Nocturnal Air Temperature Traverses across the City of Jakarta, Indonesia.

Plagiarism Scan Report

Summary	
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The Urban Heat Island (UHI) phenomenon was □irst investigated and described by Luke Howard in
the 1810s, although he was not the one to name the phenomenon (Sham, 1980; Tursilowati, 2005).
The term 'urban heat island' describes built up areas that are hotter than nearby rural areas. The
annual mean air temperature o□ a city with 1 million people or more can be 1–3°C warmer than its
surroundings. In the evening, the di□ference can be as high as 12°C, and is most apparent when winds
are weak. In a cross section diagram, the □orm o□ UHI phenomenon is like an island whereby the
highest temperature established in the middle and lowest temperature occurred within the
surrounding areas (E□fendi, 2007). Urban heat islands can a□fect communities by increasing
summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions,
heat-related illness and mortality, and water quality.
Each city's urban heat island varies based on the city structure and thus the range o temperatures
within the island varies as well. Parks and greenbelts reduce temperatures while the Central Business
District (CBD), commercial areas, and even suburban housing tracts are areas o□ warmer
temperatures. Every house, building, and road changes the microclimate around it, contributing to the
urban heat islands o□ our cities. The situation is becoming more pronounced with the increase o□
anthropogenic activities that occur in urban areas (Shaharuddin & Noorazuan, 2010; Purnomohadi,
1995). In addition, heat island phenomenon depends on the stability and the amount o□ hot wind
velocity (Oke, 1982).
In the near □uture it is expected that the global rate o□ urbanization will increase by 70% o□ the
present world urban population by 2030 (Arrau & Pena 2013; Anon, 2013). As a result, urbanization

has a negatively impact on the environment mainly by the production o pollution, the modi ication o
the physical and chemical properties o the atmosphere, and the covering o the soil sur ace. This is
also a common phenomenon in Jakarta, Indonesia nowadays whereby urbanization rate increases up
to 20.4 % rom the 1970s census (Lubis, 2010). It is expected that the population density o Jakarta
now is about 661.52 km2. Jakarta urban development has expended to other parts o Jakarta that is
Bogor, Depok, Tanggeran and Bekasi and known as 'Jabodetabek which accommodate around 23
million people. Based on this igure, there ore, Jakarta is the sixth city in the world with highest
population density. As a consequent, more human activities take places in the urban areas whereby it
will de initely alter the physical urban environment, especially urban microclimate. On this note,
there ore, this study attempts to monitor and analyse temperature di erences according to di erent
land uses in Jakarta, especially night temperature.

2. Method O Study

This study was carried out within the city o Jakarta, Indonesia. There are several methods that can
be used in order to study the UHI phenomenon and one o them is temperature traverse (Iswanto,
2008). In this study, two traverses were ormed across the Jakarta area that is the north-south and
east-west traverses. The north-south traverse was about 22 km long started at Ancol, northern part o
Jakarta right through the Jakarta area and end up at Gerbang Universitas Indonesia, in the south area.
There was 26 stations were created to measure temperatures o di erent land use types along this
traverse such as built-up area, housing area, green park, and open space and so on. Meanwhile, the
east-west traverse was about 24 km long and it started at gerbang Universitas Budi Mulia in the east
and end up at sawah Jembatan Keranji in the west. There were 20 stations along this traverse to
measure temperatures o di erent land use types.
Temperature measurement was carried out or about six months that was started in October 2011
and end up in March 2012. The nocturnal temperature measurements were taken at around
21:00 –23:00 hours West Indonesian Time (WIT). Every week two di erent days were chosen to carry out the
measurement that was working days as well as week-end and public holidays. Data rom these
measurements were then tabulated and analyzed by using excel program. The results o this analyze
were then trans ormed into cross section diagram to create the temperature traverses

across the
Jakarta area. Figure 1 shows the nocturnal temperature measurements for the north-south traverse across the
Jakarta area. This is the mean temperature measurements for the six months period taken at night
(21:00 – 23:00 hours WIT). The result showed that the average nocturnal temperature was about
28.3°C with the Coefficient of Variation of 2.3. The highest average temperature was recorded at
about 29.0°C at the Jembatan merah bus station and at the station Swiss Hotel. Meanwhile, while the
lowest average temperature of 26.9°C was recorded at the University of Indonesia Gateway station.
On a monthly basis, the low average temperature of 27.4°C was calculated for February 2012;
meanwhile the average high temperature of 29.4°C was observed in October 2011.
Further analysis was carried out in determining the average temperature differences across the
north-south traverse for the six months period. The result showed that a small temperature variation
was observed along the traverse that was confirmed by the small value of coefficient o variation (1.7).
Month to month temperature differences along the traverse displayed a small variation except for
March whereby the temperature difference i.e. between the highest and the lowest or the Urban Heat
Island Intensity (UHII) was calculated at about 2.7°C. The other months displayed a moderate UHII
across this traverse. Therefore the average UHII for the north-south traverse was calculated at around
2.1°C.

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Another temperature traverse was carried out that was the east-west temperature traverse (October 2011 - March 2012). The result o the study is shown in Figure 2. The average monthly
temperature or the traverse was calculated at about 28.3°C with the value o coe□ficient o variation
o 1.7. The highest average temperature was observed at Taman Kota Pondok station i.e. 29.2°C;
meanwhile the lowest average temperature o 27.6°C was observed at Fly over o Ciledug station. On
a monthly basis, the study □ound that October 2011 was recorded the highest temperature o 29.5°C
and the lowest temperature o 27.3°C was recorded in February 2012. Based on this □inding, there□ore, the temperature di□ferences across the traverse were small □or February 2012 as compared
with the month o October 2011.
During the month o October 2011, the highest temperature o 30.6°C was recorded at three
stations i.e. the Fly over o Pondok Kopi, Rumah Susun Pondok Kopi and McD Buaran; meanwhile the
lowest was recorded at the Universitas Budi Mulia station (27.9°C). Thus, the October Urban Heat
Island Intensity (UHII) was calculated at about 2.7°C. For the other months, UHIIs were calculated at
the moderate to small values. There□ore, the average UHII □or the east-west traverse was calculated at
about The UHI in an urban area such as in the city o Jakarta is a common urban climate phenomenon due
to rapid urban development that causes natural physical environment turn to man-made environment. The presence o UHI will de□initely create more thermal discom□ort among urban
dwellers. This is due to the □act that, in general this phenomenon creates high temperature, less
humid condition and more polluted air. In any urban area, urban design □actors such as urban
geometry, street canyon, sky view □actor and landscape play an important role in modi□ying the urban