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Bioclimatic assessment in a mediterranean climate: the city of Madrid

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This paper develops a procedure to create bioclimatic maps with the aid of a geographical information system (GIS). Through the spatial patterns of physiological equivalent temperature (PET) for the city of Madrid and nearby locations, we evaluate the influence of a large city and their different land uses and urban structures over the regional bioclimatic conditions.

The meteorological data used have been the daily maximum and minimum values of temperature, relative humidity, wind and cloudiness from 1985 to 2004, available from the synoptic network of the Spanish meteorological office (INM) and the regional network of the Comunidad de Madrid. Besides, we have use also hourly temperature, relative humidity, wind and radiation data from an automated local network (Ayuntamiento de Madrid), from 2002 to 2004. The actual calculations of mean radiant temperature, Tmrt and PET are performed with the aid of the PC software RayMan. Land use was extracted from two sources: CORINE land cover database and information from the Plan de Ordenación Urbana de Madrid. To match both sources, the following three land-use categories were adopted: urban (dense, single houses, residential), green and recreation areas and others (including here industrial, working premises and large markets surfaces). The GIS tool to combine the different sources of information was ArcView 9.1. We can summarize our findings in two main results. The first one is to quantify and corroborate the climatic contrast between the urbanized areas and the regional rural background, being the isotherms of 0°C (winter) and 34°C (summer) the boundary between both areas. PET values calculated during extreme months show that the values range from a minimum value of -3.5°C (non

urban) to a maximum of 5°C (urban) in January and from 24.4°C to 36.6°C in July, corresponding to extreme thermal sensations cold (winter) and hot (summer). Within the city, we have found significant differences between three areas. The coolest corresponds to the green areas (urban green parks, like El Retiro), delimited by a PET lower than −2°C in winter and 30°C in summer. As opposite to that one, the central built-up areas, densely urbanized and lacking of green surfaces, are the warmest, since January PET values are above 0°C, while summer values increase to 35°C. Finally, an intermediate area, which boundaries would be the isotherms of 0/−2°C (January) and 30–35°C (July) coincides with a less compact urban structure, characterized by wide streets and avenues, small gardens with significant amounts of trees between the buildings and recreational surfaces.

Outgoing research will deal with the relationships between the spatial patterns of PET and the different weather types of the region, and their link with health and mortality data.