AL – AFAQ
Jurnal Ilmu Falak dan Astronomi
Fakultas Syariah Universitas Islam Negeri (UIN) Mataram
P-ISSN: 2685-0176. E-ISSN: 2722-0176 Vol. 7, No. 2 Desember 2025

Analysis of Astrotourism Potential in Maumere: a Study of Sky Brightness Using a Sky Quality Meter

Dedi Suwandi Wahab[1]; Zakaria Al Farizi[2] , Nur Iftitah[3]
[1,2]Universitas Muhammadiyah Maumere, Jl. Jenderal Sudirman Waioti, Maumere, Sikka 86111, Indonesia
[1]dediwahab04@gmail.com*; [2] zakariaalfarizi797@gmail.com
Penulis Penanggungjawab: (Dedi Suwandi Wahab)

Abstract: *The purpose of this study is to transmit the lightness level between the night the sky in Maumere, East Nusa Tenggara, in order to assess its ability as an astrotourism destination. Measurements were conducted at two locations, namely the campus of the Muhammadiyah University of Maumere (UM Maumere) and Pantai Pintar Asia, utilizing a Sky Quality Meter (SQM) LU-DL type, which records data every minute from 18:00 to 22:00 WITA. The measurement results showed an average SQM value of 21.18 MPSAS at UM Maumere and 22.40 MPSAS at Pantai Pintar Asia. These values were then converted into Naked Eye Limiting Magnitude (NELM) of 6.2 and 6.8, respectively. According to the Bortle scale, UM Maumere is part of the rural/urban transition category, which indicates the sky is between rural and urban areas with little impact from light pollution. In contrast, Pantai Pintar Asia is in the rural sky category with darker quality and low artificial light pollution. The map showing the distribution of light pollution also supports this finding, by showing the low intensity of artificial light around Pantai Pintar Asia compared to the UM Maumere area. Thus, Pantai Pintar Asia has better potential to be developed as an astrotourism destination because its sky conditions support astronomical observations. This the study is anticipated to serve as a foundation for the preservation of dark skies the advancement of sustainable astronomical tourism in the area.*
Keywords: *Astrotourism, Night Sky Brightness, Sky Quality Meter, Bortle Scale, Light Pollution*

Abstrak: *Penelitian ini bertujuan untuk mengevaluasi tingkat kecerahan langit malam di Maumere, Nusa Tenggara Timur, guna menilai kemampuannya sebagai tempat astroturisme. Pengukuran dilakukan di dua lokasi, yaitu kampus Universitas Muhammadiyah Maumere (UM Maumere) dan Pantai Pintar Asia, memanfaatkan alat Sky Quality Meter (SQM) tipe LU-DL, yang mencatat data setiap menit dari jam 18:00 – 22:00 WITA. Hasil pengukuran menunjukkan nilai rata-rata SQM sebesar 21.18 MPSAS di UM Maumere dan 22.40 MPSAS di Pantai Pintar Asia. Nilai-nilai ini kemudian diubah menjadi Naked Eye Limiting Magnitude (NELM) masing-masing yaitu 6.2 dan 6.8. Berdasarkan skala Bortle, UM Maumere termasuk dalam kategori transisi rural/perkotaan, yang menunjukkan langit berada di antara daerah pedesaan dan perkotaan dengan sedikit dampak dari pencemaran cahaya. Sebaliknya, Pantai Pintar Asia berada dalam kategori langit rural dengan kualitas lebih gelap dan rendahnya polusi cahaya buatan. Peta yang menunjukkan sebaran pencemaran cahaya juga mendukung temuan ini, dengan memperlihatkan rendahnya intensitas cahaya buatan di sekitar Pantai Pintar Asia dibandingkan dengan area UM Maumere. Dengan demikian, Pantai Pintar Asia memiliki potensi lebih baik untuk dikembangkan sebagai destinasi astroturisme karena kondisi langitnya yang mendukung pengamatan astronomi. Penelitian ini diharapkan dapat memberikan dasar untuk pelestarian langit gelap serta pengembangan wisata astronomi yang berkelanjutan di daerah tersebut.*
Kata Kunci: *Astroturisme, Kecerahan Langit Malam, Sky Quality Meter, Skala Bortle, Polusi Cahaya*

