EMS Annual Meeting Abstracts
Vol. 15, EMS2018-815-2, 2018

Analysis of Urban Heat Island in the Desert City of Beer-Sheva, Israel, Using a Modified Local Climate Zone Classification

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This paper aims to determine the intensity and dynamics of the urban heat island (UHI) in desert cities, using the Local Climatic Zone (LCZ) methods in the case of Beer Sheva.
Previous studies show that the intensity of the Beer Sheva UHI is relatively high for its size and location in a hot, arid zone.
In the first stage, an LCZ classification map of Beer-Sheva was developed using GIS in order to subdivide the city into different zones based on similarities in degree of land cover ,urban geometry, urban morphology and land use. The next step was to analyze the UHI air temperature according to this LCZ map. 4 built LCZ types and 5 natural types were identified in the studied urban area. Air temperature data was collected by two methods; (1) fixed meteorological stations measured climatic variables during calm winter and summer weather conditions in eight case studies, and (2) mobile traverse measurements at dawn and early-afternoon were conducted in five case studies. Later, a normalized temperature was calculated for winter and summer in order to present all fixed meteorological stations at the same time. The final step was to compare intra-urban zones in Beer-Sheva according to this LCZ map and associated morphological and climate databases.

Results showed that the UHI is more significant in winter than in summer. However, during winter the UHI is more dominant pre-dawn than in the afternoon, while during the summer, the UHI is more dominant at midday.
In addition, since the morphology of Beer-Sheva is characterized by top down planning development, unlike European cities, it is possible to find LCZ2 located at the edge of the city as well as in the city center. A comparison between UHI intensity of the same LCZ located in different areas of the city showed that the same LCZ will have a higher temperature if it is located in the inner-city rather than at the edge of the city. It is also observed that during the winter nights, LCZ 5 has the higher UHI intensity of 5°C at night and 2°C midday. During the summer LCZ 3 has the higher UHI intensity of 3°C both during the day and night.
It seems that in terms of UHI mitigation in desert cities there are climatic advantages to compact city forms like LCZ2 whereas, non-compact forms like LCZ3 are not ideal from the climatological perspective.