AL – AFAQ
Jurnal Ilmu Falak dan Astronomi
Fakultas Syariah Universitas Islam Negeri (UIN) Mataram
P-ISSN: 2685-0176. E-ISSN: 2722-0176 Vol. 8, No. 1 Juni 2026

The Implications of Air Humidity on Determining the Sun's Dip for the Start of Isha Prayer

Kurlian Puspa Dwi Dharma Yanti [a,1,*], Ahmad Adib Rofiuddin [b,2], Ahmad Abdillah Rauf Syam [b,3]
[a,b,c] Universitas Islam Negeri Walisongo, Jl. Prof. Dr. Hamka, Tambakaji, Kec. Ngaliyan, Kota Semarang, 50185, Indonesia
[1] 25020680013@student.walisongo.ac.id*; [2] adibudin08@walisongo.ac.id ; [3] roufsyam14@gmail.com

Abstract: This study aims to explain the implications of air humidity on determining the beginning of Isha prayer time. This is because of the different times of Syafaq's disappearance at the same location, due to air humidity, which has led to differences of opinion regarding the dip of the Sun. This research is a qualitative study using a field research approach. The primary source is data collected through direct observation with a Sky Quality Meter (SQM) over 30 days in the highlands of Tanjung Heran Village and at Cemara Indah Beach. This study found that air humidity on the coast of Cemara Indah, with a value of <80%, detected the disappearance of Syafaq Ahmar at Dip -18°, which is the same as the dip of the Sun according to the Indonesian Ministry of Religious Affairs. Meanwhile, air humidity of 81-90% resulted in a variable dip in the Sun and, of course, Syafaq disappeared more quickly. In the highlands of Tanjung Heran Village, the air humidity of 95-99% caused Syafaq to be detected as disappearing faster than -18 °, with higher values indicating faster disappearance. Therefore, humidity levels are one of the factors that influence the calculation of the Sun's Dip to determine the start time of the Isha prayer.
Keywords : *Sun Dip, Syafaq Ahmar, Isha Prayer, Air Humidity*

Abstrak: Penelitian ini bertujuan untuk mengkaji implikasi dari kelembapan udara terhadap penentuan awal waktu salat Isya. Dikarenakan waktu hilangnya *syafaq* yang berbeda pada lokasi yang sama sebagai dampak dari kelembapan udara dan menyebabkan perbedaan pendapat penentuan Dip Matahari. Penelitian ini merupakan penelitian kualitatif dengan mengunakan pendekatan penelitian lapangan, dimana sumber primer berasal dari data yang dihasilkan observasi secara langsung menggunakan Sky Quality Meter (SQM) selama 30 hari di dataran tinggi Desa Tanjung Heran dan pantai Cemara Indah. Studi ini menemukan bahwa kelembapan udara di pantai Cemara Indah dengan nilai <80% *syafaq ahmar* terdeteksi hilang pada Dip -18°, sama dengan dip Matahari Kemenag RI. Sedangkan kelembapan udara 81-90% menghasilkan dip Matahari yang variatif dan *syafaq* hilang lebih cepat. Di dataran tinggi Desa Tanjung Heran, kelembapan udara 95-99% menyebabkan *syafaq* selalu terdeteksi hilang lebih cepat dari -18° dengan catatan semakin tinggi nilainya maka semakin cepat hilang *syafaq*nya. Oleh karena itu, kelembapan udara merupakan salah satu faktor yang memengaruhi ketampakan syafaq sehingga menyebabkan terjadinya perbedaan terhadap penentuan Dip Matahari untuk awal waktu salat Isya.
Kata Kunci : *Dip Matahari,Syafaq Ahmar, Salat Isya, Kelembapan Udara*

A. Introduction

The height of the Sun at the beginning of Isha time, as determined by the Indonesian Ministry of Religion is still a matter of controversy, giving rise to differing opinions among various groups. The government uses a Sun height of -18°[1], Slamet Hambali uses -17°[2] and Tono Saksono uses -11,5°.[3] One cause of these differences of opinion is the varying times at which twilight disappears, depending on latitude and season. The red twilight, which is also influenced by air humidity,

[1] Kementrian Agama RI, *Buku Saku Hisab Rukyat* (Jakarta: Kementrian Agama RI, 2021), 128.
[2] Slamet Hambali, *Ilmu Falak 1 (Penentuan Awal Waktu Salat Dan Arah Kiblat Seluruh Dunia)* (Semarang: IAIN Walisongo, 2011), 142.
[3] Tono Saksono, *Evaluasi Awal Waktu Subuh & Isya Perspektif Sains, Teknologi, Dan Syariah* (Jakarta: UHAMKA PRESS & LPP AIKA UHAMKA, 2017), 105.

disappears at different intervals each day at different latitudes. Additionally, it will also disappear at various times from the same location in different seasons.[4]

Air humidity is a condition where there is a lot of water vapor in the air. When humidity increases and temperature drops, water vapor condenses into water droplets at a certain altitude. Over time, more water vapor arrives, and the clouds that form become larger.[5] Thick clouds caused by this humidity, if they cover the western horizon at sunset, can reduce the light and obscure the view of the observed object.[6] This can affect the visibility of the red twilight because the remaining sunlight may be obscured by clouds, causing the red twilight to fade more quickly. Therefore, observations of the fading of the red twilight influenced by atmospheric humidity need to be conducted.

Research on Syafaq as an early indicator of the time for Isha prayer has been extensively conducted. First, research focusing on correcting the determination of the Sun's altitude at the beginning of Isha time, as conducted by Tono Saksono from ISRN UHAMKA Jakarta, which found an average value of -13.4° for dawn and 11.5° for Isha time.[7] Another correction was also made by Ahmad Abrar using SQM on Masalembu Island, Semenep Regency, East Java,[8] Aminudin Noosy using astrophotography techniques in Jomblom Kendal, Empurancak Beach in Jepara, and Cipta Beach in Semarang[9], and M. Asep Rizkiawan et al. using the Sky Quality Meter with the Cutoff Method.[10] Lidya Safrida and Machzumy in their research analyzed astronomical dusk as a sign of determining the beginning of Isha prayer time,[11] Marataon Ritonga's article discussing in detail the issues of syafaq and dawn in determining the times of Isha and Fajr prayers,[12] and Ahmad Saifulhaq Almuhtadi's research, which discusses in detail syafaq ahmar and syafaq abyadh, two natural phenomena that greatly influence the determination of the beginning and end of prayer times,

[4] Asdar and Mahyuddin Latuconsina, "Analisis Kritis Keberadaan Syafaq Abyadh Dan Implikasinya Pada Penetapan Awal Waktu Salat Isya (Studi Kasus Pantai Barombong, Losari, Akkarena, Munte)," *HISABUNA: Jurnal Ilmu Falak* 1, no. 3 (2022): 75.