A. Introduction

Astroturisme Astronomy-based tourism, often referred to as astrotourism, continues to grow around the world, including in Indonesia[1]. Astrotourism offers tourists a unique experience of observing night sky phenomena, such as constellations, meteor showers, and the Milky Way

[1]Takanashi, N, Hiramatsu, M, Kawagoe, S, Kusakabe, N, Sawada, K, & Tamazawa, H, (2024), Survey of public attitudes toward astronomy in Japan, *Publications of the Astronomical Society of Japan*, *76*(1), 108–117, https://doi,org/10,1093/pasj/psad084

galaxy, in locations with low levels of light pollution[2]. Astrotourism can serve as an educational tool while also providing economic benefits, particularly for remote areas with night skies free from light pollution[3]. To assess a region's potential for developing astro-tourism destinations, several variables need to be considered, namely sky brightness, elevation or altitude, favorable weather conditions, accessibility, and the presence of local astronomy communities that can serve as educational guides[4]. In Indonesia, there are several areas with great potential for developing astro-tourism, such as Kupang in East Nusa Tenggara and Mount Bromo in East Java.

According to Hariyadi Putaraga et al., 2023[5], the potential for astro-tourism in an area is greatly influenced by the quality of the night sky, which can be measured using tools such as the Sky Quality Meter (SQM). One location in Indonesia that has the potential to be further developed as an astro-tourism destination is Maumere, located in Sikka, East Nusa Tenggara. With its strategic geographical location and minimal light pollution compared to major cities, Maumere has great potential to become an attractive astro-tourism destination for both local and international tourists. Maumere is located at coordinates 8°37' S and 122°13' E, far enough from major urban centers.

The geographical conditions provide a darker sky compared to metropolitan areas[6]. The darkness of the sky is very important for improving the visibility of various astronomical objects, especially for tourists who are interested in observing the Milky Way, meteor showers, and other astronomical phenomena[7]. Previous studies in other locations have shown that high night sky brightness can reduce the visibility of stars and other celestial objects[8].

The urgency of this research lies in Maumere's potential as an astronomy tourism destination that has yet to be fully explored. With the increasing public interest in astro-tourism

[2]Tarek, M, Osama, N, & Abdelkafy, J, (2023), The Role of Astronomy Tourism in Promoting Egypt, *GeoJournal of Tourism and Geosites*, *50*(4), 1356–1363, https://doi,org/10,30892/gtg,50416-1134

[3]Mohammad Ananda Reza Kurniawan, Ronald Marcey, Adityah Ramdhon Jannatan, Nailah Hana Rafidah, & Muhammad Nawaf Aufa, (2025), Edukasi astronomi dasar terhadap anak-anak kaum marginal kota melalui lokakarya pembuatan jam matahari sederhana, *SELAPARANG: Jurnal Pengabdian Masyarakat Berkemajuan*, *9*(2), 0477-0486,

[4]Butar-Butar, A. J. R., Putra, S. P., Hidayat, M., & Putraga, H. (2022). The feasibility study of Barus city as the new astrotourism destination from astronomical and meteorological aspect. Journal of Physics: Conference Series, 2214(1), 012026. https://doi.org/10.1088/1742-6596/2214/1/012026

[5]Hariyadi Putraga, Abu Yazid Raisal, Marataon Ritonga, & Arwin Juli Rakhmadi. (2023). Analisis Peningkatan Polusi Cahaya Kota Medan Berdasarkan SQM dan Citra VIIRS . AL – AFAQ Jurnal Ilmu Falak Dan Astronomi, 5(1), 28–41.

[6]Asep Yudi Permana, Karto Wijaya, Hafiz Nurrahman, & Aathira Farah Salsabilla Permana. (2020). Pengembangan Desain Micro House Dalam Menunjang Program Net Zero Energy Buildings (NZE-Bs). Jurnal Arsitektur ARCADE, 4(1), 73–81.

[7]Ferng, J. (2023). Cosmogenic Histories: Aboriginal Observations on Catastrophe and Climate. In *Land Air Sea* (pp. 173–207). BRILL. https://doi.org/10.1163/9789004460829_008

[8]Hasan, A., & Paninggit, I. (2024). Variasi Lokal Pelaksanaan Rukyatul Hilal dalam Penentuan Awal Bulan Hijriyah (Tinjauan Parameter Meteorologi). *Jurnal Penelitian Agama*, *25*(1), 105–124. https://doi.org/10.24090/jpa.v25i1.2024.pp105-124

activities, such as stargazing and observing night sky phenomena, it is necessary to identify areas with good night sky quality and minimal light pollution[9].

