AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

Refined Guidelines for Selecting Hilal Observation Points in Tropical Regions: Insights from Bengkulu City

Badrun Taman[1*],
[1]Universitas Islam Negeri Fatmawati Sukarno Bengkulu, Indonesia
(Jl. Pagar Dewa, Kec. Selebar, Kota Bengkulu, Bengkulu 38211)
[*]Email: badrun.taman@mail.uinfasbengkulu.ac.id

Abstract

This research evaluates the Bengkulu Provincial Government Mess as a potential site for rukyatul hilal, given that its selection has lacked a systematic, scientific foundation. The study focuses on three main aspects: first, the region's geographical and astronomical characteristics; second, how well the chosen location aligns with established ideal parameters for crescent observation; and third, how site determination can be adapted to local conditions based on empirical findings. A qualitative approach grounded in geographical-astronomical analysis was employed. The results reveal that factors linked to the western horizon—specifically its alignment with the Indian Ocean at sea level—introduce notable meteorological disturbances, including high wave activity, strong sea breezes, and elevated water vapor content, all of which can impede visual detection of the hilal. Based on these insights, the study proposes updated criteria for selecting observation sites, recommending that optimal locations avoid a western horizon directly at sea level, particularly along the Indian Ocean frontage.

Article Info

Received:
16 Desember 2024
Revised:
21 Juni 2025
Accepted:
26 Juni 2025
Published:
30 Juni 2025

Keywords: H*ilal Observation, Site Criteria, Tropical Region, Visibility, Bengkulu*

A. Introduction

Observation of the lunar crescent (rukyatul hilal) takes place on the 29th day of a Hijri month to decide whether the next day marks the start of a new month. If observers confirm seeing the thin crescent after sunset, the following day is recorded as day one of the new Hijri month. If the crescent remains unseen after maghrib, that day stands as the 30th day, and observation is repeated at the next sunset.[1]

Thomas Djamaluddin highlights key factors affecting crescent sighting. First, because the hilal often appears as a faint, narrow arc in a still-bright sky, it is advisable—when conditions permit—to use optical aids such as binoculars or small telescopes to verify any candidate crescent. Second, urban rooftop sites, despite elevation advantages, may suffer from smoke, dust, or light pollution that degrade visibility. Third, observation points facing west but blocked by trees or structures are suboptimal; open coastal stretches providing an unobstructed western horizon are generally preferred. Fourth, distinguishing a true crescent from other sky

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

phenomena remains challenging. While sworn testimony helps ensure observer honesty, it cannot by itself guarantee that the sighted object is indeed the hilal.[2]

In practice, suitable sites allow a clear western view toward the sunset horizon, typically within azimuth angles around 240°–300°. Such open horizons are essential year-round to maintain consistent observation opportunities. Additionally, favorable weather conditions are critical: since the first-visible crescent emits only a very thin sliver of light, akin to a faint silhouette against dusk, a cloud-free sky around the western horizon at maghrib is necessary to avoid missing the delicate sighting.[3]

Several obstacles commonly impair hilal observations. For one, the Moon's considerable distance from Earth—roughly 40,000 km—means the crescent subtends only about 2.5° in the sky, occupying a very small portion of the naked-eye field without optical aid. Moreover, the brief window of visibility can easily be blocked by passing clouds. Evening light levels and atmospheric scattering may also hinder detection. Particulate matter—such as haze, smoke, or moisture—further obscures the view. The crescent's proximity to the Sun complicates identification, and psychological factors may lead observers to doubt or misinterpret faint sightings[4].

Among these challenges, the most frequent reasons for failure to see the hilal include: mismatched geographic features at the chosen observation site, air pollution from vehicles or industry, and unfavorable meteorological conditions. Coastal observations toward the western horizon can be deceived by clouds or by artificial lighting from nearby structures. Consequently, even when astronomical calculations indicate that the crescent's altitude should permit sighting, field attempts may still fail due to these non-astronomical influences.[5]

Given these recurring issues, it is essential to evaluate whether the criteria used for selecting observation sites are applied rigorously. Success in hilal observation depends heavily on choosing a location that truly satisfies the ideal parameters for visibility.[6]

In Bengkulu City, the Provincial Government Mess at Tapak Paderi Beach—offering a westward outlook over the Indian Ocean—has been designated as the hilal observation site since 2013, succeeding the previous location at Hotel Horizon near Nala Beach. Despite this, no confirmed crescent sighting has been reported there, including during the Ramadan 1442 H observation on April 12, 2021, despite multiple attempts.

Media reports—both electronic and social—about the Ramadan 1442 H crescent in Bengkulu often conflict with on-the-ground accounts. Although the author personally attended

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

the entire rukyatul hilal events at the Provincial Government Mess, participants did not express certainty in having observed the crescent. Paradoxically, publicized reports sometimes claim sightings that observers themselves could not verify.[7]

Drs. H. Tasri, MA (former Head of the Bengkulu City Ministry of Religion) notes that the Provincial Government Mess was chosen as the observation site without a scientific assessment. The rationale cited was its seaside position and lack of tree obstructions, yet no systematic evaluation against established visibility parameters was carried out.

According to Thomas Djamaluddin's guidelines from LAPAN, at least four conditions should be met for a representative hilal observation location: (a) a latitude within +28.5° N to –28.5° S to allow viewing of the crescent whether it appears north or south; (b) absence of physical obstructions; (c) minimal adverse weather interference; and (d) a westerly orientation that maximizes the crescent's illumination near sunset. To date, the Provincial Government Mess in Bengkulu has not been assessed scientifically against these criteria.[8]

A survey by the Bengkulu City Ministry of Religion on April 23, 2019 evaluated three candidate sites—Pantai File, atop Hotel Grage Horizon, and the Provincial Government Mess—and ruled out the first two due to tree obstructions blocking the western horizon, leading to the selection of the Mess. This decision appears based solely on the absence of immediate obstructions, neglecting broader geographical-astronomical considerations.

In light of this, it is necessary to reexamine the Provincial Government Mess as the hilal observation point. This study addresses three primary questions: (1) What geographical and astronomical characteristics define the current site in Bengkulu City? (2) How well does this location conform to the ideal criteria for hilal observation? (3) Based on empirical assessment, what guidelines should govern the selection of a suitable hilal observation site in Bengkulu?

The author's review shows no dedicated study has yet applied rigorous location criteria in Bengkulu. While research exists in other regions—for instance by Muhammad Nurkhanif and Awaluddin[9], Yulia Rahmadani and Fatmawati Hilal[10],Machzumy [11], Dito Alif Pratama[12], and Rian Mahendra Taruna and Tio Azhar Prakoso[13]—these works have not integrated geographic-astronomical analysis with the varied ideal parameters this study examines.

This investigation aims to furnish a scientific basis for hilal observation in Bengkulu, ensuring that observers are not confined to a single site if it fails to satisfy feasibility

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

parameters. Persisting with an unsuitable location can prevent crescent detection even when astronomical theory indicates visibility should be possible. An ill-chosen site thus significantly undermines both the effectiveness and efficiency of rukyatul hilal activities.

Although the Provincial Government Mess initially appears promising due to its coastal vantage point, repeated failures to sight the hilal in recent years indicate the necessity of a thorough evaluation. Moreover, continuing annual observations at a site without scientific validation renders the activity a formality rather than an effort to improve quality.

Therefore, the present study undertakes a comprehensive appraisal of the Provincial Government Mess as a hilal observation site: examining its geographical and astronomical attributes, comparing them with ideal criteria, and recommending alternative locations or adjusted guidelines to enhance the likelihood of successful hilal sightings in Bengkulu in future seasons.

