Integration of ground- and satellite-based data to map the Urban Heat Island effect

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Introduction

- The World is experiencing rapid urbanisation and over 66% of global population will live in cities by 2050 [1].
- Urban Heat Island (UHI) effect, which is a phenomenon where cities experience warmer temperatures than their rural surroundings [2], is intensified due to human activities such as buildings, roads, and industrial processes.
- Combined with climate change, UHI effect is becoming a serious issue as it affects human health and energy consumption [3]. Accurate measurement and monitoring urban surface temperatures (**Ts**) are crucial to preparing for tracking potential UHIs [4].
- Data-driven (fine scale Ts) recommendation is needed to advise on policy decisions.
- Few existing studies on urban heating are focused on understanding the characteristics of urban Ts at fine spatial and temporal scales.

Aims

Understand urban thermal dynamics at fine spatial and temporal scales by integrating ground and satellite data:

1. Design an algorithm to measure and monitor urban **Ts.**
2. Apply and evaluate the algorithm on Curtin campus and other urban environments.

Methods

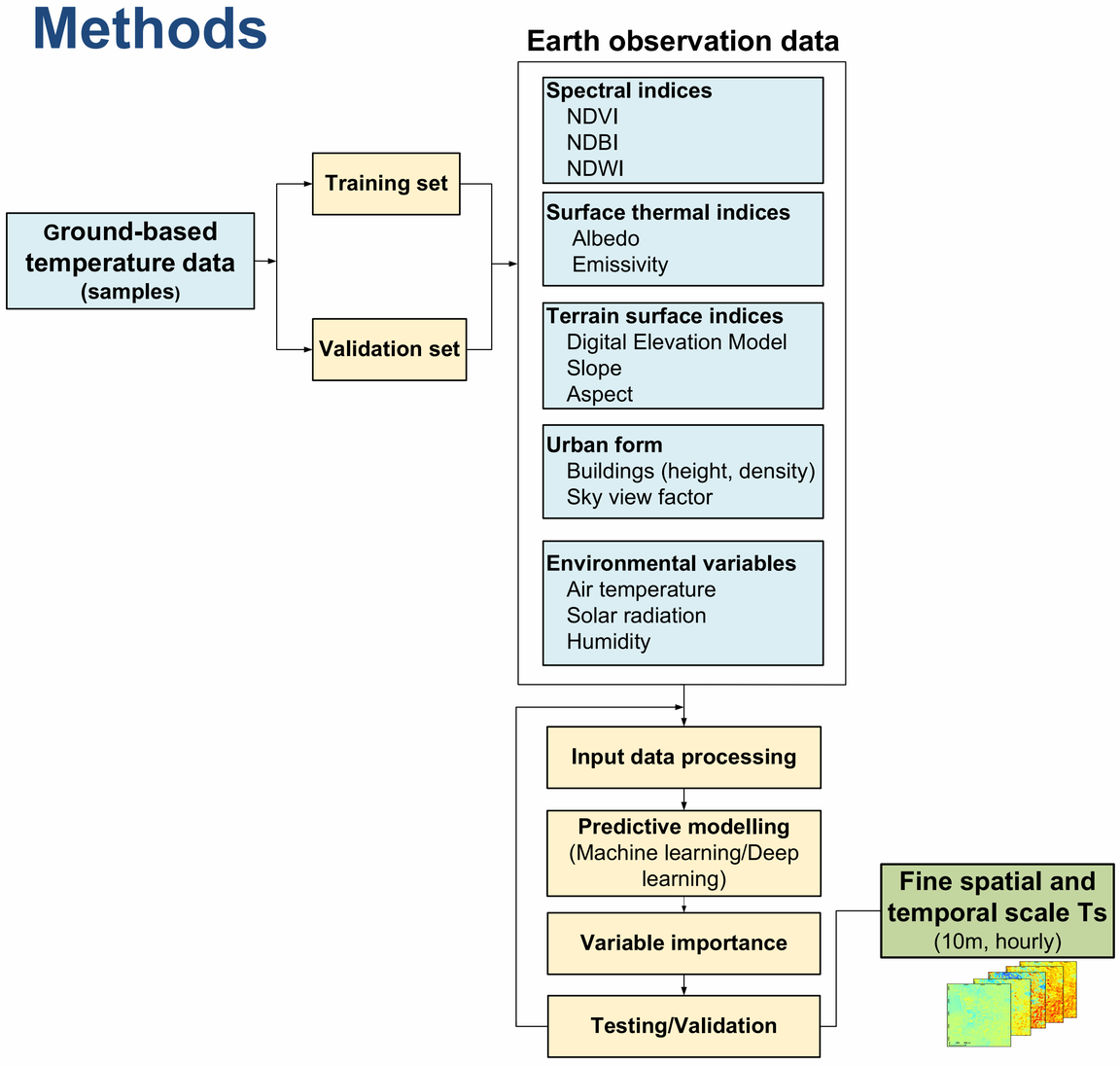


Fig. 1: Data integration framework - integration of ground-based and satellite data.

Expected outcomes

1. Fine spatial resolution urban **Ts** data.

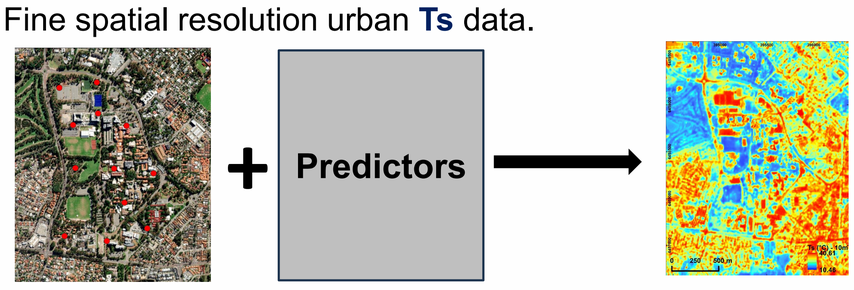


Fig. 2: Ground-based measurements (red circle), predictors and fine spatial resolution Ts (10m).

2. Fine temporal resolution urban **Ts** from ground-based measurements.

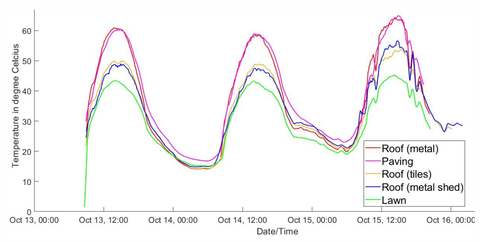


Fig. 3: Fine temporal Ts (hourly) from sensor nodes connected to a LoraWAN network.

3. Fine spatiotemporal urban **Ts.**

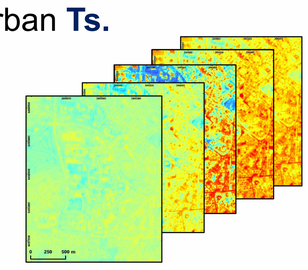
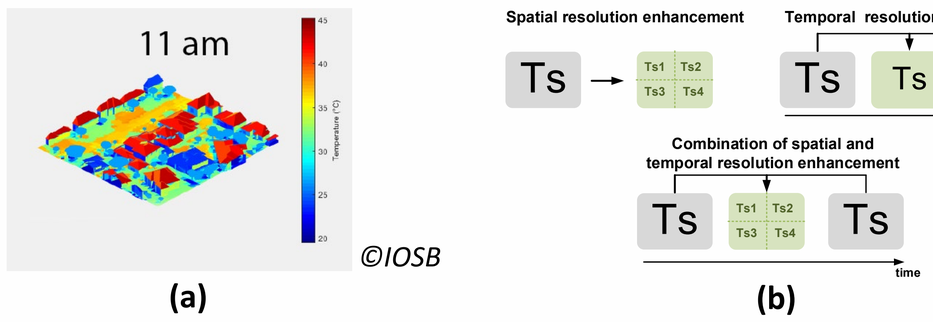


Fig. 4: Fine spatiotemporal Ts.

The predicted fine scales **Ts** will be validated with temperature simulation and satellite-derived **Ts** using spatiotemporal enhancement techniques.



(a) (b)

Fig. 5: Surface temperature simulation over time (a) and satellite-derived Ts enhancement (b).

References

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