Sky Brightness for Determination of Fajr and Isha Prayer by Using Sky Quality Meter

Siti Asma' Mohd Nor, Mohd Zambri Zainuddin

Abstract— Study of sky brightness was done during night twilight and morning twilight at Teluk Kemang, Negeri Sembilan, Pantai Cahaya Bulan, Kelantan and Kuala Terengganu, Terengganu. This study was done to ensure the time for beginning and ending of astronomical twilight are the same as the theory. Astronomical twilight is used to determine the beginning and ending of Fajr and Isha prayer time. Sky quality meter were used in this study to observe the sky brightness. The finding shows that the darkest the sky can go is to less than 20 mag per meter square in the morning (Subh) while in the night the sky can goes dark until less than 21mag per meter square. This data can be related to the sun altitude which is the condition to determine the time of beginning of Fajr and Isha prayer.

Index Terms— prayer time, sun altitude, sky brightness, twilight, astronomical twilight,magnitude.

1 INTRODUCTION

The study of sky brightness is important for determine the beginning and ending of the astronomical twilight. The time of beginning of the astronomical twilight is the time when the observer can start the observation. In Islam, the study of the sky brightness will lead to the determination of prayer time. There are two prayer times that depend on the time of beginning and ending of astronomical twilight which are Fajr and Isha prayer. Determination of Fajr and Isha prayer time differ from country to country in the world as shown in the table 1.

Convention	Fajr angle / ^{0}	Isha angle / ^{0}
Shiah Ithna Ashari(Jaafari)	16	14
Islamic Society of North America(ISNA)	15	15
Muslim World League(MWL)	18	17
Umm al-Qura, Makkah	18.5	90 mins after maghrib
Eqyptian General Authority of Survey	19.5	17.5
University of Islamic Sciences, Karachi	18	18
Malaysia	20	18

Table 1

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This angle is called solar angle where the position of the sun below the horizon. In astronomical view, Fajr prayer time begin with the dawn or morning twilight. At normal locations is when the solar altitude is equal to -20° which is also known as morning astronomical twilight. It will ends just before the sunrise. Meanwhile for Isha prayer time begins when the time at which the darkness falls and there is no scattered light in the sky. The time taken when all the scattered light disappeared are called the astronomical twilight. As mentioned before, the astronomical twilight occur when the solar elevation at 18° under the west horizon. While the astronomical twilight is define as the time when the sun is 18° below the horizon. From the end of astronomical twilight in the evening to the beginning of astronomical twilight in the morning, the sky is dark enough for all astronomical observation. It is the condition where truly dark and no perceptible twilight remains. This can be describing as in diagram 1.

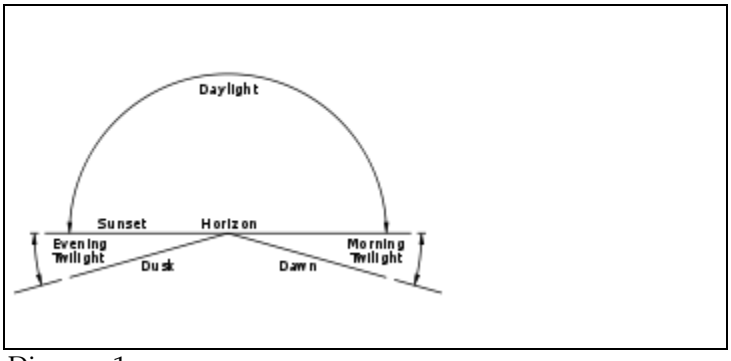


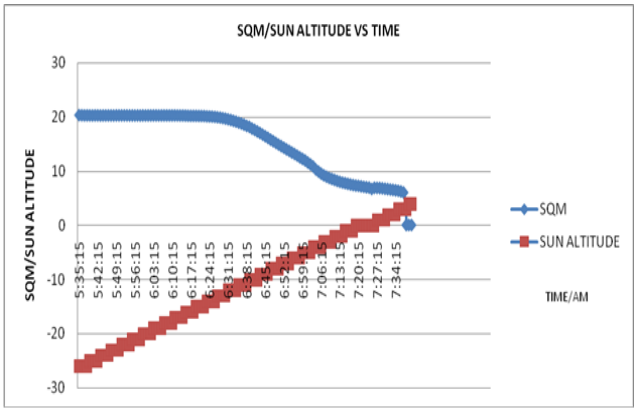
Diagram 1

This is how the sky brightness relates to the determination of Fajr and Isha prayer time. This paper will highlighted that using the Sky Quality Meter can determine the astronomical twilight and proved the sun angle same as the theoretical part.

2 METHODOLOGY

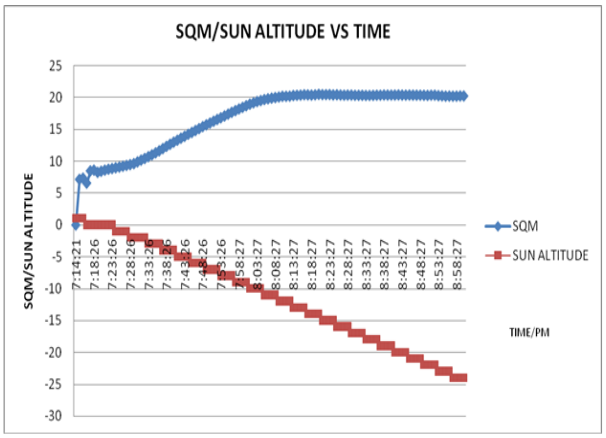
This study used the Sky Quality Meter which was directed to the sky. Observation was made at Telok Kemang, Pantai Cahaya Bulan and Kuala Terengganu. The measurement was made during the morning twilight and evening twilight. There are two types of places that data been taken which are at the west horizon and east horizon. The data was taken at morning time starting from half and hour before Fajr prayer time until the sunrise. Observation been made during the clear sky. Meanwhile during evening data was taken at half and hour before sunset until half and hour after Isha prayer time. Measurement was done at several times and the best data chosen on March 16, 2012 as in table 2 been attached in Appendix (1).

