"Estimation of anthropogenic heat flux over complex urban environment using remote sensing data"

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Anthropogenic heat flux (AHF) is a heat emitted by human and human activities and is a prime contributor to Urban Heat Island (UHI). The major sources of AHF emissions are buildings, traffic, industries and metabolic activities. It is regarded as an important parameter for various climate models. In urban regions, the majority of AHF was released due to the electricity use of building and vehicular exhaust. At present three different methods are in practise for AHF estimation, i.e. inventory approach, energy balance approach, and building energy modelling approach. The majority of the earlier studies used modelling approaches that often based on several assumptions that result in under/over estimation of AHF. Some research followed the energy balance approach for better estimation, but it requires flux towers and serious micro meteorological observation, which may be costlier for many cities of the world. However, by using an energy balance approach over remote sensing data enables to estimate AHF at higher spatial and temporal resolution at cheaper price and less time. This study is unique, because previous research follows any one of the methods mentioned above, but in this study the results of various methods had been compared. Also demonstrates an alternative methodology using remote sensing to estimate the magnitude of AHF in urban Hong Kong. The net radiation flux, sensible heat flux, latent heat flux and ground heat flux were estimated using the Advanced Space borne Thermal Emission and Reflection Radiometer (ASTER) level 1B images (geometrically and radio metrically corrected). The meteorological parameters and GIS datasets are integrated together with the satellite imagery in energy balance

method. The AST L1B images of 31-Jan-07 (Night) & 30-Nov-07 (Day) over Hong Kong were used in this study to show the spatial variation of AHF over day and night and to identify its relationship with UHI. The results of satellite based estimation are compared and validated with numerical models based on a top down approach (customized global AHF model), and bottom up approach (detailed GIS based model). The results reveal that the AHF was very high in urban areas when compared to rural areas. The large heat capacity of buildings, higher vehicle density and huge population density in urban areas results in huge AHF in urban areas of Hong Kong. The results of satellite based estimation were validated with numerical and GIS based models. The estimation of AHF at higher spatial and temporal scale will be very useful for urban planners and local governance. The method used here may be used for any city possess a similar complex urban environment of Hong Kong.

Keywords: Anthropogenic heat flux, Urban Heat Island, energy balance, ASTER, and Hong Kong.

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