A study conducted by Kohar & Taufikurrahman (2021)[10] focused on the initial identification of the year in the Sasak Rowot calendar by monitoring the appearance of the Pleiades (Rowot) star on the northeast horizon at dawn. This study revealed that sky brightness intensity is a significant variable in traditional astronomical observation practices in Lombok. These results are in line with our study, which used a Sky Quality Meter (SQM) to measure the level of sky darkness in Maumere as a basis for evaluating the potential of this area as a center for astro-tourism. Due to its relatively remote location from urban areas and minimal light pollution, Maumere has great potential to offer comparable night sky observation experiences, which are important for preserving local culture and attractive to astro-tourism visitors.

This study is in line with and reinforces the conclusions drawn by Firdaus et al., 2024[11], regarding the observation of the crescent moon using LRGB filters, which indicate that the contrast quality of astronomical entities against the sky background is significantly influenced by sky luminosity and the wavelength of light captured by the observation instrument. These results further reinforce the importance of researching the level of night sky luminosity, as done in this study through measurements with a Sky Quality Meter (SQM) to evaluate Maumere's potential as an astronomical tourist destination. With relatively unpolluted skies, Maumere is expected to provide an exemplary astronomical observation experience, both for scientific research and to promote education-oriented tourism. Maumere, as one of the regions in East Nusa Tenggara that is relatively far from large urban centers, is believed to have a sufficiently dark night sky that is ideal for astronomical activities. Therefore, this study will use a DU-LU type Sky Quality Meter (SQM) to measure the brightness level of the sky in Maumere. The measurement results will then be used to determine the sky brightness category based on the Bortle Scale, which is an international reference for assessing the suitability of a location for astronomical observation.

Under a clear, cloudless sky, observers can directly observe the beauty of night light and various patterns of star formations. They can also directly measure the range of observation of celestial objects. By understanding the importance of SQM and NELM, authors can identify objects in the sky and estimate the state of astronomical phenomena in a given location. This includes the opportunity to see comets, galaxies, and meteor showers in the maximum sky that can be achieved. As a reference for assessing the quality of the night sky, the Bortle Scale classifies nine levels of sky brightness, ranging from areas with optimal darkness to skies exposed to very high light pollution.

[9]Barentine, J. C. (2022). Night sky brightness measurement, quality assessment and monitoring. *Nature Astronomy*, *6*(10), 1120–1132. https://doi.org/10.1038/s41550-022-01756-2

[10]Kohar, A., & Taufikurrahman, A. (2021). Tinjauan Astronomis Penetuan Awal Tahun Kalender Rowot Sasak Berdasarkan Kemunculan Bintang Pleiades. *AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi*, *2*(2), 57–86. https://doi.org/10.20414/afaq.v2i2.2920

[11]Firdaus, M. D., Putraga, H., Ritonga, M., & Rakhmadi, A. J. (2024). Hilal Observation using LRGB Filters. AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi, 6(2), 227–238. https://doi.org/10.20414/afaq.v6i2.10928

The table below shows the Bortle Scale and its sky classifications:

Table 1 shows the Bortle, NELM, and SQM scales.

Bortle Method	SQM (mag/arcsec²)	NELM	Types of Sky Brightness
1	≥ 22.00	7,5-8,0	*Excellent dark-sky site* (Langit sangat gelap, tidak ada polusi cahaya)
2	21.75 – 21.99	7,0-7,5	*Typical truly dark site* (Langit benar-benar gelap, hanya sedikit polusi cahaya)
3	21.50 – 21.74	6,5-7,0	*Sky rural* (Langit pedesaan, sedikit polusi cahaya dari cakrawala)
4	21.25 – 21.49	6,0-6,5	*Rural/suburban transition* (Langit di perbatasan pedesaan dan perkotaan)
5	21.00 – 21.24	5,5-6,0	*Suburban sky* (Langit perkotaan kecil, polusi cahaya cukup terlihat)
6	20.50 – 20.99	5,0-5,5	*Bright suburban sky* (Langit pinggiran kota, polusi cahaya cukup tinggi)
7	19.50 – 20.49	4,5-5,0	*Suburban/urban transition* (Langit di daerah perbatasan kota dan desa)
8	18.50 – 19.49	4,0-4,5	*City sky* (Langit perkotaan, banyak cahaya buatan)
9	< 18.50	3,5-4,0	*Inner-city sky* (Langit dalam kota, sangat terang, hampir tidak ada bintang yang terlihat)

Source: adapted from the Bortle Scale standard and average SQM values used by amateur astronomers.