[5] Zahra Hayati and Dhiauddin Tanjun, "Pengaruh Kelembapan Udara Terhadap Efektivitas Pelaksanaan Rukyatul Hilal Awal Bulan Qamariyah," *Jurnal EDUCATIO (Jurnal Pendidikan Indonesia)* 9, no. 2 (2023): 757.

[6] Zahra Hayati and Tanjun, 760.

[7] Tono Saksono, *Evaluasi Awal Waktu Subuh & Isya Perspektif Sains, Teknologi, Dan Syariah*, 105.

[8] Ahmad Abrar, "Analisis Penentuan Waktu Salat Isya' Berdasarkan Syafaq Abyad Di Pulau Masalembu, Kabupaten Sumenep, Jawa Timur" (UIN Walisongo Semarang, 2021), 63.

[9] Aminudin Noosy, "Telaah Mengenai Syafaq Abyadh Terhadap Awal Waktu Isya Perspektif Astrofotografi (Studi Kasus Di Pantai Jomblom Kendal, Pantai Empurancak Jepara, Dan Pantai Cipta Semarang)" (UIN Walisongo Semarang, 2022), 155.

[10] M. Asep Rizkiawan, Rosalina, and Emilia Roza, "Teknik Menentukan Waktu Hilangnya Syafaq (Cahaya Merah) Menggunakan Sky Quality Meter (SQM) Dengan Metode Titik Potong (Cutoff)," *Jurnal Kumparan Fisika* 4 (2021): 103.

[11] Lidya Safrida and Machzumy, "Analisis Astronomical Twilight Sebagai Tanda Penentuan Awal Waktu Salat Isya," *ASTROISLAMICA : Journal of Islamic Astronomy* 1, no. 1 (2022): 47.

[12] Marataon Ritonga, "Problematika Syafak Dan Fajar Dalam Menentukan Waktu Salat Isyak Dan Subuh," *Al-Marshad: Jurnal Astronomi Islam Dan Ilmu-Ilmu Berkaitan* 7, no. 2 (2021): 169.

especially Maghrib and Isha prayers.[13]

Based on the two research focuses above, no study has examined the implications of air humidity levels on the height (Dip) of the Sun at the beginning of Isha prayer time. The difference in the Sun's Dip cannot be separated from the phenomenon that affects the disappearance of the red twilight on the western horizon. Knowledge of this perspective is essential to resolve the issue of differences in the Dip of the Sun at the beginning of Isha prayer time. This study is based on two research questions: First, what are the dynamics of the twilight and the Dip of the Sun at the beginning of Isha prayer time in Indonesia? Second, what are the implications of air humidity on determining the Dip of the Sun at the beginning of Isha prayer time?. Therefore, this study aims to complement previous studies that ignored the implications of air humidity in determining the Dip of the Sun at the beginning of Isha prayer time.

B. Method

This study employs a qualitative field research approach, in which primary data were collected through direct observations with a Sky Quality Meter (SQM) over 30 days. The research focuses on gathering data regarding a specific phenomenon, particularly sky brightness and the Sun's Dip at the moment of the disappearance of the syafaq ahmar, as well as air humidity data. Air humidity data were obtained from the BMKG app, which provides climatological observations from official BMKG observation stations. Secondary data was drawn from books, articles, and other literature discussing the red twilight, sunset, air humidity, and the Isha prayer.

The study was conducted at two locations: Cemara Indah Beach, which has an elevation of 0 m above sea level and a sky brightness of 21.99 mag/arcsec², and the highlands of Tanjung Heran Village, which has an elevation of 804 m above sea level and a sky brightness of 21.93 mag/arcsec². Observations were made using a Sky Quality Meter with a 3-second sampling interval, starting 10 minutes before maghrib and continuing for 10 minutes after the onset of Isya. The data were processed using the Labplot application (64-bit version) with visual analysis techniques to identify the inflection point of the curve as an indication of the disappearance of the red twilight. Visual analysis is a technique that involves physically examining the data plotted on a graph by zooming in. This method is frequently used because it is simpler, requiring no mathematical approach, and physically displays the flat point marking the disappearance of the red twilight, making it highly effective when analyzing data with disturbances.

The analyzed data were then categorized into corrupted, disrupted, and good data. Corrupted data are those with unstable curves due to cloud or rain interference and cannot be analyzed; disrupted data are those with unstable curves but can still be analyzed using visual analysis techniques; and good data are those with stable curves, making them easy to analyze. Therefore, data reduction was performed to use only good and disturbed data—totaling 12 days—because the corrupted data could not be analyzed. The processed data were then organized into a table,

[13] Ahmad Saifulhaq Almuhtadi, "Syafaqul Ahmar Dan Syafaqul Abyadh," *Al– Afaq* 1, no. 1 (2019): 67.

classified by location, observation time, relative humidity, Sun's dip, and the time when red twilight disappeared on the Sky Quality Meter, along with the Isha prayer schedule from the Indonesian Ministry of Religious Affairs. This data was then analyzed descriptively to examine how atmospheric humidity can affect variations in the Sun's dip angle, thereby influencing the start time of the Isya prayer.

