Study on Longshore Sediment Transport Variability for East Coast of Peninsular Malaysia

by

Tidja Norain Soedirman

Dissertation submitted in partial fulfillment of the requirements for the Bachelor of Engineering (Hons)

(Civil Engineering)

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Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Civil Engineering Programme
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in partial fulfillment of the requirement for the
BACHELOR OF ENGINEERING (Hons)
(CIVIL ENGINEERING)

Approved by,

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(Assoc. Prof. Ahmad Mustafa B Hashim)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
Sept 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or person.

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TIDJA NORAIN SOEDIRMAN

ABSTRACT

The East Coast of Peninsular Malaysia is exposed to very harsh waves coming from the South China Sea which results in severe coastal erosion problems for this side of the beach. In the long run, the shoreline will move further onshore and pose a threat to nearby residential or commercial areas as well as destroy the habitat of marine flora and fauna. Gradient in Longshore Sediment Transport (LST) has been known to be one of the reasons that aggravate coastal erosion.

For this research study, the author investigated the LST variability for the East Coast, highlighting on the Cendering Beach in Terengganu by analyzing the wave climate and utilizing empirical formulas which includes the widely used CERC formula and Queen's formula to calculate Longshore Sediment Transport Rate (LSTR). The aim is to distinguish the pattern of LSTR at this area so that prediction of future occurrences can be done for preventive and mitigation measures in the future. From this research, the value of LSTR had been found to increase by 80% comparing between the year 1985 to the year 2000.

ACKNOWLEDGEMENTS

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INTRODUCTION

1.1 BACKGROUND OF STUDY

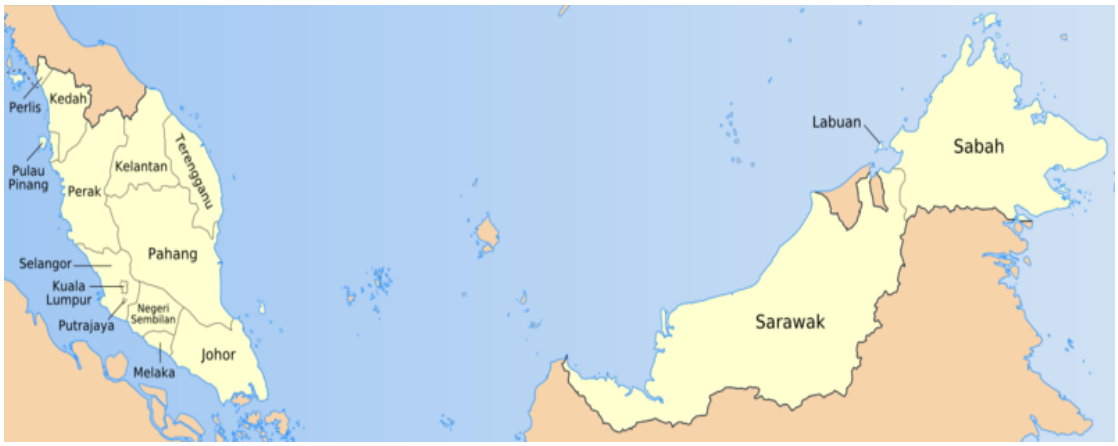

Figure 1 : Map of Malaysia (Source : http://www.campusmalaysia.com/about-malaysia)

Malaysia has about 4800 km of coastline, which is divided into two different physical formations; the mangrove mud flats and sandy beaches [1]. Coastal area can be defined as the area where terrestrial, marine environments and processes interact. These include the coastal plains, coastal wetlands, estuaries and lagoons [2].

The East Coast of Peninsular Malaysia is mainly made up of a series of large and small hook-shaped bays that is exposed to high wave energy from the South China Sea. According to the Economic Planning Unit, 1985, up to 30% of the shoreline in Malaysia is experiencing severe erosion [12].

Figure 2 : The South China Sea and direction of Northeast monsoon waves (Source : Google Map)

As a result of this realization, the government decided to commission the National Coastal Erosion Study beginning November 1984 to January 1986 to study the sediment movement trend of the coastlines in Malaysia and at the same time find ways to mitigate coastal erosion.

The study indicated that 29% of the country's coastline was facing erosion. In order to cope with this problem, the Coastal Engineering Centre under the Department of Irrigation and Drainage was set up in 1987. The main role of this centre is to carry out case studies as well as prepare detailed designs for post coastal erosion works. They also provide technical advice and coastal information of the coastlines in the country up until today.

The effects of coastal erosion can be very alarming if the problem is not mitigated in the early stage. Among the effects are loss of habitat to marine flora and fauna, destruction of nearby residential or commercial areas resulting in loss of millions of Ringgit, deterioration of marine water quality and major loss in the tourism industry.

The two types of sediment transport processes that lead to coastal erosion are the Cross-Shore Sediment Transport, which refers to the movement of sand perpendicular to the shore, and the Longshore Sediment Transport (LST) that is the transport of sediments within the surf zone in the direction parallel to the shore [13].

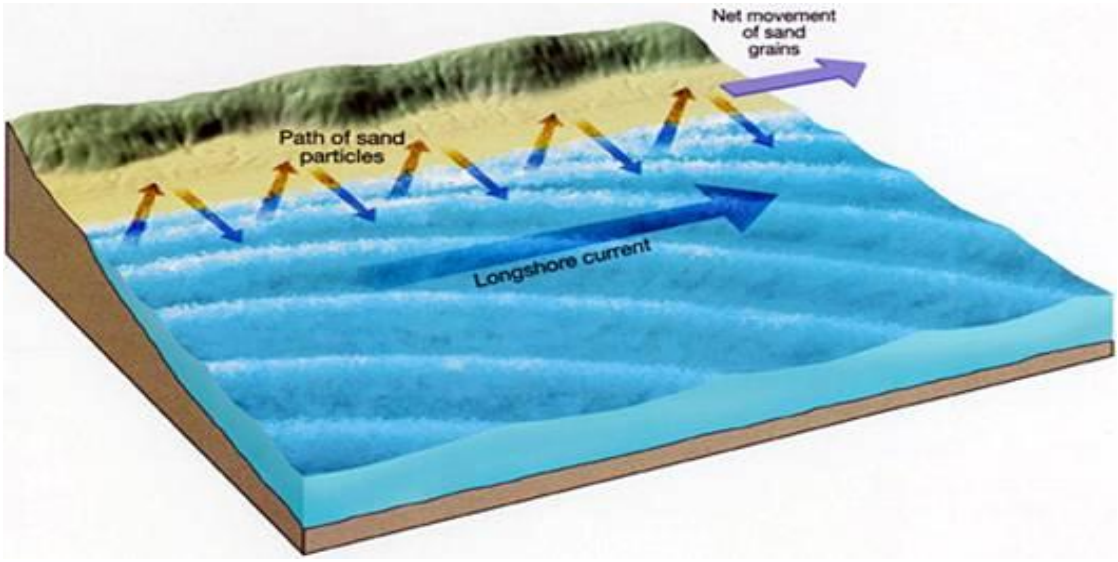

Figure 3 : Longshore Current process (Source : http://www.crd.bc.ca/)

Surf Zone refers to the region between the initial break point of the wave and the beach as illustrated in Figure 4 [14].

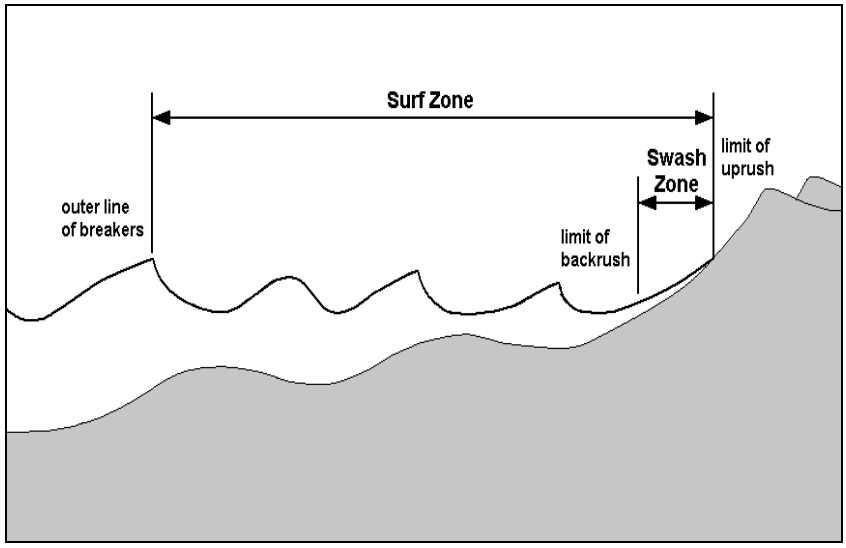

Figure 4 : Surf Zone illustration (Source : Terry Hedger)

These two types of sediment transport processes could lead to two results;

1. Accretion – When the amount of sediment settling at the shore is more than the amount of sediment leaving the shore;

2. Erosion – When the amount of sediment leaving the shore is greater than the amount of sediment settling at the shore.

Among these two, LST is the more problematic type of sediment transport for East Coast of Peninsular Malaysia. This is because most of the waves that approach the beach come at an oblique angle when at the breaking point the wave will be resolved to the longshore current and the cross shore current. The longshore current resolved from incoming oblique waves is the parameter that drives the LST processes parallel to the beach.

There are a few ways to solve erosion problems caused by LST such as by building hard structures and soft measures which includes land reclamation and beach nourishment. These procedures are costly and some studies say that it worsens the problem in the long run. This is because the coasts ability to adjust naturally will be reduced when the coasts are hardened by these structures. Therefore, prevention of these coastal hazards from happening is always better than doing control works after the damage is done.

In order for us to prevent coastal erosion and accretion from happening, we need to first understand the process of LST in detail at a particular area. One of the main drivers of LST process is the wave characteristic. The analyzing of wave climate data for the years 1999-2009 was done and the LST pattern for East Coast of Peninsular Malaysia was obtained.

In this research work, the indicator used to determine the longshore sediment transport movement pattern is the Longshore Sediment Transport Rate (LSTR). There are various ways to obtain the LSTR which among them are by; experimental and field data, empirical formula, numerical model, and neural networks [15]. For this research work, the author focused on using two different types of empirical formulas known as the CERC formula and Queen's formula to determine the LSTR.

These formulas require different parameters and have their own shortcomings since quantitative estimation of LSTR is extremely difficult [14]. The CERC formula is designed for sandy beach profile with sediment sizes of 2mm whereas for Queen's formula, they include the beach slope as well as sediment particle size in the equation. The values calculated was compared to the LSTR value obtained in the

year 1985 for the location of Cendering which was recorded to be in the range of 40,000 - 50,000 m^3/year by Stanley et. al (1985) [24].

1.2 PROBLEM STATEMENT

Shorelines undergo the accretion process, erosion process and are prone to changes. In some locations, the changes pose no threat to humans. However, in some areas the shoreline change is a major and costly problem. Coastal erosion resulting from LST processes had caused extensive damage to the coasts in Malaysia especially for the East Coast.

One of the areas affected is Cendering Beach located at 5°15'44"N 103°11'6"E and as a result the coastal activities such as fisheries, agriculture, industrial and recreational activities had been disturbed. The main objective of this research work is to be able to study the LSTR variability.

Along the way, the changes in the LSTR will be investigated by analyzing the wave climate and then comparing the values of LSTR obtained to previous year's findings. This research work is aimed to be able to help predict future occurrences so that mitigation and prevention of coastal hazards can be done in the future.

1.3 OBJECTIVE(S)

At the end of this research study, the author should achieve these objectives:

- Able to analyze the longshore sediment transport rate pattern with respect to time for the area of Cendering Beach, Terengganu;
- Able to predict longshore sediment transport (LST) variability for East Coast of Peninsular Malaysia;
- Able to determine the increase/decrease in longshore sediment transport rate (LSTR) throughout the years.

1.4 SCOPE OF STUDY

For the project to be feasible within the time frame of 24 weeks, the scope of study has been narrowed down to smaller parts. This study will cover several scopes, they are :

1. The area of study will be focused at Cendering Beach, Terengganu of the East Coast of Peninsular Malaysia coastline. This is because this area has been reported to experience severe erosion and due to availability of data. The sediment is also obtained from this area.

2. The duration of wave data obtained from UTP offshore bank will be taken from the year 1999-2009, a total of 10 years.

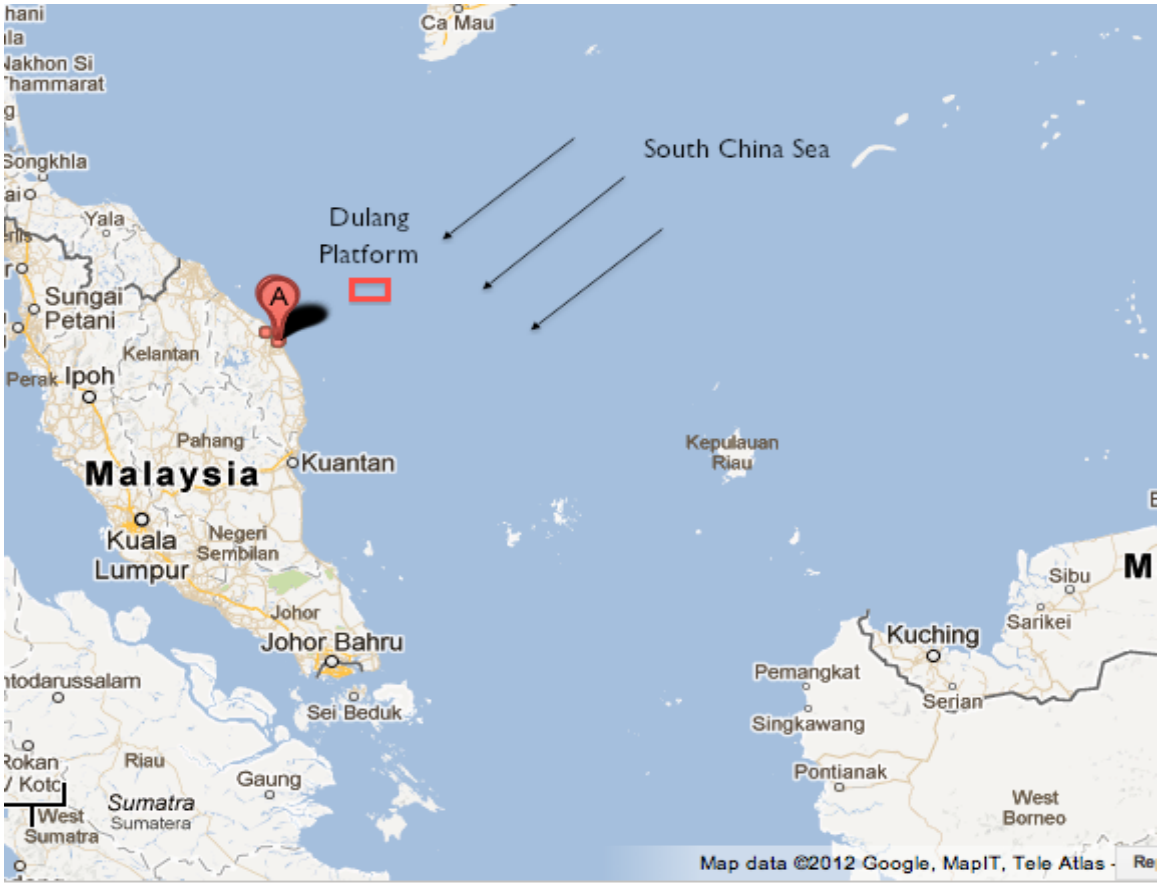

Figure 5 : *A*, the location of Cendering Beach and Dulang Platform (Source : Google Map)

CHAPTER 2

LITERATURE REVIEW AND THEORY

2.1 COASTAL EROSION

Coastal erosion has been a major problem for coastlines all around the world. At least 70% of coastlines for sandy beaches are receding [4]. In Skallingen, Denmark it is stated that the shore is eroding severely at an average rate of 3-5 m/year [3]. In China, an average of 25 m/year of coasts are lost due to erosion [5] and approximately 86% of the beach in the East Coast of the United States of America has experienced erosion for the past 100 years [6].

Malaysia is not excluded from this global problem. According to Abdullah, 1992 coastal erosion has been a major coastal problem for the East Coast of Peninsular Malaysia since the 1980's. A study conducted in 2008 reported that for the East Coast of Peninsular Malaysia alone, 52% of the coasts are being eroded [9].

As highlighted in Figure 6, the percentage of eroded coastal in the 3 states at the East Coast of Peninsular Malaysia are very high.

State	Distance	Eroded Coastal (Categerised as follows)						Total Of Distance/Eroded Coastals		
		Category 1		Category 2		Category 3				
	(KM)	(KM)	Unit	(KM)	Unit	(KM)	Unit	(KM)	Unit	(%)
Perlis	20	4.4	3	3.7	1	6.4	4	14.5	8	72.5
Kedah	148	31.4	16	2.2	1	9.9	3	43.5	20	29.4
Pulau Pinang	152	42.4	9	19.7	5	1.1	1	63.2	15	41.6
Perak	230	28.3	4	18.8	2	93.1	4	140.2	10	61.0
Selangor	213	63.5	10	22.3	7	66.1	3	151.9	20	71.3
N. Sembilan	58	3.9	2	7.7	4	12.9	1	24.5	7	42.2
Melaka	73	15.6	5	15.1	2	6	2	36.7	9	50.3
Johor	492	28.9	9	50.3	9	155.6	11	234.8	29	47.7
Pahang	271	12.4	11	5.2	3	107.8	8	125.4	22	46.3
Terengganu	244	20	6	10	6	122.4	10	152.4	22	62.5
Kelantan	71	5	3	9.5	3	37.6	5	52.1	11	73.4
W.P Labuan	59	2.5	2	3	2	25.1	2	30.6	6	51.9
Sarawak	1035	17.3	8	22.3	10	9.6	7	49.2	25	4.8
Sabah	1743	12.8	5	3.5	2	279.2	12	295.5	19	17.0
Total	**4809**	**288**	**93**	**193**	**57**	**933**	**73**	**1414.5**	**223**	**29.41**

Figure 6 : Percentage of eroded coastal in Malaysia (Source : Department of Irrigation and Drainage Malaysia)

One of the phenomena that drive coastal erosion is the LST process. At a village in North Carolina where the wave climate is reported to be among the most energetic in the US East Coast, erosion can be seen where maximum LSTR computed is as high as 1780 m^3/hr [11].

The longshore current that resolves from incoming oblique waves drives the LST processes. Oblique waves can occur naturally, and/or enhanced by human intervention such as the construction of hard structures like groynes and breakwaters. As mentioned by Marghany in one of his papers, the effects of wave forces or coastal engineering structures induces coastal hazards especially coastal erosion. These structures could trap sediment transport along the coastline as well as harden the coast which reduces the ability for the sediment transport to be in equilibrium and adapt naturally [24].

Besides that, groynes, piers and breakwaters that lie perpendicularly to the coast may physically block the movement of sediment along the shore causing accretion on one side of the structure and erosion on the other side of the structure as shown in Figure 7 [19].

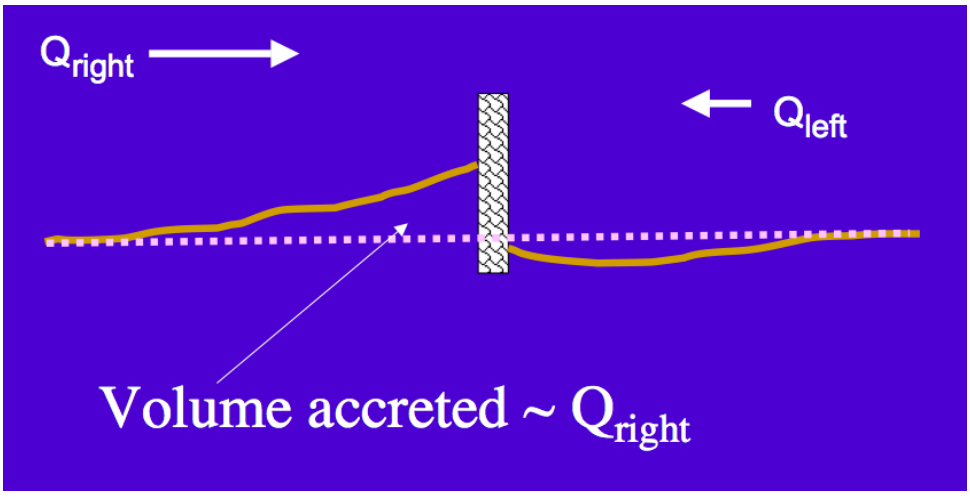

Figure 7 : Blocking of sediment movement in the existence of groynes. (Source : http://en.wikipedia.org/wiki/Longshore_drift)

In Kertih, Terengganu, 3 submerged breakwaters have been constructed to mitigate erosion. The plan was successful at first but after some time, erosion can be seen at the south and north of the protected shore area [7]. This is because the incoming oblique waves have been intensified at the unprotected part of the sea due to the obstructing breakwaters.

