost cloudless. All images are downloaded from the SearchEarthData site and edited. Total rainfall in June, April, and May for 20 years has been provided by the Meteorological Organization of Iran. ARC GIS software and geostatistical methods were used to process Excel data. Pearson correlation coefficient was also used to estimate the correlation between the data.

Results & Discussion

A standard precipitation index is a powerful tool in analyzing rainfall data. This study aimed to compare the relationship between remote sensing indices and meteorological drought indices and to determine the effectiveness of remote sensing indices in drought monitoring. The correlation between the variables with the SPI index was evaluated and calculated. The results of the indicators are different, so a criterion should be used to evaluate the performance of these indicators. SPI index on a quarterly time scale (correlation with vegetation) was selected as the preferred criterion. According to the results of correlations, the TCI index with the SPI index had a strong correlation with other indices. In the short run, this index has the highest correlation with thermal indices at the level of 1%. The correlation between meteorological drought index and plant water content and thermal indices increases with increasing time intervals. The positive correlation between vegetation indices and plant water content with meteorological drought indices shows that the trend of changes is in line. Therefore, the TCI index makes the drought more accurate and is a better method to estimate drought.

Conclusion

The results showed that among the surveyed fish, the most drought trend was observed in the eastern provinces and covers more than 50% of the region. The trend of changes in this slope was statistically significant. According to the results of correlations, the TCI index had a strong correlation with the SPI index with other indices. It can also be concluded that Modis images and processed indices along with climatic indices have the potential to monitor drought. The use of maps derived from drought indices can help improve drought management programs and play a significant role in reducing the effects of drought.

Key Words: Drought, Remote Sensing, Agricultural Economics, GIS

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