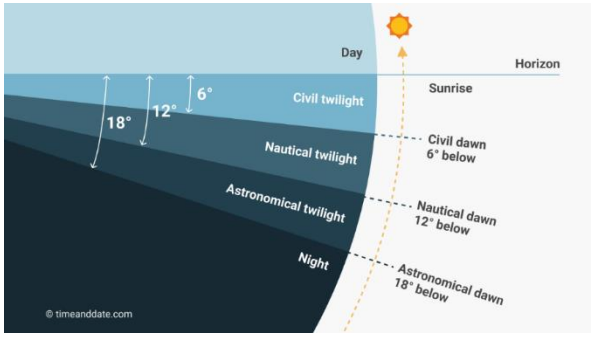
C. Results and Discussion

1. The Dynamics of Syafaq and the Height of the Sun at the Beginning of Isha Time in Indonesia

From an astronomical perspective, Syafaq is the period between sunset and sunrise, known as twilight. It can also be said that syafaq begins after sunset with colored light and ends with white light, which then diminishes and disappears completely. Astronomically, syafaq or twilight is divided into three levels in sequence, namely:

a. Civil Twilight. At this time, the Sun is 6° below the horizon, and objects in open fields are still clearly visible, as are the brightest stars.
b. Nautical Twilight. At this time, the Sun is at an altitude of 12° below the horizon, and if we are at sea, the horizon is almost invisible so that all bright stars can be seen.
c. Astronomical Twilight. At this time, the Sun is at an altitude of 18° below the horizon, and the night is completely dark, so that is when the time for Isha prayer begins.[14]

Picture I. Types of Twilight[15]



Isha time begins when the red color in the western sky where the Sun sets has wholly disappeared. The red color is due to light refraction. The sunlight that enters the house does not directly reach the interior, but the objects inside are still visible. This is due to the significant role of dust particles, which are numerous and reflect sunlight. The light visible to the eye is generally white, which is actually a mixture of colors, but the most important are blue and red. Each color

[14] Arwin Juli Rakhmadi Butar-Butar, *Fajar & Syafak (Dalam Kesarjanaan Astronom Muslim Dan Ulama Nusantara)* (Yogyakarta: LKiS, 2018), 45–46.
[15] Konstantin Bikos, "Astronomical Twilight – Astronomical Dawn & Dusk," Timeanddate, n.d., https://www.timeanddate.com/astronomy/astronomical-twilight.html.

has a different wavelength, with blue being the shortest and red being the longest. When sunlight encounters particles that are very small, with a size shorter than the wavelength of light, extraordinary scattering occurs. The degree of light scattering by these wonderful particles is inversely proportional to the fourth power of the wavelength.

As a result, blue light is scattered 9 times more strongly than red light. As a result, on a clear day, the light received by the eye is primarily blue. This causes the sky to appear blue during the day. At sunrise or sunset, the light from the Sun has lost too much of its short wavelengths before reaching the observer's eyes, so it appears yellow and even red. If the particles still receive sunlight, red light can still be seen. Once the Sun has set, it is no longer visible (18° below the horizon), so the zenith distance of the Sun is 108° at that time, maghrib ends and Isya begins (90° +18° = 108°.[16]

Scholars in Indonesia agree that Isha time is marked by the fading of Syafaq Ahmar in the western sky, which is a sign of the onset of nightfall. This event is known in Falak 'ilmiy as the end of astronomical twilight.[17] The Indonesian Ministry of Religious Affairs formulates the position of the Sun at the beginning of Isha time by observing it in the evening. This observation is carried out by empirically noting when the red light in the western sky disappears, or astronomically, when the stars reach their maximum brightness. The results of the observation show that at that time, the Sun's zenith distance = 108°,[18] in other words, the average height of the Sun at that time = -18°. The criterion for a Sun height of -18° is then applied throughout Indonesia. Moreover, the Ministry of Religious Affairs, through Bimas Islam, makes it easy for the public to access prayer schedules on the Bimas Islam website.

However, the Ministry of Religious Affairs' regulation on the start of Isya prayer when the Sun is at an altitude of -18° continues to elicit differing opinions. Research by Tono Saksono (ISRN UHAMKA) using a Sky Quality Meter and All-Sky Camera shows that the red twilight disappears at an average Sun elevation of -11.5°[19] while research by Faiz Hidayat through astrophotography in Jepara found the disappearance of the red twilight between -16° and -17°.[20] Then, Ahmad Abrar's research in Masalembu showed that syafaq ahmar disappears at an altitude of around -16°, whereas syafaq abyadh disappears at -18°, which differs from the Ministry of Religious Affairs' stipulation that syafaq ahmar disappears at -18°.[21] Aminudin Noosy's research on several beaches in Central Java also confirms this uncertainty, where the light of syafaq sometimes does not entirely disappear at -18°, or even disappears more quickly, influenced by factors such as light pollution, atmospheric

[16] A. Jamil, *Ilmu Falak (Teori & Aplikasi)*, 1st ed. (Jakarta: Amzah, 2016), 45–46.
[17] Tamhid Amri, "Waktu Shalat Perspektif Syar'i," *Asy-Syari'Ah* 16, no. 3 (2014): 213.
[18] Abdur Rachim, *Ilmu Falak* (Yogyakarta: Liberty, 1983), 39.
[19] Tono Saksono, *Evaluasi Awal Waktu Subuh & Isya Perspektif Sains, Teknologi, Dan Syariah*, 105.
[20] Faiz Hidayat, "Penentuan Awal Waktu Isya Kementerian Agama RI Menggunakan Astrofotografi : Studi Kasus Di Pantai Tegalsambi, Kabupaten Jepara" (UIN Walisongo Semarang, 2020), 72.
[21] Ahmad Abrar, "Analisis Penentuan Waktu Salat Isya' Berdasarkan Syafaq Abyad Di Pulau Masalembu, Kabupaten Sumenep, Jawa Timur," 63.

conditions, and weather.[22] The results of research by M. Asep Rizkiawan et al. in Jakarta also reinforce the finding that the red mega disappears unpredictably each day, with a time range of 18:29:33 to 18:51:54.[23] Thus, it can be understood that the determination of the Sun Dip at the beginning of Isha time needs to be reevaluated by considering the implications of air humidity in the atmosphere when the Sun sets on the western horizon.