Besides that, the construction of breakwater to protect the jetty from harsh waves for Cendering Port has resulted in erosion at Pantai Rhu Rhendang [25] and construction at Kemaman Port resulted in erosion at Pupuk Semangat. As reported in 2012 by Dr. Azman Ibrahim, a few months after the construction of Lapangan Terbang Sultan Mahmud in Terengganu, 1 km of coastline experienced severe erosion [26].

Figure 8 : A collapsed hut as a result of erosion at Pantai Rhu, Kuala Terengganu. (Source : http://www.kosmo.com.my/)

Other than that, soft structures such as beach nourishment also result in LST process although it may not directly affect that particular beach. Beach nourishment activity that has been done for Pantai Padang Temu in Melaka, 1996 had caused erosion at the estuary and as a result the sediment settled at Sungai Duyong making the place shallower and poses navigation problems for fishermen. [23]

On the other hand, major coastal erosion problems that affected the villagers hit Kemaman in the year 1997. The Department of Irrigation Malaysia resorted to beach nourishment activities to increase the horizontal distance of the beach. However, after 6 years of implementing this activity, the coastal area experienced a far more serious erosion problem compared to before. Higher wave heights with high frequencies have been identified as the source of problem. This has resulted in more wave breaking happening thus worsening the erosion problem for this area. [23]

Natural causes of LST include the wave climate properties such as the wave height, wave period, approaching angle, and the wave frequency [22]. Studies have stated that erosion at the East Coast of Peninsular Malaysia is intensified by the strong waves energy during the Northeast Monsoon season which prevails from the month of October to March [9].

It was recorded that 65% of the waves during NorthEast Monsoon season approach from a degree of 30°-60° and that December has the most amount of occurrences of wave heights greater than 2 m [10]. A report by Malaysia Kini stated that in December 2011, strong five meter high waves which was the worst ever in 50 years had hit Teluk Lipat, Terengganu beach coastline which extended up to three kilometers on shore. This phenomenon damaged the road forcing it to be closed temporarily. Kosmo Malaysia reported that for the same month, the coastlines of Kambung Kubang Badak and Tok Jembal in Kuala Terengganu was badly affected due to coastal erosion.

Figure 9 : Severe erosion at Teluk Lipat in December, 2011 (Source : http://malaysiakini.com.my/)

Besides that, coastlines that experience 4 seasons may be affected differently depending on the changing seasons. At the coastline of Kansai Airport, Osaka erosion took place from autumn to winter and accretion took place from spring to summer. This could be explained by the disappearance of berm and retreat of shoreline during autumn and winter seasons. However, the eroding rate is higher than

the accretion rate during summer which makes the recovery of the shoreline not possible for this particular beach. [27]

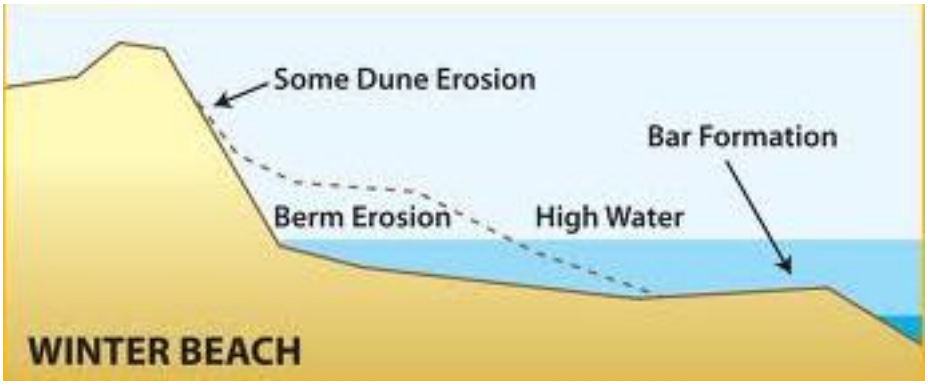

Figure 10 : Dissapearing of berm during winter. (Source : http://www.seagrant.umaine.edu/book/export/html/375)

The rise in sea level also results in coastal erosion (Bruun's Rule, 1962 & 1983). This is because rising sea levels will cause severe storm waves to occur more frequently [21]. As we all know, public consciousness of global warming has grown tremendously all around the world [20].

It is stated in the Project Document (UNEP, 1988) that if action were not taken to reduce emission of greenhouse gases, the effect would be double concentration of carbon dioxide as early as 2030. This will lead to a rise in global temperature between 1.5°C - 4.5°C that estimates a rise in global mean sea level between 20 cm to 140 cm.

According to Intergovernmental Panel on Climate Change's (IPCC) Fourth Report, global sea levels could rise up to 0.6 m by 2100. (IPCC, 2007). A more recent study by Vermeer and Rhamstorf in the year 2009 suggests that the IPCC's estimate is too low and that global sea level rise would be as much as 2 m by 2100 [21].

2.2 LONGSHORE SEDIMENT TRANSPORT EQUATIONS

For my research work, I focused on using two different types of longshore sediment transport (LST) empirical formulas which are CERC formula and Queen's formula to evaluate the longshore sediment transport rate (LSTR) along the coastline. However, there are numerous other equations out there such as Bijker's formula and Bailard formula [15].

These equations give different weightage of importance on its parameters to be able to adapt for different locations, situations and scenarios. The most suitable equation should be chosen for each area of study since quantitative estimation of LSTR is extremely difficult [14].

CERC equation that was derived from sand beaches in 1984 by the US Army Corps of Engineers is the most widely used formula [18]. It is based on the principle that volume of transported sand is directly proportional to the longshore wave power per unit length. The application of this formula is suitable for sandy beaches, thus the selection for the use in this research [28].

This equation is suitable for wave heights of more than 4 m and only takes into account the incoming wave height, angle, and period as the input. According to Liu (2001), this is unrealistic since the grain size and beach slope which plays a major role in the transport rate is not included in the equation [16].

$$S(m^3/s) = AH^2 n_o c_o \sin\theta_o \cos\theta_o$$

Figure 11 : CERC formula (US Army Corp, 1984)

where A = constant relating sand transport to longshore energy flux, H = Significant Wave Height in Deep Water, n_o = wave number at deep water, c_o = wave celerity in deep water and θ_o = wave angle in deep water.

Improvement to the CERC formula has been made by Bailard (1984) and Kamphuis (1990). Bailard modified the K coefficient by including the grain size representation in the equation [14]. This K value will be to be included as a constant in the CERC Equation.

$$K = 0.05 + 2.6 \sin^2 2\theta_b + 0.007 \mu_b/\omega_s$$

Figure 12 : K coefficient modification. (Bailard, 1984)

Where ω_s = fall velocity that represents the grain size, and θ_b = wave breaking angle.

Queen's Formula is derived from extensive lab test and field data. It is suitable for sandy beaches with low wave energy. This formula included the wave peak period, sediment size, bed slope, sediment particle properties, wave breaking angle and wave height into the empirical formula[16].

$$Q_{LS}(m^3/year) = 6.4 \times 10^4 \, H_{sb}^2 T_P^{1.5} (\tan \beta)^{0.75} D_{50}^{-0.25} (\sin 2\theta_b)^{0.6}$$

Figure 13 : Queen's formula (1990)

Where H_{sb}=wave height at breaking point, T_P= peak period, β = bed slope, D_{50} = sediment size and θ_b = wave angle at breaking point.

The suitability of the two equations which are for sandy beaches, and also CERC equation that is suitable for wave heights of more than 4 m and Queen's formula that is suitable for beach with low wave energy makes these two equations a perfect combination to be used.

This is because based on the wave height data, the range is in between high waves, particularly during the Northeast Monsoon season and low waves during other time of the year. From the CERC and Queen's equations above, it shows that the wave heights affect the longshore sediment transport rate (LSTR) by a power of two.

A study conducted in 2012 in Istanbul, Turkey stated that the comparison between measured value of LSTR and calculation using Kamphuis formula resulted in a percentage difference of 15.3% while CERC formula obtained a percentage difference of 413.9%. This is because Kamphuis is more suitable to be used for beach that has waves of low energy while CERC are suitable for wave heights of more than 4m [17]. The suitability of the equation differs from one location to another.

CHAPTER 3

METHODOLOGY

3.1 RESEARCH METHODOLOGY

When conducting the research study on sediment transport variability in the East Coast of Peninsular Malaysia, it is important to understand the basic and causes of this occurrence. The current condition of the shoreline such as the wave climate and the longshore sediment transport rate (LSTR) at respective locations along the beach as well as for other parts of the world were studied in order to be able to explain the reason behind these occurrences.

Since this is a research project, it was conducted based on information and data obtained from site and is backed up with calculations. The use of software particularly Microsoft Office Excel is useful in helping to organize the data and conducting calculations. Laboratory tests particularly the sieve analysis test was done to the sediment sample obtained at Cendering Beach to determine the sediment particle properties.

In general, the workflow of the study is illustrated as in Figure 14 :

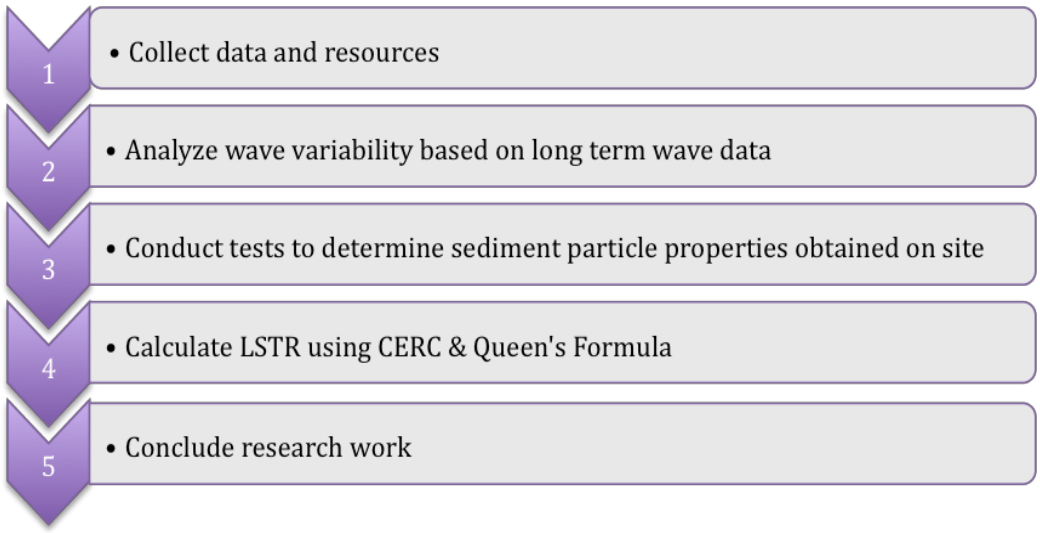

Figure 14 : Flow of Project

3.2 DATA AND HARDWARE/SOFTWARE TOOLS REQUIRED

Among the data and tools utilized to assist the author in completing this research work are listed below:

No.	Tools	Remarks
1	Long-term Wave Data	The data was obtained through online research and from UTP Civil Engineering Offshore Data Bank. The wave data obtained provides the significant wave height, H_s, peak wave period, wave breaking angle from (Dulang Project) May 1999 up to March 2006, (Bekok Project) January 2001 until April 2009 collected at intervals of 10 minutes.
2	Past journals and reports related to the research work	This will further enhance the knowledge of the author regarding the research topic.
3	Empirical Formulas	Compare and decide on the most suitable empirical formula for this research and aid in the calculation of LSTR.
4	Microsoft Office Excel	This software aids in data organizing and when making respective calculations.
5	Shaker, sieve, etc	These apparatus were used in the sieve analysis test for determining the sediment size and sediment density.

Table 1 : Tools used for this research project

3.3 PROJECT'S ACTIVITIES AND SCHEDULE

FYP is divided into FYP1 and FYP2. For the previous semester, the author underwent FYP1 that is basically the research process by obtaining and analyzing data based on reliable resources. This was to mainly develop total understanding of the wave climate, process of LST and make initial observations and hypotheses.

This second part of FYP allowed further results to be obtained backed up by quantitative evidence. Analyzing the long-term wave data is essential for this research work. The LSTR was also calculated using the two equations, CERC formula and Queen's formula to analyze the pattern and changes throughout the years.

The steps of wave analyzing and obtaining the longshore sediment transport rate (LSTR) are shown below,

Analyze Wave Variability

Step 1 : The wave data from 1999 to 2009 is organized and error data was deleted.

Step 2 : The maximum and average wave height for each month is calculated.

Step 3 : The data of the daily wave height that is taken at an interval of 10 minutes is computed as a graph. The monthly wave data is computed for monthly value for the duration of 10 years. Any peculiarity in the wave pattern is recorded.

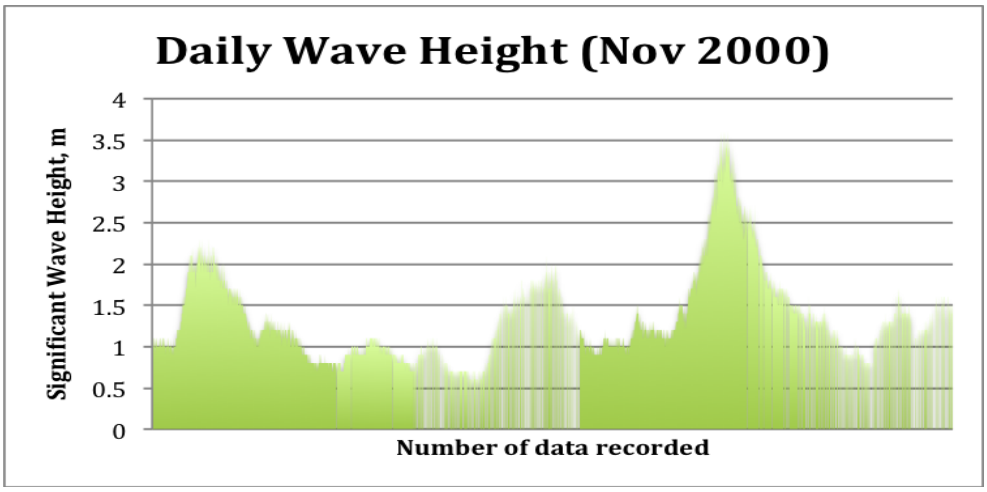

Figure 15 : Example of Daily Wave Height computation for the month of November 2000.

Step 4 : The Average and Maximum significant wave height for each month was computed in a graph to make comparison of the wave pattern for the whole year.

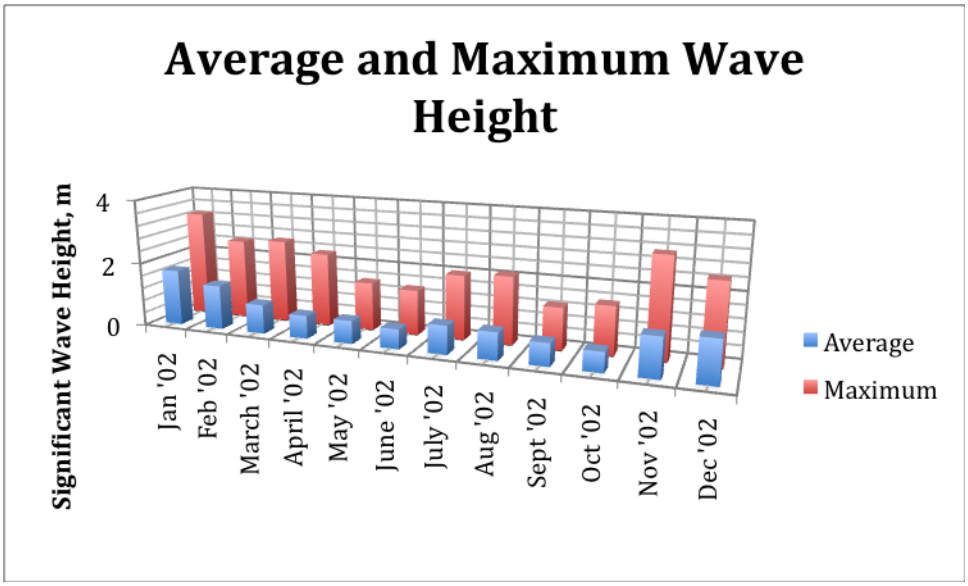

Figure 16 : Example of the chart showing the Average Wave Height and Maximum Wave Height for the Year 2002.

Calculate Longshore Sediment Transport Rate

Step 1 : The longshore sediment transport equations was selected based on the suitability for the study area. In this case, the Cendering Beach is a sandy area and

the two suitable empirical equations for this type of beach are CERC formula and Queen's formula.

Step 2 : The parameters needed are obtained. (wave height, wave breaking angle, wave celerity, peak period, bed slope, sediment size, wave number)

Step 3 : The calculation is done using Microsoft Office Excel (Appendix)

The table below shows the Key Milestone and Gantt Chart for the first and second semester of the Final Year Project;

Table 2 : Key Milestone & Gantt Chart

No.	Detail/Week	1	2	3	4	5	6	7		8	9	10	11	12	13	14	15+
	Date	17/9-23/5	24/9-30/9	1/10-7/10	8/10-14/10	15/10-21/10	22/10-28/10	29/10-31/10	1/11-4/11	5/11-11/11	12/11-18/11	19/11-25/11	26/11-2/12	3/12-9/12	10/12-16/12	17/12-23/12	24/12-6/12
1	Selection of Project Topic Selection & Research Work	FYP 1							Mid-Semester Break	FYP 1							
2	Analysis of Wave Variability																
3	Project Work Continues																
	-Wave Analysis Continues																
	-Distinguish a pattern for the wave climate																
4	Submission of Progress Report									9/11							
5	Project Work Continues																
	-Lab Work -Conclude the project work																
6	Pre-SEDEX												28/11				
7	Submission of Draft Report													7/12			
8	Submission of Dissertation (Softbound)														12/12		
9	Submission of Technical Paper														12/12		
10	Oral Presentation															19/12	
11	Submission of Project Dissertation (Hardbound)																

Suggested Milestone

Process

CHAPTER 4

RESULTS AND DISCUSSION

From the sieve analysis test, the sediment particle properties are obtained. The median grain size of the sediment, D_{50} is found to be 0.89 mm and has a density of 1455.28 kg/m^3. Other values that are obtained by making valid assumptions or by past papers are porosity to be at -0.39 and bed slope to be taken at 0.00025. The value of constant A was taken as 0.005 according to the Shore Protection Manual.

As reported by Muzathik (2011), 65% of the waves at the East Coast of Peninsular Malaysia during Northeast Monsoon season approach from a degree of 30°-60°. From the graph below, it can be seen that the effect to the LSTR is high when wave breaks at an angle of 30°-60°. The longshore sediment transport effect is the highest when the wave approaches at an angle of 45°.