B. Method

This study employs a qualitative field-based design to explore how ideal site-selection criteria for rukyat al-hilal are applied in Bengkulu City. It investigates how these theoretical guidelines influence actual visibility of the crescent and assesses whether the chosen observation point aligns with Bengkulu's specific geographical and astronomical context.[14]

Data collection involved both primary and secondary sources.[15] Primary information was gathered through on-site visits to the designated hilal observation location, as well as interviews with key stakeholders: the Rukyat Hisab Agency under the Provincial Ministry of Religion and experts at BMKG Bengkulu. These interviews focused on the historical rationale for using the Provincial Government Mess as the observation venue and on details of past rukyat activities held there. Secondary data comprised archival records of hilal sighting reports conducted at the Mess from 2013 through 2021.

For analysis, a descriptive approach was adopted to present and summarize the physical and sky-related characteristics of the Mess site and to review the history of crescent observation events at that location over the period 2015–2021. In parallel, a deductive process compared field observations with established theoretical criteria for optimal hilal sites.[16] By applying a geographical-astronomical lens, the researcher then distilled and formulated refined guidelines for selecting a hilal observation point tailored to the environmental and astronomical conditions present in Bengkulu City.[17]

C. Results and Discussion

Result

Exploring the Principles of Hilal Observation

The term rukyah comes from Arabic, literally meaning “to see.” It generally refers to visual observation with the eyes, though the concept can also extend to perception through the heart or intellect. When applied to the crescent moon (hilal), words like *ra’a*, *yara*, or *ru’yah* denote perceiving the hilal with the physical eye. Classical definitions describe *ru’yah* as looking and discerning with one’s sight. Meanwhile, hilal itself is described linguistically as a faint stroke of light—the delicate arc of moonlight that signifies the start of a new lunar month.[18]

Building on these ideas, one nuanced view frames the hilal through six characteristic dimensions: form, visibility phenomenon, lunar phase, timing, location, and clarity of transition. Specifically:

1. Form: The hilal appears as a thin, thread-like curve.
2. Visibility Phenomenon: There is an observable emergence or appearance of the crescent.
3. Phase: It occurs during the initial “sirar” stage of the lunar cycle.
4. Timing: It falls within the first one or two nights after conjunction.
5. Location: It must lie on the western horizon at sunset.
6. Clarity of Transition: The change from non-visible to visible should be distinct enough to help people determine the new month’s start.[19]

Although some sources mention sighting within the first two nights, astronomical science and the majority of scholars regard the hilal of interest as that appearing on the very first night of the Hijri month. By the second night, the crescent typically becomes too bright—no longer the faint “gurrah” characteristic needed for an early hilal sighting.[20]

In practice, rukyatul hilal means visually detecting the moon when it occupies the proper hilal position, either with the unaided eye or with optical aids such as telescopes. Astronomers often call this “crescent observation.” It aims to confirm whether the crescent

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

becomes visible after the conjunction (new moon) on the 29th day of the Hijri month. Conjunction refers to the alignment of Sun, Moon, and Earth in the same ecliptic plane; at that precise moment, a solar eclipse may also occur.[21]

Normative Basis for Observing the Hilal

Determining the start of a lunar month via hilal sighting—whether explicitly or implicitly—is grounded in the Qur'an, Sunnah, and scholarly consensus. In the Qur'an, verses indicate that witnessing the crescent marks the beginning of fasting or other rituals, and that crescent phases serve as temporal markers for worship and social dealings. The Prophet's guidance explains that fasting begins or ends when the crescent is seen, and if clouds prevent sighting, one completes thirty days by counting. This fallback approach is agreed upon by the major schools, ensuring that believers are not burdened with complex calculations but rely on clear natural signs accessible to all.[22]

Additional Qur'anic verses emphasize that the months were ordained at creation and that the initial sign of each month is the hilal. Prophetic narrations further link the obligation to fast with hilal sighting, aiming to remove hardship in determining the month's start. These teachings underscore that the timing of worship is connected to observable natural phenomena rather than elaborate arithmetic for many.[23]

Factors Shaping the Success of Hilal Observation

Influences on hilal observation can be grouped into natural and non-natural factors:

1. Natural Factors
   a. Observer Training and Familiarity: Observers need practice recognizing the faint crescent and understanding its expected shape and position at sunset.
   b. Observation Site Characteristics: The physical environment—terrain elevation, horizon profile, and absence of obstructions—affects how feasible a sighting is.
   c. Meteorological and Atmospheric Conditions: Cloud cover, humidity, aerosols, and general weather patterns can either permit or block visibility.
   d. Climatic Influences: Seasonal and regional climate variations (for example, tropical humidity or monsoon patterns) shape the likelihood of clear skies at the critical time.
2. Non-Natural Factors

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

a. Optical Equipment Quality: The availability and use of binoculars, telescopes, or other aids influence detection possibilities.
b. Astronomical Calculations (Hisab): Accurate predictions of the crescent's timing and position guide observers to prime viewing windows.
c. Intrinsic Hilal Visibility Characteristics: The fraction of illumination, elongation from the Sun, and contrast against twilight sky determine how easily the crescent can be distinguished.
d. Celestial Geometry: Relative angles among Sun, Moon, and Earth (such as elongation and altitude) define the theoretical window for observation.

By accounting for these factors—both environmental and technical—one can better identify suitable locations and conditions for successful rukyatul hilal, tailoring preparation to maximize the chance of a valid sighting.[24]

Criteria for Choosing a Hilal Observation Site

Thomas Djamaluddin's Perspective

Prof. Dr. Thomas Djamaluddin advises that an ideal hilal observation site must offer a wide, unobstructed view of the western horizon, covering latitudes from approximately +28.5° N to –28.5° S so that the Moon's position—whether north or south—is within sight. He emphasizes that the chosen location should be free of both physical obstacles (such as buildings or trees) and non-physical interferences (like dust or smoke) that could reduce visibility. Moreover, the site must not be prone to weather disturbances that obscure the sky at sunset, and it should be situated geographically in a position inherently conducive to crescent sighting, with a more westerly orientation generally enhancing the chance of detecting the faint lunar arc.[25]

BMKG's Recommendations

The Meteorology, Climatology, and Geophysics Agency (BMKG) highlights that, in addition to a clear western horizon, a suitable observation point should be elevated well above sea level to minimize coastal haze or moisture-related obstructions. BMKG further notes that sky brightness at the site must allow sufficient contrast between the thin crescent and the twilight background; thus, it should be located away from urban light pollution. Practical considerations also include ensuring access to electricity and internet connectivity on-site,

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

enabling the use of optical instruments or recording equipment and facilitating communication or data exchange during the observation process.[26]

Guidelines from Rukyatul Hilal Indonesia (RHI)

Leaders within Rukyatul Hilal Indonesia stress that site selection begins with verifying horizon alignment: observers need a vantage point where the setting Sun and emerging crescent appear simultaneously on the western skyline without hindrance. They recommend choosing open areas such as beaches or hilltops rather than urban centers crowded with tall structures. Additionally, the site must be readily accessible to support logistical requirements—travel arrangements, equipment transport, and communication networks—so that observation teams can operate efficiently.[27]

Community Organization Criteria (PERSIS and Nahdlatul Ulama)