This study plays an important role in identifying Maumere's potential as an astro-tourism destination by analyzing the brightness of the sky using a Sky Quality Meter. The results of this study provide empirical data on the quality of the night sky in several strategic locations. In addition, the results of this study contribute to dark sky conservation efforts and the development of astronomy-based ecotourism.

B. Methods

A quantitative descriptive method was used in this study to describe the brightness level of the night sky in several locations in Maumere using a direct measurement approach with a Sky Quality Meter. This method was chosen because it is suitable for capturing the actual condition of the sky, which is then analyzed quantitatively to determine its potential as an astro-tourism destination. Both locations are located in areas near the coast of Sikka Regency, as shown in

Figure 1. The use of Google Earth helped to accurately identify the coordinates of the observation sites[12].

To obtain a representative position at the test site, the SQM photometer was set to the zenith to collect measurement data.

(a) Pintar Asia *Beach* (b) UM Maumere

Figure 1. Observation Location (Pintar Asia Beach and UM Maumere
Source: https://earth.google.com/web/search)

The locations used to observe the celestial phenomena observed by researchers were selected at different times, according to the schedule of the astronomical phenomena being observed. The profile of each observation site can be seen in Table 2.

Table 2. Observation Location Profile

Location	Coordinates	Location profile
Pintar Asia *Beach*	8°34'24"S 122°10'25"E	Rural areas
Waioti	8°37'51"S 122°14'31"E	Rural areas

The SQM photometer used is the Sky Quality Meter LU-DL model, which is used to measure sky brightness in units of mag/arcsec². The SQM is then connected to a laptop via a USB cable. Readings and data are stored using Unihedron Device Manager software, allowing SQM values to be monitored in real time during observations. In addition, Google Earth is used to record precise measurement coordinates, and a notebook is used to record results, times, and surrounding conditions at the time of observation. Visual documentation is also carried out using a camera to reinforce field data reports.

Data was collected through direct measurements in the field at several strategic points in Maumere, including the Muhammadiyah University of Maumere area and the Pantai Pintar

[12]Afrizal, R., Ruspianda, R., & Pratiwi, R. (2022). Pemanfaatan Drone Dji Phantom 4 Pro Dan Aplikasi Sig (Arcgis) Untuk Identifikasi Batas Administrasi Wilayah Di Kec. Kuantan Tengah Kabupaten Kuantan Singingi. JURNAL PERANGKAT LUNAK, 4(3), 172–181. https://doi.org/10.32520/jupel.v4i3.2425

Asia area. Measurements were taken at night from 6:00 p.m. to 10:00 p.m. WITA, with data collection intervals of 1 minute. Each point was measured on several different days to ensure data reliability and to avoid bias due to weather factors.\

After that, the data obtained was analyzed descriptively and quantitatively by calculating the average SQM value at each location and observation time. The analysis results were presented in tables and graphs for easier understanding. The average SQM values were then categorized based on the Bortle and NELM scales to determine the quality of the night sky at the research location. The SQM values were converted to NELM using equation (1), which was then tested to assess the suitability of the conversion values with the sky type categories.

C. Results and Discussion

1. Presentation of Measurement Results Data

Sky brightness measurements using SQM devices were conducted at two different locations, namely at Muhammadiyah University Maumere on June 27, 2025, and at the Pantai Pintar Asia area on June 28, 2025. Data collection was carried out from 6:00 p.m. to 10:00 p.m. WITA, with data collected every minute. The data from these measurements were then processed to obtain the average sky brightness values at each location, which were subsequently used to evaluate sky quality based on the Bortle scale.

a. SQM Measurement at Muhammadiyah University Maumere

Sky brightness measurements at Muhammadiyah University Maumere were conducted on June 27, 2025, from 6:00 p.m. to 10:00 p.m. WITA. SQM data was collected every minute throughout this period. After processing, the average SQM value was obtained, indicating the level of sky darkness at this location. These values are provided in Table 3 below.