3 RESULT AND ANALYSIS



Graph 1

Graph 1 was result taken during the morning before the sunrise. Result shows that the brightness of the sky is constant from the beginning of data taken and it start moving down at certain point at 6.25am. As the magnitude of the brightness moving down, the other graph moving up which is the sun angle. At 20mag/m2 the sky is at the darkest while at the sunrise the magnitude will be zero. Result shows that during Fajr prayer time at 6.05am on March 16, 2012, the sun angle situated at 20° below the horizon.



Graph 2

Above graph shows the result taken during the evening twilight or sunset. The magnitude of the sky brightness goes constant from 8.09pm until 9.00pm. The darkest of the sky shows magnitude at 20.09mag/m2. At the Isha prayer time result shows that sun angle is at 17° below the horizon.

4 CONCLUSION

From the result shows that at Fajr prayers time the reading of the sun angle is at the 20° below the east horizon and the magnitude of the sky was 20mag/m2. While the Isha prayer time the sun is at the 17° below the west horizon and the sky magnitude was 20.09mag/m2. As mentioned in the introduction, the data proved that the theoretical are at the same as the measurement findings.

5 END SECTION

5.1 Appendices

TIME		MPSAS			
5:35:15	AM	20.38	6:11:15	AM	20.33
5:36:15	AM	20.36	6:12:15	AM	20.32
5:37:15	AM	20.34	6:13:15	AM	20.31
5:38:15	AM	20.34	6:14:15	AM	20.31
5:39:15	AM	20.33	6:15:15	AM	20.29
5:40:15	AM	20.32	6:16:15	AM	20.26
5:41:15	AM	20.33	6:17:15	AM	20.25
5:42:15	AM	20.33	6:18:15	AM	20.25
5:43:15	AM	20.31	6:19:15	AM	20.25
5:44:15	AM	20.32	6:20:15	AM	20.23
5:45:15	AM	20.32	6:21:15	AM	20.22
5:46:15	AM	20.32	6:22:15	AM	20.21
5:47:15	AM	20.32	6:23:15	AM	20.16
5:48:15	AM	20.31	6:24:15	AM	20.13
5:49:15	AM	20.33	6:25:15	AM	20.1
5:50:15	AM	20.33	6:26:15	AM	20.05
5:51:15	AM	20.33	6:27:15	AM	19.99
5:52:15	AM	20.33	6:28:15	AM	19.92
5:53:15	AM	20.33	6:29:15	AM	19.83
5:54:15	AM	20.32	6:30:15	AM	19.73
5:55:15	AM	20.32	6:31:15	AM	19.61
5:56:15	AM	20.31	6:32:15	AM	19.48
5:57:15	AM	20.32	6:33:15	AM	19.33

5:58:15	AM	20.31	6:34:15	AM	19.17
5:59:15	AM	20.33	6:35:15	AM	18.99
6:00:15	AM	20.32	6:36:15	AM	18.83
6:01:15	AM	20.33	6:37:15	AM	18.62
6:02:15	AM	20.33	6:38:15	AM	18.38
6:03:15	AM	20.33	6:39:15	AM	18.21
6:04:15	AM	20.33	6:40:15	AM	17.89
6:05:15	AM	20.32	6:41:15	AM	17.64
6:06:15	AM	20.33	6:42:15	AM	17.36
6:07:15	AM	20.33	6:43:15	AM	17.07
6:08:15	AM	20.33	6:44:15	AM	16.77
6:09:15	AM	20.33	6:45:15	AM	16.46
6:10:15	AM	20.33	6:46:15	AM	16.16

6:47:15	AM	15.84	7:23:15	AM	7
6:48:15	AM	15.54	7:24:15	AM	6.94
6:49:15	AM	15.23	7:25:15	AM	6.69
6:50:15	AM	14.91	7:26:15	AM	6.9
6:51:15	AM	14.62	7:27:15	AM	6.89
6:52:15	AM	14.33	7:28:15	AM	6.86
6:53:15	AM	14.02	7:29:15	AM	6.8
6:54:15	AM	13.75	7:30:15	AM	6.73
6:55:15	AM	13.44	7:31:15	AM	6.66
6:56:15	AM	13.17	7:32:15	AM	6.59
6:57:15	AM	12.87	7:33:15	AM	6.52
6:58:15	AM	12.54	7:34:15	AM	6.44
6:59:15	AM	12.27	7:35:15	AM	6.35
7:00:15	AM	11.96	7:36:15	AM	6.22
7:01:15	AM	11.6	7:37:15	AM	6.02
7:02:15	AM	11.23	7:38:15	AM	0
7:03:15	AM	10.86	7:39:15	AM	0
7:04:15	AM	10.3			
7:05:15	AM	9.92			
7:06:15	AM	9.53			
7:07:15	AM	9.21			
7:08:15	AM	8.96			
7:09:15	AM	8.74			
7:10:15	AM	8.55			
7:11:15	AM	8.37			
7:12:15	AM	8.18			
7:13:15	AM	8.02			
7:14:15	AM	7.88			
7:15:15	AM	7.76			
7:16:15	AM	7.64			
7:17:15	AM	7.52			
7:18:15	AM	7.41			
7:19:15	AM	7.32			
7:20:15	AM	7.27			
7:21:15	AM	7.18			
7:22:15	AM	7.09			

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