IAF EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Applications, Societal Challenges and Economic Benefits (5)

Author: Dr. Prajowal Manandhar
United Arab Emirates University (UAEU), United Arab Emirates, pmanandhar@uaeu.ac.ae

TOWARDS CREATING SMART THERMAL MONITORING URBAN CITY USING HIGH RESOLUTION SATELLITE IMAGES AND IN-SITU MEASUREMENTS

Abstract

The main objective of this study is to characterize a unique urban environment like Abu Dhabi island (in larger scale, UAE) in order to investigate the temporal variations in the Urban Heat Island (UHI) intensity by applying the Local Climate Zone (LCZ) concept. According to LCZ, the environment within each class of LCZ is supposed to be similar. Hence, this enables mapping entire Abu Dhabi island consisting of different heterogeneous building typology along with land cover classes to different LCZ classes. Furthermore, each LCZ will be modeled using Envi-met, which is an urban micro-climate modeling and simulation platform. The simulation results of the Envi-met models will be then calibrated using Machine Learning with the help of in-situ urban thermal measurements and hence, the refined models can be applied to entire Abu Dhabi island (and to UAE) based on LCZ classification. A pilot study has already been conducted in Abu Dhabi and Al Ain using low-resolution Landsat images to justify the feasibility and make a case for the proposed work. Furthermore, the work with high-resolution satellite images will open a door for new applications towards building a smarter city.

Abu Dhabi is characterized by highly heterogeneous types of built forms that comprise mainly of old mid-rise and modern high-rise buildings with varied degrees of vegetation cover in different parts of the city. Therefore, it is important to understand how micro-thermal flow is taking place and analyze the thermal difference in different parts of the city. In the last few decades, Abu Dhabi island have experienced rapid growth resulting in an urban micro-climate scenario to evolve rapidly thus, it is important to conduct detailed study and analyze the urban thermal dynamics continuously. The LCZ classification map, which considers factors related to the physical land surface property are usually mapped with satellite images from mid-scale resolution Sentinel or low-scale resolution of Landsat. Since, each building or infrastructure or land cover region contributes towards particular LCZ, it is important to use high resolution satellite image (such as Worldview-2) to understand environment in detail where intra-building thermal flow is taking place.

Thus, this work is just one such tool to help make better decisions to model a micro-climate urban environment with the integration of high-resolution remote sensing data along with in-situ environmental data. This research would also be a valuable tool to inform city planners on how to optimize street layouts, building heights, road and park formation, neighborhood orientation and even consider construction materials, to improve thermal comfort in the city. Hence, this proposed work will be of prime importance for different government entities to properly plan and manage the resources considering it to be a foreseeable future smart city and smart country.