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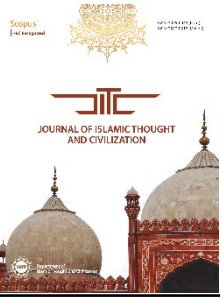


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# Exploring Flood Dynamics: Integrating Environmental, Social, Astronomical and Islamic Perspectives

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**Abstract**

Floods are a recurring natural disaster with profound implications for human livelihoods, infrastructure, and the environment. This study critically examines existing literature to identify the primary causes, impacts, and mitigation strategies associated with flash floods, integrating insights from Islamic perspectives and exploring their relationship with astronomical phenomena, a relatively understudied area. Despite substantial research on hydrological and urban factors, limited attention has been given to the interplay between astronomical elements, such as lunar phases and solar activity, and flash flood occurrences. This gap underscores the need for a multidisciplinary approach\ to understand these complex phenomena. The study employs a qualitative methodology involving systematic literature review and content analysis. Key findings highlight heavy rainfall, unplanned urbanization, inadequate drainage systems, and individual behaviors as major contributors to floods. Furthermore, the study identifies significant socioeconomic and environmental impacts, including property damage, disruption of livelihoods, and psychosocial effects. Proposed mitigation strategies emphasize improved drainage infrastructure, public awareness campaigns, and the integration of

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Islamic principles for sustainable disaster management. This research contributes to bridging critical knowledge gaps by suggesting future studies on the role of astronomical factors in flood prediction and advocating for faith-based approaches to environmental stewardship. The findings aim to inform policymakers, urban planners, and environmentalists about developing holistic and sustainable solutions.

***Keywords:*** flash floods, disaster mitigation, urbanization impacts**,** Islamic environmental, astronomical influences

## Introduction

Flooding is a natural phenomenon that frequently exerts significant impacts on human lives, infrastructure, and the environment.[1] This phenomenon typically occurs due to intense rainfall over a short duration, leading to rapid water flow increases and subsequent flooding in specific areas.[2] In the context of global climate change, the increasing frequency and unpredictability of floods demand serious attention from researchers across various disciplines.[3] Contemporary literature predominantly focuses on the causes, impacts, and mitigation strategies for floods from scientific and technical perspectives. Factors such as climate change, rapid urbanization, and inadequate drainage systems are frequently cited as primary contributors to flooding. Beyond physical damage, floods have significant social and economic implications. Numerous mitigation strategies have been proposed in prior studies, encompassing engineering approaches and modern technologies for monitoring and forecasting.[4]

However, there is a notable gap in literature concerning the examination of floods through the lens of astronomy. Astronomy plays a crucial role in understanding weather and climate patterns associated with flooding. For instance, studies on the relationship between astronomical phenomena, such as lunar phases, solar activity, and global climatic patterns, could provide deeper insights into the causes and predictability of floods.[5] This study aims to analyze existing literature on the causes, impacts, and mitigation strategies for flooding while exploring the extent to which this phenomenon has been studied within an astronomical context. By identifying knowledge gaps in current research, this study seeks to propose future directions to enhance understanding and improve mitigation strategies. The research adopts a qualitative approach, utilizing data collection and descriptive content analysis through a systematic literature review (SLR).

This study employed SLR methodology to synthesize existing research on flash flood dynamics from environmental, astronomical, and Islamic perspectives. The review followed a structured protocol encompassing the identification, selection, appraisal, and synthesis of relevant peer-reviewed articles and scholarly texts. Databases such as Scopus, Web of Science, and Google Scholar

[1]Nur Balqis Anuar, and Sulzakimin Mohamed, "Impact of the Construction of Bandar Baru Tunjong, Kota Bharu, Kelantan on Residential Areas (Impact of Flash Floods)," *Research in Management of Technology and Business* 2, no. 1 (2021): 668–677.

[2] Hanis Syazwani Ramli et al., "The Issue of 'Pocket Development' Leading to Flash Flood Problems in Suburban Areas," *Research in Management of Technology and Business* 4, no.1 (2023): 1185–1202.

[3]Nooryati, *Flash Flood Disasters in Selangor: Climate Change Factors?* (Serdang: Institut Pengajian Sains Sosial Universiti Putra Malaysia, 2022).

[4]Mohd Azrin Husin, Aummil Nadira Mohamad, and Ahmad Muhyuddin Hassan, "Flash Flood Tragedy in Kuala Lumpur: Causes and Solutions," *Prosiding Seminar Falsafah Sains dan Ketamadunan* 4, no. 2 (2022): 287–302.

[5]Dimara Kusuma Hakim, Rahmat Gernowo, and Anang Widhi Nirwansyah, "Flood Prediction with Time Series Data Mining: Systematic Review," *Natural Hazards Research* 4, no. 2 (2024): 194–220, https://doi.org/10.1016/j.nhres.2023.10.001.

were searched using keywords including "flash floods," "astronomical influences," "Islamic environmental ethics," and "disaster mitigation." Inclusion criteria focused on studies published between 2000 and 2024, written in English or Malay. Thematic content analysis was applied to identify prevailing patterns, conceptual gaps, and interdisciplinary intersections across the selected literature.

