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1. INTRODUCTION

The large cities in Japan, such as Osaka, Kobe and so on, have an originally hot and humid climate. The inhabitants of these cities are exposed to the more severe climate caused by urbanization. Therefore we must take countermeasures of urban heat island for comfortable life of inhabitants and reduction of energy consumption.

In this paper, we propose the "Urban Environmental Climate Map" as one of countermeasures against urban heat island, and discuss the framework of "Urban Environmental Climate Map" and the method of making it by using GIS.

2. 'URBAN ENVIRONMENTAL CLIMATE MAP'

2.1 Definition

"Urban Environmental Climate Map" is made for urban planning, architectural design, and environmental policy making. The role of this map is to provide some information from the view of urban heat island mitigation to the place of decision making (including public involvement). Therefore, the purpose of creating this map is to support decision. On "Urban Environmental Climate Map", the essence of climate research results by experts is described. When stakeholders (Citizen, Planner, Architect, Specialist, and so on.) make decision about urban planning, architecture design, and environmental policy, they and experts (Climatologists) can use this map as a communication tool. (Fig.1)

2.2 Urban Environmental Climate Map and GIS

Generally speaking, GIS is a good tool for the communication of the people from some positions, because the information on the effective map is easy to understand for many people. Therefore we selected GIS as a tool to make "Urban Environmental Climate Map". There are five advantages of using GIS to make "Urban Environmental Climate Map". First is to be easy to modify the data, second is to be able to manage many data, third is to be able to use effective visualization, fourth is to be operated interactively by users (stakeholders), and fifth is to be easy to integrate with other type of data such as ecological data, social

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data, and so on. Fifth advantage is effective in the case of making comprehensive plan such as master plan and land use plan.

2.3 Climate Analysis Map

"Urban Environmental Climate Map" consists of two types of maps. One is "Climate Analysis Map". This map represents the existing climate of discussed area. On this map, terrain, climate, wind, and temperature are overlaid. "Terrain" is the relief made from the elevation data. "Climate" is German word which means a landscape unit from the view of climate, and this is based on land cover. For example, all of landscape units are divided to 10 climates (forest climate, paddy field climate, field & grassland climate, industry climate, row-rise residential climate, medium-rise & high-rise climate, commercial climate, road climate, park climate, and water climate). "Wind" consists of three types of data. First is wind rose made from measured data, second is cold air drainage that was calculated, third is sea breeze and land breeze described by expert. Temperature is measured data. The countermeasures of urban heat island mainly consist of three options. They are land cover alteration, anthropogenic heat reduction, and wind utilization related geographical features. This paper focuses on the two of them, land cover alteration and wind utilization related geographical features. Therefore we treated these four elements of climate. (Fig.2)

2.4 Recommendation Map

Another is "Recommendation Map". This map is made to show each option of countermeasure of urban heat island. The options are extracted through the discussion by experts (climatologists) and planners. For example, they are "Road plan along the wind flow", "Green area plan along the wind flow", "Roof-Planting recommendation zone map", "Tree-Planting recommendation zone map", and so on. (Fig.2)

3. Discussion

Fig.3 is an example of "Climate Analysis Map" of Osaka city area (scale of data: 1/25,000) that are made by framework this paper discussed. This is the new approach to apply the results of climate researches to planning and design. Therefore, we will verify that these maps are effective in decision making about urban planning.

