



The relationship between land surface temperature and land use (case study: Letian watershed)

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Abstract

Earth's surface temperature is a main indicator of energy balance on the planet and as data input in models Climate change, urban heat islands, choosing the best time for agricultural activities, studying activities Ground heating and fire detection are used. Since the estimation of temperature with, volcanoes using satellite images. The reason for easy access to satellite data, especially Landsat and Moody's satellite images, is very interesting researchers. In this study, Modis images were used because the results of comparing the night and day temperatures of the range. The case of the study shows that Tafak is an acceptable place for this matter, which frankly, as it is known, the temperature of the night compared to the daytime temperature reaches the minimum level and has almost a sinusoidal pattern and also has good accuracy and the peak temperatures and it has shown the minimum well. And it can be noted that the presence of vegetation reduces the temperature of the soil surface and preserves it Soil moisture becomes.

Key words: Earth surface temperature, land use, Lethyan

1.Introduction

Earth surface temperature is an important indicator in the study of models Energy balance on the surface of the earth and interactions between the earth and the atmosphere is regional and global. remote sensing and satellite images are one of the methods due to their wide coverage Effective for studying the temperature of the earth's surface in different times. Many factors in the heat recovery of the earth's surface with the use of remote sensing thermal infrared images is effective which can be divided into two general categories of atmospheric factors and earth surface factors were divided. Earth

surface effects due to Therefore, the different characteristics of different types of land surfaces different levels have different radiation. Also surface temperature land is also an important factor in climate change, vegetation growth and so on (Tan et al, 2017 and Latif, 2014) in Iran in recent decades due to the occurrence of droughts Successive, increasing temperature and the occurrence of dust storms Much of the country's land cover has undergone drastic changes Is. So that many swamps, seasonal lakes and Permanently lost and a large number of tree species and The pastures have deteriorated and dried up. Such changes climate with human activities in natural areas such as destruction of forests and pastures, development of cities and regions The industrial foundation for converting permeable natural surfaces into surfaces Impenetrable hard, such as bare soil, paving, asphalt, etc Dense residential areas. The trend of surface temperature changes Land (LST) relative to the changes in the characteristics of the surfaces such as Soil moisture, land use and vegetation are very sensitive Is. Therefore, the study of these processes and their relationship with temperature Land surface can be very important. Surface temperature Earth depends on surface energy and water balance on a global scale is of great importance in similar applications Climate change, urban climate, hydrological cycle and monitoring al., 2005, Wan et al., 2004, (has plant cover Kalnay and Cai, 2003, Ramantan et al., 2001 Chapin et.) LST changes in space and time, by remote sensing Many variables are measured and estimated Geophysics such as evaporation and transpiration, water stress of plants, humidity soil and thermal index are used) et Karnieli al., 2010, Kustas and Anderson, 2009, Agam et al., 2008.) Studying the thermal changes of the earth's surface traditionally Using data from weather stations or sampling It was a feasible field that was very time-consuming and expensive. In contrast to thermal infrared remote sensing images due to Wide coverage, reproducibility and up-to-dateness, source of information Suitable for preparing thermal maps of water and land surface provides (Moradi et al., 2013) temperature Earth's surface is a function of the net energy at Earth's surface which The amount of energy reaching the earth's surface, radiation power 2 It depends on the level, humidity and air flow of the atmosphere. temperature of The surface of the earth can be seen from the infrared radiation emitted from The surface of the earth and estimated with the inverse equation of Stefan Boltzmann) 1994., al et Reutter.) According to many researches like Hijazizadeh and Parveen and Jahanbakhsh and colleagues, Iglim (especially). Rainfall and temperature (and vegetation of the country in recent decades Along with the climate changes that happened in the world, there are changes suffered. In this regard, the climate and vegetation in changes Chaharmahal and Bakhtiari province also probably contains; Therefore, checking the changes of each of these two parameters and the effects these parameters create it seems necessary. Based on this, different uses Provinces are determined and the effects of changes in these uses on the temperature to increase or decrease it Appears.

Dashtakian and colleagues (1386), in investigating the temperature of the earth's surface in relation to vegetation and urban development using remote sensing and geographic

information systems in the desert areas of Yazd-Ashkzar, reached the results that barren lands and sand dunes have the highest temperature. And agricultural and garden lands have the lowest temperature, and this is due to the relative humidity in the soil and the amount of land surface vegetation, and there was a very high correlation between the vegetation cover index (NDVI) and land surface temperature ($r=0.99$).