2. Observation of Syafaq Ahmar Using a Sky Quality Meter in Bengkulu Province

The researcher conducted observations at two locations with different elevations, namely the coast and the highlands, because elevation is one of the factors that affect air humidity in a given location.[24] Elevation can affect air humidity because, generally, the higher the elevation, the lower the air temperature and the lower the air pressure. Warmer air can hold more water vapor, while cooler air reaches saturation more quickly, causing changes in relative humidity.[25] The brightness of the sky at the observation site also needs to be considered to avoid disturbances from light or air pollution. With the help of the Light Pollution Map website, which can detect sky brightness, it is easier for researchers to assess the quality of the sky at the location to be used as the observation site. The website refers to the Bortle scale, which consists of 9 classes or levels, with the lowest being the darkest sky and the highest the brightest, such as in the middle of a city.[26]

Researchers observed the disappearance of red twilight in Bengkulu Province, where the agricultural and plantation sectors (palm oil, rice, and coffee) dominate rather than industrial or other sectors[27] resulting in extensive agricultural and plantation land. Because the area is dominated by farming and plantation land, Bengkulu Province has minimal air pollution. Therefore, at night, stars and other celestial phenomena can be clearly observed, making it a relevant location for observing the red twilight. The selected beach is Cemara Indah Beach, located in Ilir Talo Subdistrict, Seluma Regency, Bengkulu Province, with coordinates -4°10'17.33" LS and 102°33'18.1" BT and an elevation of 0 MDPL, the location is in a Class 1 dark sky zone (Excellent Dark-Sky Site) with a sky brightness of 21.99 mag/arc sec². The second location is the highlands of Tanjung Heran Village, Taba Penanjung District, Central Bengkulu Regency, Bengkulu Province, with coordinates -3°39'50" S and 102°32'45.9" E, with an altitude of 804 meters above sea level and minimal light pollution, located in zone 2 (Typical Truly Dark Site) with a sky

[22] Aminudin Noosy, "Telaah Mengenai Syafaq Abyadh Terhadap Awal Waktu Isya Perspektif Astrofotografi (Studi Kasus Di Pantai Jomblom Kendal, Pantai Empurancak Jepara, Dan Pantai Cipta Semarang)," 155.

[23] Rizkiawan, Rosalina, and Roza, "Teknik Menentukan Waktu Hilangnya Syafaq (Cahaya Merah) Menggunakan Sky Quality Meter (SQM) Dengan Metode Titik Potong (Cutoff)," 103.

[24] Trio Santoso Gunardi Djoko Winarno, Sugeng P Harianto, "Klimatologi Pertanian" (Bandar Lampung: Pusaka Media, 2019), 107.

[25] BMKG, "Kelembapan Udara Dan Relatif," GAW Bariri, 2025, https://gaw-bariri.bmkg.go.id/index.php/karya-tulis-dan-artikel/gawsarium/261-kelembapan-udara-relatif.

[26] Aminudin Noosy, "Telaah Mengenai Syafaq Abyadh Terhadap Awal Waktu Isya Perspektif Astrofotografi (Studi Kasus Di Pantai Jomblom Kendal, Pantai Empurancak Jepara, Dan Pantai Cipta Semarang)," 156–57.

[27] BPS Bengkulu, "Statistik Daerah Provinsi Bengkulu 2025," 2025, https://bengkulu.bps.go.id/id.

brightness of 21.93 mag/arc sec².

The observation of Syafaq Ahmar was conducted using a Sky Quality Meter (SQM), a device widely used by astronomy enthusiasts for its accuracy and measurement stability. The SQM is a pocket-sized device manufactured by Unihedron that can record data at any time and display results in MPSAS (mag/arcsec2) units.[28] Besides providing magnitude data, the Sky Quality Meter (SQM) also generates information about the sun's and moon's altitudes, which are calculated according to the observation time and location.[29] This type of SQM is equipped with a lens for capturing light objects, a USB connection, and a data logger that automatically records data using an adapter battery without a computer connection.[30] One disadvantage of this photometer is the absence of a display screen integrated directly with the sensor. As a result, the sky brightness value during measurement can only be determined through commands in the software displayed on the connected computer.[31]

Observations at Cemara Indah Beach and the Tanjung Heran Village Highlands were conducted over 15 days. Observations were conducted within a 10-minute window before sunset and ending 10 minutes after Isya prayer time, with data collected every 3 seconds. During the 30-day observation period, not all data were stable due to various disturbances, including lightning, rain, and moonlight interference. The moon was in its first quarter phase, appearing as a half-circle the phase leading up to a full moon, when the light becomes increasingly bright.[32] This significantly disrupted the observation data for the red twilight.

Researchers processed data from observations of Syafaq Ahmar using visual analysis methods with the Labplot application (64-bit version)[33] to facilitate analysis of the curve's slope as an indicator of Syafaq Ahmar's disappearance. Thomas Djamaluddin used this method in analyzing when the true dawn appears. He is the former head of the National Institute of Aeronautics and Space (LAPAN).[34] This visual analysis uses visuals or curve shapes directly and can also be used to identify the disappearance of Syafaq Ahmar. Researchers often use this method to determine Fajar and Syafaq because it is easier than a mathematical approach and visually shows the flat point where Syafaq ahmar disappears. Researchers chose this method because it is highly effective in

[28] Rizkiawan, Rosalina, and Roza, "Teknik Menentukan Waktu Hilangnya Syafaq (Cahaya Merah) Menggunakan Sky Quality Meter (SQM) Dengan Metode Titik Potong (Cutoff)," 104.

[29] Ahmad Abdillah Rauf Syam et al., "Determining Tahrim Prayer Times Based on Sky Brightness and Sun Altitude Parameters with a Sky Quality Meter," *Al-Afaq* 7, no. 2 (2025): 275.

[30] Unihedron, "SQM-LU-DL Operator's Manual," accessed November 30, 2025, http://unihedron.com/projects/sqm-lu-dl/.

[31] Hariyadi Putraga et al., "Analisis Peningkatan Polusi Cahaya Kota Medan Berdasarkan SQM Dan Citra VIIRS," *AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi* 5, no. 1 (2023): 31.

[32] Fauziah An Nuril Maulida et al., "Memahami Proses Fase Bulan Setengah (First Quarter) Dan Pengaruh Intensitasnya Pada Malam Hari," *BIOCHEPHY:Journal of Science Education* 4, no. 1 (2024): 46.

[33] "LabPlot," n.d., https://labplot.org/.

