



# Tidal Datum Consistency for Marine Cadastre Littoral Zone Commencement in Malaysia

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## Commission No. 4



## Presentation Outlines

- Introduction
- Current issues in Malaysia
- Objectives
- Method
- Analysis
- Conclusion



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# OVERVIEW

- The definition on Marine Cadastre
- Consistency of Tidal Datum
- Littoral Zone Generation
- Case Study :  
Langkawi Island



# Introduction

## Malaysia's Marine Cadastre Definition (Ashraf et. al, 2013)

- 3D marine parcel administration system with respect to the legal and systematic technical arrangement of marine spatial rights, restrictions and responsibilities for marine space activities.

## Littoral Zone :

- The region that lies between the lines of high tide and low tide.
- The tidal lines are formed by the intersection of the tidal datum and the foreshore terrain.



## Tidal datum:

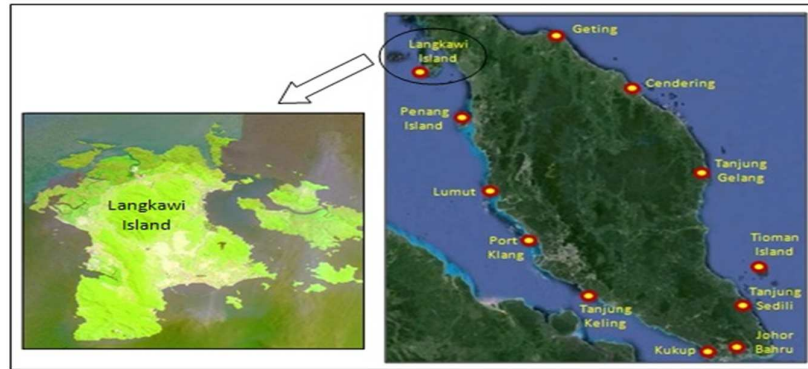
- standard elevation defined by a certain phase of the tide, used as reference level for measuring local water levels and should not be extended into area having differing oceanographic characteristics without substantial measurement.
- the basis for establishing privately owned land, state owned land, territorial sea, exclusive economic zone, and high seas boundaries.
- Mean Sea Level (MSL) is normally used as a reference level for various land development application while in the marine environment, the low water level is applied as the reference level which is called chart datum.

# Main Aspects in Marine Cadastre

- Legal
- Technical
- Social
- Institutional

# Current Issues in Malaysia

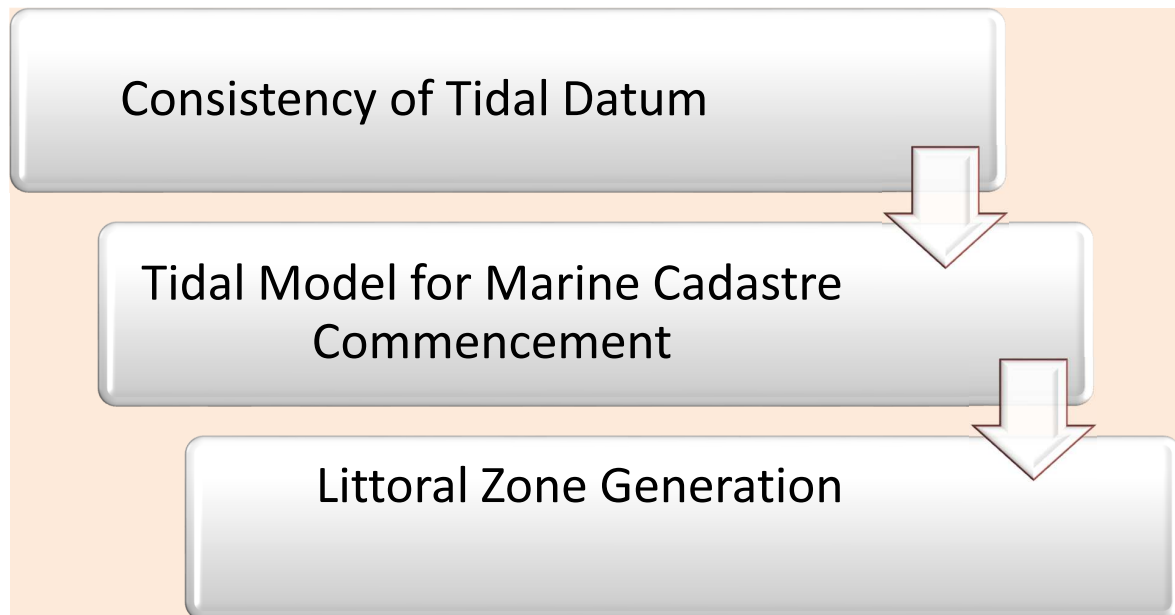
- No determination of LAT in Malaysia
- To support the development of marine cadastre



