TIDES DURING MONSOON SEASON IN PENINSULAR MALAYSIA

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Abstract

Tide, a natural phenomenon with awesome characteristics, consists lots of mysterious and knowledge which acquire continuous research. With physical terrain that is surrounded with sea, Malaysia is a country where the determination of tidal prediction, mean sea level, chart datum are carried continuously through out the years. A software named μ-TAPS was developed for the tidal analysis and prediction. It successfully tells the characteristic of tides in Malaysia and the results achieved correspond with the Royal Malaysian Navy, and the Department of Survey and Mapping Malaysia's tidal prediction. In this study, μ-TAPS is used for the tidal prediction process during monsoon season. Tidal data was gathered for few years to determine the tidal constituents. The focus of this study is year 2005 for the month of December at the southern part of Peninsular Malaysia. The rain falls data was gathered hourly during the period and it was the main factor effecting the tidal prediction through out the monsoon seasons. The tidal prediction was compared with the role data during the period, and the effect from rain fall's volume was determined with some finding of correlation. The exceeding value from the prediction was compared with the normal tidal curve and the result would determine whether floods could occur at coastal area.

Keywords: tidal, moonsoon

1.0 Introduction

A monsoon is a (wind) pattern that reverses direction on a seasonal basis. The term was originally applied to monsoonal winds in the Arabian Sea and Indian Ocean. The word is also used to label the season in which this wind blows from the southwest in India and adjacent areas that are characterized by very heavy rainfall, and specifically the rainfall that is associated with this wind. As monsoons have become better understood, the definition has been broadened to include almost all of the phenomena associated with the annual weather cycle within the tropical and subtropical continents of Asia, Australia, and Africa, and the adjacent seas and oceans. It is within these regions that the most vigorous and dramatic cycles of weather events on Earth take place.

Peninsular Malaysia is located at the course of south west monsoon and north east monsoon rise from inland of Australia and China. Monsoons bring piles of rains from sea (especially South China Sea) to the coastal of Peninsular Malaysia annually.

A rain gauge is a type of instrument used by meteorologists and hydrologists to gather and measure the amount of liquid (rain) or solid (snow) precipitation over a set period of time. Most rain gauges generally measure the precipitation in millimeters.

Figure 1: Standard Rain Gauge

Tides rise and fall each day. It is the moon and sun that create the tides mostly. Think of the sun and moon as being magnets. Their individual gravitational pull works like a true magnet does on metal; it pulls the water towards them. As the Earth rotates the moon and sun's gravitational pull drag water over to one side of the basin like a single big wave. As the Earth continues to rotate, the gravitational pull is slowly transferred to the other side of the basin pulling the water back in the opposite direction.

There are four cycles of tides each month, two neap tide cycles and two spring tide cycles. The spring tides are the tides that flood highest up the beach, but the neap tide high water mark falls someway lower. The big spring tides are caused again by the sun and moons gravitational pull. When the moon is in its full and new moon phase, it lines up roughly between the earth and the distant sun. The two gravitational pulls are then working together and have a greater magnetic influence on the water pulling a greater amount towards them resulting in a bigger wave or bulge.

Tide gauges, usually placed on piers, measure the sea level relative to a nearby geodetic benchmark. In Malaysia, tide gauges are located mostly at the coastal area or major ports. The data from tide gauges is used in tidal analysis and prediction. Now days in Malaysia, tidal analysis and prediction tasks are accomplished with the aid of software.

2.0 Location of Study Area

The locations that are chosen for this research mostly fall on the northern part of Peninsular Malaysia. It is because the locations are the most affected by monsoon inherited rains. A few stations are chosen for tidal reading, hence near by rain gauges produced rainfalls data.