While extensive studies have addressed flash flood causes, impacts, and mitigation through hydrological, urban, and socio-economic lenses, limited attention has been given to the potential influence of astronomical phenomena such as lunar phases and solar activity. This oversight restricts the predictive accuracy of flood models, especially in coastal and tidal-prone regions. Moreover, although Islamic environmental ethics have been invoked to promote sustainable practices, their practical integration into flood risk management remains underexplored. These gaps highlight the need for a multidisciplinary inquiry that incorporates scientific, astronomical, and faith-based frameworks. This study aims to fill these voids by systematically reviewing the interconnections between flash flood dynamics, celestial events, and Islamic environmental perspectives.

Generally, flooding represents one of the most frequent natural disasters in Malaysia, particularly in several states during the monsoon season. These events result in property damage, loss of life, and physical injuries. Prolonged heavy rainfall causes rivers or seas to overflow, soil erosion on slopes, and blocked drainage systems, among other effects. Such factors contribute to large-scale flooding.[6] Several definitions and types of floods have been identified. According to Kamus Dewan, flooding is defined as water submerging or inundating a large area, also referred to as *bah*.[7] The European Union defines flooding as the temporary inundation of land not normally covered by water. This includes floods from rivers, mountain streams, temporary water flows in Mediterranean regions, and sea-related floods in coastal areas, potentially excluding those caused by sewer systems.[8]

Jafar et al. describes flooding as an overflow of water exceeding riverbanks due to limited drainage capacity at maximum levels. Flood disasters also refer to the overflow of water from rivers and seas, submerging low-lying areas such as residential zones.[9] Floods can be categorized into various types, including flash floods, dam break floods, monsoon floods, coastal floods, urban floods, and mud floods. While the World Meteorological Organization classifies flood disasters as the third most significant natural catastrophe after earthquakes and volcanic eruptions, responsible for extensive loss of life and property damage.[10] Most flood incidents result from prolonged heavy rainfall. Fundamentally, flooding occurs when water bodies overflow riverbanks, lakes, or drainage systems due to heavy rainfall, tidal surges, or obstructions in water channels.

The current literature reveals a notable deficiency in integrative analyses that bridge astronomical phenomena with Islamic perspectives in the context of flood dynamics. While isolated

[6]Munirah Che Hassan, Sharifah Meryam Shareh Musa, Rozlin Zainal, and Narimah Kasim, "A Study on the Construction of Eco-Friendly Drainage Systems in New Development Areas," *Research in Management of Technology and Business* 1, no.1 (2020): 588–605, https://doi.org/10.3390/healthcare12181812.

[7]*Kamus Dewan*, Edisi Keempat (Kuala Lumpur: Dewan Bahasa & Pustaka, 2007).

[8]European Union, "Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the Assessment and Management of Flood Risks," *Official Journal of the European Union* L288/27 (2007).

[9]Adi Jafar, Nordin Sakke, Mohammad Tahir Mapa, Azali Saudi, Diana Hassan, and Fionna George, "The Effect of Monsoon Towards Flood Hazard: Case Study of Flood Plains in Beaufort, Sabah," *Jurnal Kinabalu* 26, no. 2 (2020): 165–182.

[10]World Meteorological Organization, *Floods: Natural Hazard* (Geneva: World Meteorological Organization, 2024).

studies acknowledge the influence of lunar phases and tidal forces, these are seldom examined alongside theological interpretations rooted in the Qur'ān and prophetic traditions. This fragmented approach limits a comprehensive understanding of how celestial patterns are perceived within Islamic epistemology and their potential relevance to contemporary disaster preparedness. The absence of empirical models that synthesize scientific and religious insights reflects a critical gap, hindering the development of culturally grounded and predictive flood management frameworks.

## 2. Natural and Anthropogenic Causes of Flooding: Insights from Environmental and Religious Perspectives

Efforts to identify the causes of flooding have highlighted both natural and human-induced factors, each contributing uniquely to the phenomenon. Natural causes are tied to predictable environmental cycles and align with the concept of natural laws. These include:

### 2.1. Wind Dynamics

The role of wind in precipitation is emphasized in the Qurʾān, where it is described as a carrier of rain and a means of sustaining life: "And We send the winds fertilizing (the clouds), then cause the rain to descend from the sky, and We provide it to you to drink; it is not you who store it up."[11] Najjar highlights the scientific function of wind as described in this verse.[12] Similarly, another verse states: "And it is He who sends the winds as glad tidings, heralding His mercy (rain). When they have carried heavy rainclouds, We drive them to a dead land, and then We bring down rain, thereby producing all kinds of fruits."[13] These passages reflect the critical role of wind in rainfall patterns. Jafar et al. adds that wind changes, especially during the northeast monsoon, significantly affect precipitation distribution. Areas exposed to these winds, such as Malaysia's East Coast, experience high rainfall during monsoon seasons, resulting in frequent flooding.[14]

