

# Oceanography Database Development in Bangka Seas

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**Abstract**— Bangka island is the biggest island in Bangka Belitung Province and located between Sumatra and Kalimantan Island. Furthermore, Bangka seas are connecting Natuna sea with Java sea and also become a important part of Indonesia Throughflow. This geographic condition makes Bangka island has a unique oceanography characteristics. However, the information of oceanography database of the Bangka waters remains limited. Thus, the purpose of this research is to develop a oceanography database in Bangka seas to support the development in these region like the zoning plan of Bangka Belitung.

Focus area of this study is at the Bangka seas around Bangka Island. The characteristic of oceanography will be discuss in this study covering water quality, tides, waves, and currents. For describe those oceanography characteristic, the data obtained from field observation and numerical methods.. For the current this research using MIKE21 and also using SWAN (Simulating Waves Nearshore) software for wave model. Furthermore, the tidal data from Babel Ocean Observation Science and Technologies (BOOST) Center will be used in this discussion. In addition, the data of water quality are obtained from field observation in several sampling location.

From this research, significant wave height (Hs) in Bangka seas around 0.02-1.87 meters and the currents ranges from 0.05-0.72 m/s. The direction of waves and current dominantly to the southeast when the west monsoon and head northwest when the east monsoon direction influenced by wind direction. Furthermore, tides type of Bangka seas is diurnal with around 2.3 m tidal range. For water quality, Bangka seas have around 22°C temperature, 22-31‰ salinity, and pH are around 8.

**Keywords**—*Oceanography Database, Bangka Seas, Oceanography Modelling, Quality Water*

## I. INTRODUCTION

Bangka Belitung seas is known to have lots of maritime potentials, such as on tourism and fishery sector up to the potential of its fishery. One of the areas that are potentially is Bangka island. Bangka Island itself, is the largest island in the province of Bangka Belitung. As geographically, Bangka Island bordered by Natuna Sea at Northern side,, Gaspar

Strait at Eastern side, Java Sea at southern side, and Bangka Strait at Western part. This conditions make Bangka Sea is interesting to review its hidro-oceanographic characteristics.

Furthermore, Bangka Island is famous by its tin mining that has lasted decades ever. Tin mining activities will affect the condition of Bangka Seas itself especially with the sedimentation process. Sedimentation can occur either due to natural processes such as in the lower reaches of the River as well as a result of human intervention such as tin mining activities that are well known in the province of Bangka Belitung. With high sedimentation process due to tin mining, it will be followed by a decrease in water quality of Bangka Seas. Therefore, it is important to know the Bangka Seas's characteristic by making an oceanography database and also monitor it periodically.

Oceanographic data (such as physics and chemistry of ocean) is very useful for planning coastal regions in Bangka Seas, mainly because of it is a sensitive, complex, inter-related area. The mining, tourism, industrial, and more sector are linked in Bangka Seas. The availability of oceanographic database of Bangka Seas is still limited, even though this database is a basic data for making coastal plans. So, the aim for this research is to complete the information of Bangka Seas characteristics such as water quality, tides, waves, and currents datas.

## II. RESEARCH METHOD

Focus area in this study located at Bangka Seas (Fig. 1). The primary data was obtain on 1-3 February 2017 from field survey. From it, we collect water quality, tides, waves, and currents. This data then will be analyzed and discussed in this research. Furthermore, the bathymetry data also taken and combined with General Bathymetric Chart of the the Ocean (GEBCO) 30'' data for build the numerical model using SWAN (Simulating Waves Nearshore) and MIKE21.

