

570: Intra-urban variability of climatological indices in Florence (Italy)

Martina Petralli^{1,2*}, Luciano Massetti³, Simone Orlandini^{1,2}

Department of Plant, Soil and Environmental Science, University of Florence, Florence, Italy^{1}*

Interdepartmental Centre of Bioclimatology, University of Florence, Florence, Italy^{2}*

martina.petralli@unifi.it

Institute of Biometeorology, National Research Council, Florence, Italy³

Abstract

Intra-urban thermal range can reach similar values of the urban-rural difference. In this paper 5-years of thermal measurements carried out in Florence (Italy) by 25 air temperature sensors are presented. To evaluate the thermal difference within the urban environment of Florence, daily and hourly indices were applied to hourly data. Daily extreme indices were calculated on pre-defined arbitrary threshold according to the European Climate Assessment (ECA) indices definitions. Data were analyzed by season and significant differences were observed. A mean difference of almost 3 °C between the hottest and the coolest station was found in all seasons in maximum, minimum and average daily temperature. Significant intra-urban differences were also found in all climatological indices, such as frost and summer days. The difference in tropical nights was even more evident. The results of this study contribute to quantify the thermal intra-urban temperature range in the city of Florence, suggesting important application in phenology, aerobiology, human health and urban planning.

Keywords: extreme indices; frost days; summer days; degree days indices

1. Introduction

The difference between urban and rural temperature (Urban Heat Island Effect – UHI) has been investigated all over the world [1,2,3,4]. But inside the urban environment it is possible to find a large intra-urban air temperature difference [5,6]. Even if the intra-urban air temperature difference is less studied than the UHI itself [3,7,8], it can reach values similar to those of the urban-rural difference, and can have important applications in several fields of study, such as biometeorology and phenology [9].

The aim of this study is to quantify the intra-urban thermal variability of the city of Florence by using a 5-years database of a network of air temperature sensors.

2. Materials and methods

2.1 The network of air temperature sensors

In this paper, data collected by a network of air temperature sensors (HOBO® PRO series Temp/RH Data Logger, Onset Computer Corporation, Pocasset, MA, USA; operating range T, -30°C to 50°C; RH, 0–100%; resolution, 0.2°C between 0°C and 40°C) with naturally ventilated solar radiation shields (RS1-HOBO® PRO accessories) were used. The network consisted of 25 loggers randomly located in the urban area of Florence. Data were collected at fifteen minute intervals since December 2005.

2.2 Indices of climate extremes

Daily Temperature indices (°C) and extreme indices (number of days) were calculated on pre-defined arbitrary threshold according to the European Climate Assessment (ECA) indices definition (<http://eca.knmi.nl/>) [10].

Daily temperature indices

1. TG: mean of average daily temperature (°C)
2. TN: mean of minimum daily temperature (°C)
3. TX: mean of maximum daily temperature (°C)

Daily extreme indices

1. FD: frost days (TN<0°C; days)
2. SU: summer days (TX>25°C; days)
3. TR: tropical nights (TN>20°C; days)

All indices were also calculated on a hourly basis:

Hourly extreme indices

1. FH: frost hours (T<0°C; hours)
2. SUH: summer hours (T>25°C; hours)
4. TRH: number of tropical hours during the night (T> 20°C; hours; night=from 10 p.m. to 5 a.m.)

All indices were calculated in order to analyse the intra-urban thermal variability in each season.

3. Results

Intra urban thermal difference were evident in all season (Tab. 1). The higher difference between the stations was found during summer for each index (TN, TG and TX).