Malekpour et al. (2009), in investigating the surface temperature of the earth and its relationship with urban land use cover classes in Tehran using ETM+ sensor data, believe that the method used in this research is to estimate the amount of emissivity. and the surface temperature on non-uniform urban areas with acceptable practical accuracy and can be used to estimate the amount of urban development in a period of time.

In a research, Alshaikh (2015) investigated the effect of land use on land surface temperature based on remote sensing and GIS indicators in the northwest of Al-Jawf, Saudi Arabia. The results showed that LST and NDVI and NDWI indicators have an inverse relationship, that the increase in vegetation cover and the abundance of water bodies decrease the temperature of the earth's surface.

Yue et al. (2013), in the relationship between land surface temperature and NDVI by remote sensing using Landsat 7 data in Shanghai, concluded that LST, SHDI and NDVI are three basic indicators for studying the urban environment in terms of high reliability. and the cost is relatively low, the separation power of satellite images has been recognized as appropriate in evaluating the environmental effects in the performance of urban areas.

2. Materials and methods area of study

The catchment area of Letian dam with an area of approximately 700 square kilometers is located in the northeast of Tehran province. This basin between width It is located at latitude $35^{\circ} 45'$ to $5^{\circ} 36'$ North and longitude $51^{\circ} 23'$ to $51^{\circ} 51'$ East. Average annual rainfall of this basin It is about 570 mm. Letian Dam supplies 25% of Tehran's drinking water and is one of the sub-basins of the Salt Lake Basin is. Also, the water stored behind the dam is used to irrigate gardens and agricultural lands. The height of the basin between It varies from 1565 to 4200 meters above sea level. The location of the study area is shown in Figure 1.

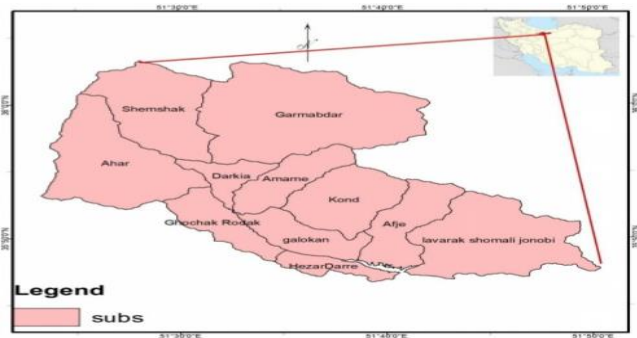


Figure1- The location of the watershed and sub-basins of Letyan Dam

In this research, in order to investigate the temperature of the earth's surface in relation to the changes in land use, using the information processing method by means of used. that the preparation of satellite images in this study Landsat satellite ETM and TM satellite images sensors WGS84 are related to the years 2015 and 2022 respectively. Used satellite images include: madis with specifications It is used through Google Earth Engine. And also for studying UTM land use maps We need LST maps. madis Earth surface temperature product in Google Earth Engine, day and night and in the form of daily products and Eight days, it contains day and night earth surface temperature bands and D emission data of bands31 and 32. In the figure 2, a view of The search for madis ground surface temperature products is displayed.