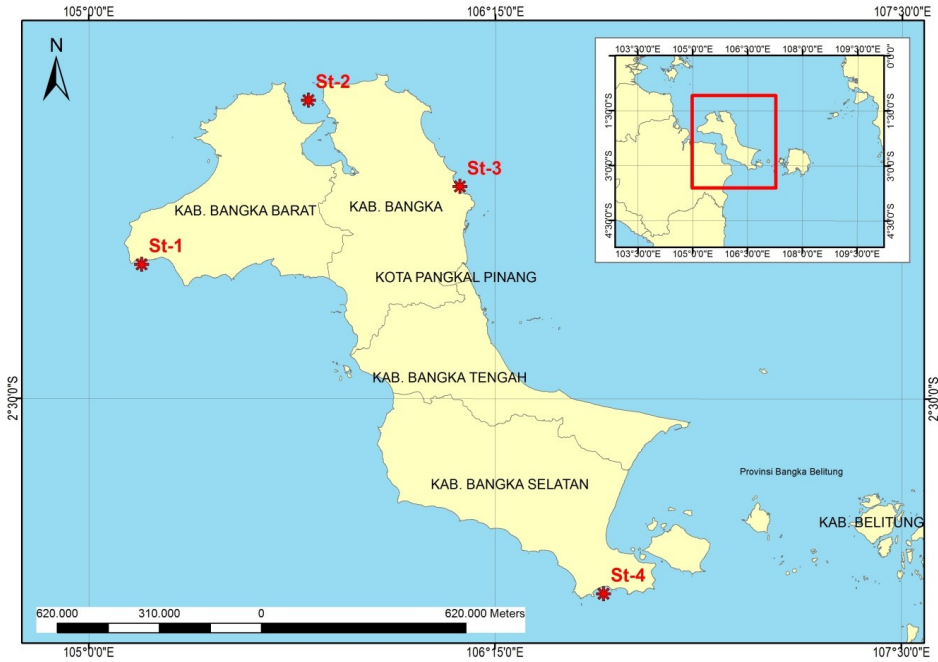


Fig. 1. Research location at Bangka Seas, Bangka Belitung

For testing the feasibility and confidence level of the model results, the data will be verified by field data. Therefore, secondary data will be taken from Babel Ocean Observation Science and Technologies (BOOST) Center. BOOST Center is a division under the Department of marine and Fisheries (DKP) Bangka Belitung Province that focus on provide the oceanographic data in Bangka Belitung. This study used the tidal data from BOOST Center which then will be compared with the numerical model's result. Furthermore, the research also collect and discuss the water quality data that obtained from field survey that held by PT. Timah, Tbk.

### III. RESULT AND DISCUSSIONS

#### A. Tides

The tidal data on 1-3 February 2017 will be compared for verification. This data compared against tidal data from model and BOOST Center data (Fig. 2). From the comparison, it obtained the Root Mean Squared Error

(RMSE) value is 0.1425. Furthermore, the correlation value 0.9418 are obtain in this model's result. The correlation value shows that the model's result and field data has similarity of its tidal phase. The correlation and RMSE value prove that the model's results are pretty good to be used in this research. Thus, the currents, tidal, and waves value from model can be used as hydro-oceanography data at Kelabat Bay waters.

In this study, we will discuss the characteristic of oceanography in 4 different location, Bangka Strait at Western side, Kelabat Bay at Northern side, Gaspar Strait at Eastern side, and also Sadai Strait at Southern side. All regions in Bangka Seas has diurnal tidal type with Formzahl number 4.709 at Kelabat Bay, 7.223 at Gaspar Strait, 12.462 at Gaspar Strait, and 7.204 at Sadai Strait. The Formzahl number over than 3 indicate the type of tides are diurnal type [5] and is caused by its dominating value of amplitude K1 and O1. From last research, it's known that at Karimata Strait is diurnal type with the largest amplitude is constituent K1, exceeding 50 cm [6]. Kelabat Bay will have a similar tides characteristic to Karimata Strait, which are diurnal type [7].