### 2.2. Topographical and Soil Characteristics

The Qurʾān also discusses the role of the earth in water retention: "And We send down water from the sky in proper measure, and We cause it to soak into the soil; and We are certainly able to withdraw it."[15] Al-Mubarakpuri explains that soil not only supports vegetation but also plays a role in absorbing rainwater.[16] However, certain soil types, such as peat and marine clay, retain water at high levels, increasing flood risk during heavy rainfall. Furthermore, low-lying areas with shallow groundwater tables are particularly prone to waterlogging. An example is the severe flooding in late 2021 in Taman Sri Muda, Shah Alam, exacerbated by exogenous processes such as erosion, sedimentation, and surface compaction, compounded by uncontrolled urban development.[17]

### 2.3. Climate Change

The Qur'an acknowledges the interconnectedness of environmental systems: "Indeed, in the creation of the heavens and the earth, the alternation of night and day, the ships that sail the seas for

[11]Al-Hijr 15:22.

[12]Zaghlul al-Najjar, *Tafsir al-Ayat al-Kawniyyah fi al-Karim* (Mesir: Maktabah Syuruq al-Dawliyyah, 2010).

[13]Al-A'raf 7:57.

[14]Adi Jafar et al., "The Effect of Monsoon Towards Flood Hazard: Case Study of Flood Plains in Beaufort, Sabah,"

[15]Al-Mukminun 23:18.

[16]Sheikh Safiur Rahman Al-Mubarakpuri, *Tafsir Ibn Kathir* (Lebanon: Maktabat Dar al-Salam, 2003).

[17]Daniel Szejba, "Importance of the Influence of Drained Clay Soil Retention Properties on Flood Risk Reduction," *Water* 12, (2020): 1315, https://doi.org/10.3390/w12051315.

the benefit of humankind, the rain that Allah sends down to revive the earth after its death, the dispersal of every creature, and the movement of winds and clouds between the heavens and the earth are signs for those who use reason."[18] This verse is interpreted as a reminder of the natural order and climate cycles. However, modern climate change has disrupted this balance, leading to extreme weather events. Rising global temperatures increase atmospheric moisture by 7% per degree of warming, intensifying rainfall and raising the likelihood of severe flooding.[19]

### 2.4. Anthropogenic Factors

Human activities significantly contribute to flooding events. The Qurʾān warns: "Corruption has spread on land and sea because of what people's hands have wrought. He will let them taste the consequences of some of their deeds so that they may turn back (to righteousness)."[20] Imam Al-Qurtubi interprets 'corruption' in this context as environmental destruction caused by human actions. Examples include deforestation, urban sprawl, and inadequate waste management. Shah, Mustaffa, and Yusof (2017) highlights that poor urban planning, driven by greed, often neglects comprehensive drainage designs, leading to recurrent flooding in areas such as Klang Valley. Flooding arises from a combination of natural phenomena and human negligence. While heavy rainfall and soil properties are unavoidable, human activities, such as deforestation and inadequate urban planning, exacerbate the risks. Comprehensive mitigation strategies must address both environmental factors and behavioral changes to reduce flooding's impacts.[21]

### 2.5. Astronomical Influences

Astronomical influences, particularly the gravitational interactions among celestial bodies, play a significant role in Earth's tidal phenomena, which can contribute to flooding events. The gravitational pull of the Moon and the Sun generates tides, with the Moon exerting a more substantial effect due to its proximity. During syzygy when the Earth, Moon, and Sun align during new or full moons gravitational forces combine to produce higher-than-normal tides, known as spring tides. Conversely, during quadrature when the Moon and Sun are at right angles relative to Earth neap tides occur, characterized by lower tidal ranges. The Moon's orbital dynamics further influence tidal patterns. The 18.6-year lunar nodal cycle, which involves a gradual shift in the angle of the Moon's orbit relative to Earth's equator, affects tidal amplitudes. Research indicates that this cycle modulates the frequency and intensity of high-tide flooding events. For instance, a study by Bult et al. projects that the combination of rising sea levels and the lunar nodal cycle will lead to a surge in coastal flooding in the mid-2030s, as the cycle enters a phase that amplifies tidal extremes.[22]

Additionally, atmospheric rivers narrow corridors of concentrated moisture in the atmosphere can interact with tidal forces to exacerbate flooding. These meteorological phenomena transport vast amounts of water vapor from tropical regions to mid-latitudes, leading to heavy precipitation upon landfall. When such events coincide with high tides, the risk of severe coastal flooding increases. Recent observations have highlighted the destructive potential of atmospheric rivers, particularly when aligned with astronomical high tides. Astronomical factors, including tidal forces driven by

[18]Al-Baqarah 2:164.

[19]Sanju Purohit, *Climate Chronicles: Unveiling the Past, Present, and Future of Global Sustainability* (Jaipur: The Global Publishers & Distributors, 2024).

[20]Ar-Rum 30:41.

[21]Syed Muzzamil Hussain Shah, Zahiraniza Mustaffa, and Khamaruzaman Wan Yusof, "Disasters Worldwide and Floods in the Malaysian Region: A Brief Review," *Indian Journal of Science and Technology* 10, no. 2 (2017): 1–9, https://doi.org/10.17485/ijst/2017/v10i2/110385.