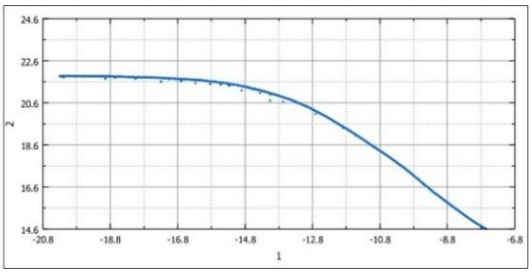
[34] Adi Nugroho, "Pengaruh Cahaya Bulan Terhadap Kemunculan Fajar Sidiq (Analisis Titik Belok Kurva Pada Penentuan Awal" (Universitas Islam Negeri walisongo Semarang, 2020), 78.

analyzing data containing disturbances.[35]

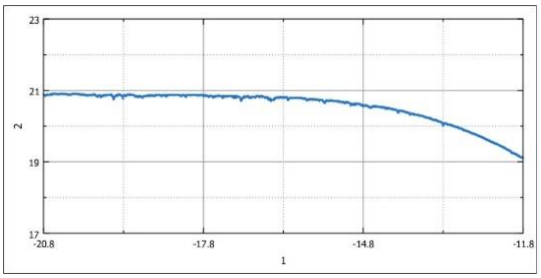
Then, data reduction was performed on the 30-day observation data. The results yielded 12 days of observation, which the researchers used for analysis, with two types of data descriptions: good data and disturbed data: good and disturbed. Good data has a stable curve, making it easy to analyze. In contrast, disturbed data has an unstable curve due to cloud or rain interference and can still be analyzed using visual analysis techniques. The following is the data on the height of the Sun at the time of the disappearance of the red twilight during the 12 days of research at Cemara Indah Beach and the Tanjung Heran Village Highlands, which was detected by Sky Quality Meter and processed using visual analysis techniques in the Labplot application:

a. Cemara Indah Beach

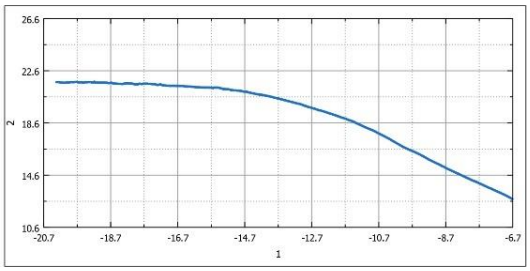
Picture 2. Analysis results for Monday, September 23, 2024, with a flat point at -18.81°



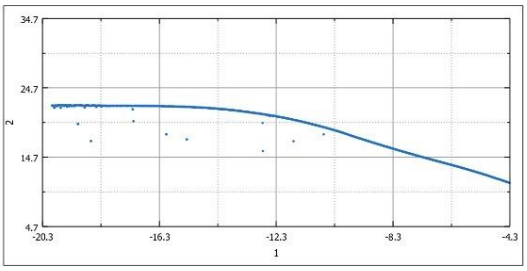
Picture 3. Data analysis results on Tuesday, September 24, 2024, with a flat point at -17.85°



Picture 4. Data analysis results on Wednesday, September 25, 2024, with a flat point at -18.67°



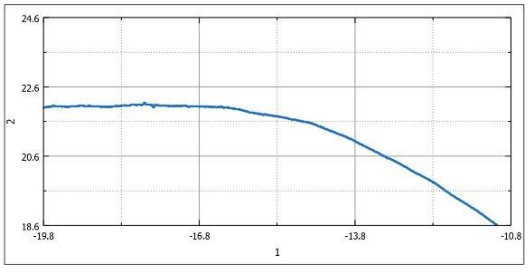
Picture 5. Data analysis results on Thursday, September 26, 2024, with a flat point at -16.3°

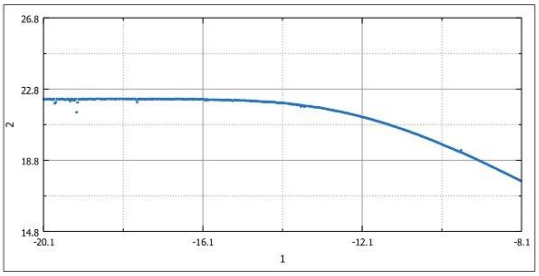


Picture 6. Data analysis results on Friday, September 27, 2024, with a flat point at -16.8°

Picture 7. Data analysis results on Saturday, September 28, 2024, with a flat point at -16.12°

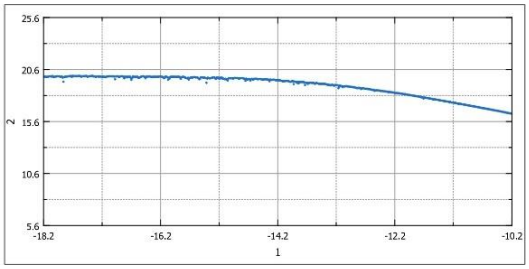
[35] M Nur Iskandar fajri, "Efektivitas Teknik Analisa Data SQM (Moving Average, Linier Dan Visual Analysis) Dalam Menentukan Fajar Sidik Pada Data Dengan Gangguan Dan Tanpa Gangguan" (Universitas Islam Negeri Walisongo, 2021), 75.



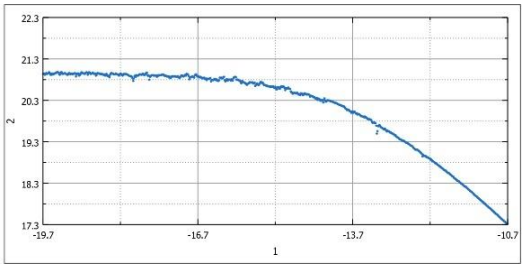


b. Tanjung Heran Village Highlands

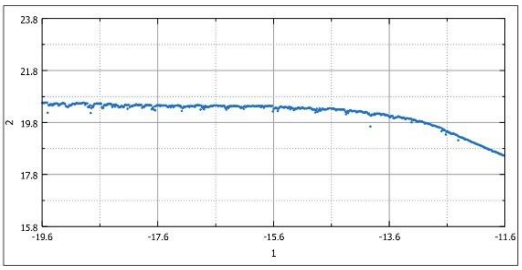
Picture 8. Data analysis results on Friday, October 25, 2024, flat point at -16.2°



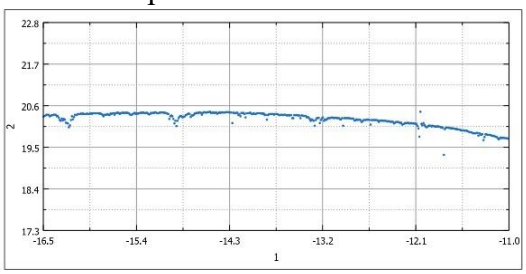
Picture 9. Data analysis results on Sunday, October 27, 2024, flat point at -16.76°