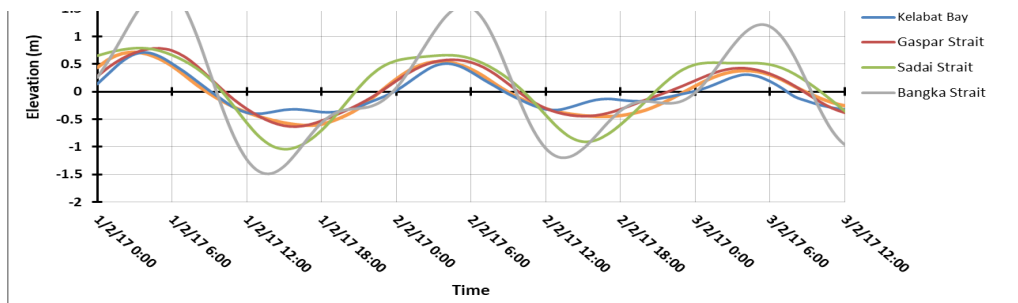


Fig. 2. Tides value comparison between model's result and measurement

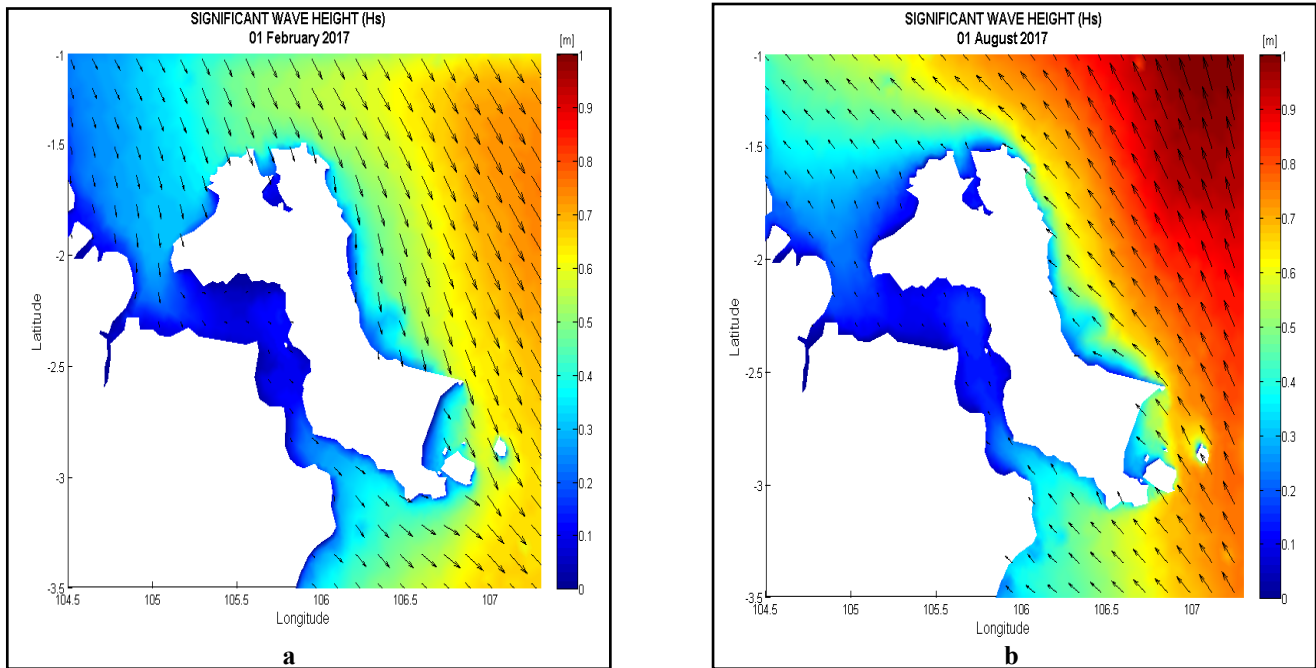


Fig. 3. The value of significant wave height at Bangka Seas on a) West monsoon, and b) East monsoon

### B. Waves

The waves modeling in Bangka Seas is focused on comparing two distinct monsoon, west and east monsoon. East monsoon comes around June-August meanwhile West monsoon comes around December until February. If we want to describe the waves characteristic, it's important to analyze its significant wave height (Hs) with two different monsoon [8]. The direction of the propagation waves in Bangka Seas on West monsoon will move dominantly from North to South at Bangka Seas (Fig. 3 a). The wave come from Natuna Sea and pass by Bangka Seas then propagate to Java Sea. On this monsoon, the wind direction will move from North to South and will influenced the wave propagation.