Langkawi Island

# OBJECTIVES

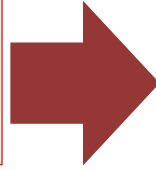
- To present some fundamental principles that can be applied to produce the tidal line.
- Analyze the consistency of Lowest Astronomical Tide (LAT) for Marine Cadastre Littoral Zone Commencement in Malaysia.
- Littoral zone generation.



## Consistency of Tidal Datum:

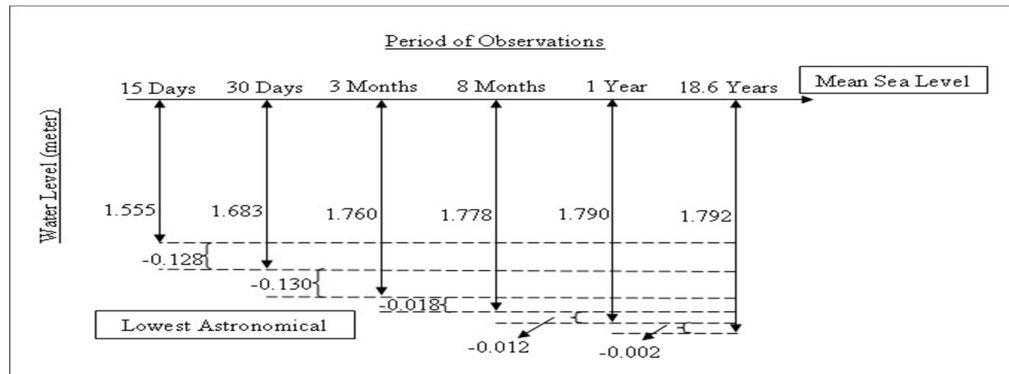
- 12 tide gauge stations – from DSMM
- Data observation (year) : 1993 – 2012
- Software : Total Tides Station (TOTIS)
- Langkawi Island :
  - ① nature of business such as infrastructure, development and tourism.
  - ② a lot of marine institutional and related agencies to support on marine administration.

Day of analysis for DSMM tide gauge station in Langkawi Island based on LAT system



Period of Observation	LAT	MLWS	MLWN	MSL	MHWN	MHWS	HAT
15 Days 1/1/2012 – 16/1/2012	Zero LAT	0.350	1.201	<b>1.555</b>	1.909	2.760	2.991
1 Month 1/1/2012 – 31/1/2012		0.429	1.323	<b>1.683</b>	2.043	2.938	3.315
3 Months 1/1/2012 – 31/3/2012		0.443	1.476	<b>1.760</b>	2.043	3.076	3.499
8 Months 1/1/2012 – 1/9/2012		0.531	1.411	<b>1.778</b>	2.144	3.024	3.557
1 Year 1/1/2012 – 31/12/2012		0.532	1.428	<b>1.790</b>	2.151	3.047	3.542
18.6 Years (Ideally) 15/12/1992 – 24/7/2011		0.560	1.451	<b>1.792</b>	2.133	3.024	3.509