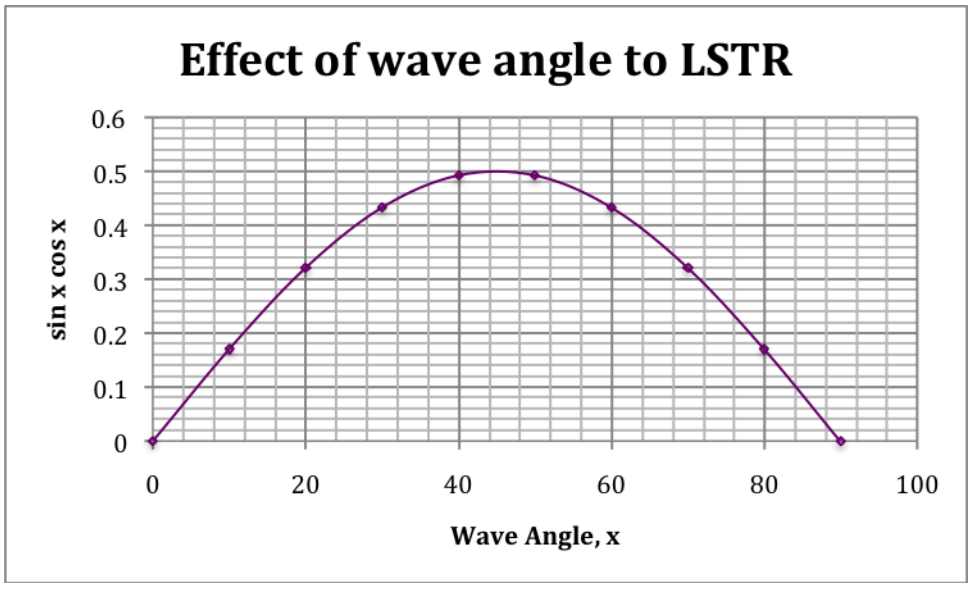

Figure 17 : Effect of wave angle to LSTR.

As in the two empirical formulas used, (CERC & Queen's formula), the wave height affects the LSTR by a power of two which is very significant. December has the most amounts of occurrences of wave heights greater than 2 m [10]. The wave height obtained from the Dulang platform can be illustrated as in Figure 18.

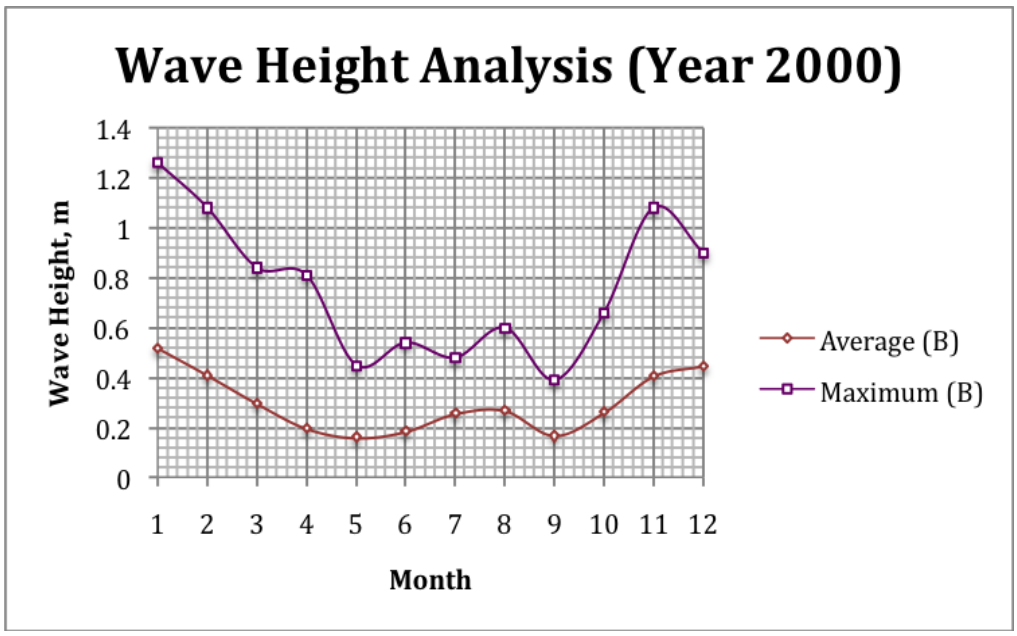

Figure 18 : Wave Height Analysis for the year 2000.

The maximum wave height are higher for the months of January-March and October-December, the months when northeast monsoon season hails. Based on these data, the LSTR is analysed to be as in Figure 19 and 21 (a) & (b) for the year 2000.

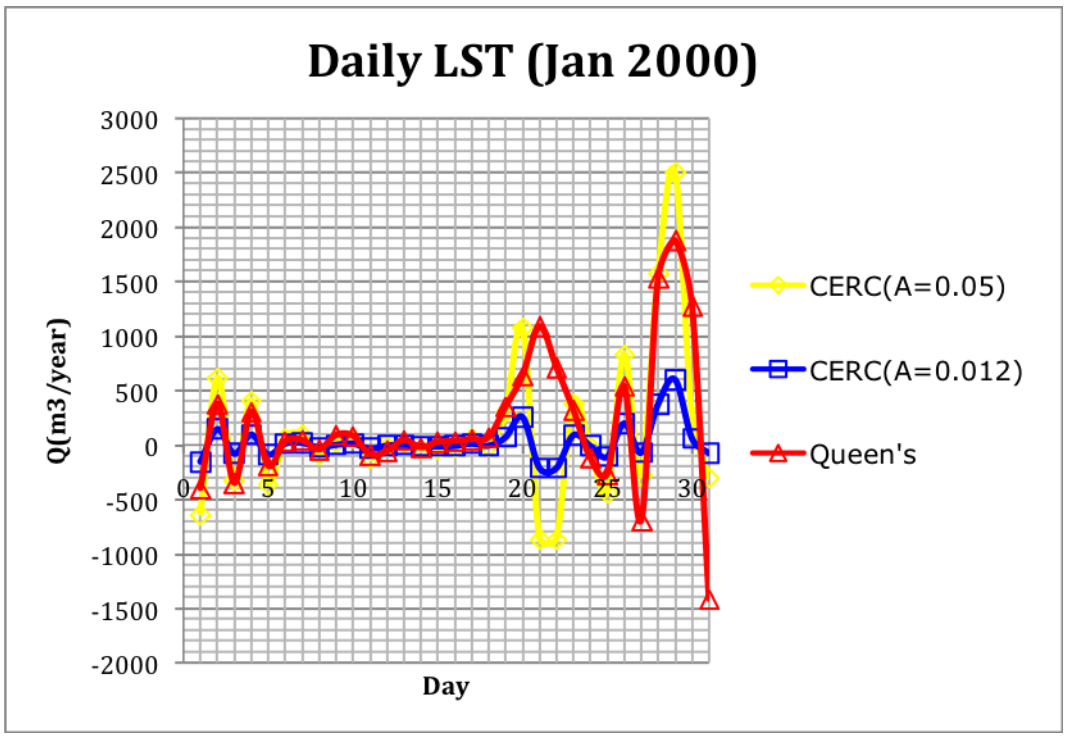

Figure 19 : The daily LSTR for the month of January, 2000.

Figure 19 shows the fluctuations of the daily longshore sediment transport rate for the month of January in the year 2000. We can see that the value varies from day to day. The first 5 days, the rate is 500 m^3/year and from the 6^{th} day of the month, the rate is at its minimum. Towards the end of the month, the LST is high.

This is because the 8^{th} of January is the 1^{st} of Syawal according to the islamic calendar. At this time, the moon is in the shape of a crescent which means the tide is low. At 15^{th} Syawal, which is 22^{nd} January 2000 the moon is experiencing full moon and as a result of the gravitational forces from the moon, the ocean experience high tide. The high tide could be the reason for the sudden increase in the LSTR. The illustration of high tide from the gravitational forces of the moon during full moon can be seen in Figure 20 :

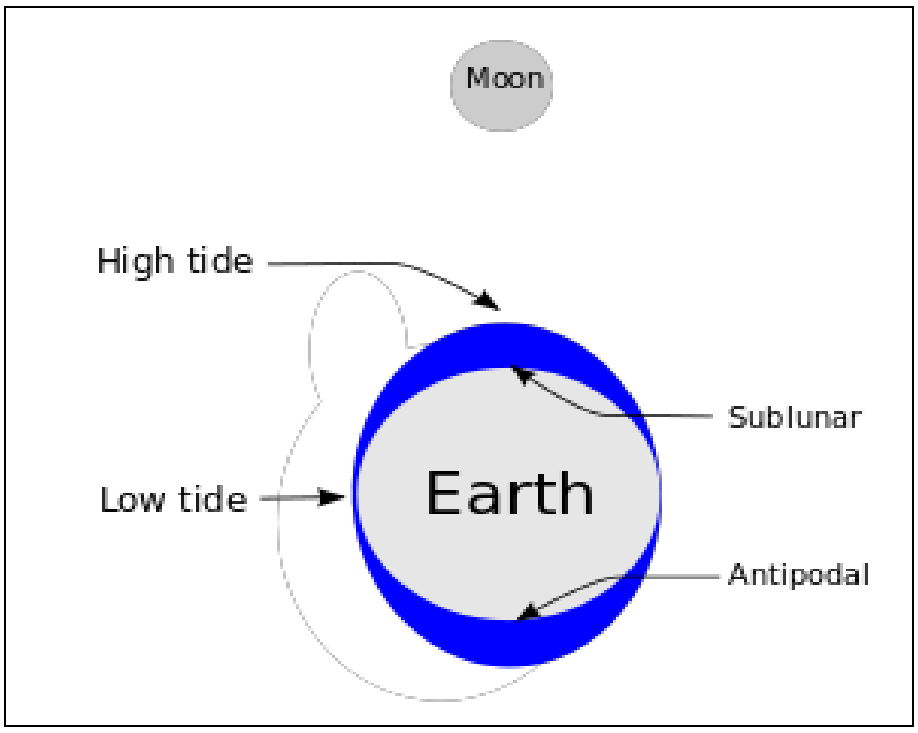

Figure 20 : High tide during full moon (Source : http://en.wikipedia.org/wiki/Tide)

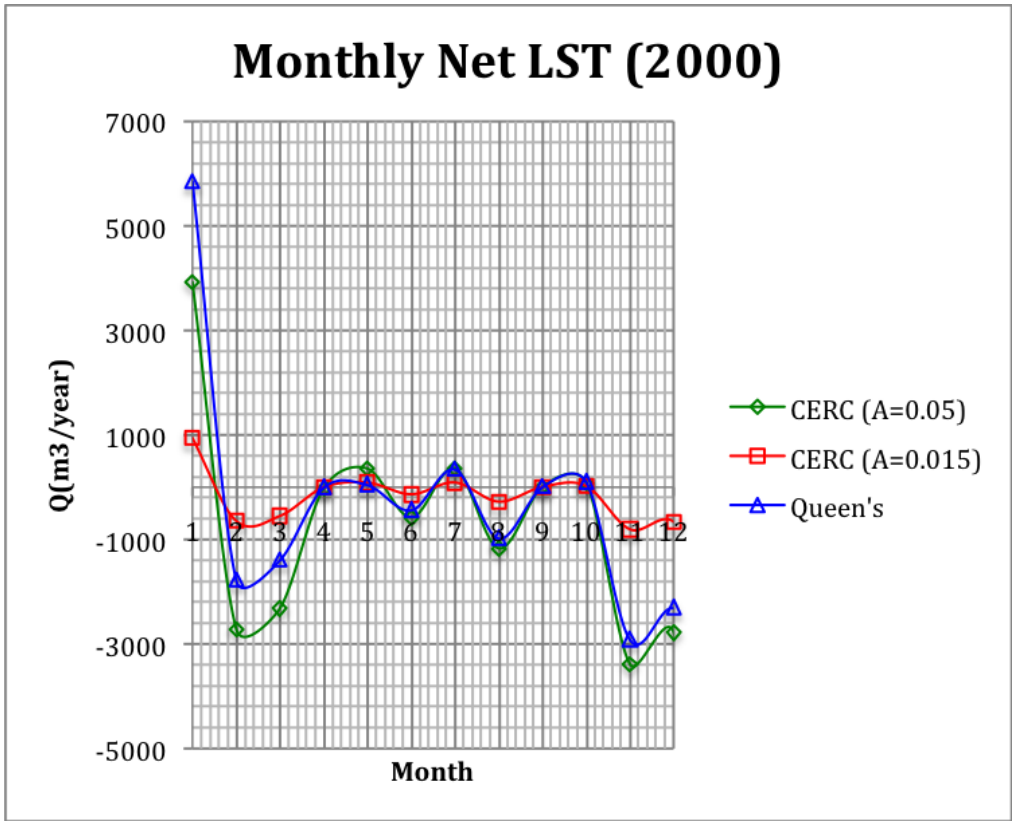

Figure 21 (a) : The monthly net LSTR for the year 2000.

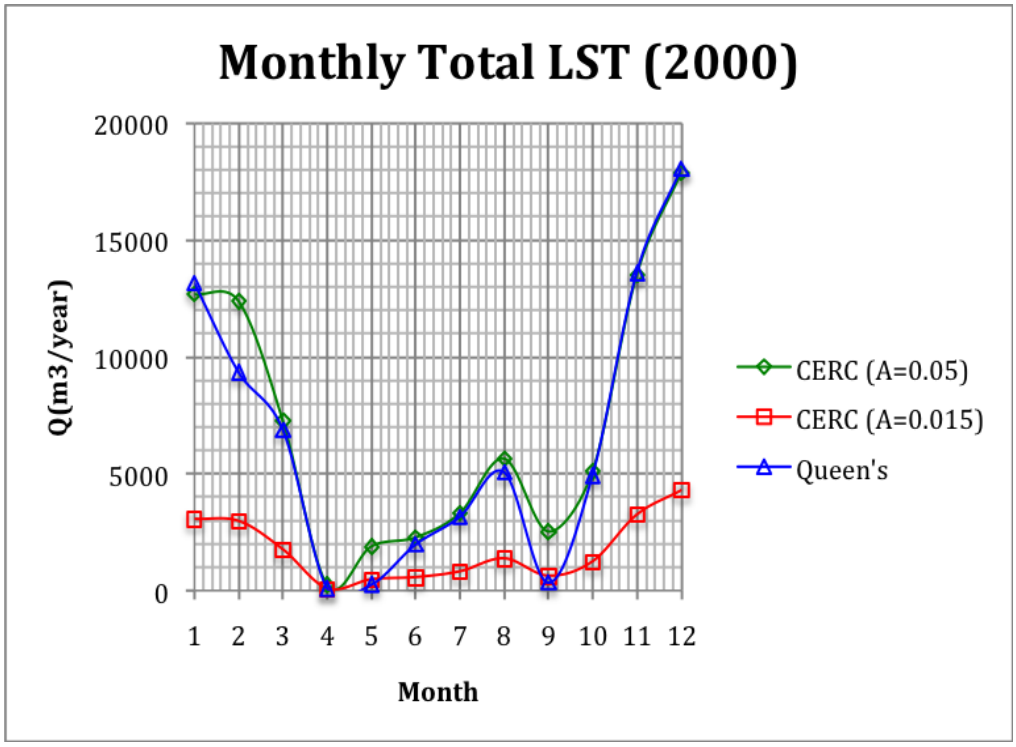

Figure 21 (b) : The monthly total LSTR for the year 2000.

For Figure 21 (a) and 21 (b), the graphs show the monthly LSTR for the year 2000. Figure 21 (a) presents the net longshore sediment transport rate which shows the LST direction of sediments; erode away or settle at that location. The area above the equilibrium indicates accretion of sediment whereas the area below the equilibrium indicates erosion.

As seen in the graph, the area below equilibrium is more than the area above the equilibrium. We can conclude that erosion is happening for Chendering Beach. Erosion is most severe for the months of January up to March and from October to December, the months when northeast monsoon season hails.

A research done by Stanley et al. in 1985 stated that the rate of LST is at a range of 40, 000 - 50, 000 m^3/year for Chendering Beach [24]. The calculation done using the combination of the two equations of CERC and Queen's formula has found that the range to be between 70, 000 - 90, 000 m^3/year in 2000. It can be concluded that there is an increase of 80% for the longshore sediment transport rate within a duration of 15 years.

The increase in the LSTR could be due to the construction of the coastal structure of Cendering Port which starts operating in the year 1992. The value calculated are subjected to a few assumptions they are ;

- The breaking wave height is taken to be 0.3 times the deep water wave height obtained from the wave data based on the distance between the assumed breaking point and the point of data measurement.
- The wave direction is taken to be the same as the wind approaching direction.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

It can be concluded that natural phenomena and human intervention aggravates longshore sediment transport processes. For natural phenomena, the tidal variation and wave characteristics play important roles. During high tide, the longshore sediment transport process will increase. For wave characteristics, higher wave height, wave breaking angle nearing 45°, higher wave period, and smaller grain size will increase the LST process.

The LST process is high during the northeast monsoon season which hails from October to March since higher wave heights, period and angle between 30°-60° has been reported for that time. The value of longshore sediment transport rate has also increased by 80% since 1985. This value is expected to increase in the future and prevention activities should be done.

For continuation of this research project, I would recommend more data to be analyzed to represent a more accurate picture of the LSTR. Besides that, the method of research can be converted to spatially instead of timely as in this research so that variation of LST pattern can be seen by comparing the LSTR from one location to another.

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APPENDICES

APPENDIX I

Calculation of Longshore Sediment Transport (LSTR) using CERC formula

Date	A (SPM)	A (Kamphuis)	H_o	n_o	c_o	ϕ_o	T	L	S (A=0.050)	S (A=0.012)	Q (A=0.050)	Q (A=0.012)
1/1/2000	0.05	0.012	1.85	0.5	7.462094208	55.68	4.78	35.66881031	-0.314820863	-0.075557007	-636.831982	-152.8396757
2/1/2000	0.05	0.012	1.86	0.5	7.30598345	60.34	4.68	34.19200255	0.304389503	0.073053481	615.7310187	147.7754445
3/1/2000	0.05	0.012	1.92	0.5	7.227928071	67.79	4.63	33.46530697	-0.157193335	-0.0377264	-317.9768394	-76.31444146
4/1/2000	0.05	0.012	1.82	0.5	7.290372374	69.48	4.67	34.04603899	0.20128258	0.048307819	407.1622933	97.71895038
5/1/2000	0.05	0.012	1.47	0.5	7.009373011	68.53	4.49	31.47208482	-0.174333154	-0.041839957	-352.6479381	-84.63550515
6/1/2000	0.05	0.012	0.98	0.5	6.68154042	85.04	4.28	28.596993	0.033729128	0.008094991	68.22860139	16.37486433
7/1/2000	0.05	0.012	0.81	0.5	5.900986633	70.04	3.78	22.30572947	0.046522386	0.011165373	94.10730529	22.58575327
8/1/2000	0.05	0.012	0.75	0.5	5.448265436	52.69	3.49	19.01444637	-0.037951025	-0.009108246	-76.76882086	-18.42451701
9/1/2000	0.05	0.012	0.95	0.5	6.494207511	47.2	4.16	27.01590325	0.011109071	0.002666177	22.4718646	5.393247505
10/1/2000	0.05	0.012	0.94	0.5	6.213208148	50.52	3.98	24.72856843	0.033443301	0.008026392	67.65041958	16.2361007
11/1/2000	0.05	0.012	1.01	0.5	5.963430936	52.3	3.82	22.78030617	-0.060839675	-0.014601522	-123.0688793	-29.53653103
12/1/2000	0.05	0.012	0.92	0.5	6.088319542	70.73	3.9	23.74444621	-0.005682368	-0.001363768	-11.49451615	-2.758683876
13/1/2000	0.05	0.012	0.78	0.5	5.713653724	62.95	3.66	20.91197263	0.010172239	0.002441337	20.576804	4.938432961
14/1/2000	0.05	0.012	0.56	0.5	5.448265436	37.25	3.49	19.01444637	-0.016706061	-0.004009455	-33.79367591	-8.110482219
15/1/2000	0.05	0.012	0.57	0.5	5.729264799	39.73	3.67	21.02640181	-0.018514629	-0.004443511	-37.45211637	-8.988507928
16/1/2000	0.05	0.012	0.66	0.5	5.635598345	89.73	3.61	20.34451003	-0.011644221	-0.002794613	-23.55438749	-5.653052997
17/1/2000	0.05	0.012	0.84	0.5	5.557542966	56.9	3.56	19.78485296	0.03167774	0.007602658	64.07897371	15.37895369
18/1/2000	0.05	0.012	0.9	0.5	5.994653087	61.3	3.84	23.01946785	-0.004722611	-0.001133427	-9.553082088	-2.292739701
19/1/2000	0.05	0.012	1.77	0.5	7.290372374	57.84	4.67	34.04603899	0.15139436	0.036334646	306.2464453	73.49914687
20/1/2000	0.05	0.012	2.28	0.5	8.429980904	66.64	5.4	45.52189688	0.532379319	0.127771037	1076.917757	258.4602616
21/1/2000	0.05	0.012	2.57	0.5	9.07003501	55.28	5.81	52.69690341	-0.425450388	-0.102108093	-860.6177225	-206.5482534