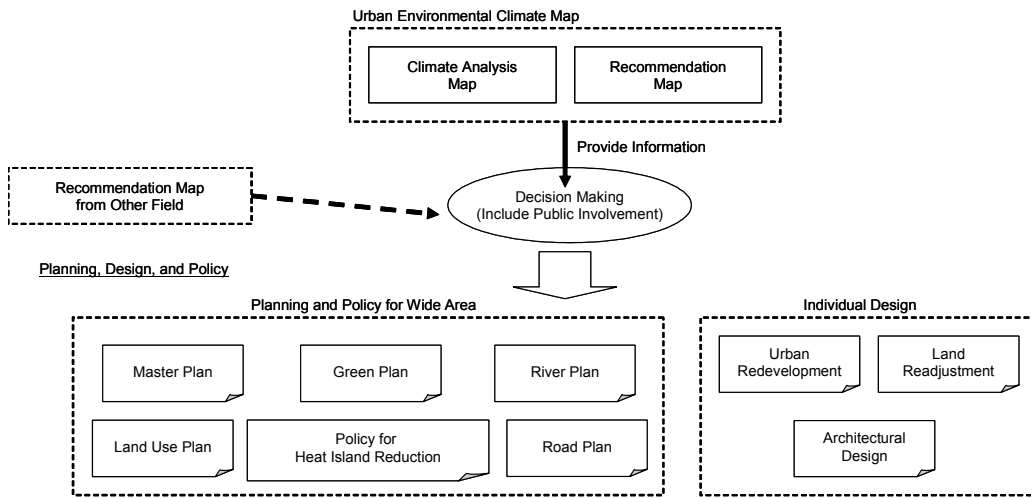


Fig.1 Diagram of Using “Urban Environmental Climate Map”

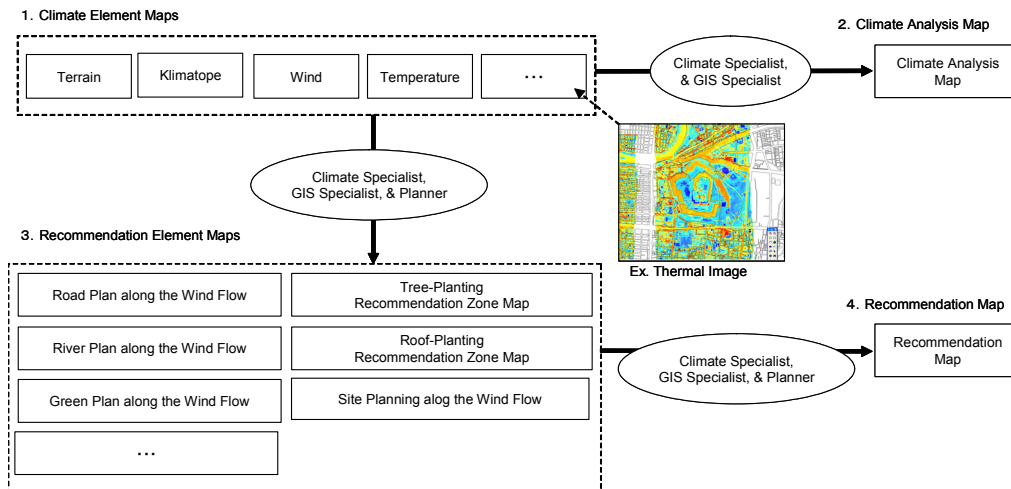


Fig.2 Diagram of Making “Urban Environmental Climate Map”

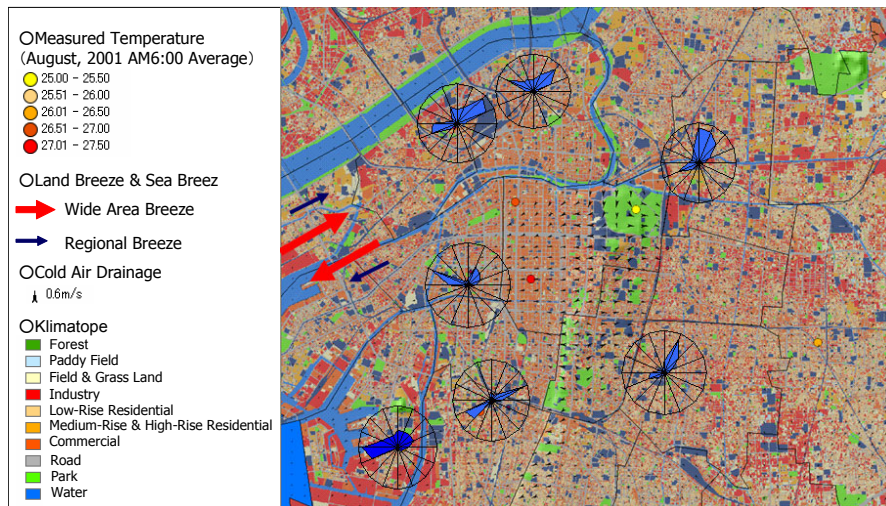


Fig.3 Overlaid “Climate Analysis Map” in Osaka City (Prototype)