The main characteristics and space distribution of urban heat island over Odessa

I.L. Marinin, O.R. Dranicher (kadicheva@yandex.ru)

Odessa State Environmental University, Odessa,Ukrain

1 INTRODUCTION

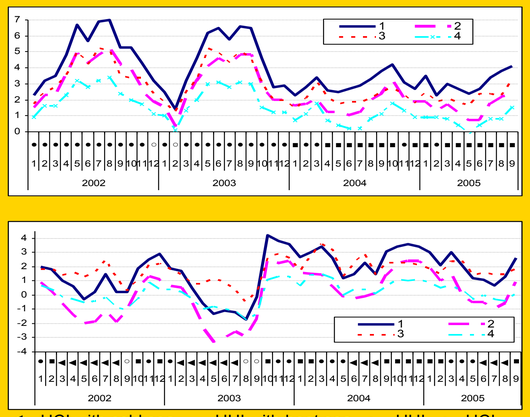
In Odessa, as well as in other cities of the world, the natural weather conditions are exposed greatly to influences of the city, its building location. Buildings, roads and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist generally become impermeable and dry. This development leads to the formation of urban heat islands (UHI) — the phenomenon whereby urban regions experience warmer temperatures than their rural surroundings.

The purpose of this study is to evaluate the integral characteristics of Odessa heat island, their temporal variability and space structure of the UHI.

3.1 RESULTS

a)

b)



◄ - UCI with cold sea, ■ - UHI with heat sea, ● – UHI, ○ - UCI

Fig.2 The time dependence of values ΔT_L (1), $\Delta \overline{T}_L$ (2), ΔT_E (3) u $\Delta \overline{T}_E$ (4) at 7 (a) and 19 (b) hour

4. CONCLUSIONS

Thus, we show that the urban heat island over Odessa formed mainly through the change of the underlying surface characteristics in the city. The quantitative characteristics of urban heat islands conform with the published data.

2 DATA AND METHODS

Initial data include the air temperature data of air monitoring stations «ПОСТ-1» (AMS) distributed in the city (terms: 07 and 19 hours of local time), and also the data of Odessa-observatory (Odessa), aerometeorological station (Airport), the data of meteorological stations in Odessa region (Serbka, Razdelnaya) and the data of sea station Port, Ilichevsk, Yuzhniy (terms: 06 and 18 UTC) from January 2002 to September 2005 (in all 45 months).

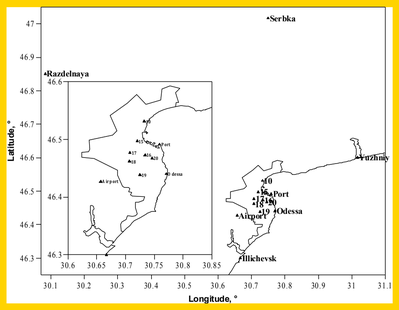


Fig.1 The location of AMS and stations

UHI is usually determined by the temperature contrast over the city and rural surroundings. However, the Odessa city is a seaside city and the sea has a direct effect on the city. Therefore, as the estimate of the temperature over the sea $\overline{T}_S$ is taken the temperature, averaged over the sea stations. The temperature over the city $\overline{T}_U$ is the average temperature between AMS and Odessa-observatory station. The averaged temperature over land $\overline{T}_L$ is calculated by the remaining stations.

The integral characteristics :

mean air temperature in rural surrounding

$$\Delta T_L = T_{U\max} - \overline{T}_L \qquad \Delta \overline{T}_L = \overline{T}_U - \overline{T}_L$$

intensity — max (min for UCI) air temperature in the city — plateau — mean air temperature in the city

analog of intensity — analog of plateau

$$\Delta T_E = T_{U\max} - \overline{T}_E \qquad \Delta \overline{T}_E = \overline{T}_U - \overline{T}_E$$

mean air temperature out of the city (rural+sea)

For the visual description of the UHI the horizontal distribution maps of mean monthly air temperatures are constructed for each month at 07 and 19 hours. Subject to the air temperature distribution between three objects (land, sea and city), the horizontal distribution maps have been divided into several groups.

1	$\overline{T}_L > \overline{T}_U > \overline{T}_S$	UCI with cold sea
2	$\overline{T}_L < \overline{T}_U < \overline{T}_S$	UHI with heat sea
3	$\overline{T}_L < \overline{T}_U > \overline{T}_S$	Urban heat island (UHI)
4	$\overline{T}_L > \overline{T}_U < \overline{T}_S$	Urban cold island (UCI)

3.2 RESULTS

a) b) c)

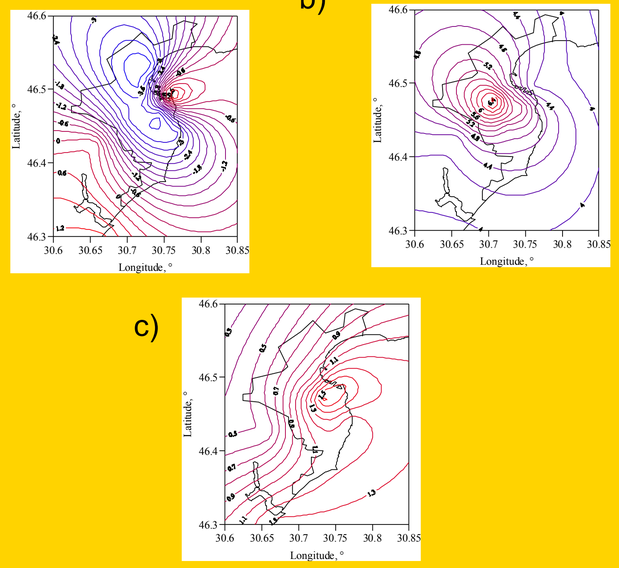


Fig.2 The horizontal distribution of mean monthly surface air temperature at 07 hour in December 2002 (a) (UCI), *in March 2004 (b)* (UHI), *, in January 2004 (c) (UHI with heat sea).*

a) b) c) d)

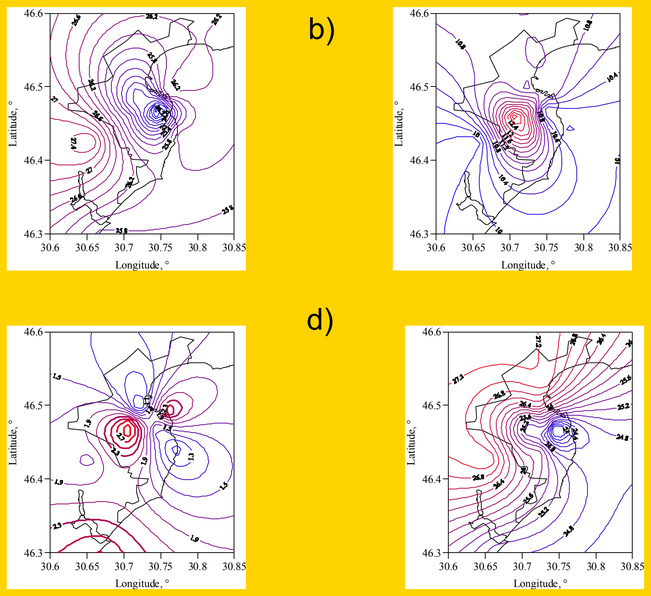


Fig.3 The horizontal distribution of mean monthly surface air temperature at 19 hour in August 2003 (a) (UCI), in April 2005 (b) (UHI), in February 2004 (c) (UHI with heat sea), in August 2002 (d) (UCI with cold sea).