22/1/2000	0.05	0.012	2.13	0.5	8.789035646	42.93	5.63	49.48227069	-0.429095038	-0.102982809	-867.9902644	-208.3176634
23/1/2000	0.05	0.012	1.58	0.5	7.743093571	51.38	4.96	38.40574411	0.191141098	0.045873864	386.6477066	92.79544959
24/1/2000	0.05	0.012	1.25	0.5	7.118650541	105.28	4.56	32.46104647	-0.010181145	-0.002443475	-20.59481989	-4.942756775
25/1/2000	0.05	0.012	1.6	0.5	6.884484405	55.66	4.41	30.36057623	-0.215621279	-0.051749107	-436.1671758	-104.6801222
26/1/2000	0.05	0.012	2.06	0.5	7.789926798	54.22	4.99	38.87173472	0.41259062	0.099021749	834.6044788	200.3050749
27/1/2000	0.05	0.012	2.27	0.5	8.273870146	58.25	5.3	43.85151178	-0.137557947	-0.033013907	-278.257608	-66.78182593
28/1/2000	0.05	0.012	3.02	0.5	9.194923616	44.4	5.89	54.1581001	0.777362244	0.186566938	1572.478819	377.3949166
29/1/2000	0.05	0.012	3.18	0.5	9.834977721	47.96	6.3	61.96035964	1.236801588	0.296832381	2501.850734	600.4441761
30/1/2000	0.05	0.012	2.83	0.5	9.023201782	53.48	5.78	52.1541063	0.131283003	0.031507921	265.5644048	63.73545715
31/1/2000	0.05	0.012	2.93	0.5	9.132479313	50.19	5.85	53.42500398	-0.147386972	-0.035372873	-298.1401453	-71.55363487
								Net Sum	1.937577467	0.465018592	3919.407652	940.6578366
								Total			12680.23	3045.41

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/2/2000	0.05	0.012	3.1	0.5	9.460311903	45.21	6.06	57.32949013	0.720026333	0.17280632	1456.497492	349.5593982
2/2/2000	0.05	0.012	2.79	0.5	9.194923616	45.87	5.89	54.1581001	-0.5298473	-0.127163352	-1071.795888	-257.231013
3/2/2000	0.05	0.012	2.08	0.5	8.913924252	144.2	5.71	50.89850748	-0.282650442	-0.067836106	-571.7563933	-137.2215344
4/2/2000	0.05	0.012	1.47	0.5	8.398758752	265.85	5.38	45.18532209	-0.15806292	-0.037935101	-319.7358705	-76.73660891
5/2/2000	0.05	0.012	1.34	0.5	8.726591343	140.23	5.59	48.78164561	-0.148213994	-0.035571359	-299.8130779	-71.95513869
6/2/2000	0.05	0.012	1.32	0.5	9.007590707	216.36	5.77	51.97379838	-0.143411463	-0.034418751	-290.0983299	-69.62359917
7/2/2000	0.05	0.012	1.6	0.5	9.616422661	176.68	6.16	59.23716359	0.306989589	0.073677501	620.9905744	149.0377378
8/2/2000	0.05	0.012	1.79	0.5	8.617313813	71.01	5.52	47.56757225	-0.208411549	-0.050018772	-421.5830503	-101.1799321
9/2/2000	0.05	0.012	2.06	0.5	8.757813495	76.54	5.61	49.1313337	0.351467255	0.084352141	710.9617411	170.6308179
10/2/2000	0.05	0.012	1.74	0.5	9.07003501	68.05	5.81	52.69690341	-0.290956081	-0.069829459	-588.5573662	-141.2537679
11/2/2000	0.05	0.012	1.24	0.5	8.351925525	71.89	5.35	44.68280156	-0.10743822	-0.025785173	-217.3302424	-52.15925819
12/2/2000	0.05	0.012	0.95	0.5	7.227928071	35.25	4.63	33.46530697	0.080136137	0.019232673	162.1025186	38.90460446
13/2/2000	0.05	0.012	0.94	0.5	6.603485041	39.77	4.23	27.93274173	-0.061380337	-0.014731281	-124.1625518	-29.79901244
14/2/2000	0.05	0.012	0.92	0.5	6.088319542	62.25	3.9	23.74444621	-0.059150269	-0.014196065	-119.6514836	-28.71635605
15/2/2000	0.05	0.012	0.78	0.5	5.463876512	73.57	3.5	19.12356779	0.020460939	0.004910625	41.38918871	9.93340529
16/2/2000	0.05	0.012	1.63	0.5	6.915706556	75.42	4.43	30.63658004	0.009999973	0.002399994	20.22833778	4.854801066
17/2/2000	0.05	0.012	1.73	0.5	7.290372374	75.23	4.67	34.04603899	-0.090041863	-0.021610047	-182.1402099	-43.71365038
18/2/2000	0.05	0.012	1.28	0.5	7.30598345	77.64	4.68	34.19200255	-0.14572593	-0.034974223	-294.7801235	-70.74722964
19/2/2000	0.05	0.012	0.9	0.5	6.587873966	87.38	4.22	27.80082813	-0.061394976	-0.014734794	-124.1921651	-29.80611962
20/2/2000	0.05	0.012	0.64	0.5	6.494207511	75.55	4.16	27.01590325	0.009938936	0.002385345	20.10486933	4.825168638
21/2/2000	0.05	0.012	0.56	0.5	6.587873966	91.51	4.22	27.80082813	0.018662007	0.004478882	37.75023964	9.060057514

22/2/2000	0.05	0.012	0.45	0.5	5.479487588	54.64	3.51	19.23300143	0.008675338	0.002082081	17.54881403	4.211715367
23/2/2000	0.05	0.012	3.1	0.5	5.307765754	112.3	3.4	18.04640356	-0.637413654	-0.152979277	-1289.385327	-309.4524784
24/2/2000	0.05	0.012	2.79	0.5	4.714544876	63.31	3.02	14.23792553	0.374811024	0.089954646	758.1824315	181.9637836
25/2/2000	0.05	0.012	2.08	0.5	5.057988542	49.79	3.24	16.38788288	-0.222651865	-0.053436448	-450.3889211	-108.0933411
26/2/2000	0.05	0.012	1.47	0.5	6.369318905	61.14	4.08	25.98682113	0.041248234	0.009899576	83.43854525	20.02525086
27/2/2000	0.05	0.012	2.37	0.5	8.523647358	52.5	5.46	46.53911458	-0.580822601	-0.139397424	-1174.910726	-281.9785742
28/2/2000	0.05	0.012	1.99	0.5	8.086537237	60.12	5.18	41.88826289	0.303223538	0.072773649	613.3724598	147.2093904
29/2/2000	0.05	0.012	1.72	0.5	7.508927435	79.84	4.81	36.11794096	0.143057081	0.034333699	289.3814714	69.45155313
								Net Sum	-1.33887708	-0.321330499	-2708.333042	-649.99993
								Total			12372.2304	2969.3352

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/3/2000	0.05	0.012	1.65	0.5	12.16102801	72.74	7.79	94.73440818	0.340618082	0.08174834	689.0156091	165.3637462
2/3/2000	0.05	0.012	1.42	0.5	12.33274984	62.21	7.9	97.42872374	-0.29436624	-0.070647898	-595.45557	-142.9093368
3/3/2000	0.05	0.012	1.33	0.5	12.53569383	66.02	8.03	100.6616214	0.025770542	0.00618493	52.12966246	12.51111899
4/3/2000	0.05	0.012	1.08	0.5	12.84791534	63.42	8.23	105.7383433	0.172933964	0.041504151	349.8176006	83.95622415
5/3/2000	0.05	0.012	0.81	0.5	12.84791534	67.71	8.23	105.7383433	-0.034295149	-0.008230836	-69.37357225	-16.64965734
6/3/2000	0.05	0.012	0.64	0.5	13.98752387	78.84	8.96	125.3282139	0.040459213	0.009710211	81.84248204	19.64219569
7/3/2000	0.05	0.012	0.63	0.5	14.12802355	111.66	9.05	127.8586131	-0.018487871	-0.004437089	-37.39798919	-8.975517406
8/3/2000	0.05	0.012	0.63	0.5	13.81580204	90.19	8.85	122.269848	-0.066212013	-0.015890883	-133.9362554	-32.1447013
9/3/2000	0.05	0.012	0.73	0.5	12.5513049	8076	8.04	100.9124914	-0.073427287	-0.017622549	-148.531594	-35.64758257
10/3/2000	0.05	0.012	0.97	0.5	12.4888606	87.78	8	99.91088479	-0.053004608	-0.012721106	-107.2197992	-25.73275181
11/3/2000	0.05	0.012	0.91	0.5	13.40991407	86.96	8.59	115.1911618	-0.125682905	-0.030163897	-254.2363061	-61.01671346
12/3/2000	0.05	0.012	0.68	0.5	15.48618714	169.94	9.92	153.6229764	0.04965062	0.011916149	100.4352199	24.10445276
13/3/2000	0.05	0.012	0.66	0.5	16.01696372	113.81	10.26	164.3340477	0.086291253	0.020709901	174.5533301	41.89279923
14/3/2000	0.05	0.012	0.44	0.5	17.35951623	72.85	11.12	193.0378205	0.038949668	0.00934792	78.78891529	18.90933967
15/3/2000	0.05	0.012	0.41	0.5	16.93801719	49.57	10.85	183.7774865	-0.035017063	-0.008404095	-70.83388783	-17.00013308
16/3/2000	0.05	0.012	0.54	0.5	12.83230426	50.63	8.22	105.4815411	0.031158347	0.007478003	63.02832514	15.12679803
17/3/2000	0.05	0.012	0.53	0.5	13.5191916	65.92	8.66	117.0761992	-0.005064401	-0.001215456	-10.24446934	-2.458672641
18/3/2000	0.05	0.012	0.49	0.5	14.42463399	50.65	9.24	133.2836181	0.030107037	0.007225689	60.90169387	14.61640653
19/3/2000	0.05	0.012	0.52	0.5	13.20697008	50.73	8.46	111.7309669	0.035758193	0.008581966	72.33307486	17.35993797
20/3/2000	0.05	0.012	0.64	0.5	16.42285169	68.87	10.52	172.7683997	-0.039578273	-0.009498785	-80.06048156	-19.21451557
21/3/2000	0.05	0.012	0.76	0.5	16.03257479	57.09	10.27	164.6545431	0.102236201	0.024536688	206.8073951	49.63377482

22/3/2000	0.05	0.012	0.79	0.5	12.95719287	96.5	8.3	107.5447008	-0.098904642	-0.023737114	-200.0681867	-48.0163648
23/32000	0.05	0.012	0.77	0.5	15.6422979	111.82	10.02	156.735825	-0.064201518	-0.015408364	-129.869347	-31.16864329
24/3/2000	0.05	0.012	0.83	0.5	14.26852323	54.92	9.14	130.4143024	0.014189575	0.003405498	28.70322899	6.888774958
25/3/2000	0.05	0.012	2.07	0.5	12.12980586	66.07	7.77	94.2485915	0.124681921	0.029923661	252.2114777	60.53075464
26/3/2000	0.05	0.012	1.94	0.5	12.14541693	84.27	7.78	94.49134373	-0.510765803	-0.122583793	-1033.197088	-247.9673012
27/3/2000	0.05	0.012	1.71	0.5	13.44113622	86.36	8.61	115.7281828	0.033183951	0.007964148	67.12579711	16.11019131
28/3/2000	0.05	0.012	1.7	0.5	13.34746976	62.1	8.55	114.1208665	-0.479415108	-0.115059626	-969.7796727	-232.7471215
29/3/2000	0.05	0.012	1.38	0.5	13.26941439	65.46	8.5	112.7900223	-0.270295421	-0.064870901	-546.7641727	-131.2234015
30/3/2000	0.05	0.012	1.37	0.5	12.69180458	68.75	8.13	103.1843713	-0.198587868	-0.047661088	-401.7113244	-96.41071787
31/3/2000	0.05	0.012	1.08	0.5	12.39519414	82.97	7.94	98.4178415	0.096671406	0.023201137	195.5507092	46.93217021
								Net Sum	-1.144646196	-0.274715087	-2315.435195	-555.7044469
								Total			7252.92425	1742.86289

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/4/2000	0.05	0.012	0.54	0.5	1.842106938	128.27	1.18	2.173686187	-0.005891871	-0.001414049	-11.91830665	-2.860393596
2/4/2000	0.05	0.012	0.75	0.5	1.576718651	115.1	1.01	1.592485837	-0.008428639	-0.002022873	-17.04978056	-4.091947334
3/4/2000	0.05	0.012	0.79	0.5	1.311330363	69.85	0.84	1.101517505	0.010178013	0.002442723	20.5884836	4.941236065
4/4/2000	0.05	0.012	0.6	0.5	1.498663272	39.76	0.96	1.438716741	-0.005601551	-0.001344372	-11.33103778	-2.719449067
5/4/2000	0.05	0.012	0.57	0.5	1.498663272	90.57	0.96	1.438716741	-0.005345956	-0.001283029	-10.81400893	-2.595362144
6/4/2000	0.05	0.012	0.54	0.5	1.342552514	123.88	0.86	1.154595162	0.002021388	0.000485133	4.088942997	0.981346319
7/4/2000	0.05	0.012	0.49	0.5	1.389385742	130.17	0.89	1.23655331	0.001670531	0.000400927	3.379215171	0.811011641
8/4/2000	0.05	0.012	0.41	0.5	1.748440484	131.41	1.12	1.958253342	-0.003229406	-0.000775057	-6.532568874	-1.56781653
9/4/2000	0.05	0.012	0.4	0.5	1.623551878	125.56	1.04	1.688493953	-0.000668671	-0.000160481	-1.352613286	-0.324627189
10/4/2000	0.05	0.012	0.35	0.5	1.607940802	124.22	1.03	1.656179026	-0.000619115	-0.000148588	-1.252370846	-0.300569003
11/4/2000	0.05	0.012	0.3	0.5	1.842106938	106.21	1.18	2.173686187	-0.001937697	-0.000465047	-3.919648734	-0.940715696
12/4/2000	0.05	0.012	0.31	0.5	1.920162317	69.01	1.23	2.36179965	-0.000481006	-0.000115441	-0.972997221	-0.233519333
13/4/2000	0.05	0.012	0.63	0.5	1.24888606	110.98	0.8	0.999108848	0.005502368	0.001320568	11.13040489	2.671297174
14/4/2000	0.05	0.012	0.89	0.5	1.24888606	98.75	0.8	0.999108848	0.005045982	0.001211036	10.20721038	2.449730491
15/4/2000	0.05	0.012	0.77	0.5	1.295719287	135.53	0.83	1.075447008	0.007419844	0.001780763	15.00915133	3.602196318
16/4/2000	0.05	0.012	0.85	0.5	1.280108211	90.17	0.82	1.049688733	-0.01103922	-0.002649413	-22.33056674	-5.359336019
17/4/2000	0.05	0.012	0.75	0.5	1.264497136	61.86	0.81	1.02424268	-0.008279928	-0.001987183	-16.74896238	-4.019750971
18/4/2000	0.05	0.012	0.56	0.5	1.420607893	113.14	0.91	1.292753183	0.000474602	0.000113904	0.960043394	0.230410415
19/4/2000	0.05	0.012	0.36	0.5	1.498663272	119.74	0.96	1.438716741	0.001598975	0.000383754	3.23446863	0.776272471
20/4/2000	0.05	0.012	0.3	0.5	1.685996181	151.77	1.08	1.820875875	0.001764025	0.000423366	3.568339882	0.856401572
21/4/2000	0.05	0.012	0.35	0.5	1.701607257	141.47	1.09	1.85475191	0.000509121	0.000122189	1.029869919	0.247168781

22/4/2000	0.05	0.012	0.47	0.5	1.311330363	138.03	0.84	1.101517505	-0.001410561	-0.000338535	-2.853338321	-0.684801197
23/4/2000	0.05	0.012	0.49	0.5	1.280108211	150.26	0.82	1.049688733	-0.003375464	-0.000810111	-6.828020628	-1.638724951
24/4/2000	0.05	0.012	0.39	0.5	1.529885423	126.12	0.98	1.499287715	0.002301037	0.000552249	4.654628251	1.11711078
25/4/2000	0.05	0.012	0.35	0.5	1.670385105	137.06	1.07	1.787312062	-0.0018374	-0.000440976	-3.716764179	-0.892023403
26/4/2000	0.05	0.012	0.5	0.5	1.576718651	141.82	1.01	1.592485837	0.003849396	0.000923855	7.78671011	1.868810426
27/4/2000	0.05	0.012	0.78	0.5	1.233274984	113.89	0.79	0.974287237	0.009378066	0.002250736	18.97031924	4.552876617
28/4/2000	0.05	0.012	0.63	0.5	1.24888606	136.5	0.8	0.999108848	0.001940599	0.000465744	3.925520586	0.942124941
29/4/2000	0.05	0.012	0.59	0.5	1.373774666	165.68	0.88	1.208921706	-0.005959451	-0.001430268	-12.05501036	-2.893202485
30/4/2000	0.05	0.012	0.47	0.5	1.498663272	135.12	0.96	1.438716741	0.000260664	6.25595E-05	0.527282296	0.126547751
								Net Sum	-0.010191322	-0.002445917	-20.61540483	-4.947697158
								Total			238.736587	57.2967807

Date	A(SPM)	A(Kamphuis)	H_0	n_0	c_0	Φ_0	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/5/2000	0.05	0.012	0.45	0.5	13.34746976	177.32	8.55	114.1208665	0.011900908	0.002856218	24.07362236	5.777669366
2/5/2000	0.05	0.012	0.46	0.5	16.51651814	219.92	10.58	174.7447619	0.000743874	0.00017853	1.504737954	0.361137109
3/5/2000	0.05	0.012	0.48	0.5	13.72213558	234	8.79	120.6175718	0.003839419	0.000921461	7.766527282	1.863966548
4/5/2000	0.05	0.012	0.38	0.5	14.79929981	110.94	9.48	140.2973622	0.024627734	0.005910656	49.81794652	11.95630716
5/5/2000	0.05	0.012	0.3	0.5	16.59457352	133.64	10.63	176.4003165	-0.004521456	-0.00108515	-9.146179378	-2.195083051
6/5/2000	0.05	0.012	0.29	0.5	18.67084659	127.84	11.96	223.3033253	-0.018370902	-0.004409016	-37.16137979	-8.91873115
7/5/2000	0.05	0.012	0.28	0.5	18.12445894	143.93	11.61	210.4249683	-0.016330158	-0.003919238	-33.03328422	-7.927988212
8/5/2000	0.05	0.012	0.31	0.5	16.90679504	161.25	10.83	183.1005902	0.017950492	0.004308118	36.31095932	8.714630236
9/5/2000	0.05	0.012	0.32	0.5	17.26584978	203.31	11.06	190.9602985	-0.021585555	-0.005180533	-43.66410718	-10.47938572
10/5/2000	0.05	0.012	0.47	0.5	13.09769255	223.89	8.39	109.8896405	0.035974156	0.008633797	72.76993342	17.46478402
11/5/2000	0.05	0.012	0.6	0.5	11.67708466	206.4	7.48	87.34459325	-0.049888709	-0.01197329	-100.9168364	-24.22004074
12/5/2000	0.05	0.012	1.1	0.5	10.38136537	221.33	6.65	69.03607973	0.047086198	0.011300687	95.24780677	22.85947362
13/5/2000	0.05	0.012	0.96	0.5	10.75603119	183.51	6.89	74.1090549	0.064378892	0.015450934	130.2281463	31.2547551
14/5/2000	0.05	0.012	0.86	0.5	10.08475493	192.72	6.46	65.14751687	0.077216461	0.018531951	156.1964843	37.48715623
15/5/2000	0.05	0.012	0.8	0.5	9.850588797	177.16	6.31	62.15721531	0.049550005	0.011892001	100.2316924	24.05560619
16/5/2000	0.05	0.012	0.65	0.5	10.74042011	196.69	6.88	73.89409039	-0.035707416	-0.00856978	-72.23036105	-17.33528665
17/5/2000	0.05	0.012	0.7	0.5	10.50625398	171.13	6.73	70.70708927	0.011115225	0.002667654	22.48431235	5.396234963
18/5/2000	0.05	0.012	0.48	0.5	13.17574793	159.56	8.44	111.2033125	-0.036781981	-0.008827675	-74.40403236	-17.85696777
19/5/2000	0.05	0.012	0.52	0.5	13.16013686	192.85	8.43	110.9399537	0.029192786	0.007006269	59.05231246	14.17255499