Consistency of zero LAT based on MSL



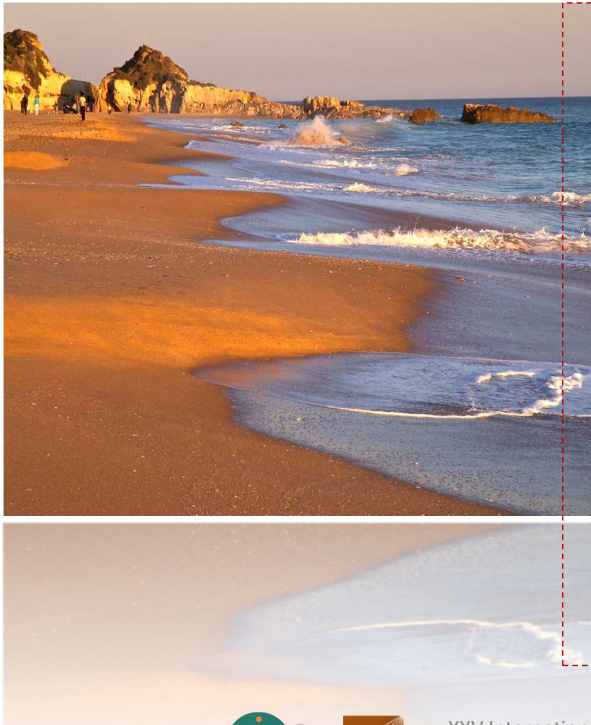
## Tidal analysis for semi-diurnal station

Station	Period of Observation	Type of Tide	LAT	MLWS	MLWN	MSL	MHWN	MHWS	HAT
Penang Island	10/7/1995 – 14/3/2013	Semi-diurnal	Zero LAT	0.707	1.378	1.601	1.825	2.495	2.950
Port Klang	15/12/2008 – 20/3/2013			1.112	2.440	3.148	3.857	5.185	6.028
Lumut	15/12/2009 – 11/3/2013			0.672	1.352	1.761	2.170	2.850	3.367
Johor Bahru	15/12/2005 – 18/3/2013			1.056	1.733	2.266	2.798	3.476	4.006
Kukup	11/12/2003 – 18/3/2013			0.390	1.254	1.747	2.240	3.104	3.903
Tanjung Keling	15/12/2006 – 20/3/2013			0.315	0.902	1.230	1.558	2.145	2.740

Station	Period of Observation	Type of Tide	LAT	MLWS	MLWN	MSL	MHWN	MHWS	HAT
Cendering	15/12/2010 – 20/1/2012	Semi-diurnal	Zero LAT	0.418	1.015	1.490	1.965	2.561	3.082
Geting	14/8/1994 – 19/3/2013			0.176	0.390	0.648	0.906	1.120	1.511
Tanjung Gelang	15/12/2009 – 18/3/2013			0.547	1.627	1.911	2.195	3.274	3.823
Tanjung Sedili	15/12/2001 – 19/3/2013			0.535	1.614	1.762	1.910	2.990	3.343
Tioman Island	25/5/1994 – 16/12/2012			0.472	1.636	1.919	2.201	3.365	3.795

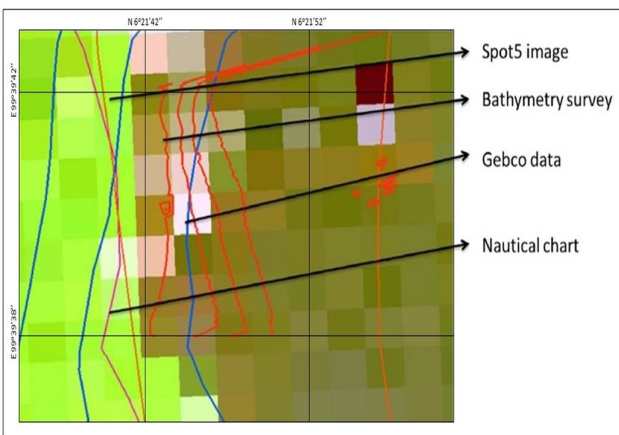
## Tidal model for marine cadastre commencement:

- There are two methods in creating tidal model:
  - By interpolating the tide height between tide gauges (open coastlines)
  - Hydrodynamic model (final data of tidal model contains the constituents: amplitude and phase)