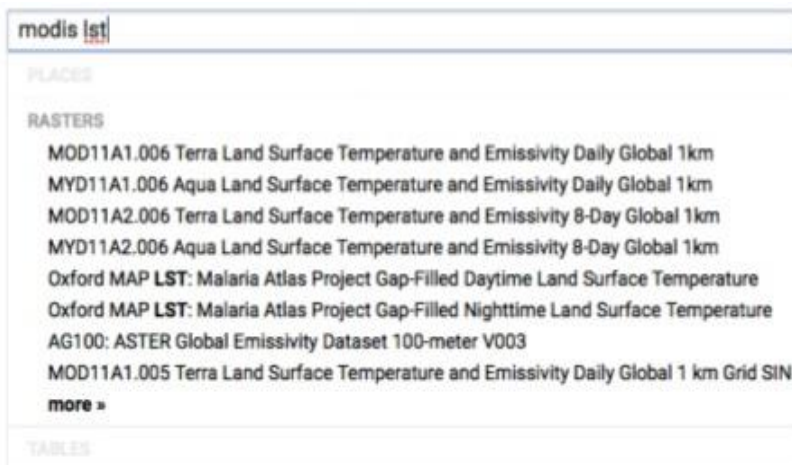


Figure 2- Search for Madis ground surface temperature products

3. Discussion and conclusions

The purpose of this research was to investigate the surface temperature of the earth and compare it with land use changes. As a result, since Most of the land in this area is covered by pastures, so for the correct analysis of the results, it is necessary to examine the vegetation of the area be placed to produce the normalized vegetation index map of the region on the two mentioned dates, from bands 5 and 4 of Landsat 8 and bands 4 and 3 Landsat 7 is used. By comparing the values of this index in the guide of two maps and also by visually comparing the condition of the coverage during this How many months is the difference when it is clear that in the second series of images related to 2022, the value of the index and the condition of the cover have improved and somehow it can be inferred that it is in the growing season of vegetation. The formula for extracting the normalized vegetation cover index from this Is supposed: $NDVI = \frac{NIR-RED}{NIR+RED}$ that in this study, due to the use of two series of images related to two different sensors, the number of bands is different, and in this case it should be Note. The NDVI map for the second period can be seen in Figure 3-6.

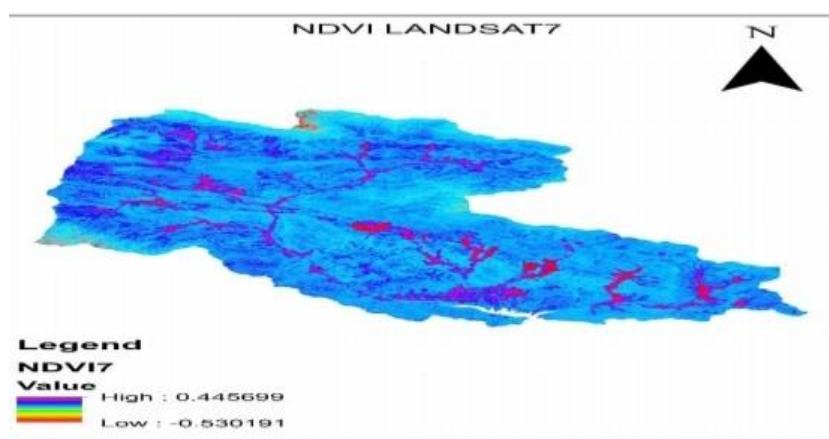


Figure 3- normalized vegetation index changes in time series

Next, a map of the surface temperature of the earth was prepared during this period of time. Average map of all available data in this time period Day and night temperatures were extracted. These maps have been prepared using night and day images of the Madis sensor, which is the average result These pictures are during the study period. In this section, the earth surface temperature product mod11a2 (eight days) is used. In order to use the product of the surface temperature of the Madis sensor, a factor of 0.02 must be applied to each of the recalled images.