Certain Islamic organizations also articulate their own standards. For example, PERSIS prefers observation sites located well away from populated areas to avoid air and light pollution, with a level, expansive horizon spanning roughly 30° north to 30° south for full coverage of possible crescent declinations. Nahdlatul Ulama, through its Falakiyah body, tends to rely on proven track records: they select sites that have historically yielded successful hilal sightings and whose geographic and astronomical features demonstrably support observation. Proposals often emerge from local branches once a location has shown consistent effectiveness in prior events.[28]

Primary Versus Supporting Parameters

Experts often distinguish between essential (primary) and ancillary (supporting) factors. Primary factors include geographical attributes—latitude range, elevation above sea level, and a horizon profile free of obstructions—and prevailing weather conditions at the time of observation, such as clear skies without heavy cloud cover. Atmospheric qualities like humidity, particulates, or haze also play a crucial role. Secondary factors encompass technical readiness: the availability and quality of telescopes or binoculars, the observer's training and psychological preparedness for detecting a faint crescent, and logistical aspects such as ease of access, adequate on-site facilities, and reliable communication infrastructure.[29]

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

Integrated Considerations and Contingencies

Taken together, these guidelines point to the necessity of selecting a site with a truly open western horizon between north and south limits appropriate for the region, situated in a geographically advantageous position (often more westerly and at higher elevation), with minimal environmental or light-pollution interference and robust technical/logistical support. If a single location cannot fulfill all conditions, observers should consider alternative venues or compensatory measures: for instance, employing more sensitive optical aids or choosing a permissible observation date nearby that may offer better atmospheric clarity. By evaluating each paragraph's criteria carefully, teams can maximize the chance of a successful hilal sighting.[30]

Modern Criteria for Crescent Visibility

The study of when the lunar crescent becomes observable has evolved into a sophisticated branch of astronomy. Beyond its religious importance for marking the start of a Hijri month, researchers and enthusiasts continually refine methods to predict and confirm hilal sightings. Two fundamental aspects dominate this discussion: first, the intrinsic brightness of the thin crescent itself, which depends on how sunlight illuminates the lunar surface; second, the background sky illumination near the horizon, influenced by atmospheric scattering of sunlight at dusk.

Accurately assessing crescent visibility demands attention to the relative geometry of Sun, Moon, and observer at sunset. Key parameters include:

- Elapsed Time Since Conjunction: Often referred to as the "age" of the new crescent, this measures how long has passed between the exact moment of conjunction and the time of attempted sighting.
- Interval Between Sun and Moon Setting: Known as the "lag," this quantifies how many minutes elapse between sunset and the Moon's setting, or similarly dawn comparisons for other months.
- Lunar Altitude Above Horizon: The elevation angle of the crescent once the Sun has set, determining how high the Moon appears.
- Arc of Light (ARCL): The angular separation between Moon and Sun along the ecliptic plane; a larger separation generally implies a thicker, more illuminated crescent.

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

- Arc of Separation (AS): Often defined via difference in right ascension between Moon and Sun, indicating relative celestial positions.
- Arc of Vision (ARCV): Also called the arc of descent, this represents the difference in altitude between Moon and Sun at sunset, affecting how readily the crescent stands out.
- Azimuth Difference (dAz): The horizontal angle between Moon and Sun directions; a smaller azimuth gap may diminish contrast.
- Crescent Width: The apparent "thickness" of the crescent arc, closely tied to illumination fraction and elongation.[31]

No single metric reliably forecasts visibility. Relying solely on the Moon's age or the time lag often yields misleading predictions. Instead, combining at least two parameters—one gauging the crescent's intrinsic illumination and another reflecting its horizon separation—yields more dependable estimates. For instance, sheer age does not directly translate into brightness: a crescent ten hours past conjunction on the ecliptic can match in brightness one formed five degrees from the ecliptic immediately post-conjunction. Consequently, measures tied to elongation (e.g., ARCL) better approximate the crescent's luminous "thickness." Yet even elongation alone can mislead: the same ARCL yields different apparent widths when the Moon is at perigee (closer, hence appearing slightly larger and brighter) versus apogee (farther, thus thinner). Therefore, the observed width of the crescent often provides the most direct indication of its actual brightness.[32]

In the 19th century, systematic observations began to accumulate data on early crescent sightings. For example, Schmidi's decades-long records yielded dozens of hilal observations, which later researchers used to derive quantitative thresholds. Early 20th-century work integrated these data with altitude and azimuth variables, refining earlier parameterizations dating back to al-Biruni. Subsequent modifications by investigators such as Mounder incorporated additional observational records, leading to empirical relations that link ARCV and azimuth difference to likely visibility zones. Though these legacy formulas formed the groundwork for modern criteria, they were often region-specific or limited in geographic applicability.[33]

Moving into the early 20th century, Danjon's analysis of multiple observations identified a lower-bound elongation (ARCL) below which no crescent was detected—often cited as the "Danjon limit." Later in the century, methodologies expanded to include sky brightness, contrast, and crescent intensity as explicit variables. One approach expressed

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

visibility as a function combining crescent width and its altitude difference from the Sun; polynomial fits to observational data provided more nuanced thresholds for when a hilal could be seen under varying conditions.[34]

More recent developments have adapted classical criteria to account for the observer's exact location (topocentric effects) and local atmospheric transparency. By treating variables such as crescent width (W) and ARCV as functions that incorporate topocentric parallax and extinction effects, these refined models aim to apply globally rather than only in lower latitudes. Researchers combined extensive datasets—hundreds of sighting reports from diverse observatories—to recalibrate visibility equations. These modern formulas often categorize sighting likelihood into tiers: visible to the naked eye, potentially visible unaided but sometimes requiring optical aids, only discernible through telescopes/binoculars, or essentially unobservable. Threshold values for each category are expressed via combinations of ARCV and crescent width, adjusted for local conditions.[35]

Some criteria further differentiate between purely atmospheric assumptions and "airless" ideal cases to isolate how haze or humidity would degrade visibility. By embedding topocentric adjustments, these models allow observers to predict under what exact horizon elevation and elongation a crescent might be detected from a given site. Additionally, visibility tables derived from these equations guide practitioners on whether a sighting is expected unaided or if magnification tools are necessary.[36]

Observatories such as those led by Caldwell and Lamey have also contributed by compiling sighting data and proposing criteria distinguishing naked-eye observations from those requiring instruments, often converging on minimal ARCV thresholds around a few degrees. Large-scale efforts, including collaborative observation projects, have amassed multi-hundred records spanning various latitudes, further refining composite criteria that blend classical thresholds with modern topocentric corrections.[37]

In practice, one uses these advanced visibility models by calculating for the intended observation date: the Moon's elongation, altitude difference from the Sun, expected width of the crescent, and local atmospheric extinction. The chosen model then indicates whether conditions meet the threshold for a probable naked-eye sighting, marginal case (better with optical aid), or below-detection scenarios. Observers can thus plan site selection and equipment needs more precisely. Such modern criteria, while not universally adopted for monthly calendar determinations in all communities, serve as valuable tools for astronomers

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

and hilal-sighting teams striving for reliable predictions and successful observations across diverse regions.

Geographical and Astronomical Overview of the Hilal Observation Site in Bengkulu City

The Provincial Government Mess in Bengkulu is situated along an extensive shoreline, with its western edge directly facing Panjang Beach. To the north, it borders the coastal expanse of western Sumatra adjoining the Indian Ocean; on the south side lie residential neighborhoods, while to the east there is a tourism zone near Paderi Beach. Because the site is predominantly surrounded by the Indian Ocean, its geographic setting strongly influences the appearance of the western horizon at sunset, as well as local climatic and atmospheric conditions that affect hilal viewing.