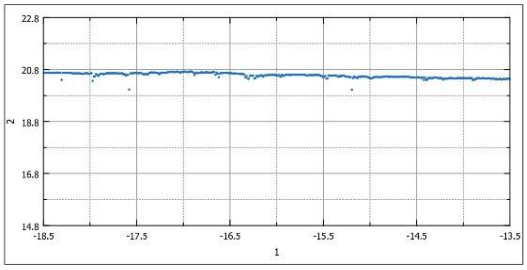
Picture 10. Results of data analysis on Tuesday, October 29, 2024, with a flat point at -15.63°



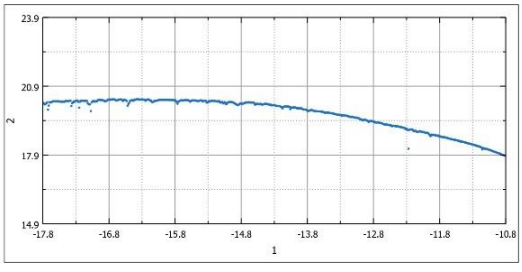
Picture 11. Data analysis results on Thursday, October 31, 2024, with a flat point at -14.28°



Picture 12. Data analysis results on Tuesday, November 5, 2024, with a flat point at -16.5°



Picture 13. Data analysis results on Friday, November 8, 2024, with a flat point at -15.79°



The disappearance of the red twilight is marked by the beginning of the curve's flat in the Sky Quality Meter data. Based on this data, during the observation at Cemara Indah Beach on the first day, the red twilight was detected to have disappeared when the Sun reached an altitude of -18.67° below the horizon. On the second day, the red twilight was detected when the Sun reached an altitude of -17.85° below the horizon; on the third day at -18.67°; on the fourth day at -16.3°; on the fifth day at -16.8°; and on the sixth day at -16.02°. In the highlands of Tanjung Heran Village, on the first day the red twilight was detected to have disappeared when the Sun reached an altitude of -16.2° below the horizon, on the second day at -16.76°, on the third day at -15.63°, on the fourth day at -14.28°, on the fifth day at -16.5°, and on the sixth day at -15.79°. These variations in the Sun's dip indicate that factors influencing the disappearance of the red twilight on the western horizon, such as air humidity levels, can affect cloud formation and rainfall—both of which can accelerate or delay the onset of twilight.

c. Implications of Air Humidity on Determining the Dip of the Sun at the Beginning of Isha Prayer Time

The disappearance of Syafaq as a phenomenon marking the end of Maghrib and the beginning of Isha is due to variations in latitude and season across different locations. Syafaq ahmar, which is also influenced by atmospheric humidity, at different latitudes, both syafaq ahmar and abyadh will disappear at different times after maghrib each day. In addition, in other seasons, both will disappear at different times from the same location.[36] The level of humidity in the air varies from place to place due to factors such as the amount of solar radiation received by the Earth, wind, altitude, and the presence of land and sea.[37]

Air humidity is a condition where there is a lot of water vapor in the air. When humidity increases and temperature drops, water vapor condenses into water droplets at a certain altitude. Over time, more water vapor arrives, and the clouds that form become larger.[38] Once it reaches a certain altitude, this collection of water vapor will condense into water droplets as the temperature decreases. These water droplets, which are denser than water vapor, will fall under Earth's gravity. These falling water droplets are what we call rain.[39] Air humidity affects the formation of clouds and rain. This occurs when higher humidity and cloud formation lead to wet aerosols forming faster as condensation nuclei in rain clouds.[40] Clouds can shorten the duration of dusk if they are dense

[36] Asdar and Latuconsina, "Analisis Kritis Keberadaan Syafaq Abyadh Dan Implikasinya Pada Penetapan Awal Waktu Salat Isya (Studi Kasus Pantai Barombong, Losari, Akkarena, Munte)," 75.
[37] Gunardi Djoko Winarno, Sugeng P Harianto, "Klimatologi Pertanian," 107.
[38] Zahra Hayati and Tanjun, "Pengaruh Kelembapan Udara Terhadap Efektivitas Pelaksanaan Rukyatul Hilal Awal Bulan Qamariyah," 757.
[39] Guslim. dkk, *Klimatologi Pertanian* (Medan: USU Press, 1987), 26.
[40] Zahra Hayati and Tanjun, "Pengaruh Kelembapan Udara Terhadap Efektivitas Pelaksanaan Rukyatul Hilal Awal Bulan Qamariyah," 760.

and darken the sky, especially if they block the Sun's rays. In addition to clouds, rain can also cause the red twilight to disappear earlier.[41]

Observation of the red twilight as a determinant of the Sun's altitude for the start of Isha prayer time using Sky Quality Meter by observing the humidity at two observation locations, namely Cemara Indah Beach and the highlands of Tanjung Heran Village, Taba Penanjung District, Bengkulu Tengah, both of which are located in Bengkulu Province. The results were then compared with the Isya prayer schedule issued by the Ministry of Religious Affairs of the Republic of Indonesia for Seluma District and Bengkulu Tengah District to identify differences and their implications:

Table 1. Results of Syafaq Ahmar Observations in Bengkulu Province

Location	Day	Date	RH	SQM Observation		Time of Isya Prayer, Kemenag RI
				h	Time of the disappearance of the red twilight	
Cemara Indah Beach	1	23/9/24	74%	-18.81	19:17:22	19.17 WIB
	2	24/9/24	81%	-17.85	19:13:17	19.16 WIB
	3	25/9/24	78%	-18.67	19:16:23	19.16 WIB
	4	26/9/24	89%	-16.30	19:06:40	19.16 WIB
	5	27/9/24	88%	-16.80	19:08:28	19.16 WIB
	6	28/9/24	90%	-16.12	19:06:21	19.16 WIB
Tanjung Heran Village Highlands	1	25/10/24	96%	-16.20	19:03:42	19.14 WIB
	3	27/10/24	95%	-16.76	19:06:11	19.14 WIB
	5	29/10/24	98%	-15.63	19:01:45	19.15 WIB
	7	31/10/24	99%	-14.28	18:56:25	19.15 WIB
	12	05/11/24	95%	-16.50	19:06:41	19.15 WIB
	15	08/11/24	97%	-15.79	19:04:26	19.17 WIB

Based on the data, it can be seen that when the air humidity at Cemara Indah Beach is 74% or 78%, the red twilight disappears at altitudes of -18.81° and -18.67°. This means that air humidity below 80% has no implications, because the Sun Dip, the time when the red twilight disappears at SQM, is the same as the Indonesian Ministry of Religious Affairs' Isha prayer schedule, which is -18°. However, air humidity at 81% indicates that the disappearance of the red twilight at SQM is detected earlier, at a dip of -17.85°, resulting in a 2 minutes and 43 seconds earlier start than the Ministry of Religious Affairs' Isya prayer schedule.

