

ESTIMATION OF LAND SURFACE TEMPERATURE IN URBANIZED AREA AND MICROCLIMATE CHANGE USING SPATIAL TECHNIQUE –A MODIS BASED APPROACH FOR COCHIN CITY

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INTRODUCTION

Land surface temperature (LST) acts as an important factor in the control of physical, chemical and biological metabolism of earth. Knowledge of the LST is necessary for many environmental studies and management activities of the Earth's resources (Li and Becker 1993). A Land surface temperature study plays a significant role in environmental management studies and identifying the changes in the climate of the environment which we thrive. This study envisages on the fluctuation in temperature of a city which has undergone lightning paced impetus towards concentrated developmental activities and industrialization resulting in unprecedented urbanization for the last few years. This rapid urbanization has led to a phenomenon termed urban heat island (UHI) Urbanization, not only leads to degradation of environment quality but it also effect ecosystem health (Douglas, 1983; UN, 2001; Peterson et al., 1999).

Land surface temperature can be estimated using different satellite data. In this study the 8 day 1 km MOD11A1 MODIS data (day and night) from the year 2000-2010 was tabulated to generate the temperature variation of the study area. MODIS is an EOS instrument that serves as the keystone (Salomonson et al. 1989) for global studies of atmosphere (King et al. 1992), land (Running et al. 1994) and ocean processes. It scans 55u from the nadir in 36 bands, with bands 1-19 and band 26 in the visible and near-infrared (NIR) range, and the remaining bands in the TIR from 3 to 15 mm. The specifications of MODIS bands have been published.

(Wan and Li 1997). The bands in transparent atmospheric windows are designed for the remote sensing of surface properties. Other bands are mainly for atmospheric studies. MODIS provides images of daylight reflection and day/night emission of the Earth.

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STUDY AREA

The study area is Cochin city of Ernakulam district (Fig. 1) located in south India. The city of Cochin has undergone concentrated developmental activities and industrialization resulting in unprecedented urbanization for the last few years. Accompanying this concentrated urbanization the city of an area of 2407 Sq Km had to face much deleterious effect on its environment including many climatic change for these years. Cochin on an average receives 3432 mm of rainfall annually, still the temperature in and around the city depicted a rise for the last few years because of the urban heat island phenomenon.



FIG: 1

METHODOLOGY

DATA

NASA's two MODIS sensors, on board both Terra and Aqua Earth Observing Satellites (EOS) launched in February 2000 and May 2002, respectively, provide tremendous environmental and geophysical data of globe coverage in four times per day with spatial resolution of 250 m to 1 km. The MODIS instrument provides high radiometric sensitivity (12 bit) in 36 spectral bands ranging in wavelength from 0.4 μm to 14.4 μm . Of the many products MODIS provides, the temperature product (MOD11A1 of Terra and MYD11A1 of Aqua) is a daily 1 km spatial resolution of land surface temperature with high accuracy of 1 $^{\circ}\text{K}$ (Wan et al. 2002a, 2004a) in both day time and night time data. In this study the MODIS 11A1 Terra data (figs. 2, 3) both day and night respectively for the year 2000, 2005 and 2010 were ordered and downloaded.

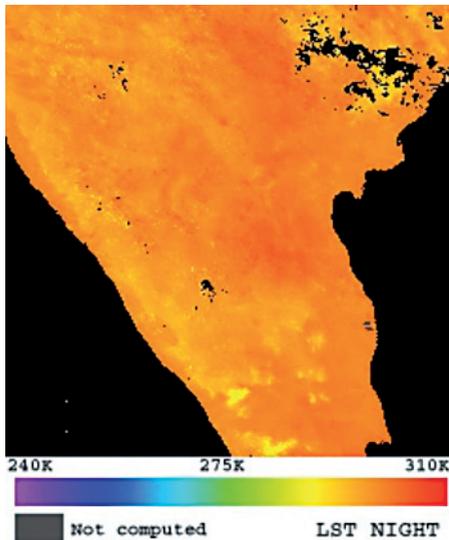


FIG: 2

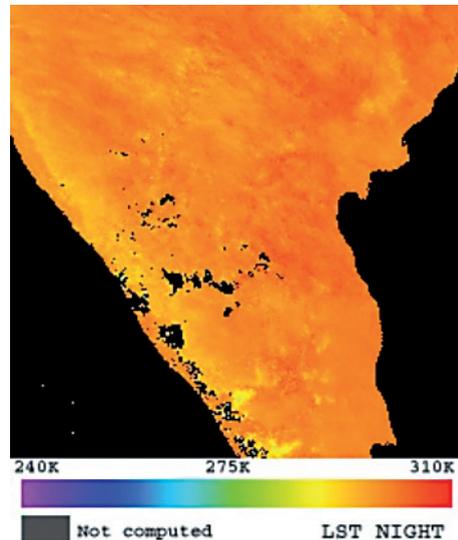


FIG: 3

METHOD

The MOD11A1 1km resolution data for the years 2000, 2005 and 2010 downloaded were reprojected using the NASA's MRT tool. LST for day and night were extracted from the reprojected data thus obtained. A split window algorithm was used to generate the temperature from each pixel of the MOD11A1 data.