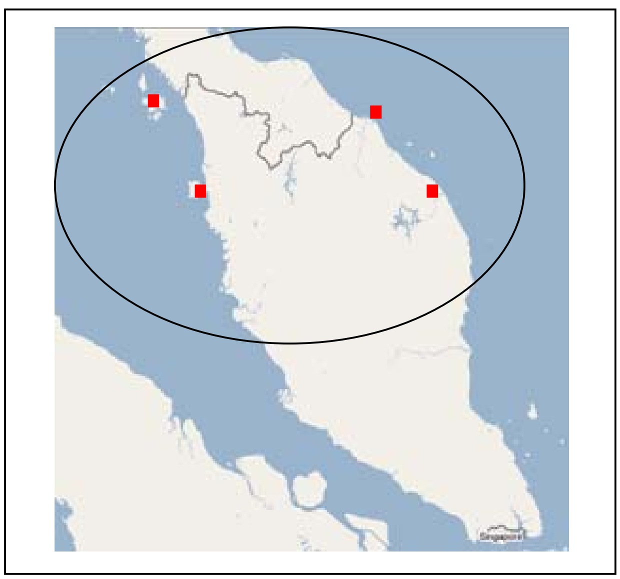


Figure 2: Study Area

The stations at the west coast are Pulau Pinang and Pulau Langkawi. In the east are Cendering at Kuala Terengganu and Geting at Kelantan.

3.0 Data and Software

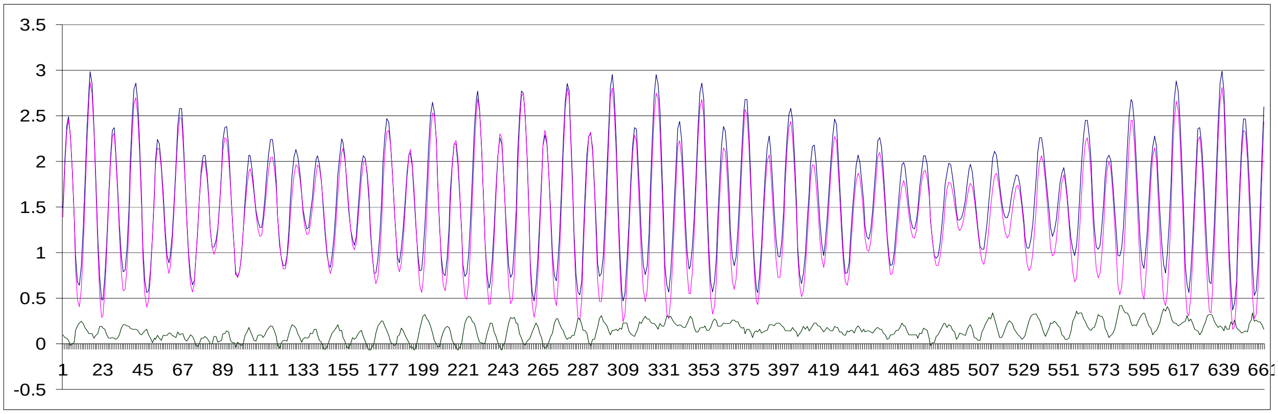
Data for tidal prediction are provided by the Department of Survey and Mapping Malaysia in a role data format. The data was processed by μ-TAPS software which was produced by Universiti Teknologi Malaysia itself. Together with the prediction task, it gives results that fitted or fulfilled the requirement of IHO.

The rainfall data was acquired from Department of Meteorology Malaysia, in a set that are completed with value and duration of rainfall for the location that are listed above. The data obtained was for year 2004 and 2005 only.