[22]Sterre V. Bult, Dewi Le Bars, Ivan D. Haigh, and Theo Gerkema, "The Effect of the 18.6-Year Lunar Nodal Cycle on Steric Sea Level Changes," *Geophysical Research Letters* 51, (2024): e2023GL106563, https://doi.org/10.1029/2023GL106563.

celestial mechanics and their interaction with atmospheric phenomena, significantly influence flooding events. Understanding these influences is crucial for accurate flood risk assessment and the development of effective mitigation strategies, especially in the context of climate change and rising sea levels. Integrating astronomical data using technology with meteorological and oceanographic observations can enhance predictive models, thereby improving preparedness and resilience against flood hazards.[23]

### 3. Analysis of Flood Impacts: Socioeconomic, Health, and Psychological Dimensions

Floods have far-reaching impacts, encompassing loss of life, damage to property, and disruption of socioeconomic systems. Various studies have examined these dimensions, revealing the multifaceted consequences of floods on individuals, communities, and economics:

#### 3.1. Socioeconomic Impacts

Buslima et al. highlights the severe negative impacts of floods, including fatalities, structural damage to buildings, and contamination of food and water supplies. Floods disrupt essential socioeconomic activities such as transportation and communication and lead to the destruction of agricultural land. These events also result in long-term economic consequences, particularly for uninsured communities, including reduced consumption and quality of life. The political ramifications of floods are also noteworthy, as they may prompt shifts in political behavior and governance priorities.[24] Further emphasizing the economic burden, Husin, Mohamad & Hassan estimated that the December 2021 floods in Kuala Lumpur incurred economic losses amounting to RM15 billion, severely affecting Selangor and Pahang. This disaster negatively impacted Malaysia's recovering economy following the COVID-19 pandemic.[25] Similarly, Botzen, Deschenes & Sanders highlighted both short-term and long-term economic losses caused by floods, including fatalities and widespread destruction of public property.[26] Mansor et al. also noted that floods disrupt income streams, particularly for individuals relying on natural resources for their livelihoods, underlining the need for enhanced awareness and knowledge about flood risks and economic recovery strategies.[27] D'Ayala et al. underscored the broader economic implications of floods, particularly in economically significant regions such as Selangor and Kuala Lumpur, which contribute approximately 45% to Malaysia's GDP. Flood-induced disruptions in these areas could escalate into a national economic crisis. Additionally, supply chain disturbances, such as factory shutdowns and limited product availability, lead to increased prices, further exacerbating economic challenges.[28]

[23]Mohd Hafiz Safiai, "Enacting Space Law in Malaysia to Transfer Knowledge About Outer Space Engineering and Technology," *International Journal of Engineering Trends and Technology* 72, no. 6 (2024): 228–237, https://doi.org/10.14445/22315381/IJETT-V72I6P123.

[24]F.S. Buslima et al., "Flood and Flash Flood Geo-Hazards in Malaysia," *International Journal of Engineering and Technology* 7, no. 4 (2018): 760–764, https://doi.org/10.14419/IJET.V7I4.35.23103.

[25]Mohd Azrin Husin, Aummil Nadira Mohamad, and Ahmad Muhyuddin Hassan, "Flash Flood Tragedy in Kuala Lumpur," 295.

[26]W. J. Wouter Botzen, Olivier Deschenes, and Mark Sanders, "The Economic Impacts of Natural Disasters: A Review of Models and Empirical Studies," *Review of Environmental Economics and Policy* 13, no. 2 (2019): 167–188.

[27]Nur Fathira Aimi Mansor et al., "Flood Disaster and Impact on Residents: Case Study in Kedah," *Geografi* 11, no. 1 (2023): 44–67.

[28]Dina D'Ayala et al.,"Flood Vulnerability and Risk Assessment of Urban Traditional Buildings in A Heritage District of Kuala Lumpur, Malaysia," *Natural Hazards and Earth System Sciences* 20, (2020): 2221–2241, https://doi.org/10.5194/nhess-20-2221-2020.

### 3.2. Health and Safety Impacts

Floods pose substantial risks to health and safety, impacting both volunteers and affected populations. Volunteers engaged in disaster response face significant occupational hazards, including physical injuries, infections, and fatigue. These risks not only compromise their well-being but also affect the quality and efficiency of their relief efforts. Md Akhir, Azman, and Md Akhir emphasized the need for robust organizational support to mitigate these challenges, highlighting the importance of safety protocols, proper training, and mental health resources for disaster volunteers.[29] From a public health perspective, floods create conditions conducive to the spread of waterborne diseases. Pathogens responsible for cholera, typhoid fever, leptospirosis, and hepatitis A thrive in the contaminated water supplies that often accompany flood events. Acosta-Espana noted that these diseases affect populations indiscriminately, placing an enormous burden on healthcare systems during and after disasters. Contaminated food and water are primary vectors, exacerbating the spread of infections and compounding the challenges faced by healthcare providers. Addressing these multifaceted health implications requires a coordinated approach, combining preventive measures, volunteer support systems, and public health interventions. Such strategies can enhance resilience, ensuring both volunteers and affected populations are better equipped to cope with the health risks posed by flooding events.[30]

