

Point to Point answers of the Reviewer's comments

(ROLL NO: 15CL92R01)

1) Response to Foreign Reviewer's comments:

General comment: In summary, the present study summarizes the comprehensive analysis of SUHII for many Indian cities and provides invaluable findings using state of the art data products and methods based on the latest and sufficient knowledge on the topic.

Answer: Thank you very much for your positive comment.

Comment 1: While it is still difficult to show very clearly the influencing factors as relationship among the parameters are very complicated, it would be clarified further in future studies. As a near future study, is there any way to untangle the complicated relationship among the factors, background climate and seasons for SUHII found in the present study?

Answer: Thank you for your comment and question. The influence of various factors that determine the UHI of a city are complicated. In-situ observations along with satellite based remote sensing datasets are used to understand these relationships. Further advancements for robust analysis of UHIs can be achieved through combining these available datasets with numerical modelling based studies. Future research could be directed to implement efficient site specific models for partitioning heat fluxes for urban areas in India and the effect of the drivers, particularly in light of the fact that new smart cities are proposed in the country. **This is incorporated in the conclusion and future scope section of the revised thesis.**

Response to Indian Reviewer's comments:

General comment: The findings from this study can serve a benchmark for the air quality, global warming climate change research communities and more particularly it will assist the socio economic policy makers. The dissertation also gives a good pathway to future scope through the use of state of the art observational and modelling technologies.

Answer: Thank you for the valuable and encouraging comment.

Comment 1: Introduction: The narrative is good; however, it could have been better if some language expert had gone through it. I find the introduction more colloquial.

Answer 1: Thank you for the comment. Necessary changes are made in the introduction section of the revised thesis to improve the readability of the thesis.

Comment 2: Repetition in some places, e.g., Section 4.2 is slight repetitive with Section 2.1

Answer 2: The repeating sections are deleted in the revised thesis.

Comment 3: Figure 4.5 is too clumsy to decipher the details.

Answer 3: Thank you for the comment. The clarity of the figure has been improved in the revised thesis.

Questions

Question 1: Chapters 3 and 4 I am still not clear, as the contents in these two chapters comprehensively detail the heat island effects for different cities in India, is there a specific reason to designate a chapter exclusively for Kolkata?

Answer 1: Thank you for the question. In chapter 3, a detailed analysis of the SUHII of Kolkata is presented. This chapter establishes the existence of SUHII in a major metropolitan city of India and paves ground for the following objectives of the thesis. In depth analysis of a city is done to identify the areas of hotspots of UHIs and also to understand the land use land cover change influence on it. Chapter 4 details the UHIs of major cities of India and the spatial variability of SUHII in a vast country like India.

Question 2: Also, the seasons summer, winter, post monsoon, and annual are separately detailed for different variables and indices, why pre monsoon Nor wester period is excluded? e.g., see Figures in chapter 3.

Answer 2: Thank you for the question. In this thesis four seasons of summer, monsoon, post-monsoon and winter are defined as the periods from March to May (MAM), June to September (JJAS), October to November (ON) and from December to February (DJF). Pre-monsoon and Nor'wester period falls within the seasons considered. These two separate seasons will be an interesting future study.

Question 3: Figure 3.3: Any particular reason why UHI is on the rise in summer during the last few years although it is partially attributed to vegetation index.

Answer 3: Thank you for the question. The reduction in vegetation cover of the city is evident from the analysis of land use land cover maps of the city. Also, a decreasing trend in NDVI was observed in the urban areas of Kolkata during the past two decades. This has led to increasing SUHII in the city. Further investigations need to be carried out to find out any other factors driving the increase during the past few years.

Question 4: Figure 3.5: It is interesting to see that there is a rising trend in night time UHI Figure 3.5 ; however, this is reasoned with the following statement the significant increase in night time temperature clearly indicates the effect of anthropogenic activities . The question is how clear, and why anthropogenic activity makes only nocturnal changes, and not during the day time here you used AOD too also in the analysis?

Answer 4: Thank you for the question. The increase in impervious surfaces for developing the cities plays a crucial part in adding to the anthropogenic load to the cities. The materials used for these constructions store heat during the daytime and release this heat slowly during the night-time. Hence, sensible heat flux is the major factor for night-time SUHII. This is the reason for attributing the increasing night time temperatures to anthropogenic activities. This has been incorporated in the revised thesis.

Question 5: It is interesting to note that SUHII 0 on annual scale during night time, and about negative during daytime over many Indian cities. Comparing Figure 3.5, why is it negative at Kolkata in Figure 4.4 d, or is it the lightness of the blue colour here?

Answer 5: Thank you for the comment. In Figure 4.4 (d), the SUHII in Kolkata is not negative. It falls in the range of 0–1°C as marked by the blue filled circle in the figure. This has been taken care in the revised thesis.