Table 3. SQM Measurement at UM Maumere

No	Date	Time	Average SQM Score
1	June 27, 2025	18,00	20,17
2		19,00	22,19
3		20,00	22,37
4		21,00	22,47
5		22,00	22,47
Average			21,18

Table 3 shows the average SQM (Sky Quality Meter) measurements on June 27, 2025, in the Muhammadiyah University of Maumere area, taken every minute from 6:00 p.m. to 10:00 p.m. WITA. This data is used to evaluate the level of night sky brightness, which reflects light pollution around the campus. At 6:00 PM, the average SQM value was recorded at 20.17 mag/arcsec², then increased to 22.19 mag/arcsec² at 7:00 PM, 22.37 mag/arcsec² at 8:00 PM, and peaked at 22.47 mag/arcsec² at 9:00 PM, remaining stable at 10:00 PM. The overall average during the observation period was 21.18 mag/arcsec². This pattern indicates that the sky gets darker as the night progresses, possibly due to reduced human activity and the dimming of light

sources. This finding is important as a basis for long-term monitoring of night sky quality and supports the management of campus lighting for educational and astronomical observation activities.

To support the data presented in Table 3, the following graph illustrates the relationship between observation time and SQM values to clarify the pattern of changes in night sky quality at the research location:

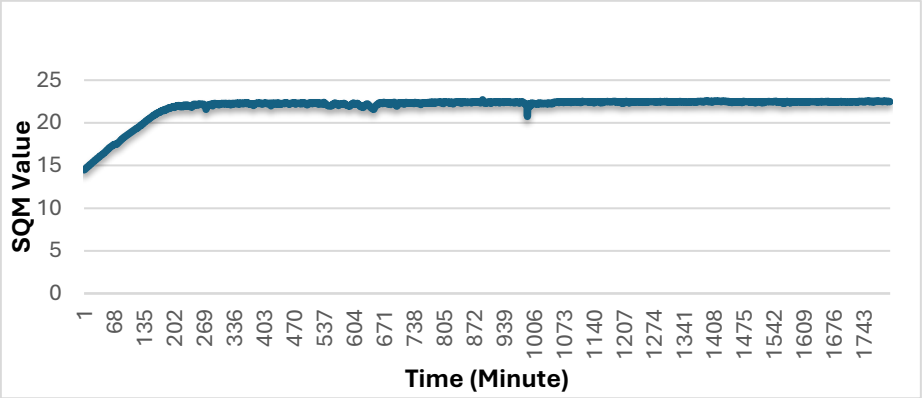

Figure 2. SQM graph for June 27, 2025, from 6:00 p.m. to 10:00 p.m. WITA

Figure 2 shows the relationship between observation time and SQM values obtained during the research period. It appears that SQM values (blue line) increased significantly at the beginning of the observation, then tended to stabilize near the highest values in the following hours, indicating that the quality of the night sky improved or became darker over time. Meanwhile, the orange line shows a regular increase in observation time in accordance with the data recording schedule. This visualization reinforces the information in the previous table by showing the pattern of decline in night sky brightness more clearly and helps explain the dynamics of changes in sky conditions at the research site.

b. SQM Measurement at Asia Smart Beach

Sky brightness measurements at Asia Smart Beach were conducted on June 28, 2025, from 6:00 p.m. to 10:00 p.m. WITA. SQM data was collected every minute throughout this period. After processing, the average SQM value was obtained, indicating the level of sky darkness at this location. These values are presented in Table 4.

Table 4. SQM measurements at Asia Smart Beach

No	Date	Time	Average SQM Score
1	June 28, 2025	18,00	19,90
2		19,00	23,01
3		20,00	23,08
4		21,00	23,01
5		22,00	23,01
Average			22,40

Table 4 presents the average results of SQM (Sky Quality Meter) measurements taken on June 28, 2025, in the Pantai Pintar Asia area. These measurements were taken every minute and then averaged every hour, from 6:00 p.m. to 10:00 p.m. WITA. The purpose of this observation was to analyze variations in nighttime sky brightness levels related to light pollution in the area. At 6:00 p.m., the average SQM value was recorded at 19.90 mag/arcsec², indicating a low brightness level, which means that the sky was still quite bright, possibly due to the surrounding lights that were still on. The SQM value then increased significantly to 23.01 mag/arcsec² at 7:00 p.m. and increased slightly to 23.08 mag/arcsec² at 8:00 p.m. Subsequently, the SQM value remained stable at around 23.01 mag/arcsec² until 10:00 p.m. Overall, the average SQM value during the observation period was 22.40 mag/arcsec², indicating that the night sky conditions at Pantai Pintar Asia were in the good and fairly dark category, making it ideal for astronomical observation and night sky research activities.