4.0 Processing

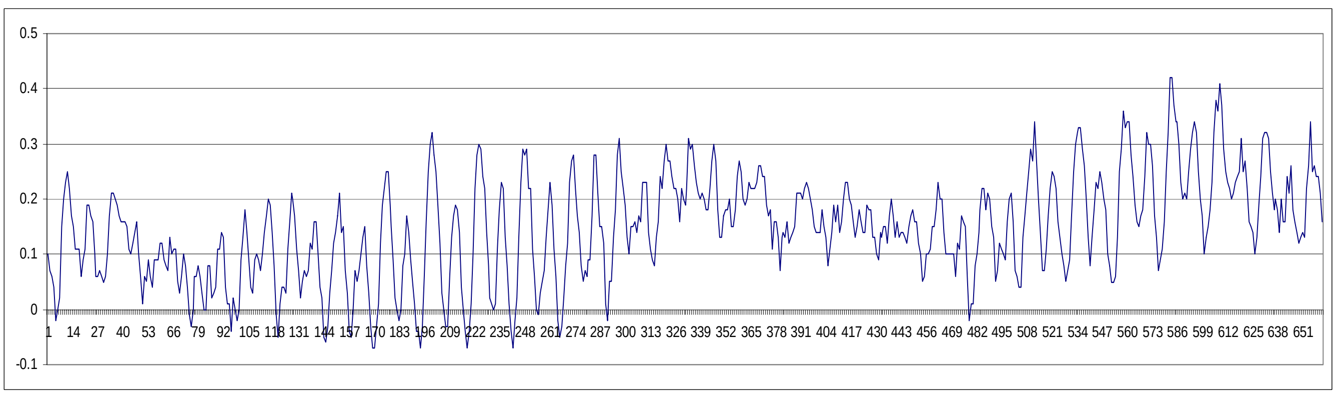
Tidal analysis and filtering was carried out at the first step with the aid of μ-TAPS. Tidal data from Department of Survey and Mapping Malaysia was converted into a file that suits the process system. From the analysis, an output file was created. It consist some information about the characteristic of the local tide and provides the value of the tidal constituents at the local area. The constituents were used as the input for the tidal prediction process. From the prediction, it generated a tide table where the standard deviation meets the requirement of IHO.

The graph below shows the different between predicted tide and actual tide during December 2005 at Pulau Langkawi.



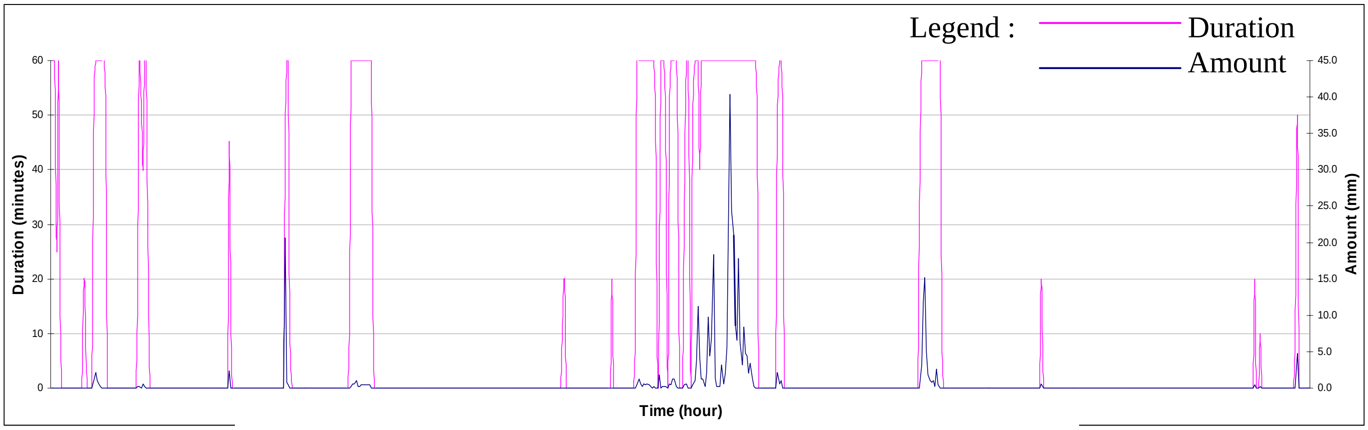
Graph 1: Comparison between predicted and actual tide

Graph 2 focuses on the different between the two set of tidal graph which is adopted from Graph 1.