Furthermore, with an air humidity of 88% at Cemara Indah Beach, the red twilight at SQM disappeared at Dip -16.80°, indicating a difference of 7 minutes and 32 seconds earlier than the

[41] Guslim. dkk, *Klimatologi Pertanian*, 67.

Isya schedule set by the Indonesian Ministry of Religious Affairs. Then, with an air humidity value of 89-90%, Syafaq Ahmar disappeared very quickly, namely at Dip -16.30° and -16.12°, thus causing a difference of 9 minutes 20-39 seconds earlier than the Isya schedule of the Indonesian Ministry of Religious Affairs.

At the second location, the highland village of Tanjung Heran, the humidity level during observations was consistently above 90%. At 95% humidity, Syafaq Ahmar on SQM disappeared at Dip -16.50° and -16.76°, resulting in a 7-8 minute difference in the Isha prayer schedule according to the Indonesian Ministry of Religious Affairs. At an air humidity value of 96%, syafaq ahmar was detected to disappear at Dip -16.20° and was 10 minutes 24 seconds faster, while at an air humidity of 97%, syafaq ahmar was detected to disappear at Dip -15.79° and 12 minutes 34 seconds earlier, at 98% humidity syafaq ahmar was detected to disappear at Dip -15.63° 13 minutes 15 seconds earlier, and at the highest humidity of 99% syafaq ahmar was detected to disappear at Dip -14.28° 18 minutes 45 seconds earlier.

Therefore, in the highlands of Tanjung Heran Village, where air humidity is always near saturation, a 1% increase in air humidity can cause *syafaq ahmar* to disappear 2-5 minutes earlier. Among the six data points at the Tanjung Heran highlands, the Sun Dip at the time the red twilight was detected disappeared at SQM, never reaching -18°, as specified by the Indonesian Ministry of Religious Affairs as the criterion for the start of the Isha prayer. In fact, it disappeared 18 minutes earlier when the air humidity reached 99%.

The results of these varied observations have similarities with the results of Aminudin Noosy's research conducted on four different beaches using Astrophotography techniques, where Syafaq was detected missing at different Sun Dips caused by several factors such as light pollution, weather, clouds and rain, the thickness of the air of a place, and the Earth's elliptical orbit.[42] However, in contrast to Ahmad Abrar's research using SQM, he found that Syafaq Ahmar was detected missing at an average Solar altitude of -16°.[43] This observation also differs from Tono Saksono's research in Depok, which found an average solar dip of -11.5° when Syafaq Ahmar was detected missing on the SQM.[44] This is certainly very different from our research findings, where Syafaq Ahmar was never detected missing at a dip of -11.5°, even in conditions with air humidity reaching 99%. A humidity of 99% is nearly saturated, but Syafaq Ahmar was detected missing at -14.28°. Therefore, many factors must be considered in Syafaq's observations, such as atmospheric humidity, weather, air pollution, and others.

Air humidity actually has a significant implication on determining the Dip Matahari at the beginning of Isha prayer time. High air humidity can increase cloud formation and rainfall. Thick,

[42] Aminudin Noosy, "Telaah Mengenai Syafaq Abyadh Terhadap Awal Waktu Isya Perspektif Astrofotografi (Studi Kasus Di Pantai Jomblom Kendal, Pantai Empurancak Jepara, Dan Pantai Cipta Semarang)," 156.

[43] Ahmad Abrar, "Analisis Penentuan Waktu Salat Isya' Berdasarkan Syafaq Abyad Di Pulau Masalembu, Kabupaten Sumenep, Jawa Timur," 63.

[44] Tono Saksono, *Evaluasi Awal Waktu Subuh & Isya Perspektif Sains, Teknologi, Dan Syariah*, 105.

even clouds in the west can refract or even block sunlight, reducing its brightness after sunset and causing the red twilight to disappear earlier. Variable humidity levels result in variable weather conditions, which can affect the duration of the red twilight's visibility on the western horizon and ultimately lead to differences in determining the solar dip for the start of Isha prayer time.

D. Conclusion

This study of the red twilight using a Sky Quality Meter focused on collecting data on sky brightness and the Sun's Dip value at the moment the red twilight was detected to have disappeared. Based on observations at Cemara Indah Beach and the highlands of Tanjung Heran Village, it was found that the higher the air humidity, the faster the red twilight disappeared. At Cemara Indah Beach, when humidity is below 80%, the disappearance of the red twilight still aligns with the criteria of the Indonesian Ministry of Religious Affairs, specifically when the Sun's altitude is at -18°. However, when air humidity rises above 80%, the red twilight is detected to disappear 2 to 18 minutes earlier than the Ministry of Religious Affairs' Isya prayer schedule. In highland areas with humidity above 90%, even a 1% increase in humidity can accelerate the disappearance of the red twilight by 2–5 minutes.

Air humidity levels actually have a significant impact on determining the time of the first dip of the Sun for the Isha prayer. High humidity levels can increase cloud formation and rainfall. Thick, widespread clouds in the west can refract or even block sunlight, reducing the brightness of the Sun after sunset and causing the red twilight to fade earlier. Variable humidity levels, which in turn produce variable weather conditions, can affect the duration of the red twilight's visibility on the western horizon and ultimately lead to differences in determining the Sun's dip for the start of Isha prayer.

Air humidity must be taken into account because it significantly affects the disappearance of the red twilight on the western horizon and affects the start time of the Isha prayer. The Indonesian Ministry of Religious Affairs (Kemenag RI) needs to consider the influence of this air humidity. However, this study has limitations because it uses air humidity data from the Info BMKG app (not in-situ measurements) and has a limited sample size (only 12 days). Further research is recommended to use air humidity data from direct on-site measurements, increase the sample size, and extend the observation period to ensure more accurate and comprehensive analysis results.