To support the data presented in Table 4, the following graph illustrates the relationship between observation time and SQM values to clarify the pattern of changes in night sky quality at the research location:

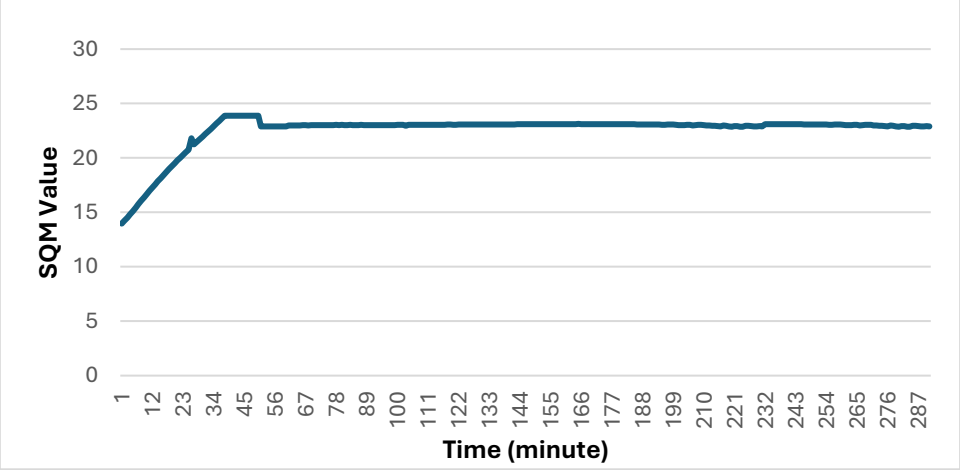

Figure 3. SQM graph for June 28, 2025, from 6:00 p.m. to 10:00 p.m. WITA

Figure 3 shows a graph of SQM value changes on June 28, 2025, at Asia Smart Beach, which is the result of measurements taken every minute from 6:00 p.m. to 10:00 p.m. WITA. From the graph, it can be seen that the blue curve representing the SQM value shows a significant increase at the beginning of the observation, from around 15 mag/arcsec² to more than 23 mag/arcsec², and then stabilizes until the end of the observation period. This indicates that the quality of the night sky is improving or getting darker over time, possibly due to reduced human activity and the extinction of light sources in the vicinity. On the other hand, the orange line shows a gradual and consistent increase in observation time. This visualization reinforces the data in Table 4 by clarifying the dynamic downward trend in night sky brightness, while emphasizing that the night sky conditions at Asia Smart Coast are ideal for astronomical observation and night sky research.

2. Converting the Average SQM Value to NELM

From observations and measurements of night sky quality at observation sites using SQM photometers, average SQM values were obtained for two locations. In the Pantai Pintar Asia area, located on the coast, the average SQM value was 22.40 MPSAS. Meanwhile, for the Muhammadiyah University of Maumere area, which is located further inland, an average SQM value of 21.18 MPSAS was obtained. These values were calculated based on data from measurements taken every minute, which were then averaged to obtain a representation of the night sky quality at each location.

The SQM values obtained from this study are the average of observations made over two days, resulting in variations in average values at each location. These variations may be triggered by various natural factors, such as inconsistent weather conditions, for example the presence of thick clouds and the influence of moonlight and atmospheric conditions at the time of observation. From the results obtained, Pantai Pintar Asia showed a better average SQM value than Muhammadiyah University Maumere. This proves that the level of brightness of the night sky at Pantai Pintar Asia is lower (the sky is darker), providing better night sky quality, making this location more suitable for astronomical observation activities in the area.

Based on the information about the average values obtained at each location, an analysis was then conducted to determine the limits of human vision in terms of nighttime brightness. This analysis was performed by converting the average SQM values into NELM (Naked Eye Limiting Magnitude) values using formula (1). The results of this conversion process are shown in Table 5.