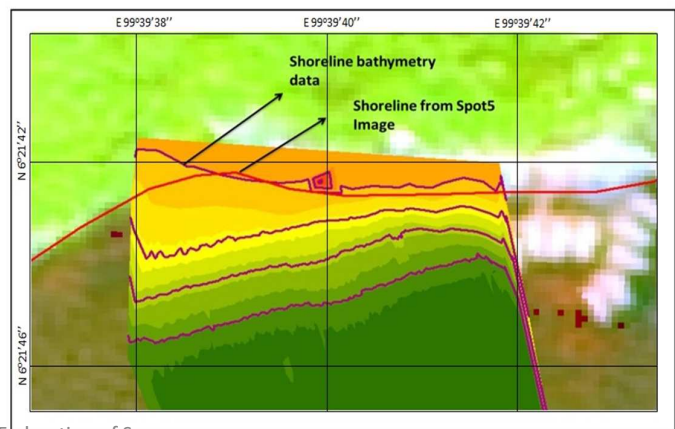
A technique to delineating the littoral zone is by using the digital model the coastal terrain and digital model of the ocean tides. The first step of delineating the littoral zone is deriving the foreshore terrain model and tidal models. Then the LAT and HAT line can be compute by using bathymetric and topographic DEMs from the terrain model. The LAT line is derived from the bathymetric data and the HAT line derived from bathymetric data.

(Nathan, 2008)

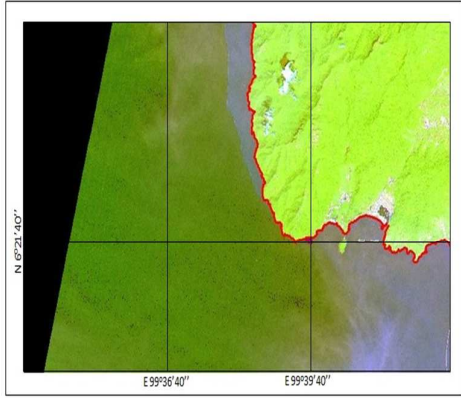


Shoreline from bathymetry data and Spot5 Image

Shoreline from all the sources of data

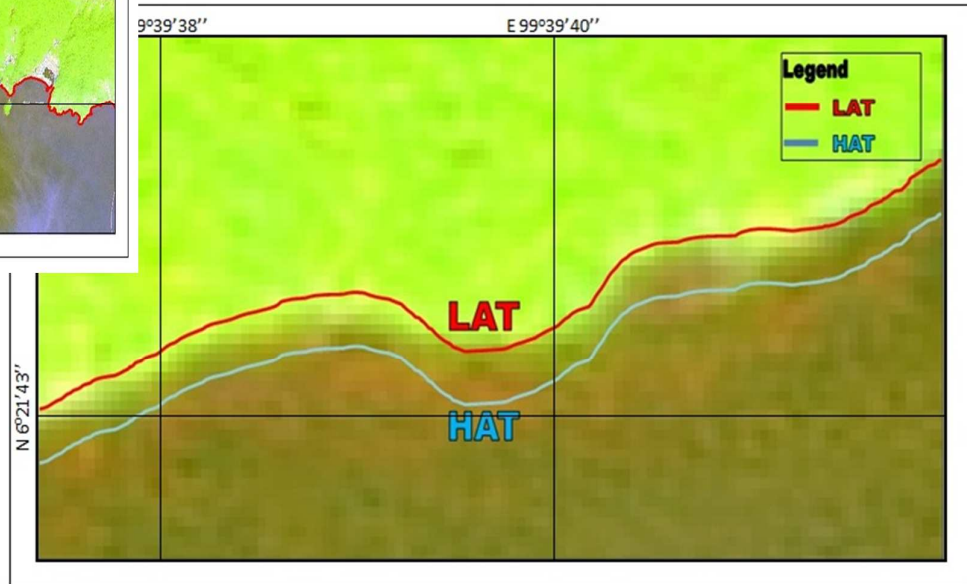






The littoral boundaries (LAT and HAT)

Shoreline model part of Langkawi Island



- The tides observation data are used to derive the tidal model and tidal line.
- Based on the analysis of tidal datum that has been conducted, it shows that is a great potential to use LAT as reference level for marine cadastre.
- This will benefit the realization of marine cadastre in Malaysia due the availability of commencement point for parcel right.

- However, to develop the homogenous datum for land and sea, there is a need to develop a model for defining the relationship between different vertical reference surfaces.
- Large scale map of LAT tidal line and littoral zone for Malaysia is important towards the realization of marine cadastre in Malaysia.

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# Thank you for your attention!

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