20/5/2000	0.05	0.012	0.6	0.5	11.73952896	173.91	7.52	88.2812578	0.041275696	0.009906167	83.49409672	20.03858321
21/5/2000	0.05	0.012	0.65	0.5	11.80197327	194.3	7.56	89.22291789	-0.050969612	-0.012232707	-103.1033283	-24.74479878
22/5/2000	0.05	0.012	0.59	0.5	13.44113622	160.74	8.61	115.7281828	0.050365645	0.012087755	101.8816018	24.45158444
23/5/2000	0.05	0.012	0.46	0.5	16.95362826	156.17	10.86	184.1164029	-0.043465241	-0.010431658	-87.9231927	-21.10156625
24/5/2000	0.05	0.012	0.49	0.5	19.79484405	190	12.68	250.9986225	0.007861147	0.001886675	15.90183531	3.816440475
25/5/2000	0.05	0.012	0.4	0.5	20.02901018	202.68	12.83	256.9722007	-0.003781753	-0.000907621	-7.649878088	-1.835970741
26/5/2000	0.05	0.012	0.33	0.5	7.227928071	197.08	4.63	33.46530697	-0.009779683	-0.002347124	-19.78272554	-4.747854129
27/5/2000	0.05	0.012	0.39	0.5	15.68913113	190.43	10.05	157.6757678	-0.019831694	-0.004759606	-40.11632727	-9.627918545
28/5/2000	0.05	0.012	0.37	0.5	16.81312858	209.72	10.77	181.0773948	-0.028751367	-0.006900328	-58.15939252	-13.95825421
29/5/2000	0.05	0.012	0.31	0.5	17.48440484	203.29	11.2	195.8253342	-0.020317338	-0.004876161	-41.09870749	-9.863689797
30/5/2000	0.05	0.012	0.41	0.5	13.55041375	215.5	8.68	117.6175913	-0.016119381	-0.003868651	-32.60691564	-7.825659753
31/5/2000	0.05	0.012	0.8	0.5	10.25647677	267.72	6.57	67.38505236	0.080390919	0.019293821	162.617903	39.02829672
											358.5832704	86.05998489
											1879.88788	451.338377

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/6/2000	0.05	0.012	0.83	0.5	10.66236474	223.36	6.83	72.82395115	0.052887402	0.012692976	106.9827097	25.67585032
2/6/2000	0.05	0.012	0.68	0.5	11.5209739	160.55	7.38	85.0247874	0.040699161	0.009767799	82.32785871	19.75868609
3/6/2000	0.05	0.012	0.7	0.5	11.69269574	128.54	7.49	87.57829106	-0.036242086	-0.008698101	-73.3119132	-17.59485917
4/6/2000	0.05	0.012	0.54	0.5	11.88002864	65.29	7.61	90.40701798	-0.042405617	-0.010177348	-85.77974338	-20.58713841
5/6/2000	0.05	0.012	0.48	0.5	12.52008275	55.91	8.02	100.4110637	-0.034516312	-0.008283915	-69.82094942	-16.75702786
6/6/2000	0.05	0.012	0.35	0.5	15.68913113	85.31	10.05	157.6757678	0.019871159	0.004769078	40.19616017	9.64707844
7/6/2000	0.05	0.012	0.42	0.5	14.14363463	199.92	9.06	128.1413297	-0.023588431	-0.005661223	-47.71560331	-11.4517448
8/6/2000	0.05	0.012	0.35	0.5	15.43935391	195.83	9.89	152.6952102	0.02037754	0.00489061	41.22048691	9.892916859
9/6/2000	0.05	0.012	0.6	0.5	11.02141948	164.5	7.06	77.81122151	0.037819177	0.009076603	76.5021144	18.36050746
10/6/2000	0.05	0.012	0.67	0.5	10.75603119	180.4	6.89	74.1090549	0.028039351	0.006729444	56.71909884	13.61258372
11/6/2000	0.05	0.012	0.57	0.5	12.75424889	211.97	8.17	104.2022134	0.009018907	0.002164538	18.2437986	4.378511663
12/6/2000	0.05	0.012	0.47	0.5	12.73863781	243.64	8.16	103.9472845	-0.011502461	-0.002760591	-23.2676289	-5.584230937
13/6/2000	0.05	0.012	0.39	0.5	14.14363463	251.15	9.06	128.1413297	-0.009342485	-0.002242196	-18.89834504	-4.535602809
14/6/2000	0.05	0.012	0.64	0.5	10.50625398	223.73	6.73	70.70708927	0.052531019	0.012607445	106.2618043	25.50283303
15/6/2000	0.05	0.012	0.53	0.5	11.70830681	220.49	7.5	87.81230108	0.037641552	0.009033973	76.14280734	18.27427376
16/6/2000	0.05	0.012	0.6	0.5	11.83319542	197.55	7.58	89.69562126	-0.035931922	-0.008623661	-72.68450076	-17.44428018
17/6/2000	0.05	0.012	0.86	0.5	10.13158816	196.92	6.49	65.75400716	-0.085144432	-0.020434664	-172.2334948	-41.33603876
18/6/2000	0.05	0.012	0.77	0.5	9.850588797	196.83	6.31	62.15721531	-0.059843649	-0.014362476	-121.0540786	-29.05297887
19/6/2000	0.05	0.012	0.83	0.5	10.03792171	235.77	6.43	64.54383657	0.02563547	0.006152513	51.85643274	12.44554386
20/6/2000	0.05	0.012	0.56	0.5	12.37958307	199.39	7.93	98.17009373	0.009748814	0.002339715	19.72028278	4.732867867

21/6/2000	0.05	0.012	0.64	0.5	12.27030554	187.1	7.86	96.44460153	-0.021570184	-0.005176844	-43.63301278	-10.47192307
22/6/2000	0.05	0.012	0.53	0.5	12.41080522	169.17	7.95	98.6659015	-0.035497357	-0.008519366	-71.8054459	-17.23330701
23/6/2000	0.05	0.012	0.6	0.5	11.08386378	167.8	7.1	78.69543285	0.026087872	0.006261089	52.77157043	12.6651769
24/6/2000	0.05	0.012	0.57	0.5	11.50536283	179.4	7.37	84.79452403	0.028590881	0.006861811	57.83475405	13.88034097
25/6/2000	0.05	0.012	0.54	0.5	11.89563972	203.13	7.62	90.64477467	-0.036357576	-0.008725818	-73.54553072	-17.65092737
26/6/2000	0.05	0.012	0.74	0.5	9.600811585	193.09	6.15	59.04499125	0.015359155	0.003686197	31.06910109	7.456584262
27/6/2000	0.05	0.012	0.48	0.5	12.67619351	241.25	8.12	102.9306913	-0.035228004	-0.008454721	-71.26058669	-17.10254081
28/6/2000	0.05	0.012	0.3	0.5	17.1253501	246.22	10.97	187.8650905	0.013686312	0.003284715	27.68520765	6.644449836
29/6/2000	0.05	0.012	0.76	0.5	11.03703055	287.5	7.07	78.03180602	-0.007046653	-0.001691197	-14.2542455	-3.421018921
30/6/2000	0.05	0.012	1.33	0.5	10.58430936	297.56	6.78	71.76161744	-0.228802262	-0.054912543	-462.8301843	-111.0792442
										Net Sum	-576.5610757	-138.3746582
										Total	2267.69263	544.231064

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/7/2000	0.05	0.012	1.04	0.5	10.63114258	242.46	6.81	72.398081	0.129042452	0.030970189	261.032131	62.64771145
2/7/2000	0.05	0.012	1.07	0.5	9.585200509	213.29	6.14	58.85313113	-0.085892376	-0.02061417	-173.7464653	-41.69915166
3/7/2000	0.05	0.012	1.24	0.5	9.132479313	205.61	5.85	53.42500398	0.056651775	0.013596426	114.5974319	27.50338366
4/7/2000	0.05	0.012	1.14	0.5	10.17842139	217.13	6.52	66.36330745	0.109054813	0.026173155	220.6003499	52.94408397
5/7/2000	0.05	0.012	1.08	0.5	10.17842139	186.54	6.52	66.36330745	0.103256898	0.024781656	208.8721008	50.1293042
6/7/2000	0.05	0.012	2.04	0.5	9.460311903	196.37	6.06	57.32949013	-0.020131318	-0.004831516	-40.72241849	-9.773380436
7/7/2000	0.05	0.012	1.02	0.5	8.991979631	189.83	5.76	51.79380267	0.053243301	0.012778392	107.7026371	25.84863291
8/7/2000	0.05	0.012	0.86	0.5	9.460311903	188.41	6.06	57.32949013	-0.014893186	-0.003574365	-30.12652092	-7.230365021
9/7/2000	0.05	0.012	0.9	0.5	9.678866964	192.15	6.2	60.00897518	0.083796132	0.020111072	169.5060999	40.68146397
10/7/2000	0.05	0.012	1.08	0.5	9.210534691	190.29	5.9	54.34215468	-0.058083305	-0.013939993	-117.4931869	-28.19836486
11/7/2000	0.05	0.012	1.16	0.5	9.460311903	194.6	6.06	57.32949013	-0.055680625	-0.01336335	-112.63295	-27.03190799
12/7/2000	0.05	0.012	0.82	0.5	10.11597708	195.82	6.48	65.55153151	0.074133638	0.017792073	149.9604286	35.99050287
13/7/2000	0.05	0.012	0.51	0.5	13.40991407	199.15	8.59	115.1911618	0.027491521	0.006597965	55.61092544	13.34662211
14/7/2000	0.05	0.012	0.58	0.5	12.19225016	205.42	7.81	95.22147374	0.033365482	0.008007716	67.4930048	16.19832115
15/7/2000	0.05	0.012	1	0.5	9.3978676	201.3	6.02	56.57516295	0.053844172	0.012922601	108.9181009	26.14034421
16/7/2000	0.05	0.012	1.34	0.5	9.272978994	198.05	5.94	55.08149523	0.053371044	0.012809051	107.9610395	25.91064947
17/7/2000	0.05	0.012	1.22	0.5	9.3978676	187.57	6.02	56.57516295	-0.168022401	-0.040325376	-339.8823	-81.57175201
18/7/2000	0.05	0.012	0.74	0.5	10.77164227	173.05	6.9	74.32433164	0.036943139	0.008866353	74.7300294	17.93520706
19/7/2000	0.05	0.012	0.35	0.5	16.40724061	213.61	10.51	172.4400988	-0.00091934	-0.000220642	-1.859677621	-0.446322629

20/7/2000	0.05	0.012	0.48	0.5	13.80019096	194.52	8.84	121.9936881	-0.01966161	-0.004718786	-39.77227494	-9.545345985
21/7/2000	0.05	0.012	0.6	0.5	11.33364099	204.62	7.26	82.28223361	0.037737068	0.009056896	76.33602077	18.32064498
22/7/2000	0.05	0.012	0.42	0.5	14.73685551	220.11	9.44	139.115916	0.012565066	0.003015616	25.41710858	6.100106059
23/7/2000	0.05	0.012	0.45	0.5	13.36308084	216.19	8.56	114.387972	-0.03100825	-0.00744198	-62.72470357	-15.05392886
24/7/2000	0.05	0.012	0.8	0.5	10.64675366	208.7	6.82	72.61085996	0.035647638	0.008555433	72.10944035	17.30626568
25/7/2000	0.05	0.012	0.98	0.5	9.694478039	210	6.21	60.20270863	-0.096226175	-0.023094282	-194.6500784	-46.71601882
26/7/2000	0.05	0.012	0.8	0.5	10.35014322	212.61	6.63	68.62144955	-0.073979552	-0.017755093	-149.6487388	-35.91569731
27/7/2000	0.05	0.012	0.68	0.5	11.19314131	229.39	7.17	80.2548232	0.006939707	0.00166553	14.03791084	3.369098601
28/7/2000	0.05	0.012	0.7	0.5	11.06825271	206.94	7.09	78.47391168	-0.049112397	-0.011786975	-99.34648283	-23.84315588
29/7/2000	0.05	0.012	0.78	0.5	9.80375557	212.36	6.28	61.56758498	-0.042405008	-0.010177202	-85.77851302	-20.58684312
30/7/2000	0.05	0.012	0.68	0.5	10.99019733	191.62	7.04	77.37098918	-0.002178661	-0.000522879	-4.407080229	-1.057699255
31/7/2000	0.05	0.012	0.34	0.5	15.92329726	191.45	10.2	162.4176321	-0.008412716	-0.002019052	-17.01757117	-4.084217081
										Net Sum	365.0757976	87.61819142
										Total	3304.69373	793.126494

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/8/2000	0.05	0.012	0.59	0.5	12.17663908	194.54	7.8	94.97778485	-0.024348641	-0.005843674	-49.25338588	-11.82081261
2/8/2000	0.05	0.012	0.53	0.5	12.59813813	199.71	8.07	101.6669747	-0.018750745	-0.004500179	-37.92974114	-9.103137875
3/8/2000	0.05	0.012	1.25	0.5	9.038812858	200.55	5.79	52.33472645	-0.150786056	-0.036188653	-305.0159447	-73.20382674
4/8/2000	0.05	0.012	0.85	0.5	10.52186505	211.48	6.74	70.91737046	0.08692925	0.02086302	175.8438951	42.20253481
5/8/2000	0.05	0.012	0.9	0.5	9.475922979	209.51	6.07	57.51885248	-0.089006022	-0.021361445	-180.0448698	-43.21076874
6/8/2000	0.05	0.012	0.88	0.5	10.14719924	219.6	6.5	65.95679504	-0.057309413	-0.013754259	-115.9277267	-27.82265441
7/8/2000	0.05	0.012	0.56	0.5	12.14541693	206.77	7.78	94.49134373	-0.0434612	-0.010430688	-87.91501865	-21.09960448
8/8/2000	0.05	0.012	0.6	0.5	11.44291852	193.12	7.33	83.87659278	0.009010823	0.002162598	18.2274459	4.374587016
9/8/2000	0.05	0.012	0.64	0.5	12.47324952	188.1	7.99	99.66126369	-0.045415562	-0.010899735	-91.86838003	-22.04841121
10/8/2000	0.05	0.012	0.43	0.5	21.51206238	183.07	13.78	296.4362196	0.049201892	0.011808454	99.52751647	23.88660395
11/8/2000	0.05	0.012	0.41	0.5	22.49556015	209.8	14.41	324.1610218	-0.046351005	-0.011124241	-93.76062991	-22.50255118
12/8/2000	0.05	0.012	0.91	0.5	10.24086569	199.15	6.56	67.18007893	0.066842374	0.01604217	135.2113753	32.45073008
13/8/2000	0.05	0.012	1.08	0.5	9.460311903	193.43	6.06	57.32949013	-0.059262012	-0.014222883	-119.8775218	-28.77060523
14/8/2000	0.05	0.012	0.91	0.5	10.20964354	210.64	6.54	66.77106875	0.031895433	0.007654904	64.5193317	15.48463961
15/8/2000	0.05	0.012	0.64	0.5	11.4585296	214.82	7.34	84.10560726	0.040340533	0.009681728	81.60241056	19.58457853
16/8/2000	0.05	0.012	1.11	0.5	10.69358689	222.66	6.85	73.25107018	-0.116544988	-0.027970797	-235.7517702	-56.58042485
17/8/2000	0.05	0.012	1.25	0.5	12.11419478	234.69	7.76	94.0061515	-0.226853669	-0.054444881	-458.8884946	-110.1332387
18/8/2000	0.05	0.012	1.14	0.5	11.66147358	195.6	7.47	87.11120767	0.188953702	0.045348888	382.2229547	91.73350913
19/8/2000	0.05	0.012	0.71	0.5	11.69269574	232.64	7.49	87.57829106	0.023476454	0.005634349	47.48909142	11.39738194
20/8/2000	0.05	0.012	1.55	0.5	11.75514004	250.22	7.53	88.51620449	-0.282305545	-0.067753331	-571.0587236	-137.0540937
21/8/2000	0.05	0.012	1.68	0.5	11.3960853	229.95	7.3	83.19142266	0.378590439	0.090861705	765.8275812	183.7986195

22/8/2000	0.05	0.012	1.49	0.5	11.17753024	217.08	7.16	80.03111649	0.180285522	0.043268525	364.6886214	87.52526914
23/8/2000	0.05	0.012	1.52	0.5	11.05264163	197.39	7.08	78.25270274	-0.278561291	-0.06685471	-563.4846996	-135.2363279
24/8/2000	0.05	0.012	1.41	0.5	9.616422661	193.21	6.16	59.23716359	-0.000980678	-0.000235363	-1.983754111	-0.476100987
25/8/2000	0.05	0.012	0.96	0.5	10.20964354	193.59	6.54	66.77106875	-0.081376716	-0.019530412	-164.612012	-39.50688287
26/8/2000	0.05	0.012	0.57	0.5	12.76985996	212.87	8.18	104.4574545	-0.05178545	-0.012428508	-104.753638	-25.14087312
27/8/2000	0.05	0.012	0.51	0.5	12.73863781	203.98	8.16	103.9472845	-0.017904467	-0.004297072	-36.21785721	-8.69228573
28/8/2000	0.05	0.012	0.63	0.5	10.9433641	205.27	7.01	76.71298234	0.045937459	0.01102499	92.92409374	22.3017825
29/8/2000	0.05	0.012	0.63	0.5	11.44291852	215.13	7.33	83.87659278	0.007820463	0.001876911	15.81953907	3.796689377
30/8/2000	0.05	0.012	0.6	0.5	11.20875239	200.15	7.18	80.47884214	-0.048832891	-0.011719894	-98.78108639	-23.70746073
31/8/2000	0.05	0.012	0.59	0.5	11.92686187	196.9	7.64	91.1212247	-0.04627237	-0.011105369	-93.60156372	-22.46437529
										Net Sum	-1166.822961	-280.0375107
										Total	5645.63066	1357.10036