Graph 2: Value of differences between predicted and actual tide

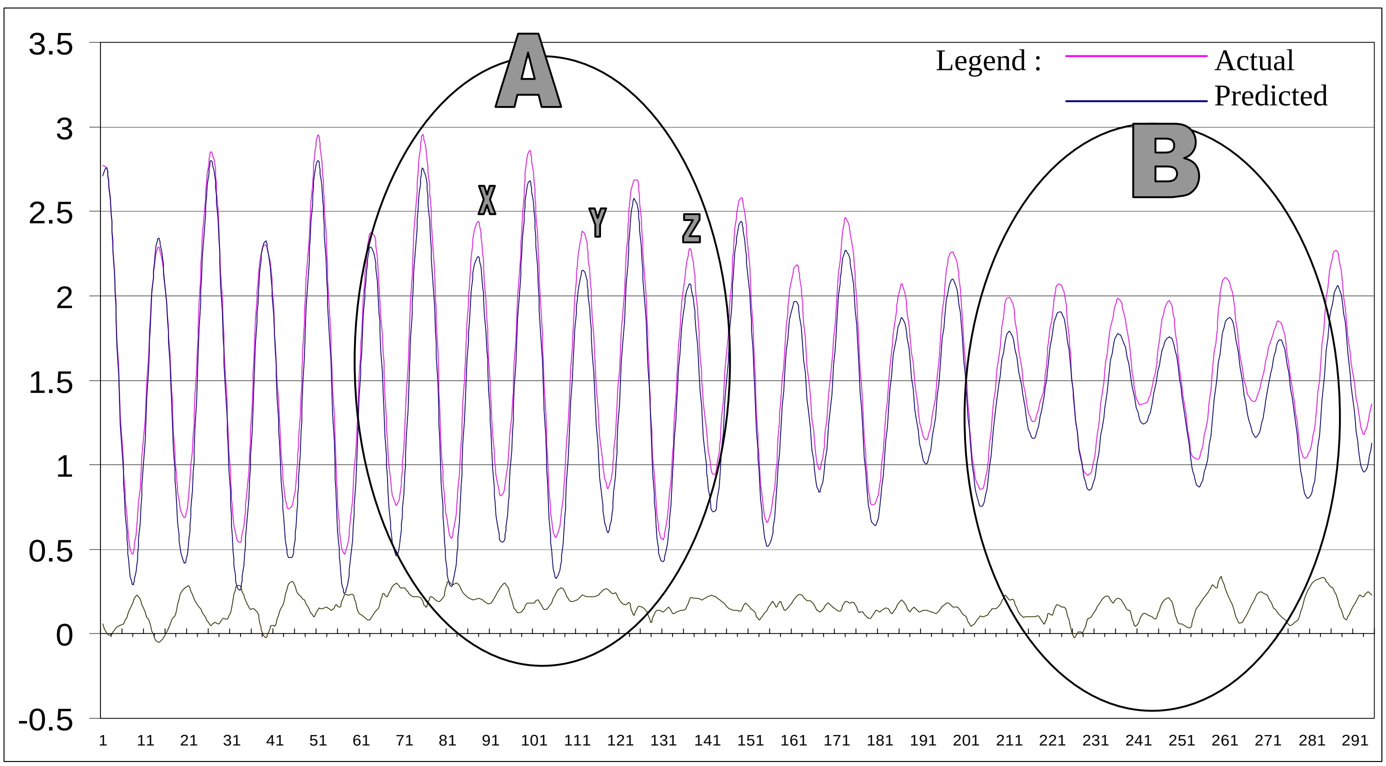
Rainfall data was presented in another way that is simplified into a single graph. Graph 4 shows the duration (minutes) and amount (mm) of rainfall through out the month.



Graph 3: Duration and Amount of Rainfall

5.0 Analysis

Adopted from Graph 1, a large differences between predicted and actual tide in Pulau Langkawi lies at the time units around point 300 to 500. It tells the abnormal curves of actual tidal compares with predicted curves. Coincidently, the period of time just comes with a spring tide follow by a neap tide in the area.