RESULTS AND DISCUSSION

MOD11A1 data from the MODIS terra sensor data of 1km resolution for the year 2000, 2005 and 2010 were analyzed. Figs. 4, 5 and 6 depicts the day and night LST variation for the year 2000, 2005 and 2010 of the study area, which clearly shows the

evidence of an increase in temperature along the cochin city for the last few years citing the existence of an (UHI) Urban heat island in the study area.

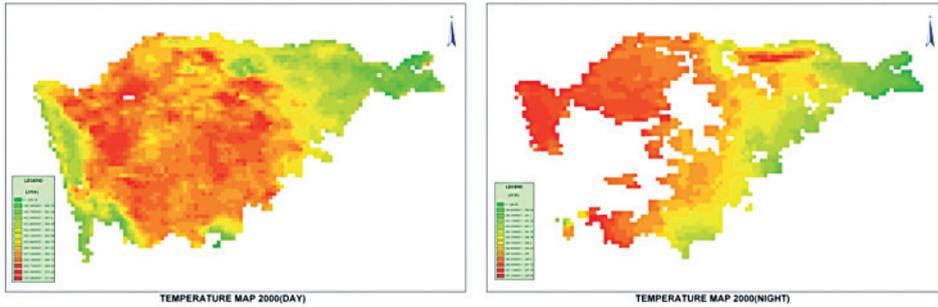


FIG: 4

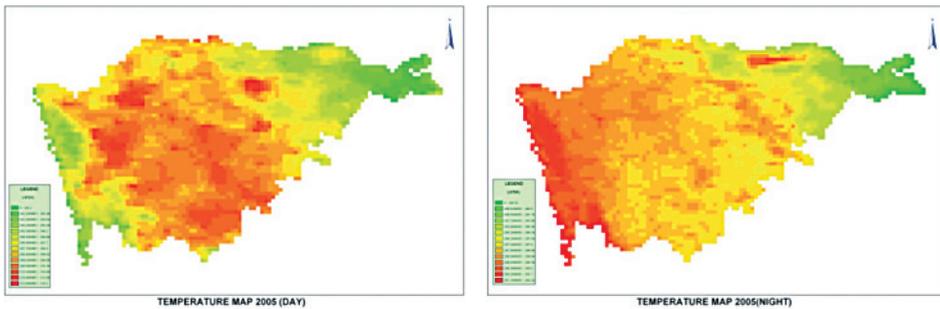


FIG: 5

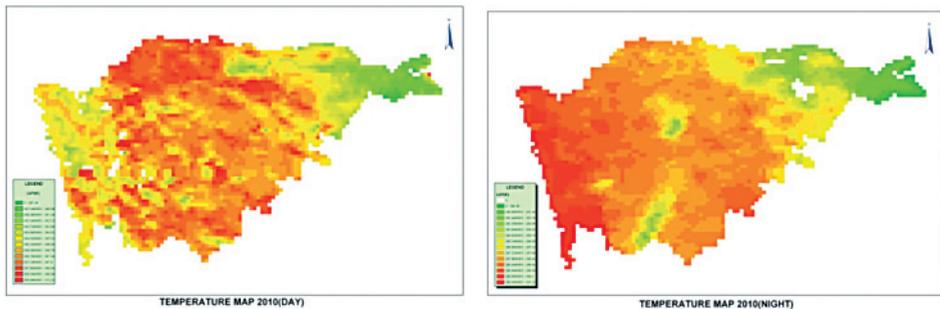


FIG: 6

The result generated from the MODIS terra data justifies the fact that there is an increase in temperature along the study area. In the year 2000 the maximum temperature

along the study area was 311.84 k (Fig. 4, day time) which showed a significant increase in the year 2005 to 315.3k (Fig. 5, day time), that is an increase of 4k for five years. Simultaneously there is an growth in night temperature values from 298.8k to 302.3k (Fig. 4 and Fig. 5) which is also an increase of 4k. For the year 2010 as the data obtained for the month of March were cloudy an exact increase could not be justified for this a detailed study has to be conducted. If the rate of urbanization amplifies in such a rate soon the city will turn in to a boiling pot, so to avoid this situation we have to adopt the technique of sustainable development. Urbanization with a green belt which serves as lungs for the Queen of Arabian Sea.

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