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/9/2000	0.05	0.012	0.58	0.5	12.89474857	175.33	8.26	106.5106232	-0.050505462	-0.012121311	-102.1644274	-24.51946258
2/9/2000	0.05	0.012	0.52	0.5	13.03524825	175.16	8.35	108.8443229	-0.044035988	-0.010568637	-89.07772282	-21.37865348
3/9/2000	0.05	0.012	0.48	0.5	13.34746976	186.16	8.55	114.1208665	0.03840798	0.009217915	77.69316822	18.64636037
4/9/2000	0.05	0.012	0.64	0.5	11.95808402	237.5	7.66	91.59892362	-0.035549649	-0.008531916	-71.91122343	-17.25869362
5/9/2000	0.05	0.012	0.48	0.5	12.9415818	194.78	8.29	107.2857131	9.35876E-05	2.2461E-05	0.189312661	0.045435039
6/9/2000	0.05	0.012	0.41	0.5	14.59635582	203.27	9.35	136.475927	-0.029334532	-0.007040288	-59.33904039	-14.24136969
7/9/2000	0.05	0.012	0.42	0.5	13.03524825	234.71	8.35	108.8443229	-0.027862629	-0.006687031	-56.36161901	-13.52678856
8/9/2000	0.05	0.012	0.42	0.5	13.44113622	230.17	8.61	115.7281828	0.029499312	0.007079835	59.67236429	14.32136743
9/9/2000	0.05	0.012	0.79	0.5	10.89653087	219.86	6.98	76.05778549	-0.008737793	-0.00209707	-17.67515003	-4.242036006
10/9/2000	0.05	0.012	1.03	0.5	12.70741566	231.63	8.14	103.4383635	-0.167203152	-0.040128756	-338.2250903	-81.17402168
11/9/2000	0.05	0.012	1.08	0.5	10.44380968	208.9	6.69	69.86908673	0.004844883	0.001162772	9.800419334	2.35210064
12/9/2000	0.05	0.012	0.86	0.5	11.09947486	201.61	7.11	78.91726623	0.091270596	0.021904943	184.6257394	44.31017746
13/9/2000	0.05	0.012	0.7	0.5	14.83052196	200.75	9.5	140.8899586	-0.053064412	-0.012735459	-107.3407723	-25.76178535
14/9/2000	0.05	0.012	0.61	0.5	17.81223743	220.66	11.41	203.2376291	0.082623852	0.019829724	167.134766	40.11234385
15/9/2000	0.05	0.012	0.56	0.5	17.73418205	210.67	11.36	201.4603081	0.024917257	0.005980142	50.4036047	12.09686513
16/9/2000	0.05	0.012	0.66	0.5	18.81134628	203.42	12.05	226.6767226	-0.10242706	-0.024582494	-207.1934716	-49.72643319
17/9/2000	0.05	0.012	0.63	0.5	19.77923297	185.98	12.67	250.6028818	0.09318735	0.022364964	188.5030244	45.24072586
18/9/2000	0.05	0.012	0.52	0.5	16.06379694	120.32	10.29	165.2964706	0.051737911	0.012417099	104.6574739	25.11779374
19/9/2000	0.05	0.012	0.58	0.5	13.5816359	160.44	8.7	118.1602323	0.024199033	0.005807768	48.9507529	11.7481807
20/9/2000	0.05	0.012	0.46	0.5	14.44024507	141.87	9.25	133.5722669	0.032070439	0.007696905	64.87334146	15.56960195
21/9/2000	0.05	0.012	0.46	0.5	13.78457989	121.14	8.83	121.7178404	-0.013434596	-0.003224303	-27.17602806	-6.522246736

22/9/2000	0.05	0.012	0.65	0.5	11.81758434	139.83	7.57	89.45911346	-0.00363366	-0.000872078	-7.350309522	-1.764074285
23/9/2000	0.05	0.012	0.61	0.5	13.34746976	148.3	8.55	114.1208665	0.059655961	0.014317431	120.6744169	28.96186005
24/9/2000	0.05	0.012	0.49	0.5	15.75157543	128.09	10.09	158.9333961	-0.046810571	-0.011234537	-94.69025753	-22.72566181
25/9/2000	0.05	0.012	0.45	0.5	15.79840866	229.05	10.12	159.8798956	-0.021664758	-0.005199542	-43.82432237	-10.51783737
26/9/2000	0.05	0.012	0.39	0.5	15.75157543	173.72	10.09	158.9333961	0.028662597	0.006879023	57.97982577	13.91515818
27/9/2000	0.05	0.012	0.34	0.5	16.95362826	206.98	10.86	184.1164029	-0.016341171	-0.003921881	-33.05556091	-7.933334619
28/9/2000	0.05	0.012	0.62	0.5	11.73952896	205.34	7.52	88.2812578	0.043065006	0.010335601	87.11358169	20.9072596
29/9/2000	0.05	0.012	0.41	0.5	15.82963081	169.84	10.14	160.5124564	0.012584075	0.003020178	25.45555974	6.109334338
30/9/2000	0.05	0.012	0.35	0.5	18.12445894	127.07	11.61	210.4249683	0.008967061	0.002152095	18.1389226	4.353341425
										Net Sum	10.48127834	2.5155068
										Total	2521.25127	605.100317

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/10/2000	0.05	0.012	0.45	0.5	15.98574157	135.36	10.24	163.6939936	0.020909078	0.005018179	42.29570253	10.15096861
2/10/2000	0.05	0.012	0.6	0.5	11.67708466	266.91	7.48	87.34459325	-0.013038544	-0.003129251	-26.37487842	-6.32997082
3/10/2000	0.05	0.012	0.6	0.5	11.77075111	97.36	7.54	88.7514634	-0.003109813	-0.000746355	-6.29065135	-1.509756324
4/10/2000	0.05	0.012	0.44	0.5	14.90857734	131.12	9.55	142.3769136	-0.035954595	-0.008629103	-72.73036492	-17.45528758
5/10/2000	0.05	0.012	0.63	0.5	10.89653087	213.08	6.98	76.05778549	-0.048095409	-0.011542898	-97.28927836	-23.34942681
6/10/2000	0.05	0.012	0.56	0.5	12.19225016	177.73	7.81	95.22147374	-0.021219178	-0.005092603	-42.92298574	-10.30151658
7/10/2000	0.05	0.012	0.48	0.5	12.69180458	289.81	8.13	103.1843713	0.036552127	0.00877251	73.93907546	17.74537811
8/10/2000	0.05	0.012	0.7	0.5	10.31892107	294.75	6.61	68.20806827	-0.056873389	-0.013649613	-115.0457204	-27.6109729
9/10/2000	0.05	0.012	1.1	0.5	10.4281986	283.15	6.68	69.66036665	0.114599966	0.027503992	231.8173032	55.63615277
10/10/2000	0.05	0.012	1.28	0.5	11.08386378	288.64	7.1	78.69543285	-0.158517002	-0.03804408	-320.6544046	-76.95705709
11/10/2000	0.05	0.012	1.43	0.5	11.72391789	276.57	7.51	88.04662333	0.06530882	0.015674117	132.1092413	31.70621792
12/10/2000	0.05	0.012	1.34	0.5	11.73952896	258.81	7.52	88.2812578	0.178212408	0.042770978	360.4950441	86.51881057
13/10/2000	0.05	0.012	1.3	0.5	11.5834182	248.02	7.42	85.94896308	-0.079672612	-0.019121427	-161.1648837	-38.67957209
14/10/2000	0.05	0.012	1.51	0.5	11.63025143	271.89	7.45	86.64537317	-0.093028832	-0.02232692	-188.1823675	-45.16376821
15/10/2000	0.05	0.012	0.89	0.5	11.41169637	140.83	7.31	83.41950048	-0.099829719	-0.023959133	-201.9394689	-48.46547255
16/10/2000	0.05	0.012	0.58	0.5	15.82963081	254.83	10.14	160.5124564	0.04399052	0.010557725	88.98574877	21.3565797
17/10/2000	0.05	0.012	0.89	0.5	13.05085933	278.98	8.36	109.105184	-0.122359867	-0.029366368	-247.5143361	-59.40344066
18/10/2000	0.05	0.012	1.85	0.5	11.23997454	283.61	7.2	80.92781668	0.474523237	0.113885577	959.884206	230.3722094
19/10/2000	0.05	0.012	1.23	0.5	13.0664704	260.36	8.37	109.3663573	-0.174550505	-0.041892121	-353.0876039	-84.74102493
20/10/2000	0.05	0.012	0.82	0.5	12.27030554	216.16	7.86	96.44460153	-0.096843538	-0.023242449	-195.8989054	-47.01573729

21/10/2000	0.05	0.012	0.75	0.5	11.16191916	236.44	7.15	79.80772199	0.07828836	0.018789206	158.364763	38.00754311
22/10/2000	0.05	0.012	0.89	0.5	10.95897518	225.36	7.02	76.93200573	-0.107981106	-0.025915465	-218.428414	-52.42281937
23/10/2000	0.05	0.012	0.54	0.5	12.62936028	155.22	8.09	102.1715247	0.025138061	0.006033135	50.85025613	12.20406147
24/10/2000	0.05	0.012	0.53	0.5	12.06736155	224.23	7.73	93.28070481	0.030031556	0.007207574	60.74900929	14.57976223
25/10/2000	0.05	0.012	0.51	0.5	12.9415818	178.95	8.29	107.2857131	-0.010065499	-0.00241572	-20.36088651	-4.886612763
26/10/2000	0.05	0.012	0.58	0.5	12.4264163	186.86	7.96	98.91427371	0.006749212	0.001619811	13.65257065	3.276616955
27/10/2000	0.05	0.012	0.63	0.5	11.72391789	147.08	7.51	88.04662333	-0.053084271	-0.012740225	-107.3809446	-25.77142671
28/10/2000	0.05	0.012	0.71	0.5	11.23997454	240.88	7.2	80.92781668	-0.063002031	-0.015120488	-127.4429788	-30.58631492
29/10/2000	0.05	0.012	1.13	0.5	10.61553151	295.7	6.8	72.18561426	0.119231641	0.028615594	241.1864382	57.88474517
30/10/2000	0.05	0.012	1.04	0.5	13.69091343	196.18	8.77	120.0693108	0.06156857	0.014776457	124.5433169	29.89039604
31/10/2000	0.05	0.012	1.1	0.5	16.96923934	226.24	10.87	184.4556316	0.023236369	0.005576729	47.00343853	11.28082525
										Net Sum	83.16704068	19.96008976
										Total	5089.58518	1221.26045

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/11/2000	0.05	0.012	1.03	0.5	19.10795672	84.18	12.24	233.8813902	-0.24318858	-0.058365259	-491.9313919	-118.0635341
2/11/2000	0.05	0.012	1.84	0.5	14.23730108	90.46	9.12	129.8441859	-0.579319567	-0.139036696	-1171.87033	-281.2488791
3/11/2000	0.05	0.012	1.87	0.5	13.86263526	86.55	8.88	123.1002011	-0.186238001	-0.04469712	-376.7295292	-90.415087
4/11/2000	0.05	0.012	1.36	0.5	13.37869192	106.6	8.57	114.6553897	-0.128466513	-0.030831963	-259.8670983	-62.3681036
5/11/2000	0.05	0.012	1.21	0.5	16.06379694	114.69	10.29	165.2964706	-0.012853826	-0.003084918	-26.00122289	-6.240293494
6/11/2000	0.05	0.012	1.01	0.5	17.20340547	142.21	11.02	189.5815283	0.21813682	0.052352837	441.2557107	105.9013706
7/11/2000	0.05	0.012	0.79	0.5	15.34568746	101.8	9.83	150.8481077	0.067944102	0.016306584	137.4399923	32.98559815
8/11/2000	0.05	0.012	0.89	0.5	11.44291852	75.91	7.33	83.87659278	0.096753205	0.023220769	195.7161757	46.97188216
9/11/2000	0.05	0.012	1.01	0.5	10.25647677	88.81	6.57	67.38505236	0.129842156	0.031162117	262.6498028	63.03595268
10/11/2000	0.05	0.012	0.81	0.5	11.47414067	115.64	7.35	84.33493396	-0.087633722	-0.021032093	-177.2689272	-42.54454253
11/11/2000	0.05	0.012	0.95	0.5	10.95897518	92.35	7.02	76.93200573	0.075209565	0.018050296	152.1368566	36.51284558
12/11/2000	0.05	0.012	0.67	0.5	12.5513049	107.46	8.04	100.9124914	0.067703254	0.016248781	136.952797	32.86867128
13/11/2000	0.05	0.012	0.84	0.5	11.98930617	113.85	7.68	92.07787142	0.10551915	0.025324596	213.448272	51.22758528
14/11/2000	0.05	0.012	1.51	0.5	11.34925207	82.63	7.27	82.50906254	0.306391146	0.073533875	619.7800207	148.747205
15/11/2000	0.05	0.012	1.75	0.5	12.0985837	81.17	7.75	93.76402371	-0.395334401	-0.094880256	-799.6979239	-191.9275017
16/11/2000	0.05	0.012	1.51	0.5	13.37869192	106.1	8.57	114.6553897	-0.37744473	-0.090586735	-763.5099964	-183.2423991
17/11/2000	0.05	0.012	1	0.5	12.64497136	101.44	8.1	102.424268	0.15325441	0.036781058	310.0090289	74.40216695
18/11/2000	0.05	0.012	1.03	0.5	11.84880649	80.23	7.59	89.93244128	-0.037163164	-0.008919159	-75.17510509	-18.04202522
19/11/2000	0.05	0.012	1.22	0.5	11.4585296	97.56	7.34	84.10560726	0.071347033	0.017123288	144.3235743	34.63765784
20/11/2000	0.05	0.012	1.24	0.5	12.0985837	82.8	7.75	93.76402371	0.182786516	0.043868764	369.7477297	88.73945513

21/11/2000	0.05	0.012	2.04	0.5	12.33274984	80.94	7.9	97.42872374	-0.63906839	-0.153376414	-1292.732591	-310.2558219
22/11/2000	0.05	0.012	3.08	0.5	14.20607893	83.16	9.1	129.2753183	0.308892468	0.074134192	624.8397939	149.9615505
23/11/2000	0.05	0.012	2.33	0.5	13.39430299	87.03	8.58	114.9231197	-0.868787796	-0.208509071	-1757.418011	-421.7803226
24/11/2000	0.05	0.012	2.65	0.5	14.59635582	124.14	9.35	136.475927	-0.120493706	-0.028918489	-243.7393911	-58.49745387
25/11/2000	0.05	0.012	2.38	0.5	13.34746976	110.24	8.55	114.1208665	0.508806058	0.122113454	1029.232839	247.0158814
26/11/2000	0.05	0.012	1.16	0.5	13.5191916	91.06	8.66	117.0761992	-0.020975302	-0.005034072	-42.42966311	-10.18311915
27/11/2000	0.05	0.012	0.88	0.5	13.56602482	184.28	8.69	117.8887557	-0.110049142	-0.026411794	-222.6117187	-53.42681249
28/11/2000	0.05	0.012	1.26	0.5	11.44291852	146.19	7.33	83.87659278	-0.047756228	-0.011461495	-96.60316992	-23.18476078
29/11/2000	0.05	0.012	1.29	0.5	12.00491725	214.71	7.69	92.31781365	0.207137935	0.049713104	419.0067353	100.5616165
30/11/2000	0.05	0.012	1.4	0.5	13.01963717	228.6	8.34	108.583774	-0.317442185	-0.076186124	-642.1344956	-154.1122789
										Net Sum	-3383.181236	-811.9634966
										Total	13496.2603	3239.10237

Date	A(SPM)	A(Kamphuis)	H_o	n_o	c_o	Φ_o	T	L	S(A=0.050)	S(A=0.012)	Q(A=0.050)	Q(A=0.012)
1/12/2000	0.05	0.012	1.38	0.5	13.14452578	102.46	8.42	110.6769071	-0.205495127	-0.04931883	-415.6835976	-99.76406343
2/12/2000	0.05	0.012	1.42	0.5	13.05085933	99.77	8.36	109.105184	-0.328554236	-0.078853017	-664.6123871	-159.5069729
3/12/2000	0.05	0.012	1.21	0.5	13.67530236	180.96	8.76	119.7956486	-0.14882904	-0.03571897	-301.0572166	-72.25373199
4/12/2000	0.05	0.012	1.17	0.5	17.34390516	279.21	11.11	192.6907863	-0.209451927	-0.050268462	-423.6875683	-101.6850164
5/12/2000	0.05	0.012	1.54	0.5	8.180203692	168.93	5.24	42.86426735	-0.240170275	-0.057640866	-485.8258477	-116.5982034
6/12/2000	0.05	0.012	1.45	0.5	18.24934755	258.08	11.69	213.3348729	0.386979154	0.092874997	782.7966025	187.8711846
7/12/2000	0.05	0.012	1.53	0.5	18.2805697	273.28	11.71	214.0654712	-0.041212479	-0.009890995	-83.3662173	-20.00789215
8/12/2000	0.05	0.012	1.6	0.5	13.09769255	306.46	8.39	109.8896405	-0.127631538	-0.030631569	-258.1780789	-61.96273893
9/12/2000	0.05	0.012	1.56	0.5	13.05085933	262.72	8.36	109.105184	-0.283138261	-0.067953183	-572.7431741	-137.4583618
10/12/2000	0.05	0.012	1.36	0.5	12.92597072	141.29	8.28	107.0270376	-0.048596788	-0.011663229	-98.3034882	-23.59283717
11/12/2000	0.05	0.012	1.25	0.5	12.81669319	91.74	8.21	105.2250511	0.238909875	0.05733837	483.2762607	115.9863026
12/12/00	0.05	0.012	0.95	0.5	13.45674729	204.97	8.62	115.9971617	0.151700251	0.03640806	306.8652143	73.64765143
13/12/2000	0.05	0.012	0.79	0.5	12.70741566	178.4	8.14	103.4383635	-0.096540466	-0.023169712	-195.2858382	-46.86860117
14/12/2000	0.05	0.012	0.85	0.5	16.12624125	121.5	10.33	166.5840721	-0.129621065	-0.031109056	-262.2025715	-62.92861717
15/12/2000	0.05	0.012	1.45	0.5	13.33185869	92.07	8.54	113.8540732	0.328307225	0.078793734	664.1127242	159.3870538
16/12/2000	0.05	0.012	1.4	0.5	12.28591661	103.05	7.87	96.69016375	-0.285182028	-0.068443687	-576.8773863	-138.4505727
17/12/2000	0.05	0.012	1.77	0.5	11.98930617	86.21	7.68	92.07787142	0.168731463	0.040495551	341.3166178	81.91598827
18/12/2000	0.05	0.012	1.73	0.5	12.37958307	90.23	7.93	98.17009373	-0.455521743	-0.109325218	-921.4472376	-221.147337
19/12/2000	0.05	0.012	1.62	0.5	12.89474857	90.25	8.26	106.5106232	-0.41877983	-0.100507159	-847.1242566	-203.3098216
20/12/2000	0.05	0.012	1.14	0.5	11.70830681	81.83	7.5	87.81230108	0.055696101	0.013367064	112.6642573	27.03942174

21/12/2000	0.05	0.012	1.28	0.5	10.89653087	80.74	6.98	76.05778549	-0.212385603	-0.050972545	-429.6219237	-103.1092617
22/12/2000	0.05	0.012	2.12	0.5	11.88002864	73.82	7.61	90.40701798	0.009913972	0.002379353	20.05437096	4.813049031
23/12/2000	0.05	0.012	2.43	0.5	14.87735519	87.58	9.53	141.7811949	-0.763797454	-0.183311389	-1545.03943	-370.8094633
24/12/2000	0.05	0.012	2.32	0.5	16.29796308	136.18	10.44	170.1507346	0.897359662	0.215366319	1815.2143	435.6514321
25/12/2000	0.05	0.012	1.94	0.5	16.04818587	119.06	10.28	164.9753507	-0.4515053	-0.108361272	-913.3226207	-219.197429
26/12/2000	0.05	0.012	1.59	0.5	14.84613304	200.58	9.51	141.1867252	-0.385364591	-0.092487502	-779.5306012	-187.0873443
27/12/2000	0.05	0.012	1.69	0.5	15.23640993	179.82	9.76	148.7073609	0.542535471	0.130208513	1097.462018	263.3908843
28/12/2000	0.05	0.012	1.67	0.5	13.92507957	107.93	8.92	124.2117097	0.383229327	0.091975039	775.2113055	186.0507133
29/12/2000	0.05	0.012	1.64	0.5	13.31624761	87.64	8.53	113.5875921	-0.270647988	-0.064955517	-547.4773601	-131.3945664
30/12/2000	0.05	0.012	1.62	0.5	12.69180458	78.97	8.13	103.1843713	0.315631034	0.075751448	638.4708286	153.2329989
31/12/2000	0.05	0.012	1.83	0.5	12.52008275	79.86	8.02	100.4110637	0.251833351	0.060440004	509.418374	122.2604097
										Net Sum	-2774.523928	-665.8857426
										Total	17868.2497	4288.37991

