Geophysical Research Abstracts
Vol. 21, EGU2019-17659, 2019
EGU General Assembly 2019
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Multi-scale approach to quantify the influence of urban green spaces on climate behavior of the Viladecans-Gavà-Castelldefels conurbation in the metropolitan area of Barcelona

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Literature widely recognize the strong influence of urban green spaces in the microclimatic regulation and its potential applications to mitigate warming in cities. Promote viable actions to the climate change adaptation from cities through vegetation and help to palliate the urban heat island effect (UHI) to reduce health risk during extreme heat episodes, requires accurate criteria for each context in its different scales. This study presents a multi-scale approach to quantify the influence of urban green spaces on climate behavior of the Viladecans-Gava-Castelldefels conurbation in the metropolitan area of Barcelona. For this purpose, first, air (Ta) and surface (Ts) temperature of 124 points located in the interior and surroundings of seven green spaces are registered through field measurement campaigns during day and night between July 26 and August 4 of 2018. Then, Land Surface Temperature (LST) and Normalized Difference Vegetation Index (NDVI) from Landsat 8 and Sentinel 2 data imagery for a clear-sky day nearby to the measurement days are retrieved and complemented with the NDVI of the spring-summer period of 2018 (1m) available in the Cartographic and Geographic Institute of Catalonia (ICGC). Analytical methods departed from the UHI characterization of the three-municipal area, resulted in 1.63°C LST increase in the urban Corine land cover (CLC) in relation with the rural at the whole ambit. Then, an OLS model to predict LST is constructed with NDVI and distance to parks (spaces with NDVI>=0.30) in the whole ambit (R^2=0.59) and in the urban area (R^2=0.47). At this point, results indicate that increase a tenth of NDVI reduces 1.15°C the LST of the whole ambit and 0.73°C on the urban area ($p<0.01$); while for each 100m further from parks, the LST rises 0.61°C for the whole ambit and 1.81°C on urban area ($p<0.01$). Particularly for the seven study cases, field measurements registered coincident spatial distribution with LST and NDVI, as well as highlighted the UHI effect during night. The quantification of the intensity and extent of the cooling effect of the study cases, registered a maximum cooling intensity of 2.7°C with a 300m buffer area; as well as the cooling effect calculation through concentric rings resulted between 40 to 130m extents from the parks boundaries and cooling intensity from 0.29 to 2.15°C. In conclusion, even when the multiple-scale analysis present coincidences and discrepancies between the different approaches, the models and methods applied in this study resulted in values that allow starting to talk about adequate actions to adapt to climate change in the context of the metropolitan area of Barcelona. The present study is part of the "Urban-CLIMPLAN. The urban heat island: effects on climate change and modeling for territorial and urban planning strategies. Application to the metropolitan region of Barcelona" and financed by the Ministry of Economy and Competitiveness of Spain (MINECO) and the European Regional Development Fund (ERDF).