### 3.3. Psychological Impacts

Floods also result in substantial psychological stress for victims. According to Heanoy & Brown, prior evidence that natural disasters adversely affect mental health through direct and indirect mechanisms. Disasters are unique events with varying impacts on individuals, ranging from temporary disruptions to permanent life changes. While many individuals demonstrate resilience and return to normalcy after adversity, others experience short or long-term psychological distress, leading to conditions such as depression, anxiety, and PTSD. The study highlights the less-explored transitional properties of disaster-how material and psychological changes during pre- and post-disaster periods differentially affect mental well-being. For instance, individuals who lose jobs and homes face greater transitions and are likely to experience more severe mental health outcomes than those with fewer disruptions. Quantifying disaster-induced transitions is crucial for understanding their mental health effects. The study emphasizes the potential of the Transitional Impact Scale (TIS) as a tool for objectively assessing these transitions and their relationship with mental health outcomes across time. Incorporating the TIS can enhance the generalizability of findings and aid in identifying patterns of disaster-related mental health consequences.[31]

Additionally, future research should explore community-level effects, cross-cultural differences, and regional disparities in disaster impacts. Understanding these dynamics is essential for developing targeted interventions and fostering collaborative disaster preparedness, response, and recovery efforts. This aligns with Meseka assertion that achieving psychological balance requires maintaining both physical and mental health. Floods, as natural processes caused by sudden surges of water, are inevitable and have far reaching consequences for human health and the environment. Scholars have identified climate change, deforestation, industrialization, and rivers as the primary causes of flooding in Western Equatoria. The aftermath of floods often manifests in psychological

[29]Nur Hafizah Md Akhir, Azlinda Azman, and Noremy Md Akhir, "Impact of Disaster on Volunteers' Health and Safety," *Jurnal Psikologi Malaysia* 34, no. 2 (2020): 93–104.

[30]Jaime David Acosta-España et al., "Infectious Disease Outbreaks in the Wake of Natural Flood Disasters: Global Patterns and Local Implications," *Infez Med* 32, no. 4 (2024): 451–462.

[31]Eamin Z Heanoy, and Norman R Brown, "Impact of Natural Disasters on Mental Health: Evidence and Implications," *Healthcare* 12, no. 18 (2024): 1812, https://doi.org/10.3390/healthcare12181812.

and physical effects such as fear, trauma, illness, and loss of appetite.[32]

### 3.4. Environmental and Infrastructure Impacts

Anuar and Mohamed noted that floods in Malaysia frequently result from both natural factors and human activities. The damage extends to property, infrastructure, merchandise, agricultural yields, transportation networks, and the environment. Moreover, infrastructure failures, such as ineffective drainage systems in residential developments, exacerbating flood impacts. Floods exert profound negative effects across various dimensions, including loss of life, destruction of property, socioeconomic instability, and adverse impacts on physical and psychological health.[33] Addressing these challenges demands a comprehensive and integrative approach. This includes fostering socioeconomic awareness, implementing targeted public health interventions, and developing resilient infrastructure. By adopting such multidimensional strategies, communities can enhance their preparedness and resilience, thereby mitigating the detrimental consequences of future flood events. Proactive measures, rooted in interdisciplinary collaboration, are essential for minimizing vulnerability and ensuring sustainable recovery in the face of increasingly frequent and severe flooding episodes.[34]

## 4. Integrated Flood Mitigation Strategies: Structural Innovations and Community Engagement in Malaysia

Flood mitigation strategies in Malaysia have evolved to incorporate both structural and non-structural approaches, with a strong emphasis on community engagement, advanced technologies, and sustainable infrastructure. Research efforts have highlighted the need for comprehensive solutions encompassing prevention, preparedness, response, recovery, and management.

### 4.1. Structural and Technological Innovations

Muzamil et al. proposed a multifaceted flood mitigation plan that includes upgrading drainage systems, identifying high-risk zones, creating data repositories for vulnerable communities, and installing standalone power generators. Other recommendations include enhancing telemetry systems, implementing reforestation programs, introducing innovative insurance policies for at-risk populations, and strengthening river mitigation projects. Similarly, initiatives such as early warning systems and strict enforcement of disaster management standard operating procedures were emphasized.[35]

In Kuala Lumpur, Arshad et al. explored structural measures such as regular maintenance of drainage channels, the use of natural methods like hollow pits, and the construction of SMART tunnels to alleviate urban flooding. These proactive measures underscore the importance of integrated flood management, including structural upgrades, non-structural strategies, and flood forecasting

[32]Tabitha Meseka, "The Impact of Flood Disaster Response Strategies on Health Outcomes: A Study of Western Equatoraia," *International Journal of Dentistry, Diabetes, Endocrinology and Oral Hygiene* 6, no. 1 (2024): 40–56, https://doi.org/10.37745/ijddeoh.18/vol6n14056.

[33]Nur Balqis Anuar, and Sulzakimin Mohamed, "Impact of the Construction of Bandar Baru Tunjong," 673.