Being adjacent to the open sea, the location experiences a pronounced maritime climate. The proximity to the Indian Ocean brings relatively large waves and robust winds compared to areas along smaller bodies of water (for instance, the Java Sea). Such oceanic dynamics can interfere with crescent sighting: substantial wave crests may intrude upon the low-altitude line of sight, and elevated sea breezes can carry moisture or spray particles upward into the viewing zone, potentially obscuring the delicate lunar arc.

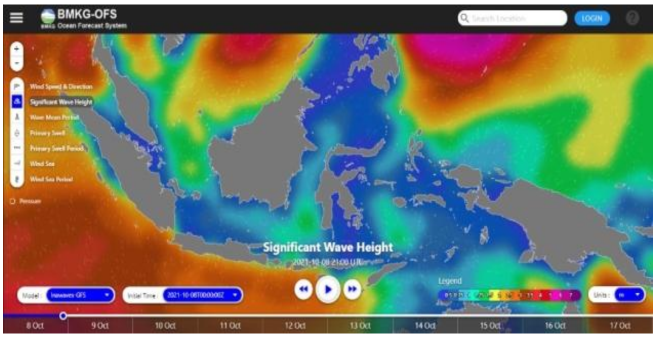

Figure 1. wave height in the indian ocean waters of Bengkulu

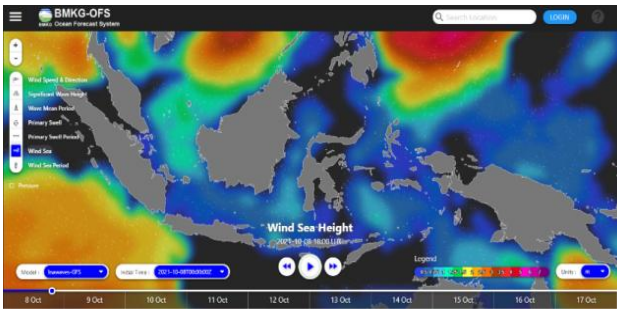

Figure 2. Sea breeze elevation in the West Indian Ocean of Bengkulu

Analysis of wave data (see Figure 1) indicates that, in these western Sumatran waters off Bengkulu, wave heights commonly reach between two and five meters above sea level. By contrast, typical wave amplitudes along the northern coast of Java are considerably smaller—often under one meter—so the likelihood of waves blocking the hilal sightline is lower there. Likewise, measurements of onshore wind-driven spray (Figure 2) show sea breezes rising to heights of roughly two to three meters; these air-entrained water droplets can form a barrier in the observer's line of sight toward the horizon, particularly when the crescent lies at a scant elevation above the sea level.

Because the crescent appears at a very low altitude soon after sunset, any obstruction or opacity in that narrow sky band—whether from wave spray, mist, or elevated humidity—can critically degrade visibility. Thus, the combination of high marine waves and strong onshore breezes in the vicinity of the Government Mess site must be carefully considered when evaluating its suitability for hilal observation. Although the site offers an apparently open western horizon, these maritime factors imply a significant risk of hindrance, suggesting that alternative or supplementary observation points (potentially at slightly higher ground or further from direct sea spray) may yield better viewing conditions.

Meteorological and Climatological Characteristics at the Bengkulu Provincial Government Mess

The site of the Provincial Government Mess in Bengkulu lies within the equatorial belt, between latitudes 10° N and 10° S, specifically around 3°47′8″ S. This equatorial positioning means that the local atmosphere contains a relatively high proportion of water vapor—approximately 4% of the volume—which in turn elevates ambient humidity levels throughout the area surrounding the Mess.

1. Water Vapor Influence

In this tropical setting, water vapor extends through much of the troposphere, often reaching altitudes near 12 kilometers above sea level. Because the Mess directly faces the Indian Ocean, moisture evaporating from the sea strongly influences the western horizon's air mass. The immediate adjacency to open ocean ensures that the lower atmosphere over the site frequently carries abundant moisture. As water vapor condenses, clouds often populate the western skyline above the beach, risking obscuring the faint lunar crescent during observation attempts.

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

2. Aerosol Contributions

Tiny solid and liquid particles—collectively known as aerosols—also play a significant role in sky clarity. Sea salt lifted from breaking waves, dust, smoke, ash from regional sources, and biological particulates combine in the air column. Typical aerosol composition includes a substantial fraction of salt crystals (originating from ocean spray), plus contributions from dust, combustion byproducts, and other materials. The prevalence and vertical distribution of these particles depend on their source strength, atmospheric heating and cooling, and regional wind patterns. In Bengkulu, aerosol levels have been elevated in recent years due to factors such as widespread biomass burning on Sumatra. When these aerosols mix with the salt-laden maritime air above the Mess site, they can scatter and absorb light near the horizon, further diminishing the likelihood of detecting the hilal.

3. Weather Patterns and Observation Days

Examination of meteorological records for hilal observation dates from 2014 through 2021 reveals considerable variability in solar radiation, rainfall, temperature, and wind conditions. Solar insolation on those specific days ranged widely—from effectively zero hours under overcast skies to as much as eleven hours under clear conditions—often inversely related to precipitation amounts. For instance, heavier rainfall corresponded with shorter sunshine durations, while dry days exhibited extended sunlight. Approximately half of the recorded observation days enjoyed more than eight hours of daylight, whereas the remainder fell below seven hours, indicating frequent cloudiness or rain around observation times.

Temperatures at the Mess site remain consistently warm, reflecting its tropical coastal environment. Average daily values on observation occasions hovered between roughly 25.5 °C and 28.7 °C, aligning closely with nearby sea-surface temperatures. Such heat, combined with high moisture content, fosters robust convective activity, often leading to cloud development and potentially obstructive conditions at dusk.

Relative humidity levels on those hilal sighting dates were also high, typically between 76% and 91%. This elevated moisture near the ocean surface contributes to haze or mist formation, which can blur the thin crescent against the twilight sky. The persistent moisture influx from evaporation over the Indian Ocean ensures that the air over the Mess remains laden with water vapor, posing a recurring challenge for clear horizon viewing.

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

4. Implications for Crescent Observation

Taken together, the abundant atmospheric moisture, aerosol loading from marine spray and regional fires, and variable cloud cover create a setting where the western horizon can often be obscured or hazy at the critical moment after sunset. Although the Mess site offers an ostensibly open outlook toward the sea, these meteorological and climatological factors indicate a substantial risk of interference when attempting to observe the hilal. Observers may therefore consider alternative locations—perhaps slightly elevated inland or at sites less directly exposed to onshore spray and frequent low clouds—to improve the chances of a successful sighting under such challenging tropical conditions.

Astronomical Characteristics of the Bengkulu Provincial Government Mess

Situated at approximately 3°47′ south latitude, the Mess site in Bengkulu experiences classic tropical climate influences: abundant rainfall, consistent year-round solar exposure, a clear division between wet and dry seasons, and persistently high atmospheric humidity. These climatic attributes arise from its proximity to the equator, shaping both weather patterns and sky conditions relevant to crescent observation.

In terms of longitude—around 102°14′ east—the Mess location observes sunsets slightly later than regions further east in Indonesia. From an astronomical standpoint, this westward position can offer the fledgling lunar crescent a marginally higher apparent altitude above the horizon at dusk compared to eastern locales. However, the benefits of this longitudinal advantage are often tempered by the tropical climate's effects: frequent clouds, high moisture levels, and other meteorological factors near the equator can interfere with the crescent's visibility, potentially offsetting any gain in altitude that the longitude might otherwise provide.

