

## A SIMPLE METHOD FOR SPATIAL SHARPENING OF THERMAL SATELLITE IMAGES FOR URBAN HEAT ISLAND STUDIES

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### ABSTRACT :

This study examines and validates a technique for sharpening the spatial resolution of thermal satellite images, while simultaneously correcting the image derived temperatures for emissivity differences of urban surface materials. The method combines a classified image derived from a higher resolution visible wavelength sensor, with a lower resolution thermal image using existing, compiled spectral emissivities for urban surfaces. This method effectively ratios the visible and thermal datasets in the emissivity correction equation using the Planck function. This has the effect of simultaneously correcting the image-derived 'Brightness Temperature' (**T<sub>b</sub>**) to the surface radiant temperature (**T<sub>s</sub>**), while enhancing the spatial resolution of the thermal data. Although the method has been used for studies of the urban heat island, it has never been validated by comparison with 'in situ' derived surface or air temperatures, and researchers may be discouraged from its use due to the fact that it creates sharp boundaries in the image. The present study uses a night-time ASTER image covering both urban and rural areas of Hong Kong, and compares the uncorrected and corrected image radiant temperatures to surface and air temperatures collected at the image time.

This study made use of an ASTER Level 1B and Level 2 night time image over Hong Kong on 31-Jan-2007. Field measurements of surface and air temperatures were collected within 2 hours of ASTER overpass time. Following image sharpening of the level 1B data, the correlation between image and field data obtained an R<sup>2</sup> value of 0.84, compared with 0.67 for the unsharpened data and 0.70 for the system processed Level 2 product (AST2B3). The sharpened image values were also much more representative of air temperatures than were the unsharpened values.

The method described is not synonymous with the image fusion techniques developed for VNIR images which can be fused with high resolution panchromatic data, where both datasets represent radiance of similar wavelengths, the main difference being pixel size. In the present case, the **T<sub>b</sub>** values within each 90m pixel block are adjusted for emissivity differences within the block, and sharpening of the resolution depends on the extent to which the emissivities allocated represent the true emissivity values within the block. The spatial resolution of the thermal data remains that of the original large pixel block, and the emissivity correction merely sharpens the spatial resolution, while performing an emissivity correction.