Bybliography

A. Jamil. *Ilmu Falak (Teori & Aplikasi)*. 1st ed. Jakarta: Amzah, 2016.

Abdur Rachim. *Ilmu Falak*. Yogyakarta: Liberty, 1983.

Ahmad Abrar. "Analisis Penentuan Waktu Salat Isya' Berdasarkan Syafaq Abyad Di Pulau Masalembu, Kabupaten Sumenep, Jawa Timur." UIN Walisongo Semarang, 2021.

Ahmad Saifulhaq Almuhtadi. "Syafaqul Ahmar Dan Syafaqul Abyadh." *Al– Afaq* 1, no. 1 (2019).

Aminudin Noosy. "Telaah Mengenai Syafaq Abyadh Terhadap Awal Waktu Isya Perspektif Astrofotografi (Studi Kasus Di Pantai Jomblom Kendal, Pantai Empurancak Jepara, Dan Pantai Cipta Semarang)." UIN Walisongo Semarang, 2022.

Asdar, and Mahyuddin Latuconsina. "Analisis Kritis Keberadaan Syafaq Abyadh Dan Implikasinya Pada Penetapan Awal Waktu Salat Isya (Studi Kasus Pantai Barombong, Losari, Akkarena, Munte)." *HISABUNA: Jurnal Ilmu Falak* 1, no. 3 (2022).

BMKG. "Kelembapan Udara Dan Relatif." GAW Bariri, 2025. https://gaw-bariri.bmkg.go.id/index.php/karya-tulis-dan-artikel/gawsarium/261-kelembapan-udara-relatif.

BPS Bengkulu. "Statistik Daerah Provinsi Bengkulu 2025," 2025. https://bengkulu.bps.go.id/id.

Butar-Butar, Arwin Juli Rakhmadi. *Fajar & Syafak (Dalam Kesarjanaan Astronom Muslim Dan Ulama Nusantara)*. Yogyakarta: LKiS, 2018.

Faiz Hidayat. "Penentuan Awal Waktu Isya Kementerian Agama RI Menggunakan Astrofotografi : Studi Kasus Di Pantai Tegalsambi, Kabupaten Jepara." UIN Walisongo Semarang, 2020.

Gunardi Djoko Winarno, Sugeng P Harianto, Trio Santoso. "Klimatologi Pertanian." Bandar Lampung: Pusaka Media, 2019.

Guslim. dkk. *Klimatologi Pertanian*. Medan: USU Press, 1987.

Hambali, Slamet. *Ilmu Falak 1 (Penentuan Awal Waktu Salat Dan Arah Kiblat Seluruh Dunia)*. Semarang: IAIN Walisongo, 2011.

Kementrian Agama RI. *Buku Saku Hisab Rukyat*. Jakarta: Kementrian Agama RI, 2021.

Konstantin Bikos. "Astronomical Twilight – Astronomical Dawn & Dusk." Timeanddate, n.d. https://www.timeanddate.com/astronomy/astronomical-twilight.html.

"LabPlot," n.d. https://labplot.org/.

Maulida, Fauziah An Nuril, Agustin Beta Puji Tria, Imamy Halwa Shofa, and Ika Fachrina. "Memahami Proses Fase Bulan Setengah (First Quarter) Dan Pengaruh Intensitasnya Pada Malam Hari." *BIOCHEPHY:Journal of Science Education* 4, no. 1 (2024).

Nugroho, Adi. "Pengaruh Cahaya Bulan Terhadap Kemunculan Fajar Sidiq (Analisis Titik Belok Kurva Pada Penentuan Awal." Universitas Islam Negeri walisongo Semarang, 2020.

Nur Iskandar fajri, M. "Efektivitas Teknik Analisa Data SQM (Moving Average, Linier Dan Visual Analysis) Dalam Menentukan Fajar Sidik Pada Data Dengan Gangguan Dan Tanpa Gangguan." Universitas Islam Negeri Walisongo, 2021.

Putraga, Hariyadi, Abu Yazid Raisal, Marataon Ritonga, and Arwin Juli Rakhmadi. "Analisis Peningkatan Polusi Cahaya Kota Medan Berdasarkan SQM Dan Citra VIIRS." *AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi* 5, no. 1 (2023).

Ritonga, Marataon. "Problematika Syafak Dan Fajar Dalam Menentukan Waktu Salat Isyak Dan Subuh." *Al-Marshad: Jurnal Astronomi Islam Dan Ilmu-Ilmu Berkaitan* 7, no. 2 (2021).

Rizkiawan, M. Asep, Rosalina, and Emilia Roza. "Teknik Menentukan Waktu Hilangnya Syafaq (Cahaya Merah) Menggunakan Sky Quality Meter (SQM) Dengan Metode Titik Potong (Cutoff)." *Jurnal Kumparan Fisika* 4 (2021).

Safrida, Lidya, and Machzumy. "Analisis Astronomical Twilight Sebagai Tanda Penentuan Awal Waktu Salat Isya." *ASTROISLAMICA : Journal of Islamic Astronomy* 1, no. 1 (2022).

Syam, Ahmad Abdillah Rauf, Ahmad Adib Rofiuddin, Muhammad Zainal Mawahib, and Hestyana Tasya. "Determining Tahrim Prayer Times Based on Sky Brightness and Sun Altitude Parameters with a Sky Quality Meter." *Al-Afaq* 7, no. 2 (2025).

Tamhid Amri. "Waktu Shalat Perspektif Syar'i." *Asy-Syari'Ah* 16, no. 3 (2014).

Tono Saksono. *Evaluasi Awal Waktu Subuh & Isya Perspektif Sains, Teknologi, Dan Syariah*. Jakarta: UHAMKA PRESS & LPP AIKA UHAMKA, 2017.

Unihedron. "SQM-LU-DL Operator's Manual." Accessed November 30, 2025. http://unihedron.com/projects/sqm-lu-dl/.

Zahra Hayati, and Dhiauddin Tanjun. "Pengaruh Kelembapan Udara Terhadap Efektivitas Pelaksanaan Rukyatul Hilal Awal Bulan Qamariyah." *Jurnal EDUCATIO (Jurnal Pendidikan Indonesia)* 9, no. 2 (2023): 760.