Therefore, while the site's geographic longitude might theoretically afford a somewhat elevated hilal position at sunset, the equatorial latitude's associated weather conditions—especially increased cloud cover and humidity—pose challenges that must be accounted for when evaluating this location for reliable hilal sighting.

Discussion

Assessment of Bengkulu Provincial Government Mess against Hilal Observation Site Requirements

An evaluation comparing the Bengkulu Provincial Government Mess with established

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

guidelines for ideal crescent-sighting locations reveals mixed alignment across different criteria sets.

From the standpoint of Thomas Djamaluddin's recommendations, the Mess meets several benchmarks: it offers an unobstructed western horizon spanning the necessary latitude band, and it lacks significant man-made or natural obstructions such as excessive light, tall structures, or smoke that might impede viewing. Its geographic positioning otherwise appears favorable for hilal observation. However, the site fails to escape frequent meteorological disruptions; local weather patterns often introduce clouds or haze that conflict with the requirement for minimal atmospheric disturbance.

Considering BMKG's standards, the Mess satisfies some conditions but not others. The western outlook remains clear of immediate visual barriers, and connectivity to electricity and internet is assured, allowing use of observational instruments and data sharing. Light pollution is low due to its relative remoteness from dense urban centers. Conversely, the location lies at sea level rather than elevated terrain, making it vulnerable to coastal effects, and the twilight sky brightness combined with the thin crescent's contrast often falls below the recommended threshold for reliable naked-eye detection under BMKG's guidelines.

When measured against the guidance of Rukyatul Hilal Indonesia (RHI), the Mess aligns well: the horizon permits simultaneous sighting of the setting Sun and emerging crescent without obstruction, its beachside setting (rather than an urban core) reduces environmental interference, and it remains accessible for observers and equipment logistics. Thus, from RHI's perspective, the site generally fulfills their procedural requirements.

In relation to PERSIS's framework, the Mess also largely conforms: it is sufficiently distant from dense settlements to minimize light and air pollution, and it provides a relatively flat westward span covering approximately thirty degrees north to south, accommodating the crescent's declination range. Therefore, by PERSIS standards, the location is acceptable.

Overall, the Mess's shortcomings primarily emerge in two areas: inability to avoid weather-related impediments as per Thomas Djamaluddin's "free from potential atmospheric disturbances" criterion, and lack of elevation away from the coast as specified by BMKG. These factors underscore that, despite clear horizons and logistical conveniences, the prevailing tropical weather and sea-level position often undermine optimal viewing conditions on the western skyline. As such, while the site satisfies many spatial and access-related requirements, its exposure to frequent cloud cover, humidity, and coastal effects suggests that

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

alternative or supplementary observation points—ideally higher or set back from direct ocean influence—should be considered to ensure more consistent success in hilal sighting.

Selecting Hilal Observation Sites Aligned with Bengkulu's Geographical and Astronomical Context

To evaluate how well the Provincial Government Mess in Bengkulu aligns with local geographical and astronomical factors affecting crescent visibility, this study adopts Moh Odeh's visibility framework. Odeh's model is especially suitable because it synthesizes extensive observational datasets—from early records by Schaefer, Yallop, and the SAAO (spanning 1859 to 2005) plus hundreds of more recent ICOP observations—yielding a comprehensive astronomical basis for predicting hilal sighting.

One advantage of Odeh's approach lies in its reliance on two topocentric measures: the difference in altitude between Moon and Sun as seen from the observer (often called the "rukyah arc" or topocentric relative altitude) and the apparent width of the crescent as viewed from that specific location. In contrast, other methods may use combinations such as Moon age with elongation, or geocentric-relative metrics, but Odeh's dual topocentric variables capture both the crescent's geometric separation and its illuminated thickness in the local sky, making the criterion more directly attuned to on-site viewing conditions.

Another feature of Odeh's scheme is its classification of visibility into distinct zones. It defines a zone where the crescent should be easily naked-eye visible (Zone A), a range where it is apparent with optical aids yet may sometimes be glimpsed by eye under clear skies (Zone B), a category where only instruments allow detection (Zone C), and a domain where even telescopes cannot pick up the hilal (Zone D). There is also provision for situations where astronomical circumstances (e.g., conjunction at sunset or Moon setting before Sun) preclude any opportunity for sighting (Zone E). This multi-tiered zoning offers a finer-grained prediction than simpler two- or three-level schemes, helping observers decide when and how to plan.[38]

Importantly, Odeh's formula blends theoretical calculation ("hisab") with empirical observation ("rukyat"), since it derives its thresholds from hundreds of real sighting records while employing precise topocentric geometry. Moreover, it explicitly addresses both naked-eye and instrument-assisted cases, reflecting practical needs: sometimes binoculars or small telescopes are available, and the criterion indicates when such aids become essential. This

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

inclusiveness of viewing modes strengthens its applicability for diverse observation teams.

Furthermore, Odeh's visibility determination factors in average atmospheric parameters—like humidity and pressure—by requiring these climate inputs when computing likelihoods. Although the model typically uses climatological averages rather than instantaneous measurements, integrating local humidity and pressure effects allows a better match between calculated thresholds and real-world conditions. Thus, Odeh's method helps identify whether a given site's typical tropical climate will support a plausible sighting, making it a useful tool for harmonizing geographical-astronomical analysis with practical location choice.

The key variables in Odeh's framework—crescent width (W) and topocentric altitude difference (the rukyah arc)—can be visualized in plots showing the minimum altitude gap needed for various widths. Practically, these translate into tables indicating, for each possible crescent thickness (e.g., from about 0.1° up to nearly 1°), the minimum altitude separation at which the hilal should fall into Zone A, B, C, or D. For instance, a very slim crescent of roughly 0.1° width requires a larger altitude difference—on the order of 12°—to be easily seen by the naked eye, whereas a thicker crescent of about 0.9° might only need around 7.5° of separation. Similarly, intermediate widths correspond to progressively lower altitude thresholds for different visibility categories. By referencing such a table for the specific date, time, and location, one can gauge whether the Mess site's expected topocentric geometry and average climate conditions place it in a favorable zone or whether another site might offer a higher probability of success.

In summary, applying Moh Odeh's visibility criterion provides a structured way to match Bengkulu's geographic coordinates, typical atmospheric profile, and lunar geometry at sunset to forecast hilal sighting prospects. This harmonized assessment can guide the choice or adjustment of observation venues—suggesting, for example, slight inland shifts or elevation gains if the Mess site often falls into marginal zones—so that future rukyatul hilal activities in Bengkulu have a better chance of yielding a confirmed crescent sighting.

When applying Moh Odeh's visibility framework, the predicted hilal sighting prospects for Bengkulu City at the Provincial Government Mess observation center are presented in the table below.