APPENDIX II

Calculation of Longshore Sediment Transport Rate (LSTR) using Queen's formula

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/1/2000	0.555	4.78	0.00025	0.89	55.68	111.36	421.7113567	-404.0842711
2/1/2000	0.558	4.68	0.00025	0.89	60.34	120.68	412.975857	377.2532191
3/1/2000	0.576	4.63	0.00025	0.89	67.79	135.58	433.0159951	-349.5668664
4/1/2000	0.546	4.67	0.00025	0.89	69.48	138.96	394.1378034	306.2125356
5/1/2000	0.441	4.49	0.00025	0.89	68.53	137.06	242.400871	-192.535689
6/1/2000	0.294	4.28	0.00025	0.89	85.04	170.08	100.2646403	34.90423034
7/1/2000	0.243	3.78	0.00025	0.89	70.04	140.08	56.85095082	43.5656316
8/1/2000	0.225	3.49	0.00025	0.89	52.69	105.38	43.24049553	-42.30461109
9/1/2000	0.285	4.16	0.00025	0.89	47.2	94.4	90.28533245	90.12558222
10/1/2000	0.282	3.98	0.00025	0.89	50.52	101.04	82.71995898	81.79802708
11/1/2000	0.303	3.82	0.00025	0.89	52.3	104.6	89.79823218	-88.04702792
12/1/2000	0.276	3.9	0.00025	0.89	70.73	141.46	76.86038584	-57.86565018
13/1/2000	0.234	3.66	0.00025	0.89	62.95	125.9	50.22741513	44.26344737
14/1/2000	0.168	3.49	0.00025	0.89	37.25	74.5	24.10705671	-23.57710617
15/1/2000	0.171	3.67	0.00025	0.89	39.73	79.46	26.93263235	25.94279032
16/1/2000	0.198	3.61	0.00025	0.89	89.73	179.46	35.22724412	35.16635232
17/1/2000	0.252	3.56	0.00025	0.89	56.9	113.8	55.88092213	52.97911928
18/1/2000	0.27	3.84	0.00025	0.89	61.3	122.6	71.86407675	70.96182606
19/1/2000	0.531	4.67	0.00025	0.89	57.84	115.68	372.7793516	350.2295234
20/1/2000	0.684	5.4	0.00025	0.89	66.64	133.28	769.1133129	635.7311479
21/1/2000	0.771	5.81	0.00025	0.89	55.28	110.56	1090.587311	1089.62603
22/1/2000	0.639	5.63	0.00025	0.89	42.93	85.86	714.5815424	713.5831088
23/1/2000	0.474	4.96	0.00025	0.89	51.38	102.76	325.1372167	320.2953471
24/1/2000	0.375	4.56	0.00025	0.89	105.28	210.56	179.3896097	-119.5477221
25/1/2000	0.48	4.41	0.00025	0.89	55.66	111.32	279.5296267	-267.889423
26/1/2000	0.618	4.99	0.00025	0.89	54.22	108.44	557.7187614	540.3564605
27/1/2000	0.681	5.3	0.00025	0.89	58.25	116.5	741.3025838	-693.5379394
28/1/2000	0.906	5.89	0.00025	0.89	44.4	88.8	1537.152031	1536.949748
29/1/2000	0.954	6.3	0.00025	0.89	47.96	95.92	1885.363344	1879.323966
30/1/2000	0.849	5.78	0.00025	0.89	53.48	106.96	1312.183655	1277.638414
31/1/2000	0.879	5.85	0.00025	0.89	50.19	100.38	1432.184717	-1418.075214
								5849.874986
								13162.938

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/2/2000	0.93	6.06	0.00025	0.89	45.21	90.42	1690.294269	1285.428822
2/2/2000	0.837	5.89	0.00025	0.89	45.87	91.74	1311.932056	-958.0801577
3/2/2000	0.624	5.71	0.00025	0.89	144.2	288.4	696.0025445	-461.6844827
4/2/2000	0.441	5.38	0.00025	0.89	265.85	531.7	317.9348082	-255.964766
5/2/2000	0.402	5.59	0.00025	0.89	140.23	280.46	279.8061808	-236.7076355
6/2/2000	0.396	5.77	0.00025	0.89	216.36	432.72	284.7354738	-235.9348
7/2/2000	0.48	6.16	0.00025	0.89	176.68	353.36	461.4674027	460.8049165
8/2/2000	0.537	5.52	0.00025	0.89	71.01	142.02	489.9420033	-361.9969939
9/2/2000	0.618	5.61	0.00025	0.89	76.54	153.08	664.8271208	562.3614756
10/2/2000	0.522	5.81	0.00025	0.89	68.05	136.1	499.9109967	-452.7085162
11/2/2000	0.372	5.35	0.00025	0.89	71.89	143.78	224.3386171	-176.3093428
12/2/2000	0.285	4.63	0.00025	0.89	35.25	70.5	106.0104534	104.9115022
13/2/2000	0.282	4.23	0.00025	0.89	39.77	79.54	90.63506558	-81.72415947
14/2/2000	0.276	3.9	0.00025	0.89	62.25	124.5	76.86038584	-73.02754947
15/2/2000	0.234	3.5	0.00025	0.89	73.57	147.14	46.97007644	30.70552605
16/2/2000	0.489	4.43	0.00025	0.89	75.42	150.84	292.0860349	44.54890434
17/2/2000	0.519	4.67	0.00025	0.89	75.23	150.46	356.1209491	-183.15257
18/2/2000	0.384	4.68	0.00025	0.89	77.64	155.28	195.5774205	-192.5028807
19/2/2000	0.27	4.22	0.00025	0.89	87.38	174.76	82.79110715	-78.77332859
20/2/2000	0.192	4.16	0.00025	0.89	75.55	151.1	40.97603565	19.85437414
21/2/2000	0.168	4.22	0.00025	0.89	91.51	183.02	32.05344593	26.37733574
22/2/2000	0.135	3.51	0.00025	0.89	54.64	109.28	15.70058004	11.84793194
23/2/2000	0.93	3.4	0.00025	0.89	112.3	224.6	710.3489752	-710.2274986
24/2/2000	0.837	3.02	0.00025	0.89	63.31	126.62	481.6691329	426.679044
25/2/2000	0.624	3.24	0.00025	0.89	49.79	99.58	297.4912389	-262.9190534
26/2/2000	0.441	4.08	0.00025	0.89	61.14	122.28	209.9688691	89.128279
27/2/2000	0.711	5.46	0.00025	0.89	52.5	105	844.9201182	-829.8936714
28/2/2000	0.597	5.18	0.00025	0.89	60.12	120.24	550.4663649	465.9735658
29/2/2000	0.516	4.81	0.00025	0.89	79.84	159.68	367.9632986	247.1628706
							Net Sum	-1775.822858
							Total	9327.39195

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/3/2000	0.495	7.79	0.00025	0.89	72.74	145.48	697.9174707	620.9487764
2/3/2000	0.426	7.9	0.00025	0.89	62.21	124.42	527.8947231	-499.9063784
3/3/2000	0.399	8.03	0.00025	0.89	66.02	132.04	474.5768997	114.1100047
4/3/2000	0.324	8.23	0.00025	0.89	63.42	126.84	324.6962395	309.4933501
5/3/2000	0.243	8.23	0.00025	0.89	67.71	135.42	182.6416347	-59.44561481
6/3/2000	0.192	8.96	0.00025	0.89	78.84	157.68	129.5245099	91.95088952
7/3/2000	0.189	9.05	0.00025	0.89	111.66	223.32	127.4042638	-33.60456905
8/3/2000	0.189	8.85	0.00025	0.89	90.19	180.38	123.2043381	-119.0133208
9/3/2000	0.219	8.04	0.00025	0.89	8076	16152	143.2385079	-125.7976869
10/3/2000	0.291	8	0.00025	0.89	87.78	175.56	251.0200687	-90.58280077
11/3/2000	0.273	8.59	0.00025	0.89	86.96	173.92	245.8116859	-222.5665767
12/3/2000	0.204	9.92	0.00025	0.89	169.94	339.88	170.3394845	94.48604302
13/3/2000	0.198	10.26	0.00025	0.89	113.81	227.62	168.7869662	167.7150856
14/3/2000	0.132	11.12	0.00025	0.89	72.85	145.7	84.64328869	80.8877946
15/3/2000	0.123	10.85	0.00025	0.89	49.57	99.14	70.83408948	-69.69181187
16/3/2000	0.162	8.22	0.00025	0.89	50.63	101.26	81.02615697	63.49924706
17/3/2000	0.159	8.66	0.00025	0.89	65.92	131.84	84.40313389	-9.004801548
18/3/2000	0.147	9.24	0.00025	0.89	50.65	101.3	79.51153027	63.94207613
19/3/2000	0.156	8.46	0.00025	0.89	50.73	101.46	78.44986975	68.67293831
20/3/2000	0.192	10.52	0.00025	0.89	68.87	137.74	164.7834354	-77.56250843
21/3/2000	0.228	10.27	0.00025	0.89	57.09	114.18	224.1366337	208.0421741
22/3/2000	0.237	8.3	0.00025	0.89	96.5	193	175.95488	-172.1642136
23/32000	0.231	10.02	0.00025	0.89	111.82	223.64	221.7241648	-122.7909312
24/3/2000	0.249	9.14	0.00025	0.89	54.92	109.84	224.4426942	61.46388046
25/3/2000	0.621	7.77	0.00025	0.89	66.07	132.14	1094.213867	406.4073683
26/3/2000	0.582	7.78	0.00025	0.89	84.27	168.54	962.948033	-860.7931132
27/3/2000	0.513	8.61	0.00025	0.89	86.36	172.72	871.017625	172.8943774
28/3/2000	0.51	8.55	0.00025	0.89	62.1	124.2	851.8772297	-846.9970806
29/3/2000	0.414	8.5	0.00025	0.89	65.46	130.92	556.4377123	-476.14069
30/3/2000	0.411	8.13	0.00025	0.89	68.75	137.5	512.9876949	-342.1252418
31/3/2000	0.324	7.94	0.00025	0.89	82.97	165.94	307.6863711	211.3881149
								-1392.285219
								6864.08946

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/4/2000	0.162	1.18	0.00025	0.89	128.27	256.54	4.406974379	-4.074600455
2/4/2000	0.225	1.01	0.00025	0.89	115.1	230.2	6.731852358	-5.711063756
3/4/2000	0.237	0.84	0.00025	0.89	69.85	139.7	5.665041644	5.6477455
4/4/2000	0.18	0.96	0.00025	0.89	39.76	79.52	3.992448708	-3.571695341
5/4/2000	0.171	0.96	0.00025	0.89	90.57	181.14	3.603184959	-3.333369827
6/4/2000	0.162	0.86	0.00025	0.89	123.88	247.76	2.741985738	1.613161019
7/4/2000	0.147	0.89	0.00025	0.89	130.17	260.34	2.376879501	1.372918788
8/4/2000	0.123	1.12	0.00025	0.89	131.41	262.82	2.349225696	-2.174308583
9/4/2000	0.12	1.04	0.00025	0.89	125.56	251.12	2.000782991	-0.77522828
10/4/2000	0.105	1.03	0.00025	0.89	124.22	248.44	1.50980869	-0.659470213
11/4/2000	0.09	1.18	0.00025	0.89	106.21	212.42	1.360177278	-1.306431474
12/4/2000	0.093	1.23	0.00025	0.89	69.01	138.02	1.545649614	-0.603418225
13/4/2000	0.189	0.8	0.00025	0.89	110.98	221.96	3.348467395	3.118225208
14/4/2000	0.267	0.8	0.00025	0.89	98.75	197.5	6.682592652	3.902875557
15/4/2000	0.231	0.83	0.00025	0.89	135.53	271.06	5.286017346	4.52818348
16/4/2000	0.255	0.82	0.00025	0.89	90.17	180.34	6.325409188	-6.152546842
17/4/2000	0.225	0.81	0.00025	0.89	61.86	123.72	4.834817108	-4.632610142
18/4/2000	0.168	0.91	0.00025	0.89	113.14	226.28	3.209727311	0.732503422
19/4/2000	0.108	0.96	0.00025	0.89	119.74	239.48	1.437281535	1.11871219
20/4/2000	0.09	1.08	0.00025	0.89	151.77	303.54	1.190990062	1.140264448
21/4/2000	0.105	1.09	0.00025	0.89	141.47	282.94	1.643636703	0.617099477
22/4/2000	0.141	0.84	0.00025	0.89	138.03	276.06	2.00513972	-1.138909076
23/4/2000	0.147	0.82	0.00025	0.89	150.26	300.52	2.102049475	-1.944973589
24/4/2000	0.117	0.98	0.00025	0.89	126.12	252.24	1.739795978	1.511588661
25/4/2000	0.105	1.07	0.00025	0.89	137.06	274.12	1.598607147	-1.310829812
26/4/2000	0.15	1.01	0.00025	0.89	141.82	283.64	2.991934381	2.580032135
27/4/2000	0.234	0.79	0.00025	0.89	113.89	227.78	5.036859508	5.036540366
28/4/2000	0.189	0.8	0.00025	0.89	136.5	273	3.348467395	1.6685501
29/4/2000	0.177	0.88	0.00025	0.89	165.68	331.36	3.388114093	-3.325884328
30/4/2000	0.141	0.96	0.00025	0.89	135.12	270.24	2.449810888	0.466332596
							Net Sum	-5.660606996
							Total	75.7700729

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/5/2000	0.135	8.55	0.00025	0.89	177.32	354.64	7.505665388	4.013255929
2/5/2000	0.138	10.58	0.00025	0.89	219.92	439.84	10.79590774	0.937459035
3/5/2000	0.144	8.79	0.00025	0.89	234	468	8.901860554	2.197614773
4/5/2000	0.114	9.48	0.00025	0.89	110.94	221.88	6.248772287	5.951389181
5/5/2000	0.09	10.63	0.00025	0.89	133.64	267.28	4.624421437	-1.974937162
6/5/2000	0.087	11.96	0.00025	0.89	127.84	255.68	5.157126267	-4.956373556
7/5/2000	0.084	11.61	0.00025	0.89	143.93	287.86	4.598110372	-4.371987841
8/5/2000	0.093	10.83	0.00025	0.89	161.25	322.5	5.077864083	4.715308102
9/5/2000	0.096	11.06	0.00025	0.89	203.31	406.62	5.584028762	-5.505627362
10/5/2000	0.141	8.39	0.00025	0.89	223.89	447.78	7.958911153	7.933552764
11/5/2000	0.18	7.48	0.00025	0.89	206.4	412.8	10.91867394	-10.5838075
12/5/2000	0.33	6.65	0.00025	0.89	221.33	442.66	30.76329413	14.93478921
13/5/2000	0.288	6.89	0.00025	0.89	183.51	367.02	24.71077114	16.68293404
14/5/2000	0.258	6.46	0.00025	0.89	192.72	385.44	18.00365487	16.0784158
15/5/2000	0.24	6.31	0.00025	0.89	177.16	354.32	15.03969442	11.38502335
16/5/2000	0.195	6.88	0.00025	0.89	196.69	393.38	11.30379753	-8.562974001
17/5/2000	0.21	6.73	0.00025	0.89	171.13	342.26	12.6833412	4.422341002
18/5/2000	0.144	8.44	0.00025	0.89	159.56	319.12	8.375507737	-8.220373601
19/5/2000	0.156	8.43	0.00025	0.89	192.85	385.7	9.812124469	7.621178138
20/5/2000	0.18	7.52	0.00025	0.89	173.91	347.82	11.00637387	9.491677949
21/5/2000	0.195	7.56	0.00025	0.89	194.3	388.6	13.02040239	-11.53974966
22/5/2000	0.177	8.61	0.00025	0.89	160.74	321.48	13.03838347	11.91994853
23/5/2000	0.138	10.86	0.00025	0.89	156.17	312.34	11.2273019	-11.01913914
24/5/2000	0.147	12.68	0.00025	0.89	190	380	16.07259642	4.776007693
25/5/2000	0.12	12.83	0.00025	0.89	202.68	405.36	10.90121655	-2.645313871
26/5/2000	0.099	4.63	0.00025	0.89	197.08	394.16	1.608475187	-1.602648202
27/5/2000	0.117	10.05	0.00025	0.89	190.43	380.86	7.184446352	-5.623754248
28/5/2000	0.111	10.77	0.00025	0.89	209.72	419.44	7.173680043	-7.170672703
29/5/2000	0.093	11.2	0.00025	0.89	203.29	406.58	5.340297126	-5.23497915
30/5/2000	0.123	8.68	0.00025	0.89	215.5	431	6.373269753	-4.530155952
31/5/2000	0.24	6.57	0.00025	0.89	267.72	535.44	15.97875831	15.78389973
							Net Sum	45.30230128
							Total	232.387289

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/6/2000	0.249	6.83	0.00025	0.89	223.36	446.72	144.9830512	104.1302073
2/6/2000	0.204	7.38	0.00025	0.89	160.55	321.1	109.3030708	81.3457917
3/6/2000	0.21	7.49	0.00025	0.89	128.54	257.08	118.4264747	-78.69810819
4/6/2000	0.162	7.61	0.00025	0.89	65.29	130.58	72.17628088	-71.27537467
5/6/2000	0.144	8.02	0.00025	0.89	55.91	111.82	61.69841711	-60.1019882
6/6/2000	0.105	10.05	0.00025	0.89	85.31	170.62	46.0166688	41.06408076
7/6/2000	0.126	9.06	0.00025	0.89	199.92	399.84	56.71799531	-47.9687632
8/6/2000	0.105	9.89	0.00025	0.89	195.83	391.66	44.9221487	41.09097441
9/6/2000	0.18	7.06	0.00025	0.89	164.5	329	79.6231853	67.67009196
10/6/2000	0.201	6.89	0.00025	0.89	180.4	360.8	95.72126587	60.42855503
11/6/2000	0.171	8.17	0.00025	0.89	211.97	423.94	89.45668309	31.34125437
12/6/2000	0.141	8.16	0.00025	0.89	243.64	487.28	60.71010012	-31.04546769
13/6/2000	0.117	9.06	0.00025	0.89	251.15	502.3	48.90480208	-25.93395903
14/6/2000	0.192	6.73	0.00025	0.89	223.73	447.46	84.31649394	83.12493511
15/6/2000	0.159	7.5	0.00025	0.89	220.49	440.98	68.02579553	64.52093234
16/6/2000	0.18	7.58	0.00025	0.89	197.55	395.1	88.58012815	-69.95774894
17/6/2000	0.258	6.49	0.00025	0.89	196.92	393.84	144.1763221	-136.1560774
18/6/2000	0.231	6.31	0.00025	0.89	196.83	393.66	110.8040116	-98.34541908
19/6/2000	0.249	6.43	0.00025	0.89	235.77	471.54	132.4349583	63.86771862
20/6/2000	0.168	7.93	0.00025	0.89	199.39	398.78	82.56877284	31.52039501
21/6/2000	0.192	7.86	0.00025	0.89	187.1	374.2	106.4201244	-56.0351879
22/6/2000	0.159	7.95	0.00025	0.89	169.17	338.34	74.23905367	-65.64369589
23/6/2000	0.18	7.1	0.00025	0.89	167.8	335.6	80.30082717	54.43033356
24/6/2000	0.171	7.37	0.00025	0.89	179.4	358.8	76.6444899	57.07966619
25/6/2000	0.162	7.62	0.00025	0.89	203.13	406.26	72.3185936	-65.0662425
26/6/2000	0.222	6.15	0.00025	0.89	193.09	386.18	98.47049208	41.16400952
27/6/2000	0.144	8.12	0.00025	0.89	241.25	482.5	62.85596722	-61.52484583
28/6/2000	0.09	10.97	0.00025	0.89	246.22	492.44	38.55515433	1.40357647
29/6/2000	0.228	7.07	0.00025	0.89	287.5	575	128.022499	-29.87048297
30/6/2000	0.399	6.78	0.00025	0.89	297.56	595.12	368.1949417	-363.2357009
								-436.67654
								1953.75419

