Estimation of Surface Temperature and Cropping Intensity in Hamedan Province Using Remote Sensing Data

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Extended Abstract

Introduction

Surface temperature and cropping intensity maps are the most important components of the water requirements in basin scale and are also the most difficult to measure. Conventional methods are very local, ranging from region to field scales. Estimates of the Surface temperature and crop density over the entire area, especially for irrigated areas, are essential. Today, surface temperature, actual cropped area, crop pattern and cropping intensity under different conditions can be estimated by using satellite data and Remote Sensing (RS) techniques. In order to obtain the surface temperature and cropping intensity, a set of satellite images have been used. Estimated temperatures have been compared with measured values at 5 cm soil depth in meteorological stations.

Methodology

The study area is Hamedan Province, in west of Iran and at latitudes between 33^{O} and 33' to 35^{O} and 38' north and longitude 47^{O} 45' to 49^{O} and 36' east. The area of this province is 19546 Km^2. According to Climatic diagram of Emberger its Climate is cold semi- arid with the minimum and maximum temperature of 2/8 and 19/2, respectively.

In this paper, we have used data of five meteorological stations in Hamedan and Kordestan

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provinces. A set of 12 Landsat 7 images during the 1998-2002 have also been used. Geometric and radiometric corrections have been performed on all the images. Normalized Difference Vegetation Index (NDVI) and Soil Adjusted Vegetation Index (SAVI) were established. Based on these indicators the surface temperature (T_s) has been estimated using the SEBAL (Surface Energy Balance Algorithm for Land) algorithm and compared by the measured data reported by meteorological stations of Hamedan province.

Six statistical parameters including coefficient of determination (R^2), Root Mean Square Error (RMSE), Modeling Efficiency (EF), Mean Error (ME), Coefficient of Residual Mass (CRM) and Mean Absolute Error (MAE) (Equation 7 to 12) have been used to compare surface temperature of satellite images and the temperature reported by meteorological stations.

Results and Discussion

Results of Normalized Difference Vegetation Index (NDVI) and surface temperature imply that there is high and reversed correlation between these indices Results of comparison of surface temperatures in the dense vegetation surrounding meteorology stations with recorded weather temperature in passing time of satellite show that there is not a striking difference between these parameters.

Results show that Root Mean Square Error between surface temperature of SEBAL algorithm and the temperature reported by meteorological stations for different stations is different from 4/4 to 6/6 degree. Results of modeling of Efficiency index show that all stations with efficiency over 10% are acceptable. CRM index for all data show -0/02 and imply that estimated values have a good precision. The results of Mean Absolute Error index and Mean Error imply that the model with 4/2 error and -0/7 deviation degree from surface temperature are estimated and has acceptable precision. Generally, algorithm of assessment index about estimating surface temperature shows that this algorithm has a relative high precision and coefficient correlation.

Conclusion

Results indicated that there is no significant difference between surface temperature using remote sensing data and the statistics reported by meteorological stations. Primary results showed that there was a significant relationship between measured and estimated surface temperature. The results of correlation coefficient were 0.75 and Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) were 5.4°C and 4.2°C, respectively.

Results of the present and performed researches indicate that remote sensing can play a effective role to determine timely maps of plant cover, air temperature and surface temperature and optimizing usage of irrigation resources. By remote sensing and geographical information system can be used as suitable and confident tool to study dispersion and intensity of plant cover, air temperature, and plant level faced with environmental pressure.

Keywords: Crop Density, Hamedan, Remote Sensing, Surface Temperature.