Review of: "Thermal Remote Sensing: A tool to Determine Temporal Land Surface Temperature in Hawassa City, Ethiopia"

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Potential competing interests: No potential competing interests to declare.

This manuscript explores the use of satellite datasets (Landsat-7 (ETM+) and Landsat-8 (OLI)) and a specified mathematical algorithm in retrieving land use maps and associated temporal land surface temperature map in Hawassa City Administration, Ethiopia. The topic itself is of paramount interests in the urban development and remote sensing community, however there are some weaknesses in terms of presentation and formatting, logical flow and its connection with existing studies, especially on land use / land surface temperature retrieval in developing cities.

Major modifications needed / Details to be added in the revised manuscript

(1) **Section 1: Introduction** is rather short and lacking of details right now - it should have a summary of existing scientific progress / advancements made in this discipline. Results of recent studies should have been described here, for example, how Landsat satellite images are being used and processed in an effective manner, and how thermal images can be used to derive land surface temperature.

(2) In **Section 1: Introduction,** the research gaps of land use / land temperature retrieval are missing. Therefore, the scientific contribution of this manuscript is rather vague at this stage.

(3) **Section 2.1: Description of Study Area** - The second paragraph provides the population figures of the city administration, however these numerical figures are not much related to this study. The authors should get more focused on the urban development plans, urban growth and spatial dynamics of the city in recent years.

(4) **Section 2.2: Data Used** - The authors mentioned that Landsat 8 attributes can be used to calculate land surface temperature. A short summary of the calculation process and proper illustrations / applications should be included here.

(5) **Section 2.5: Validation of retrieved Land Surface Temperature** - Are there any available ground truth measurements conducted in this city / neighboring regions of Ethiopia? If so, those raw measurement datasets should definitely be used for comparison in this context. If not, please derive the land surface temperature / land use spatial maps via numerical modelling techniques and framework. Modelled outputs can also be used for validation, provided that the accuracy of the model is well-justified and validated. The method of comparison within this manuscript is lacking of proper scientific rigor, because satellite datasets are only compared with satellite images, which means that the accuracies based on the usage of different image processing techniques are somewhat in doubt.

(6) **Section 3: Results and Discussion** - In the 2nd paragraph, the recent advancement of techniques in retrieving land use of developing cities / countries (especially the use of Machine Learning / Artificial Intelligence / Data Analytics) should

be highlighted and acknowledged. The form of built-up area expansion in Ethiopia should also be inter-compared with other cities / countries as well. Here are some useful references:

https://www.mdpi.com/2072-4292/13/16/3337/htm

https://link.springer.com/article/10.1007/s10708-022-10678-5

https://www.sciencedirect.com/science/article/abs/pii/S0048969722006519

https://www.mdpi.com/2072-4292/14/10/2349/htm

(7) **Section 3: Results and Discussion** - In the 2nd paragraph, the authors mentioned that changes of land use can be attributed to the encroachment of forested area, cash crop development in the periphery of the city etc., are there any formal government plans / documents that can be cited here as supporting references? It would be even better if some official statistical tables provided by local government can be found.

(8) **Figure 3 -** The authors should provide a summary of image processing techniques that have been applied to obtain these spatial plots, otherwise the figures shown here are lack of proper scientific rigor.

(9) For "**Single channel (SC) equation-based method**" under "Land Surface Temperature Analysis", some further descriptions are needed.

(10) The authors have obtained land surface temperature results via Landsat-8 for March 22, 2019 and another day in 2002, how are these results when compared with other similar studies conducted in Ethiopia? The results / numerical figures obtained in neighboring cities are alright to be used here for comparison.

(11) The authors claimed that the changes in lowest and maximum temperature within the spatial region can be attributed to the change in urban environment from natural to artificial or manmade surface. This is definitely one of the underlying reasons, however the authors may need to provide some fine details here, for example, describing the exact process that constitutes such changes.

(12) **The later part of Section 3** mentioned the connection between urban expansion / expansion of impervious surface and the change in local land surface temperature. However, there is no proper scientific evidence provided throughout the entire manuscript, and the connection between changes of land use and changes of LST is rather unclear here. Logical deduction should be added.

(13) The authors mentioned that sensitivity analyses of MODIS data resampling methodology is needed, this is really a good point. I believe that they should also put more emphasis on the handling and processing of satellite datasets of different resolutions, no matter in temporal or spatial manners. Some numerical / image processing techniques are essential when dealing with images of coarse resolutions. Another shortcoming of this manuscript is that no ground truth datasets were being used for validation / comparison. This point can also be included in the last paragraph of **Results**.

Minor Modifications needed

(1) The spelling of some words and the use of units in different places are inaccurate, for example the spelling of "algorithms", "degree Celsius" missing when describing the numerical figure of SD, "km^2" instead of "square km" in Section 2.1, "latitude and longitude from …. to " in Section 2.1, "Normalized difference vegetation index" (with a "d" after Normalize), (2012-2017) in the description of Figure 6.

(2) In **Section 2.3**, the detailed description of the methodology should be in Figure 2, but not Figure 1.

(3) Please check the formatting of all **Equations**. Some equations cannot be visualized at this stage.
(4) A proper round of grammatical editing should be conducted, and the authors should use more “commas” to separate the sentences, otherwise it might be hard for readers to follow.
(5) In the **3rd paragraph of Section 1. Introduction**, the authors try to connect LST with different disciplines, for example, hydrology, agriculture, climate change, urban planning etc. Please add some appropriate references here. Further, we can “alleviate” environmental problems, but not “evaluate” these problems. Tools are needed for “evaluating” natural problems.
(6) Some further technical details of each step in **Figure 2** should also be provided in the main context of this manuscript, for the sake of clarity.

Overall, the topic selected and the connection between changes of LST and changing land use in developing cities (especially in recent decades) is of practical interests, and results can hopefully help a local government in laying down future development goals and plans. Nevertheless, this manuscript has to be rewritten in a more broad, detailed and structured manner. Moreover, some scientific / technical details have to be added in different parts, especially **Methodology and Results.** The scientific contribution of this study has to be explicitly mentioned in **both Introduction and Conclusion** as well.