

The Data of Night Sky Brightness in Depok City from March to December 2017 using Sky Quality Meter (SQM)

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Page No.: 28-31 Volume: 14, Issue 3, 2020 ISSN: 1991-7708 Online Journal of Earth Sciences Copy Right: Medwell Publications Abstract: The sky brightness measurements were performed using sky quality meter as small size and portable photometer with output directly in magnitudes per arc second square (mass). Observation with 3 sec temporal resolution was recorded at Depok city (-6.392559 S, 106.761605 E) from March 15th to December 16th 2017 but I select data with rules: only 2 days after and before moon-sun conjunction and sky brightness only in range with limitation astronomical twilight after sunset to astronomical twilight before sunrise. The data which I was collected are 21 days it shows the range between 13.8-19.01 mass, the average is 15.11 mass with standard deviation 0.89 mass. According Bortle scale, Depok city is in inner city or the 9th scale, so in Depok city what can be seen only cllestial objects like the moon, planets and some bright stars.

INTRODUCTION

Observations of sky brightness have been carried out for various studies including health, finding the best location for astronomical observations^[1], determining prayer time, bird behavior around the airport^[2], monitoring the level of light pollution in a city^[3-10]. Monitoring the level of light pollution becomes important because in addition to being a waste of energy it also results in other things such as accidents caused by excessive street lighting^[11], cycle orientation in some animals, duet problems to the diminishing accuracy of astronomical observations to disrupt environmental balance^[12]. The sources of night sky brightness consist of moon light, the sunlight scatterred arround the edge of the Earth from stars only on moonless nights and other planets are compatable to that of bright stars, dust particels that scatter sunlight toward the Earth as zodiacal

light, air glow and galactic and cosmic light^[3, 13]. Shortly, based on Arumaningtyas, factors which influence the night sky brightness consist of two sources. First, the source from the atmosphere and the second one from space^[14]. Light source in the atmosphere is an interaction or emition of light sources from earth surface like road lighting, billboard and resident lighting with Na and O molecules or aerosol^[13]. Another factor which influences night sky brightness is cloud amount with effect up to 3 magnitudes^[13]. The observation uses photometry instrument named Sky Quality Meter (SQM) in magnitudes per arc-second scale (mass) which leads to zenit^[15].

Like what Dr. Chun Shing Jason Pun and Mr. Chu Wing Sho has collected observational data from 171 volunteers from 199 different locations between March 2008 and May, 2009. In this study, I conducted research for a relatively long-time span between March, 15th until



Online J. Earth Sci., 14 (3): 28-31, 2020

Fig. 1: The city of Depok sky brightness level category is based on Dark Site Finder

Table 1: Bortle scale

		Sky brightness			
Colors					
magnitude	Bortle class	Mag/arcsec 2	Artifi/Natural		
7.6-8.0	1	>21.90	>0.01		
7.1-7.5	2	21.90-21.50	0.01-0.11		
6.6-7.0	3	21.50-21.30	0.11-0.331		
6.3-6.5	4	21.30-20.80	0.33-1.00		
6.1-6.3	4.5	20.80-20.10	1.00-3.00		
5.6-6.0	5	21.1-19.10	3.00-9.00		
5.0-5.5	6,7	19.10-18.00	9.00-27.00		
<4.5	8, 9	<18.00	<27.0		

December, 16th 2017 in a single location, namely in Depok and became the only study to date that provides observational data of sky brightness.

Observation of sky brightness using sky quality meter instrument with retrieval tempo every 3 sec. The observation process is carried out throughout the day. The data generated is processed using Microsoft Excel by selecting data that is in the range of 2 days before and after the moon-sun conjunction to eliminate the influence of the moon's light on the observations. As well as the resulting data is selected between the time only in range with limitation astronomical twilight after sunset and before sunrise^[14]. The resulting data is confirmed by Bortle scale^[16] as in Table 1 to find out in what class of Depok city is currently.

Based on the map from Dark Site Finder, Depok city entered in the fifth category with limiting magnitudes between 19.10-21.1 that shown as Fig. 1. In this research done NSB observation used SQM between March, 2016 to February, 2017 to know the light pollution in Depok city.



Fig. 2: SQM monitoring station

MATERIALS AND METHODS

Instruments: Night sky brightness observation in this research using SQM LU-DL type with serial number 3532, USB serial number A104VL0Y. SQM installed leads to zenit. SQM emits sky brightness data in magnitudes per arc-second scale (mass) and data range every 3 sec. The application used for SQM setting is the Unihedron Device Manager (UDM) that is installed on the PC computer and is operated for 24 h every day Fig. 2.

Location: The location of observation conducted in one location within the span of at least 1 year, precisely location in Sawangan Depok, -6.392559 S 106.761605 E. The location of observation is a suburban area adjacent to the capital city of Indonesia namely Jakarta Fig. 3.



Online J. Earth Sci., 14 (3): 28-31, 2020

Fig. 3: Night sky brightness data range to calculate

Table	2:	Davs	of	observation
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Date	Average of MASS	SD	
26-03-2017	14.50	0.06	
28-03-2017	15.75	0.08	
29-03-2017	16.01	0.26	
30-03-2017	15.62	0.05	
24-04-2017	15.50	0.64	
27-04-2017	14.57	0.49	
28-04-2017	15.81	0.31	
24-05-2017	14.93	0.31	
25-05-2017	15.01	0.37	
26-05-2017	15.32	0.31	
27-05-2017	15.11	0.29	
28-05-2017	14.82	0.16	
21-06-2017	15.47	0.24	
22-06-2017	15.27	0.31	
23-06-2017	14.50	0.21	
24-06-2017	14.75	0.43	
25-06-2017	14.74	0.43	
26-06-2017	15.14	0.60	
27-06-2017	14.91	0.78	
21-09-2017	15.57	1.05	
16-12-2017	17.88	0.79	

RESULTS AND DISCUSSION

Data selection: Observation were done in the span of March, 15 to December 16, 2017 but not all data collected due to the observation of obstacles such as power down and computer turn off. Observation data used must fulfill the requirements in the span of 2 days after and after the moon-sun conjunction or moonless night to avoid moon light interference with SQM in the range of sun elevation more than -18° after sunset and before

sunrise. The txt data used to support the findings of this study are available from the corresponding. From 277 days of observation, 22 data were selected according to criteria, as shown in Table 2.

CONCLUSION

For observations in the span of March 15 to December 16, 2017 in Depok city, the lowest sky brightness is 13.18 mass, the highest brightness is 19.01 mass, the average sky brightness in Depok city is 15.11±0.89 mass, based on Bortle Scale, Depok city includes class 9 inner-city sky, so in Depok city what can be seen only cellestial objects like the moon, planets and some bright stars, this result a little bit different with Dark Site Finder maps for Depok city which states that Depok is in class 5-6. This research limits in the span of March to December 2017 and only in one location in the future it can be done in longer time and wider location spread. In other researches like UCLA Institute of the Environmental and The Urban Wildlands Group^[17]; Steinbach et al.^[11]; Gil et al.^[2]; Lamphar and Kocifaj^[18]; Kocifaj^[19]; Kocifaj and Lamphar^[20,21], assumed that there are relation between night sky brightness level and environment condition, so, needed integration night sky brightness data and the data of environment condition monitoring such as cloud amount data, Na and O molecules data and other particles data which influence night sky brightness level.

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