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The effect of pavement-watering on subsurface pavement temperatures

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ABSTRACT

Pavement-watering is currently viewed as a potential climate change adaptation and urban heat island mitigation technique. The effects of pavement-watering on pavement temperature measured 5 cm deep are presented and discussed. Subsurface temperature measurements could not be used to improve or optimize pavement-watering methods as was seen in previous work on surface temperatures or subsurface pavement heat flux measurements.

1. Introduction

While evaporative cooling has been used in warm regions for centuries, pavement-watering has gained renewed interest in recent years as a potential climate change adaptation and urban heat island (UHI) mitigation technique. In the last 20 years, several studies have been conducted in Japan (Kinouchi and Kanda, 1997; Yamagata et al., 2008; Takahashi et al., 2010) or elsewhere around the world (Wei and He, 2013; Maillard et al., 2014). As climate change is predicted to increase the frequency and intensity of heat-waves in the Paris region in France (Lemonsu et al., 2013), authorities in Paris have taken an interest in the potential benefits of a city-wide pavement-watering strategy, backed by numerical and experimental studies (Météo France and CSTB, 2012; Bouvier et al., 2013).

One such field experiment of pavement-watering was conducted at two sites over the summers of 2013 and 2014 and has been extensively analyzed by the authors. Pavement heat flux and surface temperatures were used to propose improvements of the watering method applied at the Louvre site (Hendel et al., 2015a, 2014) and the microclimatic effects of pavement-watering were studied and compared for the Louvre and Belleville sites with differing watering strategies (Hendel et al., 2015b).

Pavement temperature 5 cm below the surface was also measured but has not been discussed to date. We therefore propose to determine the effects of pavement-watering on pavement temperature. In addition, the potential for these measurements to be used to improve the watering method, similarly to pavement heat flux and surface temperature measurements, will also be considered.

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2. Methodology

A description of the test site, instrument installation, and watering method used for this study can be found in Hendel et al. (2015a).

The pavement sensor described in that paper and used to measure pavement heat flux also includes a Type T thermocouple used to record pavement temperature 5 cm below its surface discussed here. As was the case for pavement heat flux, pavement temperature was recorded every minute in local daylight savings time (UTC +2).

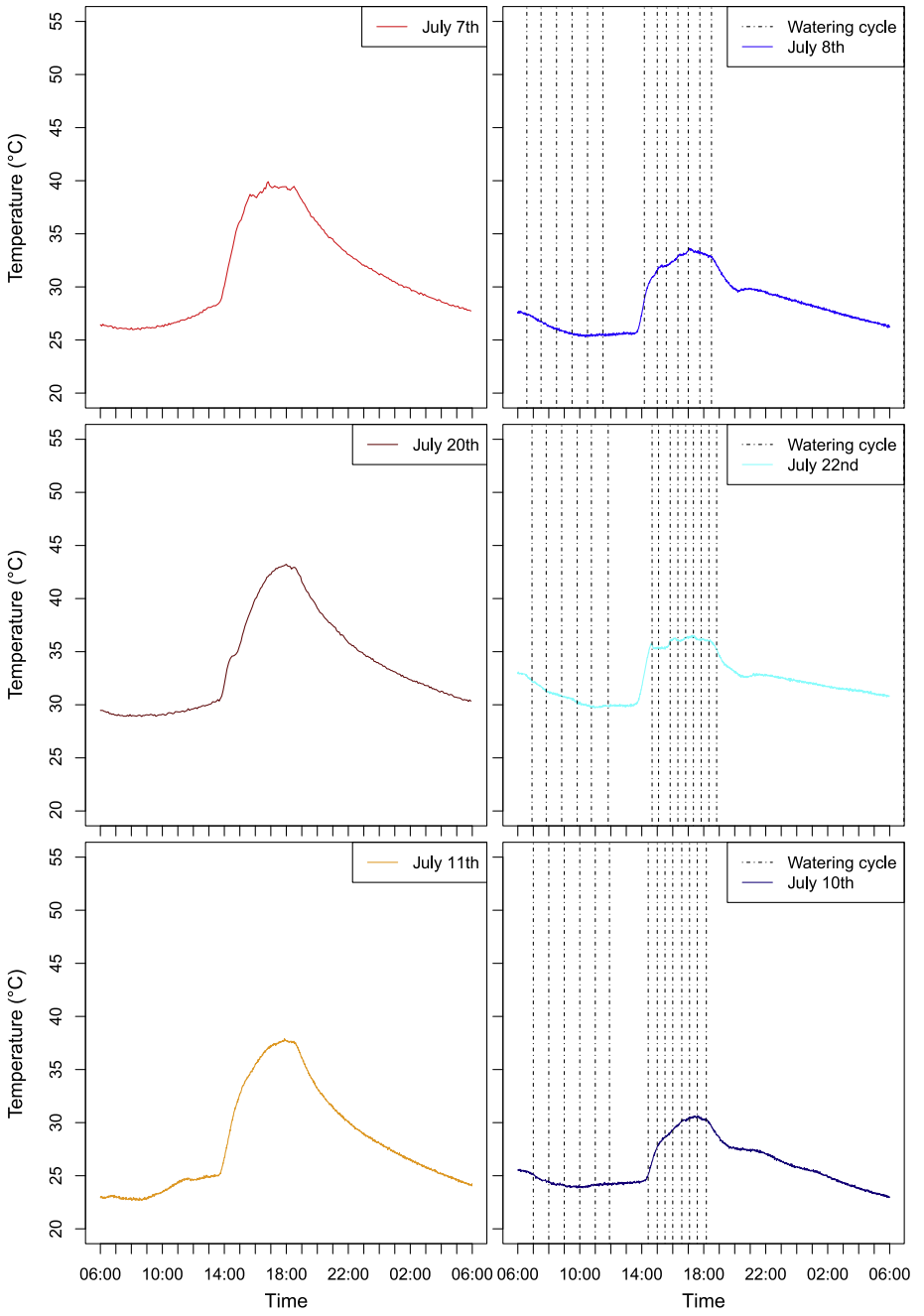

Fig. 1. Pavement temperature 5 cm below the surface on control days (left) and watered days (right) measured in July 2013.