[34]Shuang Zhong, Lianping Yang, and Sam Toloo, Zhe Wang, Shilu Tong, Xiaojie Sun, David Crompton, Gerard FitzGerald, and Cunrui Huang, "The Long-Term Physical and Psychological Health Impacts of Flooding: A Systematic Mapping," *The Science of the Total Environment* 626, (2018): 165–194, https://doi.org/10.1016/j.scitotenv.2018.01.041..

[35]Syed Ahmad Hakim Syed Muzamil et al., "Proposed Framework for the Flood Disaster Management Cycle in Malaysia," *Sustainability* 14, (2022): 4088, https://doi.org/10.3390/su14074088.

systems to enhance preparedness.[36] Additional innovations include bio-ecological drainage systems (BIOECODS) aligned with Manual Saliran Mesra Alam (MSMA) principles.[37] Components such as grassed swales, detention ponds, and infiltration monitoring were found effective in mitigating stagnant water and mosquito breeding. Similarly, Yusoff & Thomas recommended the implementation of retention ponds, rainwater harvesting systems, green infrastructure, and rooftop greening to reduce surface runoff and enhance rainfall interception.[38]

### 4.2. Community-Centric Approaches

Community adaptation and awareness are integral to effective flood mitigation strategies. Hashim et al. underscore the significance of education, socioeconomic stability, and awareness in fostering disaster preparedness, particularly among coastal communities in Selangor. Their findings reveal that communities with robust socioeconomic foundations and heightened awareness levels demonstrate greater adaptability to rising sea levels and the attendant flood risks. This highlights the role of informed and economically stable populations in mitigating disaster vulnerabilities.[39] Similarly, Lamond, Bhattacharya & Bloch emphasizes that addressing floods requires a behavioral paradigm shift. Factors such as poor drainage systems, improper waste management, and inadequate urban planning, often exacerbated by human negligence, intensify flood risks. Educating communities on the underlying causes and consequences of flooding is therefore imperative to cultivating a culture of proactive disaster management.[40] By understanding flood processes and adopting preventive behaviors, communities can actively contribute to mitigating flood impacts. Collectively, these studies underscore the need for integrating socioeconomic stability, community education, and behavioral change to enhance flood preparedness. Such efforts not only reduce immediate risks but also build long-term resilience, enabling communities to withstand and recover more effectively from future flood events.[41]

### 4.3. Non-Structural Measures and Policy Recommendations

Muhamad et al. highlighted the utility of flood and landslide vulnerability maps for identifying

[36]Siti Hasniza Muhammad Arshad et al., "Evaluation of the Effectiveness of the SMART Tunnel in Kuala Lumpur in Preventing Flash Floods]," Geografia: Malaysian Journal of Society and Space 16, no. 3 (2020): 184-200.

[37]Mohd Luqman Ismail, Sharifah Meryam, and Shareh Musa, "Study on the Implementation of Drainage System at Universiti Tun Hussein Onn Malaysia (UTHM)," *Journal of Techno-Social* 12, no. 2 (2021): 12–20; Nursyafika Mohamad Razip, Sharifah Meryam Shareh Musa, Rozlin Zainal, Hamidun Mohd Noh, Narimah Kasim, "A Study on Drainage System Construction Issues as a Cause of Flooding Problems in Residential," *Research in Management of Technology and Business* 2, no. 2 (2021): 523–538.

[38]Safiah Yusmah Muhammad Yusoff, and Rafidah Thomas, "Mapping Flash Flood Hotspots in Kuala Lumpur: Flash Flood Hotspot Mapping," *Malaysian Journal of Tropical Geography* 47 no. 1&2 (2021): 123–142.

[39]Noorazuan Md Hashim et al., "Determination of an Adaptation Model to Sea Level Rise Vulnerability in Selangor, Malaysia," *e-BANGI Jurnal Sains Sosial dan Kemanusiaan* 16, no. 4 (2019): 1–15.

[40]Jessica Elizabeth Lamond, Namrata Bhattacharya-Mis, and Robin Bloch, "The Role of Solid Waste Management as a Response to Urban Flood Risk in Developing Countries, A Case Study Analysis," *WIT Transactions on Ecology and The Environment* 159, (2012): 193–204, https://doi.org/10.2495/FRIAR120161.

[41]Sheikh Kamran Abid et al., "Community-Based Flood Mitigation in Malaysia: Enhancing Public Participation and Policy Effectiveness for Sustainable Resilience," *Journal of Global Health* 20, no. 14 (2024): 04290, https://doi.org/10.7189/jogh.14.04290.

high-risk areas prior to development. Factoring in topography, geology, and geomorphology during planning stages is essential to minimize disaster risks.[42] Safiah et al. (2020) underscored the integration of structural measures, such as multipurpose dams, with non-structural actions like land-use planning and flood warning systems.[43] A notable advancement is the application of the FR-AHP (Flood Risk–Analytic Hierarchy Process) method in Sungai Pinang, which provides more precise land-use and drainage planning compared to traditional methods.[44]

Furthermore, innovations such as floating structures for protecting valuables in mosques and suraus during floods enhancing community resilience.[45] Ruslan et al. recommended upgrading traditional drainage systems to eco-friendly designs, building retention ponds, and constructing embankments to manage overflow. Measures such as widening and deepening river channels and enhancing flood catchment areas were also identified as crucial for reducing flood risks.[46] Flood mitigation in Malaysia requires a holistic approach that integrates structural and non-structural measures, advanced technologies, and community participation. From enhancing drainage infrastructure to adopting bio-ecological systems and leveraging community awareness, these strategies aim to reduce flood impacts and foster resilience. Future efforts should focus on interdisciplinary collaboration to optimize disaster management outcomes and promote sustainable development.