Table 5. Shows the average SQM value for observation locations

Location	Date	SQM Score	NELM	Criteria
UM Maumere	27 Juni 2025	21.18	6.215	*Rural/suburban transition* (Langit di perbatasan pedesaan dan perkotaan)
Pantai Pintar Asia	28 Juni 2025	22.40	6.8	*Sky rural* (Langit pedesaan, sedikit polusi cahaya dari cakrawala)

Table 5 shows the average values of night sky brightness measurements (SQM), the threshold for human eye health in seeing the faintest stars (NELM), and night sky quality categories according to the Bortle classification at two different data collection sites. From the available data, the first location, Muhammadiyah University Maumere (UM Maumere) on June 27, 2025, recorded an average SQM value of 21.18 MPSAS, which when converted, resulted in an NELM value of approximately 6.2. Referring to the Bortle scale, this place is classified as a rural/urban transition category, which is an area of night sky on the border between rural and urban areas. The sky conditions in this category indicate that although the Milky Way can

still be seen without aids, some details of the fog and fine star clusters begin to disappear due to light pollution from the surrounding environment.

Meanwhile, the second place, Asia Smart Beach, on June 28, 2025, shows better night sky quality. The average measured SQM reached 22.40 MPSAS, with a NELM of 6.8. Referring to the Bortle scale, the sky quality in this area is classified as rural sky, which reflects the sky in sparsely populated areas with little light pollution, especially around the horizon. Under these conditions, the Milky Way is clearly visible with striking details, and the sky at the summit is relatively free from artificial light. This shows that Asia Smart Coast has nighttime environmental conditions that are more conducive to stargazing or night sky research without being greatly affected by human light sources.

The difference in night sky quality between these two locations can be understood through geographical factors and the level of human activity in the surrounding areas. UM Maumere is located closer to residential areas and artificial lighting, resulting in higher light pollution than at the more remote Pantai Pintar Asia, which is far from densely populated areas. This situation highlights the importance of managing lighting in the environment, especially in educational and tourism areas that have the potential to be places of learning or destinations for astronomical tourism. These results also indicate the need for continuous monitoring of night sky quality to ensure that sky conditions are maintained for research purposes and to protect the beauty of the night sky.

To reinforce the explanation regarding nighttime quality at both monitoring locations, the following map shows the distribution of light pollution in the area around maumere, indicating the distribution of sky brightness levels caused by artificial light sources.

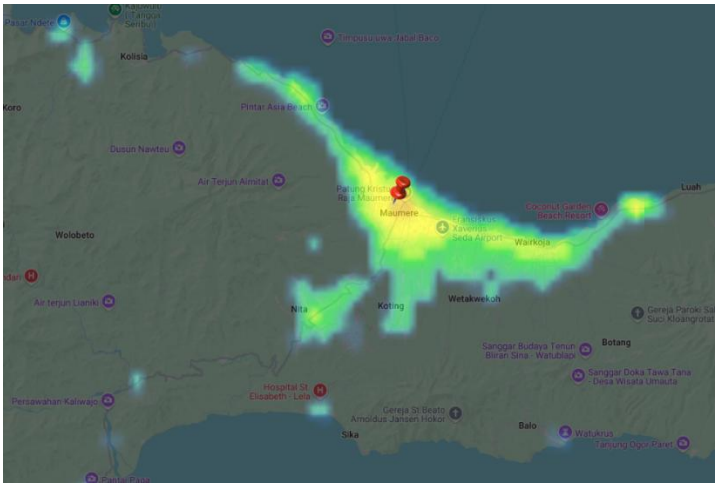

Figure 4. Map of Light Pollution Distribution in the Maumere Region

The light pollution map shown above displays the level of artificial light around Maumere with color variations reflecting the brightness of the night sky. It can be seen that the UM Maumere area is located in the yellow to light green zone, indicating a significant level of light pollution due to lighting activities in the center of the area, resulting in night sky conditions that fall into the transitional category between rural and urban areas. On the other hand, the location

of Pantai Pintar Asia appears to be in an area with a softer green color towards blue, indicating a lower level of light pollution. This finding is in line with previous findings which show that Pantai Pintar Asia has a darker night sky, supporting astronomical observation activities, when compared to the UM Maumere campus area which is affected by light from the surrounding settlements.