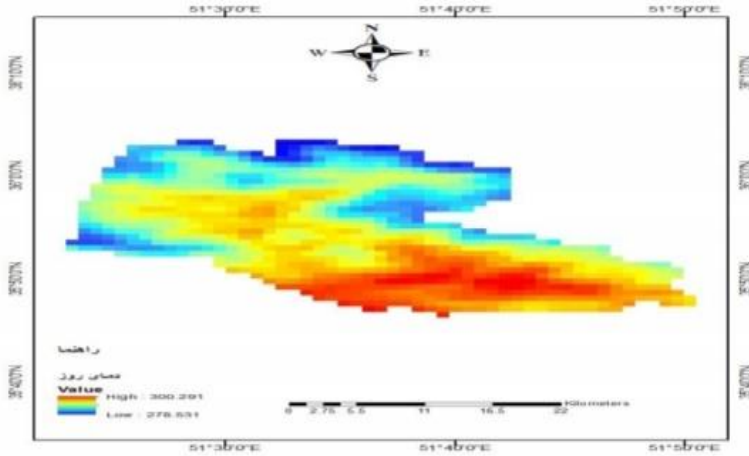


Figure 4- Day temperature map of the study area

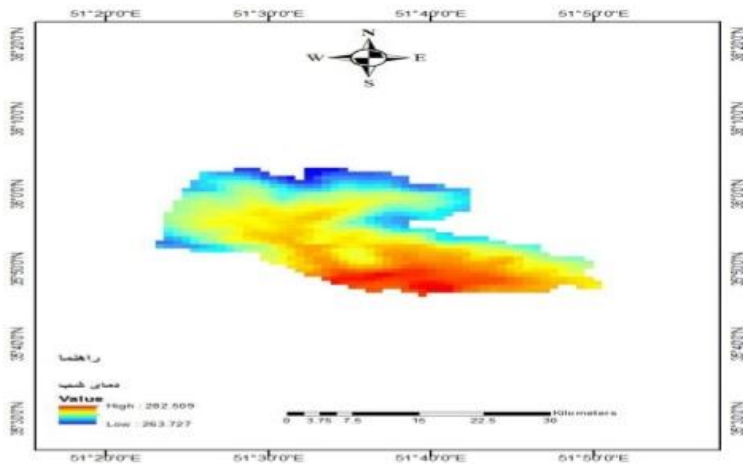


Figure 5- Night temperature map of the study area

Also, a land use map was prepared for the study area (Figure 6). Images are in Envy software. In this regard, two maps, one for the beginning of the study period and the other for the end of the time period, have been prepared because then, by making comparisons, it was determined that there were not so many changes in this scale over the ruling range. Therefore, the following map for Analysis of the results is used.

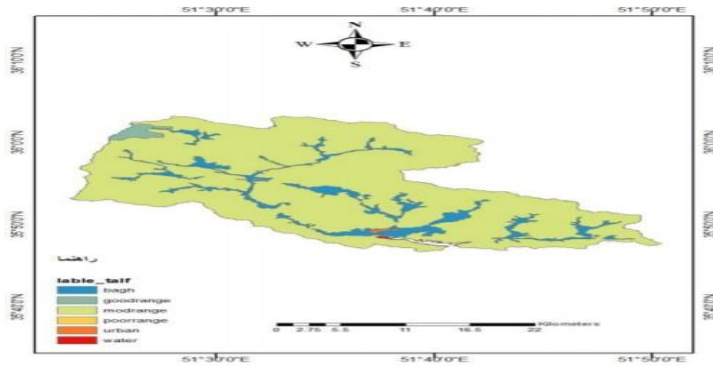


Figure 6- Land use map for the studied area

Also, a comparison chart has been prepared to compare the night and day temperature of the region (Fig. 7).

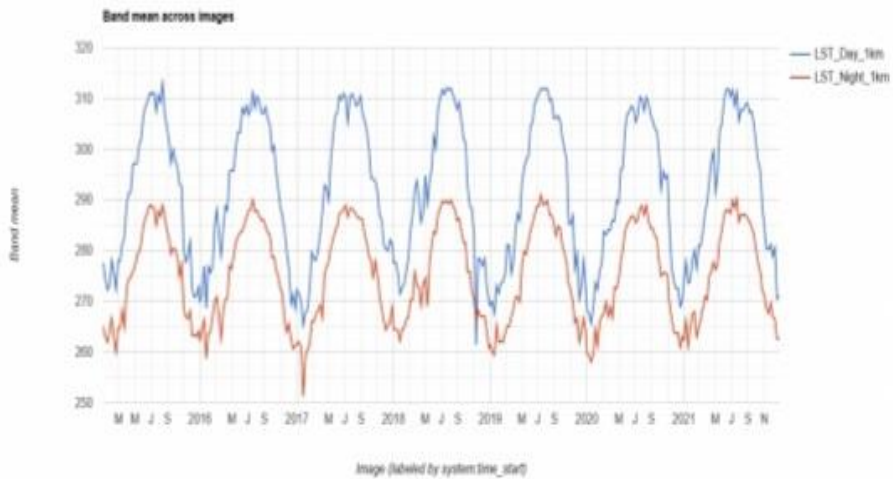


Figure 7- Comparison chart of night and day temperatures of the study area

4. Conclusion

The temperature of the earth's surface is a main indicator of energy balance in the earth and is used as data input in climate change models, urban heat islands, choosing the best time for agricultural activities, studying volcanoes, geothermal activities and fire detection. Calculating LST is one of the appropriate methods for determining the temperature of the earth's surface, and in order to achieve this, standards, methods, algorithms, and programs can be used to prevent natural and unnatural hazards by using minimum costs and ease of obtaining information. The results of this research can be a way for planners and experts in the region to obtain information about the temperature of the earth's surface and their relationship with land use, which can open the way for management decisions for the protection of natural resources and agriculture. Since the estimation of temperature using satellite images is of great interest to researchers due to the ease of access to satellite data, especially the images of Landsat and Moody's satellites. Meanwhile, MODIS images are highly desirable due to their acceptable spatial separation. The results obtained from the manual and visual comparison of two maps of the surface temperature of the earth indicate that in the second time period, which is related to the period of vegetation growth, the areas covered by vegetation have a lower temperature than to urban areas. Also, by comparing two normalized vegetation maps, it can be deduced that in the second time period, a wider vegetation covers the surface of the earth. Due to the fact that the picture of the first period is related to the winter season.

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