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

Table 1. Assessment of Crescent Sighting Prospects in Bengkulu City Using the Moh Odeh Visibility Model

Lunar Month (Hijri)	Apparent Crescent Thickness (arcminutes)	Topocentric Altitude Gap (Moon vs. Sun, degrees)	Visibility Outcome	Visibility Category
Ramadan 1442	0.05'	04.3°	Undetectable even with optical aids	D
Shawwal 1442	0.10'	06.4°	*Detectable only with instruments*	C
Zulhijjah 1442	0.06'	04.2°	Undetectable even with optical aids	D
Ramadan 1441	0.05'	04.4°	Undetectable even with optical aids	D
Shawwal 1441	0.14'	07.6°	*Detectable only with instruments*	C
Zulhijjah 1441	0.21'	09.1°	*Detectable with instruments and possibly by naked eye*	B
Ramadan 1440	0.11'	06.5°	*Detectable only with instruments*	C
Shawwal 1440	0.02'	0.2°	Undetectable even with optical aids	D
Zulhijjah 1440	0.05'	04.2°	Undetectable even with optical aids	D
Ramadan 1439	0.06'	00.1°	Impossible to observe (conjunction after sunset)	E
Shawwal 1439	0.19'	08.4°	*Detectable with instruments and possibly by naked eye*	B
Zulhijjah 1439	0.00'	00.0°	Undetectable even with optical aids	D
Ramadan 1438	0.23'	09.1°	*Detectable with instruments and possibly by naked eye*	B
Shawwal 1438	0.08'	04.3°	Undetectable even with optical aids	D
Zulhijjah 1438	0.17'	08.2°	*Detectable with instruments and possibly by naked eye*	B
Ramadan 1437	0.09'	04.5°	Undetectable even with optical aids	D
Shawwal 1437	0.05'	-01.0°	Impossible to observe (Moon sets before Sun)	E
Zulhijjah 1437	0.00'	00.0°	Impossible to observe (Moon sets before Sun)	E
Ramadan 1436	0.07'	-02.0°	Impossible to observe (Moon sets before Sun or conjunction after sunset)	E

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

Lunar Month (Hijri)	Apparent Crescent Thickness (arcminutes)	Topocentric Altitude Gap (Moon vs. Sun, degrees)	Visibility Outcome	Visibility Category
Shawwal 1436	0.09'	03.4°	Undetectable even with optical aids	D
Zulhijjah 1436	0.01'	0.8°	Undetectable even with optical aids	D
Ramadan 1435	0.05'	0.6°	Undetectable even with optical aids	D
Shawwal 1435	0.11'	03.9°	Undetectable even with optical aids.	D
Zulhijjah 1435	0.01'	00.8°	Undetectable even with optical aids	D

Analysis of the results in Table 1 shows that, per Moh Odeh's model, hilal sighting prospects at the Provincial Government Mess in Bengkulu fall into two distinct groups. In the first group (Zone C), the crescent would only be detectable through optical instruments; this applies to the hilal of Shawwal 1442, Shawwal 1441, and Ramadan 1440. The second group (Zone B) comprises cases where the crescent might be picked up with instruments and, under clear-sky conditions, could even be glimpsed by the unaided eye; these include Zulhijjah 1441, Shawwal 1439, Ramadan 1438, and Zulhijjah 1438.

Despite these theoretically favorable astronomical settings, actual hilal sightings at the Mess have not succeeded. This lack of observation is likely attributable to adverse atmospheric conditions along the western horizon at the site. When considering the location's geographic context at each observation date, the prevailing weather factors can be summarized in the following table:

Table 2. Atmospheric Parameters When Crescent Was Potentially Observable

Crescent Month	Expected Detection Level	Weather Conditions			
		Radiation	Temperature	humidity	Rainfall
Shawwal 1442	*Detectable only via instruments*	0.0	28.4	87	16.1
Shawwal 1441	*Detectable only via instruments*	2.5	27.1	78	0.0
Ramadan 1440	*Detectable only via instruments*	11.0	26.4	90	5.5
Zulhijjah 1441	*Detectable with instruments; possible naked-eye under clear skies*	8.1	28.1	79	0.0
Shawwal	*Detectable with instruments;*	9.5	27.4	85	-

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

1439	*possible naked-eye under clear skies*				
Ramadan 1438	*Detectable with instruments; possible naked-eye under clear skies*	8.0	28.7	82	0.0
Zulhijjah 1438	*Detectable with instruments; possible naked-eye under clear skies*	1.5	26.9	84	-

Analysis of the recorded cases where the crescent might have been seen reveals that, during those observation days, the western horizon above the Provincial Government Mess in Bengkulu exhibited elevated daytime temperatures, high moisture levels, and occasional precipitation. Daytime readings typically fell between roughly 26 °C and 28 °C, while relative humidity often ranged from the upper 70s into the 90s percent. Such warm, moisture-laden air readily fosters cloud development. Moreover, the site's vantage over the Indian Ocean means abundant water vapor influx, further amplifying the tendency for cloud formation along the horizon.

These local temperature values closely mirror sea-surface conditions just offshore: average air temperatures around ten meters above the sea near Bengkulu also hover near 28 °C. In equatorial regions, warm air combined with high humidity creates vigorous convective processes, yielding clouds with substantial liquid-water content. As warm, moisture-rich parcels rise from the surface, they condense into cloud droplets, and the plentiful vapor sourced from the adjacent ocean exacerbates this effect, frequently leading to a sky layer that can obscure the faint lunar arc.

Atmospheric moisture concentration is greatest in the lowest layers, tapering off with altitude, since evaporation originates at the surface and condensation often begins there as well. Sea-derived vapor, in particular, contributes higher absolute moisture compared to land surfaces. Consequently, a horizon directly at sea level—especially facing the West Indian Ocean with its characteristically warm surface waters—tends to have a dense near-surface moisture burden, creating a persistent barrier for hilal observation.

Given these climatic realities, crescent-sighting in Bengkulu should ideally occur at sites where the horizon is not immediately at ocean level. Selecting locations set above or inland from the shoreline can reduce the impact of local water vapor and cloud cover generated by high temperatures and humidity over the sea. By moving the horizon away from

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

direct sea-level exposure, observers diminish the likelihood of moisture-induced obscuration, improving the odds of a successful hilal sighting.

Revised Guidelines for Selecting Hilal Observation Sites in Bengkulu Based on Study Findings

The following proposal refines existing site-selection recommendations by integrating insights from falak experts with the specific geographic and astronomical context of Bengkulu.

Reviewing the compatibility assessment shows that the Provincial Government Mess fails two key requirements: the need for a location free from likely meteorological interference (per Thomas Djamaluddin) and the preference for elevated terrain set back from the shoreline (per BMKG). These unmet conditions stem from the Mess's western horizon facing the Indian Ocean at sea level, where weather factors frequently disrupt clear viewing.

Our analysis of local geographic and sky conditions confirms that the primary source of obstruction arises from the ocean-facing horizon. Factors include large waves, brisk sea breezes laden with moisture, elevated sea-surface temperatures leading to abundant vapor, and persistently high humidity—all contributing to frequent cloud formation and haze near the horizon. Such marine influences can obscure the slim crescent, since its low angle above the sea makes it vulnerable to being masked by spray, vapor-laden air, or wave crests.

To address these shortcomings, a supplemental requirement is introduced: the western horizon should not be defined by sea level—particularly ocean exposure. This addition reinforces the unmet criteria of avoiding potential weather disturbances and being situated on higher ground, removed from direct coastal influence. In other words, even a site on elevated terrain remains problematic if its western view still terminates at the open sea; the marine environment continues to pose a high risk of atmospheric interference. By insisting that the horizon itself be land-based or at an elevation above sea level, observers can minimize moisture and cloud-related obstructions.

Implementing this new guideline aims to improve the likelihood of a clear crescent sighting by ensuring that the chosen location's western skyline does not directly border the sea. Future hilal observation points should therefore be positioned inland or at heights where the horizon overlooks terrain rather than the ocean, thereby reducing the impact of maritime weather and enhancing the chance of successful rukyatul hilal.

