

Fractal geometry of the ground surface and its heat transfer coefficient

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The history of the research of the heat island phenomenon is assumed to be a long start from the research of Howard in 1833. At first, it was thought that the principal cause of the heat island was in the heat inertia on the surface of the city different from suburbs. In this case, the daily difference of the atmosphere and the ground level both grows small by the city part in suburbs. However, when it came to be able to measure the temperature of the ground level by the remote sensing by becoming 1970's, the temperatures fluctuate at daytime and nighttime of the ground level became clear larger than suburbs the city part. The surface of the city part meant the heat inertia was small, and the explanation by the heat inertia model failed if this was simply interpreted. Afterwards, it has not arrived to specify the main cause though the research to which it looks for the cause of the heat island phenomenon besides the heat inertia has been actively performed.

We observe the temperature of the Kyoto city from 2004 to 2006, and when the heat inertia on the surface of the city is caused, are still digits with the conclusion. This seemingly contradicts the result of the above-mentioned remote sensing. Then, if it is shown that the heat transfer coefficient to the atmosphere is greatly different according to the shape of the ground level, and considers this difference, it is shown that it is the one that not the one that the result of the remote sensing reflected the heat inertia but the heat transfer coefficient was reflected, and not the one to mean the heat inertia of the city part is small.

The heat transfer coefficient on the surface of the object is examined in detail in the field of information heat engineering, and first of all, Nusselt number is obtained and empirical formula is obtained for various shape as a function of the Reynolds number. The dependency to the Reynolds number is somewhat different according to shape, and if it follows empirical formula when putting it under a radiation environment as the same as direct sunshine, the temperature difference between the surface temperature of the very thing body and the temperature of the circumambient air is proportional to the 0.2-0.5th feature L size power of the object. That is, the surface temperature rises by the object large. The aluminum board that painted sized different and the black was measured and the rise in heat was measured under direct sunshine. how to approve this result in the wind of nature because this result was a result of the wind tunnel experiment accurately controlled. As a result, it has been understood to reach about 30 degrees in the board of 1m while rise in heats are about ten degrees in the board of several cm in proportion to about the 0.3th L size power. That is, the surface temperature changes greatly depending on the size of the object that composes the ground level. Actually, it is understood that it is a size of several cm in suburbs, for example, the leaf while the surface where the city part is composed has the size of 10m or more, and the temperature increases only by this by a factor of several.

As for the reason why the heat radiation efficiency of the fractal structure is good, the rose is scattered on three dimension space, and a small receiving optical side seems by the turbulent diffusion to work advantageously because it takes the size with various spaces between on can heat transmission to a large amount of air in a short time, and a receiving optical side. The surface of the city part and about several cm with the surface in 10m so is thought to be thought that the heat transfer coefficient on the surface is about several times different, and for this to be observed as a difference of the surface temperature in daytime in suburbs where the fractal is distributed.