ABSTRACT
ASTER-BASED STUDY OF THE NIGHTTIME URBAN HEAT ISLAND EFFECT IN METRO MANILA

Mary Rose Tiangco
University of the Philippines, 2006

Adviser: Dr. Alfredo Lagmay
Reader: Dr. Josefina Argete

The urban heat island effect is the warmer temperatures cities experience compared to their surrounding rural areas. It is caused by urbanization, the replacement of natural land and vegetation with materials such as asphalt, cement, brick, and stones. The process reduces the amount of vegetation in urban areas and thus decreases evapotranspiration which cools the surface. With less vegetation, built materials can store more solar radiation and release heat into the atmosphere, thereby causing elevated temperatures in cities. In this study, satellite remote sensing, specifically the Advanced Spaceborne Thermal Emission and Reflection (ASTER) radiometer was used to derive surface temperature to quantify the nighttime surface heat island effect in Metro Manila. Heat island intensity was determined by comparing temperature differences between Metropolitan Manila and its adjacent rural towns of Bulacan and Cavite/Laguna. Spatial patterns of temperature throughout the study areas were also analyzed. Transects were drawn across from a rural to an urban region passing through different land cover features to characterize the heat island profile. The seasonal variation of the heat island effect was also examined. Normalized Difference Vegetation Index (NDVI) was used to determine the correlation between amount of vegetation and temperature. Results revealed a heat island intensity of 2.96°C as the highest and a maximum temperature of 35.5°C both recorded for the 4 May 2002 satellite scene. Regions with a concentration of warm temperature within the image coincided with land features that are highly built-up while cooler regions with those that are predominantly vegetated such as golf courses and open spaces. The cross section of the heat island profile, which is characterized by gradients of 'cliffs,' 'plateaus,' and a 'peak' occurring in the city center, also coincided with the locations of the land features that exhibit them. The 4 May 2002 scene supports reports that heat island is more intensified during the summer. However, no conclusions were drawn for the general variation of the heat island effect over the seasons. The inverse relationship of NDVI and temperature also supported findings that vegetation can lower warm temperatures. More plants should therefore be planted to reduce the urban heat island effect.