## 5. Theological and Scientific Perspectives on Floods: Lessons from History and Modern Insights

Floods are frequently depicted in theological and scientific discourse as both a natural phenomenon and a divine instrument for delivering warnings or consequences to humankind. The Qurʾān and the sayings of Prophet Muhammad (PBUH) provide profound insights into historical flood events, while modern science elucidates the mechanisms driving these occurrences, blending faith and empirical understanding.

### 5.1. Theological Perspectives on Floods

The Qurʾān recounts the catastrophic flood during the time of Prophet Noah as a punishment for those who denied divine guidance. Allah says: “They rejected Noah, so We saved him and his followers in the Ark and made them successors while drowning those who denied Our signs. See then what was the end of those who were warned.”[47] In Tafsir Ibnu Kathir, this flood was unparalleled, annihilating all except the faithful aboard the ark. While Dr. Wahbah Zuhaili, in Tafsir

[42]Nurfashareena Muhamad et al., “The Need for Disaster Vulnerability Maps as Input in Land Use Management: A Case Study at Universiti Kebangsaan Malaysia,” *Sains Malaysiana* 48, no. 1 (2019): 33–43, https://doi.org/10.17576/JSM-2019-4801-05.

[43]M. Y. Safiah Yusmah et al., “Understanding Urban Flood Vulnerability and Resilience: A Case Study of Kuantan, Pahang, Malaysia,” *Natural Hazards: Journal of the International Society for the Prevention and Mitigation of Natural Hazards* 101, no. 2 (2020): 551–571, https://doi.org/10.1007/s11069-020-03885-1.

[44]Azlan Saleh, Ali Yuzir, and Nuridah Sabtu, “Flash Flood Susceptibility Mapping of Sungai Pinang Catchment Using Frequency Ratio,” *Sains Malaysiana* 51, no. 1 (2022): 51-65.

[45]Abdul Muhaimin Ab. Wahid, Zaiwannizar Zainal Abidin, Mohd Esham Mamat, Noraini Md Zain, Mohammad Nasharudine Shuib, and Mohd Nazri Abdullah, “An Analysis of Defects on Floating Mosque in Perak,” *International Journal of Business and Technology Management* 5, no. S3 (2023): 12-19.

[46]Muhammad Akmal Ilham Ahmad Ruslan and “Improvements to the Drainage System Causing Flash Floods in Jalan Kluang, Batu Pahat, Johor,” *Research in Management of Technology and Business* 4, no. 1 (2023): 1129–1142.

[47]Yunus 10:73.

Al-Munir, describes this flood as so immense that even mountains were submerged. It is further elaborated in Qurʾān: "Until when Our command came and the fountains of the earth gushed forth, We said, 'Carry on board (the Ark) two of every kind of creature, as well as your family—except those who have been destined to perish."[48]

Tafsir Jalalayn highlights the precursors to this flood, such as darkened skies and strong winds. These signs underscore the Qurʾānic lesson that natural disasters often come with forewarnings, discernible to those attentive to nature's behavior. The story of Prophet Noah illustrates the theological perspective that floods can serve as divine warnings. The Qurʾān's mention of pre-disaster signs emphasizes the importance of vigilance and preparedness. Meanwhile, scientific advancements provide tools for understanding and mitigating flood risks through better urban planning, sustainable forestry practices, and robust flood management systems. The Qurʾān employs the term Al-Tuufan (the deluge) to describe immense floods, such as those that struck Prophet Nuh's people (Surah Al-Ankabut, verse 14) and Pharaoh's nation.[49] Ali (2005) interprets Al-Tuufan as revolving forces of nature, such as whirlwinds or torrential waters, which possess destructive upward and downward pulling forces capable of submerging even large ships.[50]

### 5.2. Scientific Perspectives on Floods

Flooding arises from a complex interplay of natural and anthropogenic factors, as evidenced by modern scientific research. Natural triggers include intense rainfall, high tides, low-lying topographies, and storm systems.[51] Kundzewicz highlights how upstream rainfall can elevate river levels, leading to breaches and inundation of surrounding areas.[52] Similarly, Rijal et al. identify prolonged and widespread rainfall as the most dominant natural cause of flooding, underlining its role in catastrophic water accumulation.[53] Human-induced factors exacerbate these natural occurrences, significantly increasing flood risks. Activities such as unplanned urbanization, deforestation, dam failures, and insufficient flood management infrastructure disrupt natural water retention capacities, intensifying surface runoff and magnifying flood severity.[54]

These anthropogenic influences not only heighten the frequency of flooding but also amplify its destructive consequences for human settlements and ecosystems. To address these challenges, an integrative flood mitigation approach is essential. This requires tackling both natural vulnerabilities and human-induced risks through sustainable development, improved urban planning, and investments in advanced flood management infrastructure. Such comprehensive strategies aim to minimize the adverse impacts of flooding and build long-term resilience.[55]

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[48]Hud 11:40.