D. Conclusion

Based on the average night sky quality measurements at the two observed locations, it was concluded that the sky conditions at Pantai Pintar Asia were better than those at UM Maumere. The average SQM value of 22.40 MPSAS and NELM of 6.8 indicate that the night sky falls into the rural sky category according to the Bortle scale. This means that the sky is only slightly affected by artificial light pollution, making it ideal for astronomical observation. On the other hand, the UM Maumere location showed an average SQM value of 21.18 MPSAS with a NELM of 6.215, which falls into the rural/suburban transition category. This indicates the presence of light from surrounding settlements, although it is still good enough for night sky observation. These findings emphasize the importance of light pollution control measures, especially in areas close to educational and research activities, to ensure that the quality of the night sky is maintained for astronomical observation and related educational activities.

References

Afrizal, R., Ruspianda, R., & Pratiwi, R. (2022). Pemanfaatan Drone Dji Phantom 4 Pro Dan Aplikasi Sig (Arcgis) Untuk Identifikasi Batas Administrasi Wilayah Di Kec. Kuantan Tengah Kabupaten Kuantan Singingi. JURNAL PERANGKAT LUNAK, 4(3), 172–181. https://doi.org/10.32520/jupel.v4i3.2425

Asep Yudi Permana, Karto Wijaya, Hafiz Nurrahman, & Aathira Farah Salsabilla Permana. (2020). Pengembangan Desain Micro House Dalam Menunjang Program Net Zero Energy Buildings (NZE-Bs). Jurnal Arsitektur ARCADE, 4(1), 73–81.

Barentine, J. C. (2022). Night sky brightness measurement, quality assessment and monitoring. *Nature Astronomy*, *6*(10), 1120–1132. https://doi.org/10.1038/s41550-022-01756-2

Butar-Butar, A. J. R., Putra, S. P., Hidayat, M., & Putraga, H. (2022). The feasibility study of Barus city as the new astrotourism destination from astronomical and meteorological aspect. Journal of Physics: Conference Series, 2214(1), 012026. https://doi.org/10.1088/1742-6596/2214/1/012026

Ferng, J. (2023). Cosmogenic Histories: Aboriginal Observations on Catastrophe and Climate. In *Land Air Sea* (pp. 173–207). BRILL. https://doi.org/10.1163/9789004460829_008

Firdaus, M. D., Putraga, H., Ritonga, M., & Rakhmadi, A. J. (2024). Hilal Observation using LRGB Filters. AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi, 6(2), 227–238. https://doi.org/10.20414/afaq.v6i2.10928

Hariyadi Putraga, Abu Yazid Raisal, Marataon Ritonga, & Arwin Juli Rakhmadi. (2023). Analisis Peningkatan Polusi Cahaya Kota Medan Berdasarkan SQM dan Citra VIIRS . AL – AFAQ Jurnal Ilmu Falak Dan Astronomi, 5(1), 28–41.

Hasan, A., & Paninggit, I. (2024). Variasi Lokal Pelaksanaan Rukyatul Hilal dalam Penentuan Awal Bulan Hijriyah (Tinjauan Parameter Meteorologi). *Jurnal Penelitian Agama*, *25*(1), 105–124. https://doi.org/10.24090/jpa.v25i1.2024.pp105-124

Kohar, A., & Taufikurrahman, A. (2021). Tinjauan Astronomis Penetuan Awal Tahun Kalender Rowot Sasak Berdasarkan Kemunculan Bintang Pleiades. *AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi*, *2*(2), 57–86. https://doi.org/10.20414/afaq.v2i2.2920

Mohammad Ananda Reza Kurniawan, Ronald Marcey, Adityah Ramdhon Jannatan, Nailah Hana Rafidah, & Muhammad Nawaf Aufa, (2025), Edukasi astronomi dasar terhadap anak-anak kaum marginal kota melalui lokakarya pembuatan jam matahari sederhana, *SELAPARANG: Jurnal Pengabdian Masyarakat Berkemajuan*, *9*(2), , 0477-0486,

Takanashi, N., Hiramatsu, M., Kawagoe, S., Kusakabe, N., Sawada, K., & Tamazawa, H. (2024). Survey of public attitudes toward astronomy in Japan. *Publications of the Astronomical Society of Japan*, *76*(1), 108–117. https://doi,org/10,1093/pasj/psad084

Tarek, M., Osama, N., & Abdelkafy, J. (2023). The Role Of Astronomy Tourism In Promoting Egypt. *GeoJournal of Tourism and Geosites*, *50*(4), 1356–1363. https://doi,org/10,30892/gtg,50416-1134