On the other hand, the direction of the dominant waves are moving north direction on East monsoon. On this monsoon, the significant wave height (Hs) tend to be smaller than West monsoon. This wave direction also influenced the wind direction on East monsoon. Bangka Seas can be divided into 4 main regions there are Bangka Strait, Kelabat Bay, Gaspar Strait, and Sadai Strait (Fig. 1). Significant wave height at Bangka Seas are around 0-1.051 m at Bbangka Strait, 0-1.475 m at Kelabat Bay, 0-1.476 m at Gaspar Strait, and 0-1.452 m at Sadai Strait .

### C. Current

From this research, we find the interesting pattern of currents in Bangka Seas because it's very influenced by the wind monsoon. This conditions happen due to the location of Bangka Seas itself. Geographically, Bangka Seas are located between two big islands (Sumatera and Kalimantan Islands) and two oceans (Natuna and Java Seas). Bangka Seas also can be divided into 4 main regions that are Bangka Strait, Kelabat Bay, Gaspar Strait, and Sadai Strait. (Fig. 1). Each of those regions has different characteristics and will

influence the hydro-oceanographic conditions at Bangka Seas.

If we focus on geographical location of Bangka Seas, the current in this region more likely to be affected by monsoon wind not influenced by its geograpical condition such as Pelabuhan Ratu Bay's currents [9]. In Indonesia seas, there are lots of region are affected by wind monsoon for their current pattern such as at Java Seas [10]. West monsoon's currents profile are presented in Fig. 4a and East monsoon in Fig. 4b.

On February 1<sup>st</sup> 2017 which West monsoon, the currents of Bangka Seas dominantly flow from Natuna Sea to Java Sea. This condition are caused by the direction of wind on West monsoon that move from Northern to Southern part of Earth. The current pattern will stream with two main lane which are Bangka Strait at Western side and Gaspar Strait at Eastern side of Bangka Islands (Fig. 1). On West monsoon, the speed of current at Bangka Seas between 0 - 0.6 m/s. The currents tend to be higher at Bangka Strait and Gaspar Strait because there are a shallow and narrow regions. Furthermore, if we focus on Kelabat Bay on the Northern part of Bangka (Fig. 1), there are a huge currents that can reach around 1.3 m/s depend on the tidal condition. It's similar to Ambon Bay. When low to high tide, the current will flow from Teluk Ambon Luar toward Teluk Ambon Dalam and vice versa at high to low tide [11] with the magnitude around 0-1.463 m/s [12].

On the East monsoon precisely on August 1<sup>st</sup> 2017, the currents of Bangka Seas dominantly flow from Java Seas to Natuna Sea. This condition are opposite from on West monsoon that wind will move from Northern to Southern part of Earth. When West monsoon, the current speed at Bangka Seas tend to be lower than at East monsoon. The current speed at Bangka Seas at West monsoon can reach 0.3 m/s.

