Geophysical Research Abstracts
Vol. 20, EGU2018-6744-1, 2018
EGU General Assembly 2018

Estimation of surface air temperature of Barcelona metropolitan region from MODIS land surface temperature and GIS data

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The metropolitan region of Barcelona (RMB) is one of the most densely populated areas in the Mediterranean region. Therefore, evaluating the intensity of its urban heat island, UHI, is a very important issue. For this purpose, the distribution of the land surface air temperature, LSAT, over the RMB should be known with a higher spatial resolution than that provided by the meteorological network, given that the number of stations is insufficient and they are not homogenously distributed. One of the methods to improve the spatial resolution of LSAT estimations is based on a multiple regression analysis where remote sensing data and Geographical Information Systems, GIS, variables are taken into account to obtain estimations of minimum, Tmin, maximum, Tmax, and mean, Tmean, daily surface air temperatures. Essentially, it is assumed that maximum, minimum and mean daily air temperatures depend on ten independent variables. The LSAT measurements considered for the regression correspond to the year 2015 and are obtained from 48 meteorological stations distributed throughout the RMB. The remote sensing variables, derived from MODIS data, are nocturnal and diurnal daily land surface temperature (LST), and NDVI and NDBI indices of vegetation and building respectively. The other six variables are geographical data: latitude, longitude, altitude, distances to shore-line, orientation and slope. The remote sensing variables and the geographical data are obtained with a spatial resolution of 1 km. The results are derived with a square multiple regression coefficient of 0.92 for Tmin and Tmax and 0.95 for Tmean . The averaged discrepancy between empiric LSAT and those derived from multiple regression ranges from 1.5 to 2.0 oC. Tmin is found to depend mostly on nocturnal LST, latitude and longitude; Tmax on nocturnal and diurnal LST, latitude, longitude and altitude; and Tmean on nocturnal and diurnal LST.