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/7/2000	0.312	6.81	0.00025	0.89	242.46	484.92	226.6299701	212.4334613
2/7/2000	0.321	6.14	0.00025	0.89	213.29	426.58	205.3761968	-155.0799308
3/7/2000	0.372	5.85	0.00025	0.89	205.61	411.22	256.5116915	130.1457623
4/7/2000	0.342	6.52	0.00025	0.89	217.13	434.26	255.1003716	198.7274723
5/7/2000	0.324	6.52	0.00025	0.89	186.54	373.08	228.9543502	184.1779239
6/7/2000	0.612	6.06	0.00025	0.89	196.37	392.74	731.9800863	-107.5417768
7/7/2000	0.306	5.76	0.00025	0.89	189.83	379.66	169.5758738	105.7654067
8/7/2000	0.258	6.06	0.00025	0.89	188.41	376.82	130.0875797	-44.97188151
9/7/2000	0.27	6.2	0.00025	0.89	192.15	384.3	147.4356634	134.2162803
10/7/2000	0.324	5.9	0.00025	0.89	190.29	380.58	197.0858857	-119.1957929
11/7/2000	0.348	6.06	0.00025	0.89	194.6	389.2	236.6763755	-126.048731
12/7/2000	0.246	6.48	0.00025	0.89	195.82	391.64	130.7736389	120.4486848
13/7/2000	0.153	8.59	0.00025	0.89	199.15	398.3	77.20760718	58.54550201
14/7/2000	0.174	7.81	0.00025	0.89	205.42	410.84	86.56902635	66.90075508
15/7/2000	0.3	6.02	0.00025	0.89	201.3	402.6	174.1505025	109.0547269
16/7/2000	0.402	5.94	0.00025	0.89	198.05	396.1	306.492082	135.4563439
17/7/2000	0.366	6.02	0.00025	0.89	187.57	375.14	259.2056079	-253.0866953
18/7/2000	0.222	6.9	0.00025	0.89	173.05	346.1	117.0218799	77.30260317
19/7/2000	0.105	10.51	0.00025	0.89	213.61	427.22	49.21190283	-6.762493037
20/7/2000	0.144	8.84	0.00025	0.89	194.52	389.04	71.39879255	-46.80537727
21/7/2000	0.18	7.26	0.00025	0.89	204.62	409.24	83.03045673	69.30253846
22/7/2000	0.126	9.44	0.00025	0.89	220.11	440.22	60.32350496	34.11123036
23/7/2000	0.135	8.56	0.00025	0.89	216.19	432.38	59.79511006	-56.75538051
24/7/2000	0.24	6.82	0.00025	0.89	208.7	417.4	134.3960582	79.69309167
25/7/2000	0.294	6.21	0.00025	0.89	210	420	175.234473	-156.3376268
26/7/2000	0.24	6.63	0.00025	0.89	212.61	425.22	128.8191003	-120.3997197
27/7/2000	0.204	7.17	0.00025	0.89	229.39	458.78	104.6710435	27.42226475
28/7/2000	0.21	7.09	0.00025	0.89	206.94	413.88	109.0675174	-89.88743819
29/7/2000	0.234	6.28	0.00025	0.89	212.36	424.72	112.89083	-80.46628296
30/7/2000	0.204	7.04	0.00025	0.89	191.62	383.24	101.8372842	-13.4604782
31/7/2000	0.102	10.2	0.00025	0.89	191.45	382.9	44.4005231	-24.27780013
							Net Sum	342.6266428
							Total	3144.78145

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/8/2000	0.177	7.8	0.00025	0.89	194.54	389.08	89.40790577	-56.07585036
2/8/2000	0.159	8.07	0.00025	0.89	199.71	399.42	75.92626499	-45.36723168
3/8/2000	0.375	5.79	0.00025	0.89	200.55	401.1	256.6657188	-233.4961478
4/8/2000	0.255	6.74	0.00025	0.89	211.48	422.96	149.0588243	141.3034931
5/8/2000	0.27	6.07	0.00025	0.89	209.51	419.02	142.8229669	-136.5336648
6/8/2000	0.264	6.5	0.00025	0.89	219.6	439.2	151.3092137	-109.5135879
7/8/2000	0.168	7.78	0.00025	0.89	206.77	413.54	80.23714081	-75.99975484
8/8/2000	0.18	7.33	0.00025	0.89	193.12	386.24	84.23420043	29.60039749
9/8/2000	0.192	7.99	0.00025	0.89	188.1	376.2	109.0712052	-88.89619583
10/8/2000	0.129	13.78	0.00025	0.89	183.07	366.14	111.5169114	110.8185419
11/8/2000	0.123	14.41	0.00025	0.89	209.8	419.6	108.4160748	-107.1480952
12/8/2000	0.273	6.56	0.00025	0.89	199.15	398.3	164.047093	124.3947295
13/8/2000	0.324	6.06	0.00025	0.89	193.43	386.86	205.1570484	-123.5817904
14/8/2000	0.273	6.54	0.00025	0.89	210.64	421.28	163.2974497	79.58193136
15/8/2000	0.192	7.34	0.00025	0.89	214.82	429.64	96.03599336	76.70783044
16/8/2000	0.333	6.85	0.00025	0.89	222.66	445.32	260.4424726	-211.6412602
17/8/2000	0.375	7.76	0.00025	0.89	234.69	469.38	398.2379127	-388.307109
18/8/2000	0.342	7.47	0.00025	0.89	195.6	391.2	312.8387922	312.3560733
19/8/2000	0.213	7.49	0.00025	0.89	232.64	465.28	121.834257	61.34004633
20/8/2000	0.465	7.53	0.00025	0.89	250.22	500.44	585.3098809	-511.8430014
21/8/2000	0.504	7.3	0.00025	0.89	229.95	459.9	656.3460088	633.0879872
22/8/2000	0.447	7.16	0.00025	0.89	217.08	434.16	501.5013025	362.1358626
23/8/2000	0.456	7.08	0.00025	0.89	197.39	394.78	513.176851	-472.9133393
24/8/2000	0.423	6.16	0.00025	0.89	193.21	386.42	358.376306	-13.25068413
25/8/2000	0.288	6.54	0.00025	0.89	193.59	387.18	181.7352127	-145.7006045
26/8/2000	0.171	8.18	0.00025	0.89	212.87	425.74	89.62097449	-89.54200238
27/8/2000	0.153	8.16	0.00025	0.89	203.98	407.96	71.48346329	-43.21936826
28/8/2000	0.189	7.01	0.00025	0.89	205.27	410.54	86.85365933	78.56753496
29/8/2000	0.189	7.33	0.00025	0.89	215.13	430.26	92.86820597	28.27025827
30/8/2000	0.18	7.18	0.00025	0.89	200.15	400.3	81.66184019	-80.09119103
31/8/2000	0.177	7.64	0.00025	0.89	196.9	393.8	86.67104965	-80.90641542
							Net Sum	-975.862608
							Total	5052.19198

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/9/2000	0.174	8.26	0.00025	0.89	175.33	350.66	11.8397098	-11.34584196
2/9/2000	0.156	8.35	0.00025	0.89	175.16	350.32	9.672782	-9.669731851
3/9/2000	0.144	8.55	0.00025	0.89	186.16	372.32	8.539779286	8.535415518
4/9/2000	0.192	7.66	0.00025	0.89	237.5	475	12.87413627	-9.290954698
5/9/2000	0.144	8.29	0.00025	0.89	194.78	389.56	8.153222045	0.224508148
6/9/2000	0.123	9.35	0.00025	0.89	203.27	406.54	7.125250368	-6.937361596
7/9/2000	0.126	8.35	0.00025	0.89	234.71	469.42	6.310202458	-6.193552272
8/9/2000	0.126	8.61	0.00025	0.89	230.17	460.34	6.607212998	6.588684204
9/9/2000	0.237	6.98	0.00025	0.89	219.86	439.72	17.0628792	-4.35734374
10/9/2000	0.309	8.14	0.00025	0.89	231.63	463.26	36.52801363	-36.35697295
11/9/2000	0.324	6.69	0.00025	0.89	208.9	417.8	29.92276261	3.780957626
12/9/2000	0.258	7.11	0.00025	0.89	201.61	403.22	20.78817208	19.37711991
13/9/2000	0.21	9.5	0.00025	0.89	200.75	401.5	21.27142023	-15.40710258
14/9/2000	0.183	11.41	0.00025	0.89	220.66	441.32	21.26195214	21.22723871
15/9/2000	0.168	11.36	0.00025	0.89	210.67	421.34	17.80158001	9.618345094
16/9/2000	0.198	12.05	0.00025	0.89	203.42	406.84	27.01366072	-27.01354726
17/9/2000	0.189	12.67	0.00025	0.89	185.98	371.96	26.53756193	25.72733856
18/9/2000	0.156	10.29	0.00025	0.89	120.32	240.64	13.23258672	12.85497208
19/9/2000	0.174	8.7	0.00025	0.89	160.44	320.88	12.79822867	7.645357919
20/9/2000	0.138	9.25	0.00025	0.89	141.87	283.74	8.825580121	7.947052109
21/9/2000	0.138	8.83	0.00025	0.89	121.14	242.28	8.231362315	-4.521832295
22/9/2000	0.195	7.57	0.00025	0.89	139.83	279.66	13.04624506	-2.368824471
23/9/2000	0.183	8.55	0.00025	0.89	148.3	296.6	13.79189181	13.46588719
24/9/2000	0.147	10.09	0.00025	0.89	128.09	256.18	11.40890356	-11.34160602
25/9/2000	0.135	10.12	0.00025	0.89	229.05	458.1	9.6651989	-6.691047175
26/9/2000	0.117	10.09	0.00025	0.89	173.72	347.44	7.22738122	7.039670875
27/9/2000	0.102	10.86	0.00025	0.89	206.98	413.96	6.133629958	-4.810709883
28/9/2000	0.186	7.52	0.00025	0.89	205.34	410.68	11.75236143	9.995244145
29/9/2000	0.123	10.14	0.00025	0.89	169.84	339.68	8.047104579	4.491209481
30/9/2000	0.105	11.61	0.00025	0.89	127.07	254.14	7.184547456	3.647563005
							Net Sum	5.860135823
							Total	318.472993

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/10/2000	0.135	10.24	0.00025	0.89	135.36	270.72	78.23569727	52.6459771
2/10/2000	0.18	7.48	0.00025	0.89	266.91	533.82	86.83301737	-37.62652737
3/10/2000	0.18	7.54	0.00025	0.89	97.36	194.72	87.87989202	-16.03687964
4/10/2000	0.132	9.55	0.00025	0.89	131.12	262.24	67.36594485	-67.22674906
5/10/2000	0.189	6.98	0.00025	0.89	213.08	426.16	86.29670782	-80.45050672
6/10/2000	0.168	7.81	0.00025	0.89	177.73	355.46	80.70168449	-49.5790006
7/10/2000	0.144	8.13	0.00025	0.89	289.81	579.62	62.9721162	62.97183698
8/10/2000	0.21	6.61	0.00025	0.89	294.75	589.5	98.18118382	-92.15724795
9/10/2000	0.33	6.68	0.00025	0.89	283.15	566.3	246.3088741	203.3517647
10/10/2000	0.384	7.1	0.00025	0.89	288.64	577.28	365.4579867	-294.6254745
11/10/2000	0.429	7.51	0.00025	0.89	276.57	553.14	496.205959	198.9079598
12/10/2000	0.402	7.52	0.00025	0.89	258.81	517.62	436.5825294	345.2764401
13/10/2000	0.39	7.42	0.00025	0.89	248.02	496.04	402.7379523	-205.4129943
14/10/2000	0.453	7.45	0.00025	0.89	271.89	543.78	546.6612609	-255.0451376
15/10/2000	0.267	7.31	0.00025	0.89	140.83	281.66	184.5806087	-171.3633136
16/10/2000	0.174	10.14	0.00025	0.89	254.83	509.66	128.0686745	99.88868658
17/10/2000	0.267	8.36	0.00025	0.89	278.98	557.96	225.7456677	-218.4768041
18/10/2000	0.555	7.2	0.00025	0.89	283.61	567.22	779.6006571	773.4200179
19/10/2000	0.369	8.37	0.00025	0.89	260.36	520.72	431.944954	-350.6339385
20/10/2000	0.246	7.86	0.00025	0.89	216.16	432.32	174.6994424	-168.2279146
21/10/2000	0.225	7.15	0.00025	0.89	236.44	472.88	126.7977609	126.6097217
22/10/2000	0.267	7.02	0.00025	0.89	225.36	450.72	173.7063427	-173.2001883
23/10/2000	0.162	8.09	0.00025	0.89	155.22	310.44	79.11162351	55.02905266
24/10/2000	0.159	7.73	0.00025	0.89	224.23	448.46	71.17885132	57.89662465
25/10/2000	0.153	8.29	0.00025	0.89	178.95	357.9	73.19849352	-31.02992627
26/10/2000	0.174	7.96	0.00025	0.89	186.86	373.72	89.07494929	26.08797044
27/10/2000	0.189	7.51	0.00025	0.89	147.08	294.16	96.30991498	-91.17004809
28/10/2000	0.213	7.2	0.00025	0.89	240.88	481.76	114.8273751	-107.0392209
29/10/2000	0.339	6.8	0.00025	0.89	295.7	591.4	266.9624941	216.2120918
30/10/2000	0.312	8.77	0.00025	0.89	196.18	392.36	331.2043741	171.1063137
31/10/2000	0.33	10.87	0.00025	0.89	226.24	452.48	511.2810324	120.9890279
							Net Sum	101.0916139
							Total	4919.69536

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/11/2000	0.309	12.24	0.00025	0.89	84.18	168.36	535.6444029	-522.592586
2/11/2000	0.552	9.12	0.00025	0.89	90.46	180.92	1099.405483	-1073.803502
3/11/2000	0.561	8.88	0.00025	0.89	86.55	173.1	1091.019862	-537.5392903
4/11/2000	0.408	8.57	0.00025	0.89	106.6	213.2	547.1155327	-322.9327864
5/11/2000	0.363	10.29	0.00025	0.89	114.69	229.38	569.8017751	-87.12556305
6/11/2000	0.303	11.02	0.00025	0.89	142.21	284.42	439.9923589	438.5127346
7/11/2000	0.237	9.83	0.00025	0.89	101.8	203.6	226.785067	161.4415009
8/11/2000	0.267	7.33	0.00025	0.89	75.91	151.82	185.3386393	168.5889433
9/11/2000	0.303	6.57	0.00025	0.89	88.81	177.62	202.5446597	201.669235
10/11/2000	0.243	7.35	0.00025	0.89	115.64	231.28	154.1455677	-147.6976778
11/11/2000	0.285	7.02	0.00025	0.89	92.35	184.7	197.9168972	146.882623
12/11/2000	0.201	8.04	0.00025	0.89	107.46	214.92	120.660098	117.8366269
13/11/2000	0.252	7.68	0.00025	0.89	113.85	227.7	177.0640515	176.8363689
14/11/2000	0.453	7.27	0.00025	0.89	82.63	165.26	526.9695317	510.0967324
15/11/2000	0.525	7.75	0.00025	0.89	81.17	162.34	779.0380071	-708.4431933
16/11/2000	0.453	8.57	0.00025	0.89	106.1	212.2	674.4583295	-670.3484328
17/11/2000	0.3	8.1	0.00025	0.89	101.44	202.88	271.8050512	266.8139879
18/11/2000	0.309	7.59	0.00025	0.89	80.23	160.46	261.5574582	-110.123305
19/11/2000	0.366	7.34	0.00025	0.89	97.56	195.12	348.9745423	180.9523215
20/11/2000	0.372	7.75	0.00025	0.89	82.8	165.6	391.134315	338.5319495
21/11/2000	0.612	7.9	0.00025	0.89	80.94	161.88	1089.509363	-1086.979132
22/11/2000	0.924	9.1	0.00025	0.89	83.16	166.32	3070.389813	1109.651255
23/11/2000	0.699	8.58	0.00025	0.89	87.03	174.06	1608.691507	-1565.654101
24/11/2000	0.795	9.35	0.00025	0.89	124.14	248.28	2367.222932	-573.0995358
25/11/2000	0.714	8.55	0.00025	0.89	110.24	220.48	1669.67937	1151.560402
26/11/2000	0.348	8.66	0.00025	0.89	91.06	182.12	404.3177535	-96.75685264
27/11/2000	0.264	8.69	0.00025	0.89	184.28	368.56	233.8971899	-52.84211759
28/11/2000	0.378	7.33	0.00025	0.89	146.19	292.38	371.4728239	-145.7579815
29/11/2000	0.387	7.69	0.00025	0.89	214.71	429.42	418.4069842	374.0120107
30/11/2000	0.42	8.34	0.00025	0.89	228.6	457.2	556.5896707	-554.9769525
							Net Sum	-2913.286318
							Total	13600.06

Date	H_{sb}	T_P	β(bed slope)	D_{50}	θ_b	$2\theta_b$	$Q_{LS}/(\sin 2\theta)^{0.6}$	Q_{LS}
1/12/2000	0.414	8.42	0.00025	0.89	102.46	204.92	548.6006339	-426.2745168
2/12/2000	0.426	8.36	0.00025	0.89	99.77	199.54	574.66679	-574.2551038
3/12/2000	0.363	8.76	0.00025	0.89	180.96	361.92	447.5658018	-327.6565664
4/12/2000	0.351	11.11	0.00025	0.89	279.21	558.42	597.6856199	-484.9157117
5/12/2000	0.462	5.24	0.00025	0.89	168.93	337.86	335.4041	-333.4652544
6/12/2000	0.435	11.69	0.00025	0.89	258.08	516.16	990.8040343	871.0925398
7/12/2000	0.459	11.71	0.00025	0.89	273.28	546.56	1105.982358	-237.5723479
8/12/2000	0.48	8.39	0.00025	0.89	306.46	612.92	733.5215908	-359.4023016
9/12/2000	0.468	8.36	0.00025	0.89	262.72	525.44	693.5672982	-566.2507092
10/12/2000	0.408	8.28	0.00025	0.89	141.29	282.58	519.5810664	174.7218725
11/12/2000	0.375	8.21	0.00025	0.89	91.74	183.48	433.3759002	421.4068598
12/12/2000	0.285	8.62	0.00025	0.89	204.97	409.94	269.3010857	269.1853935
13/12/2000	0.237	8.14	0.00025	0.89	178.4	356.8	170.8916272	-168.1959333
14/12/2000	0.255	10.33	0.00025	0.89	121.5	243	282.8253471	-263.72728
15/12/2000	0.435	8.54	0.00025	0.89	92.07	184.14	618.6610945	594.975387
16/12/2000	0.42	7.87	0.00025	0.89	103.05	206.1	510.2090584	-493.943494
17/12/2000	0.531	7.68	0.00025	0.89	86.21	172.42	786.1734223	425.4471773
18/12/2000	0.519	7.93	0.00025	0.89	90.23	180.46	788.0104599	-780.211907
19/12/2000	0.486	8.26	0.00025	0.89	90.25	180.5	734.5647692	-730.1461348
20/12/2000	0.342	7.5	0.00025	0.89	81.83	163.66	314.7252541	150.6253898
21/12/2000	0.384	6.98	0.00025	0.89	80.74	161.48	356.2321141	-345.8097146
22/12/2000	0.636	7.61	0.00025	0.89	73.82	147.64	1112.445394	88.99953471
23/12/2000	0.729	9.53	0.00025	0.89	87.58	175.16	2048.244952	-1647.327099
24/12/2000	0.696	10.44	0.00025	0.89	136.18	272.36	2140.704455	1898.126063
25/12/2000	0.582	10.28	0.00025	0.89	119.06	238.12	1462.591775	-1074.378158
26/12/2000	0.477	9.51	0.00025	0.89	200.58	401.16	874.1682306	-776.832797
27/12/2000	0.507	9.76	0.00025	0.89	179.82	359.64	1026.781726	1025.168776
28/12/2000	0.501	8.92	0.00025	0.89	107.93	215.86	876.0123299	760.1531072
29/12/2000	0.492	8.53	0.00025	0.89	87.64	175.28	790.0257337	-584.1123547
30/12/2000	0.486	8.13	0.00025	0.89	78.97	157.94	717.2917611	607.4710865
31/12/2000	0.549	8.02	0.00025	0.89	79.86	159.72	896.7961331	577.7102043
							Net Sum	-2309.393993
							Total	18039.561