# Evaluation of Accuracy of Split-Window Algorithm in Estimation of Land Surface Temperature (Yazd Plain-Ardakan)

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## INTRODUCTION

Land surface temperature is one of the most important affecting parameters among the components of water balance in the drainage basin surface (Kaviani et al., 2013: Fathizad et al., 2017: Aliabad et al., 2019: Ardakani et al., 2018). In the past, the fixed stations or infrared thermometers were used to measure the temperature, and it is while the surface temperature of a parameter varies over space and time that its fluctuation interval is higher in wide areas. On the other hand, point measurements are required spending much time and cost. In this regard, the remote sensing science has shown its ability compared to this parameter changes by using thermal bands of the satellite images (Maimaitiyiming, 2014; Friedel, 2012: Ardakani et al., 2018).

## MATERIALS AND METHODS

### 1. Land surface temperature (LST) Index

In order to perform radiometric correction, the relations shown below were used to convert the digital values of the image into spectral radiance related to optical bands and the amount of brightness temperature for the thermal bands.

### 2. Fractional Vegetation Cover (FVC): Use the formula to calculate LSE for band 10 and band 11, individually:

$$Mean\ of\ LSE = m = \frac{LSE10+LSE11}{2}\ (6) \quad Difference\ of\ LSE = \Delta m = LSE10-LSE11\ (7)$$

### 3. Split-Window Algorithm

LST= TB10+C1 (TB10-TB11)2+C0+ (C3+C4W) (1-m) + (C5+C6W) Δm-237.15 (8) TB10 and TB11: Brightness temperature of band 10 and band 11, C0-C9: Prayb amounts of Split-Window algorithm, m: LSE mean Δm: LSE different of band 10 and band 11, W: The amount of water vapor in the atmosphere (in this study, equal to 0.013) (Shahid Lati, 2014).

### 4. Land taking

16 points were randomly determined in the area to estimate the accuracy of the Split-Window method in determining land surface temperature and the soil surface temperature was measured using a digital thermometer.

## RESULTS AND DISCUSSION

As mentioned in previous sections, (SW) algorithm method is one of the appropriate methods for determining the land surface temperature which different criteria are used to achieve this. Each of these criteria was calculated by mathematical equations. The temperature of the study area was obtained by replacing in the formula for calculating the land surface temperature. The temperature values have been fluctuated between 56 to 7 degrees Celsius. The maximum temperature values were related to areas without vegetation cover. The results obtained from the comparison between the measured temperature and the temperature obtained from Split-Window method showed that the correlation between these two temperatures was 0.75 and the maximum absolute error was 2.95 and the minimum absolute error was 0.9 (Figure 14 and Table3). Thus, the maximum error for the Split-Window method was about 3 ℃ and this algorithm is an appropriate method to determine the temperature of land surface by using the satellite images. Land surface temperature and surface emissivity are two important indicators in studies of the Earth's surface. These indicators are the most important indicators in the fields of energy budget estimation, assessment of land cover and heat transfer study. Considering that the soil temperature is high in the desert areas and this fact is very important, weather stations for this temperature are determined point to point. So, to estimate the surface temperature of the whole area using the satellite images is essential. Landsat 8 with having thermal bands and high spatial resolution, prepared an image with suitable quality in order to determine land surface temperature and the Split-Window method presented in this study with high accuracy and minimum absolute error of 3 ℃ could well determine the land surface temperature in all points of the surface; and has reduced problems such as errors in temperature readings, lack of temperature measurement stations, the cost and time of taking temperature and etc. According to the results of this study, it is necessary to seek a way in order to use thermal energy of the land surface in the desert areas which have a lot of energy.
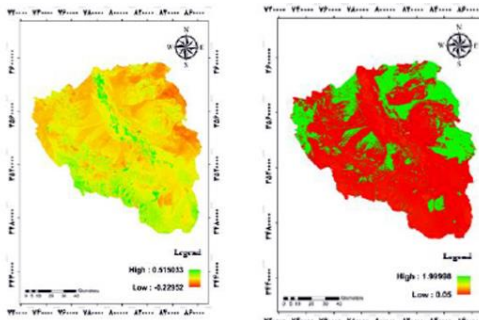


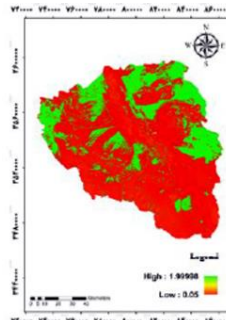Fig 3. NDVI vegetation cover index in Yazd plain-Ardakan
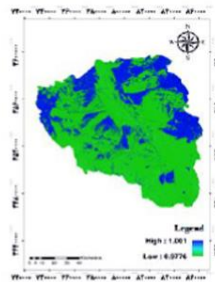
Fig 4. Fractional vegetation cover index of Yazd plain

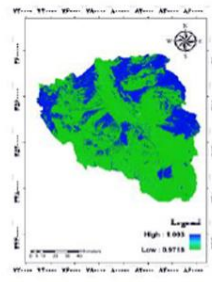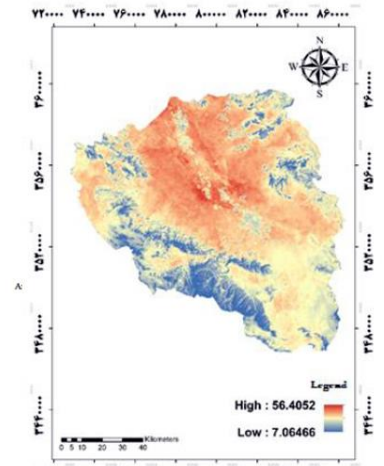Fig 10. Land Surface Emissivity of band 11

Fig 9. Land Surface Emissivity of band 10

Map of land surface temperature using Split-Window method