Site Selection for Hilal Observation in Bengkulu City Using Revised Criteria

To identify suitable observation points for rukyatul hilal under the newly introduced requirement, it is essential to integrate existing guidelines with the additional condition derived from our analysis. Below is a consolidated set of conditions, tailored to Bengkulu's local geographical and astronomical context, which will guide the choice of hilal observation sites in the city:

1. **Unobstructed Westward View across Latitudes**
   Ensure the site offers a clear sightline toward the western horizon spanning roughly +28.5° N to –28.5° S, so the Moon's position is visible whether northward or southward.
2. **Non-Marine Western Horizon**
   The western skyline should not terminate at sea level—particularly not facing the Indian Ocean—so that maritime influences (moisture, spray, wave effects) do not interfere with sighting.
3. **Elevated and Inland Position**
   The location should be situated on higher ground and set back from the immediate coastline to reduce direct exposure to coastal weather effects.
4. **Minimal Atmospheric Disturbances**
   Choose a place that is generally free from frequent cloud cover, haze, or other weather phenomena that could obscure a low-altitude crescent.
5. **Absence of Local Obstructions**
   Confirm there are no nearby barriers—such as tall structures, dense vegetation, or sources of light/smoke pollution—that might impede the viewing corridor.
6. **Adequate Sky Contrast**
   The site must allow sufficient contrast between the faint crescent and twilight sky brightness, meaning ambient light conditions at dusk should not overwhelm the lunar sliver.
7. **Geographically Favorable Setting**
   Beyond elevation and horizon view, the general position should align with known favorable parameters for hilal observation in terms of latitude, terrain profile, and astronomical sighting geometry.
8. **Ease of Access and Support**
   The venue must be reachable and equipped for observers, with necessary communication

AL-MARSHAD: JURNAL ASTRONOMI ISLAM DAN ILMU-ILMU BERKAITAN
ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

links and basic facilities to support observation teams.

By applying these combined conditions—including the new imperative that the western horizon not be at ocean level—observers in Bengkulu can better pinpoint locations where the chance of clear hilal sighting is maximized. The additional criterion is crucial: even when elevation and horizon openness appear sufficient, if the view still ends at the sea, marine weather effects remain problematic. Hence, selecting an inland elevated vantage with a land-based western skyline helps avert moisture-laden interference.

Findings

Maritime vs. Inland Effects

Bengkulu's coastal sites exhibit high sea-surface temperatures and humidity, frequent cloud formation, sizable waves, and moist sea breezes—all factors that often obscure a low-lying crescent above the western horizon. Although the city's longitude (around 102°14′ E) can theoretically yield a slightly higher lunar altitude at sunset compared to locations further east, its near-equatorial latitude (~3°47′ S) subjects it to tropical weather patterns (heavy rainfall, high humidity) that disrupt visibility.

Mismatch with Previous Criteria

The Provincial Government Mess, for example, fails to meet the "minimal weather disturbance" requirement (per Thomas Djamaluddin) and the "higher elevation, away from coast" standard (per BMKG) because its western horizon remains at sea level. These conditions lead to frequent atmospheric impediments that hinder hilal observation from that site.

Role of the New Criterion

Our analysis underscores that whenever the western horizon remains ocean-facing, the site remains vulnerable to waves, sea spray, elevated vapor, and humidity-driven clouds, regardless of other favorable traits. Therefore, any recommended observation point in Bengkulu must satisfy the extra requirement: its western view should not be bounded by the sea. Prioritizing inland or upland positions whose western skyline overlooks land or higher terrain reduces marine interference and enhances the probability of a clear sighting.

In conclusion, applying this expanded criterion set—particularly excluding sea-level

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

western horizons—will guide the determination of hilal observation locations in Bengkulu City that are better aligned with both geographical realities and astronomical prerequisites, thereby improving the success rate of rukyatul hilal events.

D. Conclusion

The introduction of an extra site-selection requirement for crescent observation is anticipated to substantially enhance the choice of observation points in Bengkulu City. By adding this condition, planners can more accurately identify locations less prone to maritime interference. Moreover, regions sharing similar geographic and astronomical profiles to Bengkulu may also benefit from adopting this guideline. Even so, this additional rule should be applied alongside the established, comprehensive set of ideal criteria drawn from various expert sources to ensure a well-rounded selection process.

Nonetheless, further investigation is necessary in a few key areas. First, it would be valuable to quantify how the faint crescent's contrast compares against twilight sky brightness under tropical conditions, particularly in Bengkulu. Second, a systematic comparison between horizons over the Indian Ocean at sea level and those overlooking other bodies of water—such as the Java Sea—or inland terrain would help clarify how different horizon types affect visibility.

Practitioners organizing hilal observations are encouraged to rigorously apply the full suite of ideal site criteria, including the newly identified requirement. In the Bengkulu context, this means giving careful thought to whether the western viewpoint ends directly at ocean level. To mitigate potential obstructions, organizers should favor observation spots whose western horizon rises above or lies inland from the Indian Ocean, thereby reducing the likelihood that waves, sea spray, or high humidity will obscure the delicate lunar crescent.

References

[1] Z. T. Allawi, "A Pattern-Recognizer Artificial Neural Network for the Prediction of New Crescent Visibility in Iraq," *Computation*, vol. 10, no. 10, 2022, doi: 10.3390/computation10100186.

[2] A. B. Sado, "Kajian Fiqh Sains Terhadap Kecerlangan Hilal Sebagai Prasyarat Terlihat Hilal Kriteria Danjon Dan Kriteria Djamaluddin," 2017. doi: 10.20414/ijhi.v16i2.4.

[3] M. S. Qureshi, "Computational Astronomy and the Earliest Visibility of Lunar Crescent," *International Crescent Observation Project*, no. January, 2005.

[4] N. Faizah and A. Anam, "Scientific Analysis of Evaluating the Methodology of

Confirming Hilal Observing Reports in Determining the Beginning of the Hijri Month," *AL - AFAQ : Jurnal Ilmu Falak dan Astronomi*, vol. 6, pp. 1–13, Jun. 2024, doi: 10.20414/afaq.v6i1.9876.

[5] N. Nafhatun, Z. Hamidi, and M. S. Faid, "The Impact of Light Pollution on Islamic New Moon (hilal) Observation," *International Journal of Sustainable Lighting*, vol. 19, pp. 10–14, Jun. 2017, doi: 10.26607/ijsl.v19i1.61.

[6] A. Mulyadi, "Non-Astronomical Aspects of the Success of Rukyatul Hilal in East Java," *Samarah: Jurnal Hukum Keluarga dan Hukum Islam*, vol. 8, p. 1859, Nov. 2024, doi: 10.22373/sjhk.v8i3.25258.

[7] "https://bengkulu.antaranews.com/berita/154550/sidang-rukyatul-hilal-terlihat-tipis-di-bengkulu?utm_source=chatgpt.com".

[8] Muh. M. Sudibyo, "Observasi Hilāl Di Indonesia Dan Signifikansinya Dalam Pembentukan Kriteria Visibilitas Hilāl," 2014. doi: 10.21580/ahkam.2014.24.1.136.

[9] M. Awaludin, M. Nurkhanif, and . A., "Implementasi Parameter Kelayakan Tempat Rukyat Al Hilal Di Pantai Alam Indah Tegal," *AL - AFAQ : Jurnal Ilmu Falak dan Astronomi*, vol. 1, no. 2, 2020, doi: 10.20414/afaq.v1i2.1947.

[10] Y. Rahmadani and F. Hilal, "RUKYATUL HILAL: KELAYAKAN TEMPAT OBSERVASI PANTAI BAROMBONG KOTA MAKASSAR," *HISABUNA: Jurnal Ilmu Falak*, vol. 1, pp. 18–29, Mar. 2020, doi: 10.24252/hisabuna.v1i1.13078.