[49]Al-A'raaf 7:133.

[50]Abdul Halim Ali, *Encyclopedia of Science Education in the Qur'ān* (Kuala Lumpur: Emedia Publication, 2005).

[51]Andreas N. Angelakis et al., "Evolution of Floods: From Ancient Times to the Present Times (ca 7600 BC to the Present) and the Future," *Land* 12, no. 6 (2023): 1211, https://doi.org/10.3390/land12061211.

[52]Zbigniew W. Kundzewicz et al., "Flood Risk and Climate Change: Global and Regional Perspectives," *Hydrological Sciences Journal* 59, no. 1 (2013): 1–28.

[53]Madhab Rijal et al., "Global Systematical and Comprehensive Overview of Mountainous Flood Risk Under Climate Change and Human Activities," *Science of The Total Environment* 941, (2024): 173672, https://doi.org/10.1016/j.scitotenv.2024.173672.

[54]Shashikant Nishant Sharma, and Dauda Ayuba, *Nature Based Solutions to Prevent Urban Flooding* (New Delhi: Edupedia Publications, 2024).

[55]Harman Singh, Miriam Nielsen, and Helen Greatrex. "Causes, Impacts, and Mitigation Strategies of Urban Pluvial Floods in India: A Systematic Review." *International Journal of*

## 6. Conclusion

Flash floods are predominantly caused by excessive rainfall, rapid urbanization, and inadequate drainage systems. Research indicates that unplanned urban growth significantly exacerbates surface runoff, as the replacement of natural catchments with impermeable surfaces leads to accelerated water accumulation during intense precipitation events. Additionally, poor waste management practices, such as indiscriminate disposal of garbage, contribute to clogged drainage networks, thereby compounding flood risks. While these terrestrial factors are well-documented, limited research explores the role of astronomical influences. Preliminary studies suggest that lunar phases, solar activity, and tidal dynamics may interact with meteorological conditions to influence precipitation patterns, highlighting a gap that warrants systematic investigation. Flash floods have significant socioeconomic and environmental consequences. On the socioeconomic front, they result in widespread property damage, income losses, and severe psychological distress among affected populations. Environmental impacts include accelerated soil erosion, water pollution, and habitat destruction, which collectively undermine ecological stability. Vulnerable communities, particularly those in low-income or high-risk areas, are disproportionately affected, underscoring the need for targeted mitigation strategies.

However, few studies comprehensively address the long-term ramifications of flash floods, particularly their effects on economic resilience and mental health, leaving critical aspects of disaster management unexamined. Mitigation efforts against flash floods involve both structural and non-structural approaches. Structural interventions, such as upgrading drainage systems and constructing retention basins, are commonly recommended; however, their success depends on regular maintenance and strategic urban planning. Non-structural strategies, including early warning systems and public education campaigns, are equally critical in fostering preparedness and resilience. Recent research highlights the potential of integrating Islamic principles into disaster management frameworks, emphasizing values such as environmental stewardship and collective responsibility to promote sustainable practices. Despite its promise, the practical implementation of faith-based frameworks in policy and planning remains underexplored.

Although substantial progress has been made in understanding the hydrological and socioeconomic dimensions of flash floods, significant research gaps remain. The potential influence of astronomical factors, such as lunar phases and solar activity, on precipitation and flood dynamics remain largely uncharted. Furthermore, while the integration of Islamic perspectives into disaster management is gaining attention, empirical evidence on its practical impact is scarce. Addressing these gaps is crucial for developing holistic and culturally sensitive disaster mitigation strategies. The existing literature provides a foundational understanding of flash flood mechanics and impacts but lacks a multidisciplinary perspective. Incorporating non-terrestrial factors, such as astronomical influences, could enhance predictive models and improve disaster preparedness. Additionally, leveraging culturally resonant frameworks, particularly in regions with strong religious identities, can bridge the gap between technical solutions and community acceptance. By integrating theological insights with scientific methods, a holistic approach to flood preparedness and response can be developed, fostering resilience and promoting environmental stewardship. All stakeholders that can benefit from this study are Policy Makers and Urban Planners, Disaster Management Agencies and Religious Scholars and Environmental Educators.

### Author Contribution

**Mohd Hafiz Safiai:** conceptualization. **Izzat Muazam Mustafa Kamal:** investigation; **Mohd Izhar Ariff Mohd**

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All authors critically reviewed, revised, and approved the final manuscript, ensuring its academic rigor and integrity.

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The authors of the manuscript have no financial or non-financial conflict of interest in the subject or materials discussed in this manuscript.

### Data Availability Statement

The data associated with this paper is available from the authors upon request.

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