Graph 4: Comparison at period of spring tide and neap tide

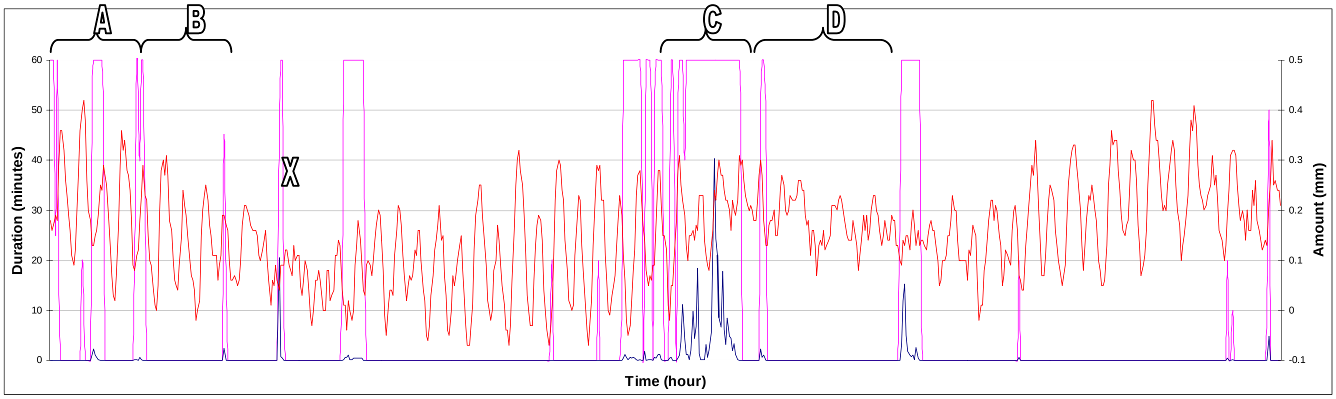
Circle A (during spring tide) shows:

1. Actual water levels are above predicted.
2. It is a Semi-Diurnal type. This means two epoch of high water occurred in one day. The large differences in comparison falls on the second high water of the day and the value at X, Y and Z peaks averagely reached 0.3 metres.
3. Meanwhile, the daily low water seems to increase by 0.2 metres only.
4. During the spring tide period, timing accuracy proven to be satisfied as the curves meets together in either raising or falling of water level.

Circle B (during neap tide) shows:

1. The different of water level seems scattered.
2. The major effect of rain during neap tide is that it effect the time of the rising water level. The actual tide that consists with pouring rain raise earlier than the predicted curve in an hour or two.

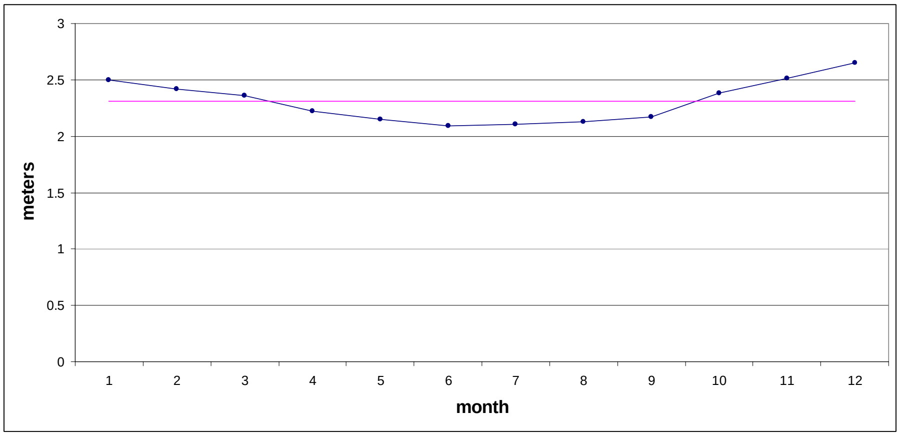
When Graph 2 and Graph 3 combined into a visual graft (Graph 5), it tells the effect of rainfall folowing the pattern of tidal curves.



Graph 5: Visual graph

At column A and C, they are the period of pounding rain. At that moment, the differential graph seems rather consistence compared with the scattered graph at area B and D. It tells that the effect takes place after a pouring rain. The period of effect depends on the amount of rain that is brought by the monsoon. For example, column C are the period with great amount of rain so the effect last longer, but large amount of rain in a short period (at X) does effect much at the tidal graph.

Monsoon period occur during the early of a year and the end of the year. The rain that she brings raises annual mean sea level. It is clear that the monthly mean sea level through out the year would not be the same (refer to Graph 6).



Graph 6: Annual and monthly mean sea level

6.0 Conclusion

The following are the conclusions made:

1. Rainfall during monsoons brings piles of rains that change the characteristic of tide in coastal area.
2. The effect takes place usually after a period of rain.
3. Amount of rain cause the periodic effect.
4. Tidal prediction at the real time should be made due to the chanting rain to estimate the possibility of getting the highest water level, before reaching the hazardous level.

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