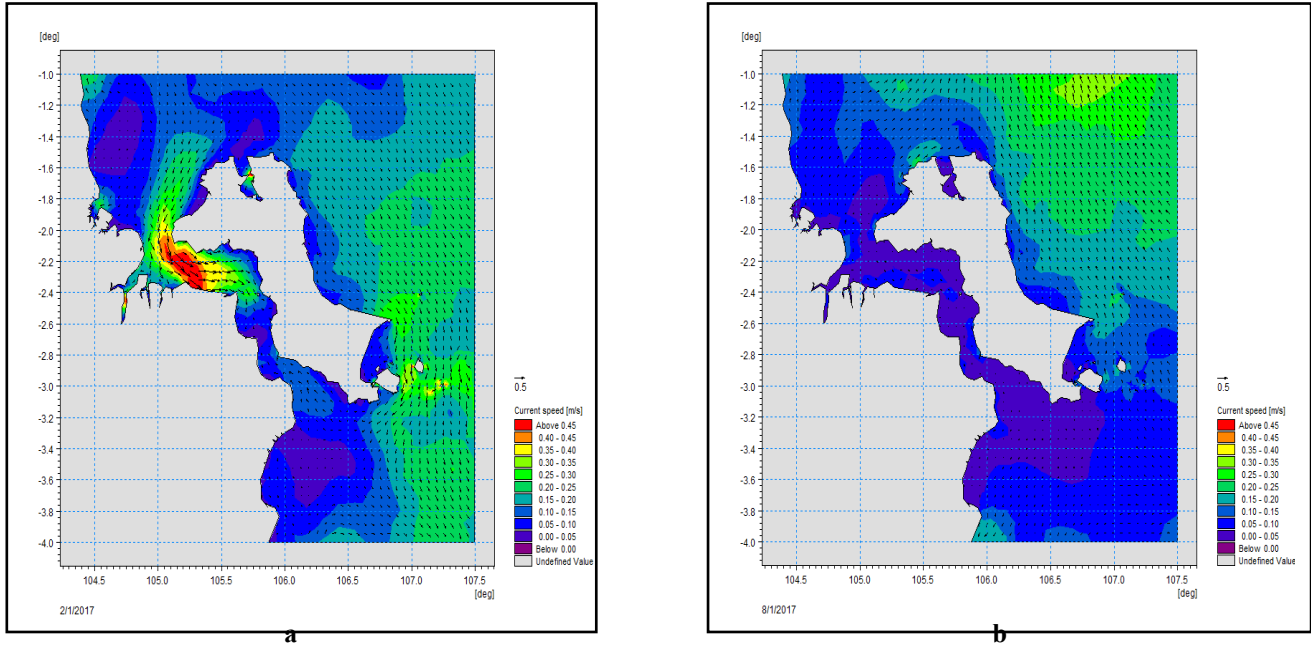


Fig. 4. Profile of the current at Bangka Seas on West monsoon when a) high tide, and b) low tide

D. Water Quality

Bangka Belitung are famous because its tin mining both in land or ocean area. This activities has lasted decades ever and will affect the condition of Bangka Seas itself especially with the sedimentation process. The quality of water at Bangka Seas presented at Table 1. Those datas obtained from PT. Timah, Tbk. that held sampling on April 2nd, 2018. We divided the area of Bangka Seas into 4 main regions which are Bangka Strait (represented by St-1), Kelabat Bay (St-2), Gaspar Strait (St-3), and Sadai Strait (St-4) (Fig. 1). From those data we can know that overall the values of temperature, pH, and dissolve oxygen are similar in each regions. Bangka Seas has temperature 22oC, pH 8, and dissolve oxygen 3.3-4.5. Salinity at St-1 are lower than the others due to there are many big river that flow to Bangka

Strait both from Sumatera or Bangka Island that reduce the salinity. Furthermore, the most important parameter in Bangka Seas is Total Suspended Solid (TSS) that influenced by tin mining activities in Bangka itself. TSS values are 3 mg/l at Bangka Strait (St-1), 215 mg/l at Kelabat Bay (St-2), 245 mg/l at Gaspar Strait (St-3), and 686 mg/l (St-4).

Overall, Bangka Seas has TSS higher than the standart quality of water around 20-80 mg/l. Only Muntok, that has fewer tin mining activities has TSS lower than the standart. On the other regions, there are still lots of tin mining activities especially illegal mining (TI) that held by people of Bangka itself. From this data indicate that tin mining activities in Bangka Island will reduce water quality of Bangka Seas seen by the huge number of TSS.

TABLE I. WATER QUALITY OF BANGKA SEAS

Parameter	Units	Standart	Sampling Station			
			St-1	St-2	St-3	St-4
Temperatur	°C	-	22	22	22	22
Salinity	‰	-	25	29	31	31
pH	-	-	8	8	8	8
Dissolve Oxygen	Mg/L	-	4	4.5	3.6	3.3
Total Suspended Solid	Mg/L	20-80	3	215	245	686

#### IV. CONCLUSION

From this research, we can conclude that Bangka Bay tidal type is diurnal that high tide and low tide occurs only once a day. The significant wave height at Bangka Seas are around 0-1.4.75 meter. The direction of waves propagation in Bangka Seas and current profile will leading into Java Seas from Natuna Seas on West monsoon and vice versa when East monsoon influenced by wind direction in every season. The highest current speed at Bangka Seas is around 0.6 m/s at open ocean and around 1.3 m/s at the gap of Kelabat Bay (Northern part of Bangka Island). Furthermore, tin mining activities in Bangka very influence the water quality of Bangka Seas seen by the huge TSS value in most regions.

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