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Interactive comment on "In-situ air temperature and humidity measurements over diverse landcovers in Greenbelt, MD Nov. 2013–Nov. 2015" *by* Mark L. Carroll et al.

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This paper reports on a dataset collected over a period of 2 years at the Goddard Space Flight Centre (GSFC) in Greenbelt Maryland. The dataset consists of observations made at 15 minute intervals by identical instruments at 12 sites representing different landcovers. The objective of the research was to: evaluate the contributions of various land cover types at the GSFC facility to urban heat island formation'. The paper is clearly written and the descriptions of the instruments and their calibration is clear. However, I have some questions about the substantive nature of the project, specifically: âĂć The link between the data acquired and the urban heat island phenomenon (UHI) âĂć The metadata provided for each of the measurement sites which does not

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include a map showing the position of the station over each land cover types selected. âĂć The use of a 'local' weather station at BARC, chosen on the basis of proximity.

The urban heat island phenomenon is the best studied of all urban climate effects and has been a subject of research for over 200 years. There are four types of UHI, each with its own driver: substrate temperature; surface temperature; near surface air temperature (within the urban canopy layer, below roof level) and; air temperature above the canopy (within the urban boundary layer). This work fits the third type best. The canopy level UHI which has generally found to be strongest in calm and clear weather conditions, at night following a dry spell. Research over the last 50 years has shown that it is an outcome of several factors associated with urban form and function: 1. Form: land cover (e.g. proportion vegetated), fabric (e.g. asphalt) and geometry (e.g. the dimensions of urban spaces, such as streets); 2. Function: the generation of anthropogenic heat by human activities. The canopy level UHI appears at night as the urban surface cools more slowly than the surrounding 'non-urban' landscape. In other words, the UHI is defined by comparison to a reference station selected to represent the 'natural' environment, that is, the landscape that would exist in the absence of urbanisation (the background climate). Naturally, this poses methodological issues as the nature of the UHI depends on the selection of both the urban and the background station (see Stewart and Oke, 2012). The paper has few references to the phenomenon under study and the ones that are used to present the UHI are published after the experiment has begun, one is specifically on satellite derived UHIs, which is based on surface and not air temperature. The abstract refers to 'the conductive properties of concrete and asphalt', which is true but does not refer to surface albedo, heat capacity, lack of water and so on that are equally relevant (see Oke, 1981). On p4, it is stated that the UHI 'occurs when dense concentrations of built surfaces retain heat differently than their suburban or rural surroundings'. This statement is correct and should inform the observation strategy, I think. This would include making explicit, the decisions about different urban environments on the GSFC site. However, the stations locations are selected to represent land cover types and from Figure 1 I see none located on the ground in the spaces between buildings. Two of the selected locations are rooftops, which have peculiar climates owing to the relatively small size, turbulent circulations generated by edge effects, and the presence of heating/cooling systems (see Oke, 2006). There needs to be better information on the location of the instruments I think. In essence, these instruments are sampling from microscale environments (carpark, rooftop, etc.) so it is essential to know for example, how close to the edge of the land cover type that the instrument is located so that the observations can be attributed to that land cover type. There is no indication as to whether the instruments are likely to capture edge effects and the advection of air from one surface to another. The land cover classification was based on the National Land Cover Database but there is no indication of the resolution of these data or why it was needed – do the authors want to link these measurements to the national coverage? There needs to be more information about the climate station BARC, which is used to represent the background climate against which the urban effect is judged. We need to know about its setting, instrumentation and exposure and whether these properties changed over the period. Moreover, as the article itself makes clear, we need more information than air temperature and humidity to interpret the differences. It would be useful to provide other information from BARC such as information on precipitation, wind, cloud, soil moisture, radiation, etc. For example, the UHI is generally stronger after a dry period, not because the urban landscape has changed but because the natural landscape has become drier; this reduces its ability to store energy and results in more rapid cooling at night-time. Overall, I think that the justification for the inclusion of these records as a valuable resource must be made. I do not think that they are indicative of the urban heat island phenomenon as the observational study has not been designed with this in mind. Given the proximity of the instruments on the site, they indicate the different microclimates that are present in the facility, each of which is likely to respond differently under climate change scenarios, depending on how the background climate changes (e.g. precipitation, sunshine, wind). However, to interpret these changes, the weather information for the background station needs to be included also.

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