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Abstract

ANALYSIS OF URBAN HEAT ISLAND EFFECT OF
MACAO BY ARPS SIMULATION

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As rapidly developing the urbanization and industrialization, the so-called urban heat island (UHI) effect is more and more serious and concerned by both public and government. So it is very important to study the effect and to find out proper way to solve the problem. Now there are many methods to research UHI such as remote sensing, weather monitoring, computing simulation and so on. Therefore, this project which is supported by Macao government-provided research fund (i.e., FDCT fund) is to use computer program and hydrodynamics method to study and simulate UHI of Macao.

This thesis illustrates how to use the numerical simulation method to analyze urban heat island effect (UHI) of Macao. Specifically the so-called ARPS (Advanced Regional Prediction System) model was used, which is a completely non-hydrostatic model system which was developed by the Center for Analysis and Prediction of Storms (CAPS) at the University of Oklahoma. It is a multi-scale non-hydrostatic atmospheric simulation and prediction model. This program is applied to simulation of the variation of weather and micro-climate of Macao in one typical early summer day to estimate the current status of urban heat island of Macao. Through analyzing heat balance and variation of heat fluxes involved, it is attempted to find out the factors influencing the urban heat island effect. An estimation value of anthropogenic heat is added into the assessment model system to evaluate the influence. At last, the solution of mitigating urban heat island effect of Macao is discussed, based on the simulation results.

In this paper, Chapter 1 is introduction which is to introduce definition and perception of UHI and its impacts on public health as well as city ecosystems. Chapter 2 is to introduce research methods for the UHI effect, which may include weather monitoring, remote sensing, and numerical calculation. Chapter 3 is to introduce the ARPS program itself and its physical basis as well as the mathematic equations, involving governing equations, radiation and ground surface physical models as well as boundary conditions. Chapter 4 gives the calculation conditions, results and discussions of UHI in Macao. Chapter 5 discusses the strategies of mitigating UHI, based on the simulation results. Chapter 6 and Chapter 7 involve discussions and conclusions of this thesis.