[11] T. H. Panjaitan, M. Jafar M.Ali, and M. Diah, "Pengaruh Awan Terhadap Visibilitas Hilal Di POB Blang Tiron Bukit Pole Kompleks Perumahan PT. Perta Arun Gas Lhokseumawe," 2023. doi: 10.47766/astroislamica.v2i2.1920.

[12] D. Pratama, "RU'YAT AL-HILĀL DENGAN TEKNOLOGI : Telaah Pelaksanaan Ru'yat al-Hilāl di Baitul Hilal Teluk Kemang Malaysia," *Al-Ahkam*, vol. 26, p. 271, Dec. 2016, doi: 10.21580/ahkam.2016.26.2.930.

[13] R. Taruna and T. Prakoso, "PERKIRAAN KETINGGIAN OBJEK ALAM TERHADAP HORIZON UNTUK EVALUASI LOKASI PENGAMATAN HILAL DI LOMBOK," *Jurnal Penelitian Fisika dan Aplikasinya (JPFA)*, vol. 7, p. 115, Dec. 2017, doi: 10.26740/jpfa.v7n2.p115-122.

[14] N. Faizah and Khairunnas, "ANALYSIS OF RUKYATUL HILAL PLACES IN RIAU PROVINCE," *KULMINASI: Journal of Falak and Sharia*, vol. 3, pp. 20–44, Aug. 2024, doi: 10.22373/kulminasi.v3i1.4176.

[15] M. Trumbull and K. Watson, "Qualitative research Method. Integrating quantitative and Qualitative Methods in Research," in *G. R Taylor, Ed.*, 2010.

[16] E. Barroga *et al.*, "Conducting and Writing Quantitative and Qualitative Research," *J Korean Med Sci*, vol. 38, no. 37, 2023, doi: 10.3346/jkms.2023.38.e291.

[17] J. P. Takona, "Research design: qualitative, quantitative, and mixed methods approaches / sixth edition," 2024. doi: 10.1007/s11135-023-01798-2.

[18] A. Musonnif, "KRITIK IDEOLOGIS METODE HISAB DAN RUKYAT (Menyingkap Fungsi Ideologis Term Ummi dalam Penetapan Awal Bulan Islam)," *Ahkam: Jurnal*

Hukum Islam, vol. 3, no. 1, 2015, doi: 10.21274/ahkam.2015.3.1.19-40.

[19] M. H. K. L. A. H. Badrun Taman, "Hilal Dalam Perspektif Tafsir Al-Quran," *Al-Marshad: Jurnal Astronomi Islam Dan Ilmu-Ilmu Berkaitan*, vol. 7, no. 1, pp. 14–35, Jun. 2021.

[20] W. Segura, "Predicting the First Visibility of the Lunar Crescent," *Academia Letters*, 2021, doi: 10.20935/al2878.

[21] B. E. Schaefer, "An Algorithm for Predicting the Visibility of the Lunar Crescent," in *Proceedings of the IIIT Lunar Calendar Conference*, 2019. doi: 10.2307/j.ctvkc683s.16.

[22] M. Umpa, "Sighting the New Moon as the Methodology for Determining the Month of Ramadhān," *JPAIR Multidisciplinary Research*, vol. 33, Nov. 2018, doi: 10.7719/jpair.v33i1.611.

[23] M. Gharaybeh, "Jurisprudential Reliance on Astronomical Calculations in Determining the Beginnings of the Hijri month," 2025, pp. 160–177. doi: 10.1007/978-981-96-3276-3_13.

[24] R. Supratama, E. Kholifah, A. Millah, and W. Helwiyah, "Scientific perspective on rukyatul hilal: A case study of assalam kartasura sukoharjo observatory," *Amorti: Jurnal Studi Islam Interdisipliner*, May 2024, doi: 10.59944/amorti.v3i2.293.

[25] F. Suleman and D. Usup, "The Role of Modern Observation in Understanding the Beginning of the Hijri Month," *Jurnal Ilmiah Al-Syir'ah*, vol. 19, no. 1, pp. 106–121, 2021, [Online]. Available: http://journal.iain-manado.ac.id/index.php/JIS

[26] S. Hassan, "HILAAL-CTM: Algorithm to Determine and Visualize the First Visibility of Lunar Crescent Using Contrast Threshold Model," *Journal of Information Systems Engineering and Management*, vol. 10, pp. 714–720, May 2025, doi: 10.52783/jisem.v10i49s.9955.

[27] M. Arkanuddin and Muh. M. Sudibyo, "Kriteria Visibilitas Hilal Rukyatul Hilal Indonesia (RHI) (Konsep, Kriteria, dan Implementasi)," *Al-Marshad: Jurnal Astronomi Islam dan Ilmu-Ilmu Berkaitan*, vol. 1, no. 1, 2015.

[28] M. Marwadi, "Pembaruan Kriteria Visibilitas Hilal dan Peluangnya terhadap Penyatuan Kalender Hijriyah di Indonesia (Studi Pemikiran LP2IF-RHI)," *Al-Manahij: Jurnal Kajian Hukum Islam*, vol. 7, pp. 139–154, Jan. 1970, doi: 10.24090/mnh.v7i1.583.

[29] M. Mochammad Sahid, Habibullah, A. Cemda, and M. Kasduri, "Lunar Crescent Visibility Criteria in Determining the New Islamic Month in Malaysia," vol. 1, pp. 197–209, Dec. 2024.

[30] Y. Rahmadani and F. Hilal, "RUKYATUL HILAL: KELAYAKAN TEMPAT OBSERVASI PANTAI BAROMBONG KOTA MAKASSAR," *HISABUNA: Jurnal Ilmu Falak*, vol. 1, pp. 18–29, Mar. 2020, doi: 10.24252/hisabuna.v1i1.13078.

[31] T. Ahmed, "Predicting the Visibility of the First Crescent," *KIET Journal of Computing and Information Sciences*, vol. 3, no. 2, 2018, doi: 10.51153/kjcis.v3i2.52.

[32] J. Judhistira and S. Siregar, "USULAN KRITERIA VISIBILITAS HILAL DI INDONESIA DENGAN MODEL KASTNER," *Jurnal Pendidikan Fisika Indonesia*,

ISSN 2442-5729 (print) || ISSN 2598-2559 (online)
http://jurnal.umsu.ac.id/index.php/almarshad
DOI: https://doi.org/10.30596/jam.v11i1.17800 || Vol. 11, No. 1 Juni 2025

vol. 9, Aug. 2014, doi: 10.15294/jpfi.v9i2.3040.

[33] M. Ilyas, "A modern guide to astronomical calculations of Islamic calendar, times and qibla," Jan. 1984.

[34] L. J. Fatoohi, F. R. Stephenson, and S. S. Al-Dargazelli, "The Danjon limit of first visibility of the lunar crescent," *Observatory*, vol. 118, no. 1143, 1998.

[35] M. Odeh, "New Criterion for Lunar Crescent Visibility," *Exp Astron (Dordr)*, vol. 18, pp. 39–64, Apr. 2004, doi: 10.1007/s10686-005-9002-5.

[36] B. Yallop, "A Method for Predicting the First Sighting of the New Crescent Moon," *NAO Technical*, no. 69, 1997.

[37] A. A. Yaqin, "Peluang dan Tantangan Kalender Islam Internasional Mohammad Ilyas," *Azimuth: Journal of Islamic Astronomy*, vol. 1, no. 1, 2020.

[38] M. S. Odeh, "New criterion for lunar crescent visibility," *Exp Astron (Dordr)*, vol. 18, no. 1–3, 2004, doi: 10.1007/s10686-005-9002-5.