BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, June 2017. Vol. **14**(2), p. 509-512

Metocean Environment for Aquaculture Seaweed Farming System

O. O. Sulaiman, M.F. Akhir and Shamila Azman

University Malaysia Terengganu, School of Ocean Engineering, 21030, Kuala Terengganu, Malaysia.

http://dx.doi.org/10.13005/bbra/2472

(Received: 11 May 2017; accepted: 20 May 2017)

The study and analysis of metocean data is essential in predicting future environmental conditions. In relation with design nearshore structure for of seaweed cultivation, this study focuses on the collection and analysis of metocean data of potential sites in Malaysia so as to prevent under-designing and over-designing of the structure. The study investigates the metocean environment for the spatial design and monitoring of a seaweed aquaculture farm at monsoons proton East Coastal region.

Keywords: Metocean environmental; conditions; investigates

Recent trends have shown that companies are becoming more involved in joint industry projects (JIP) when planning on a certain project which is beneficial in saving costs but having risks such as losing shared equipment and data altogether as well as having to wait for the technical scope for a significant amount of time and getting many contracts signed and agreed. However, when it comes to collecting metocean data, which is not sensitive or confidential amongst companies, companies are encouraged easily to work together to gather such data.

Seaweeds are comprised of many species that are native to certain habitats with specific environmental conditions. Hence, it is essential for one study and analyse potential locations for deployment of any project, especially a project that involves spatial planning. Seaweeds are sensitive to environmental changes and thus, require deep analysing of the location to ensure the survival of the seaweed farm. Metocean data of a certain region can assist in determining the design criteria of offshore or nearshore infrastructures which can prevent structural failure and even overdesigning.

The paper highlights Collection of historical metocean data of potential sites and hydrodynamic simulation of the metocean data to enhance management of deployment of seaweed aquaculture farm.

Background

Metocean data collection are normally collected using measuring instruments such as using buoys and wave radars which aids in observing wave heights and wave directions of a specific region as well as installing anemometer on offshore platforms to measure wind speed and direction. Wave radars can also be applied for structural monitoring, weather forecasting, sea state assessment for operations, water level observations and wind farm monitoring. Instruments are prone to malfunction and thus, missing data is inevitable. Yet, the fragmented data that are acquired from the instruments are used for processing and analyzing.

* To whom all correspondence should be addressed.
E-mail: oolanrewaju8@gmail.com

The validation of the data consisted of comparing continuous wave hindcast against NOAA data buoy sea state measurements at one location while comparing the data with TOPEX and ERS satellite altimeter wave height data for the whole basin. The verification was on paired data and probability distributions.

Methodology of metocean data and environmental data factors which affects the survivability and growth of the native seaweed species for vulnerable east coast of Malaysia is investigated (Fig. 1).

The design of offshore or nearshore structure can bring about safety issues so it is essential for the right data to be gathered and analysed that can be understood by engineers when planning an offshore project. The design criteria must be able to fulfill the requirements of being conservative for today's solutions and simultaneously have room for additional modifications to the structure in the future (Shaw & Shell Global Solutions, n.d.).

Metocean data studies usually involves gathering the relevant historical metocean data that ranges for 20 to 30 years at least from reliable sources based on the venue of the potential sites. Besides, metocean data collection of the present conditions of the potential sites is also carried out via measuring instruments that are available and reliable to use. After collecting the metocean data, the data will be processed and analysed via numerical and hindcast modelling. For this study, MIKE 21/3 HD FM software is used for analyzing, simulating and calibrating the models.

The parameters of the data that are used for hindcast modelling will include wind, wave and current. The wind data will comprise of speed and direction, the wave data will comprise of height and lastly, the current will comprise of speed and direction. Moreover, there are several sources where metocean data of specific regions can be obtained namely, the University Corporation for Atmospheric Research (UCAR) and the National Center for Atmospheric Research (NCAR). The institutions provide a number of suggested products or programs that have online databases on certain ocean parameters such as the Climate Forecast System Reanalysis (CFSR) (National Center for Atmospheric Research Staff, 2014), Surface Flux and Meteorological Dataset: National Oceanography Centre (NOC) V2.0 (Kent

Drag Force for Mooring Components and Seaweed

Current Speed (m/s)	Drag Force
1 to 1.5	Minimal
2 to 3	Large
>3	Large (Intolerable)
Current Direction (Degree)	**Max Drag Force**
0 to 10	Ultimate limit state
90	Accidental limit state

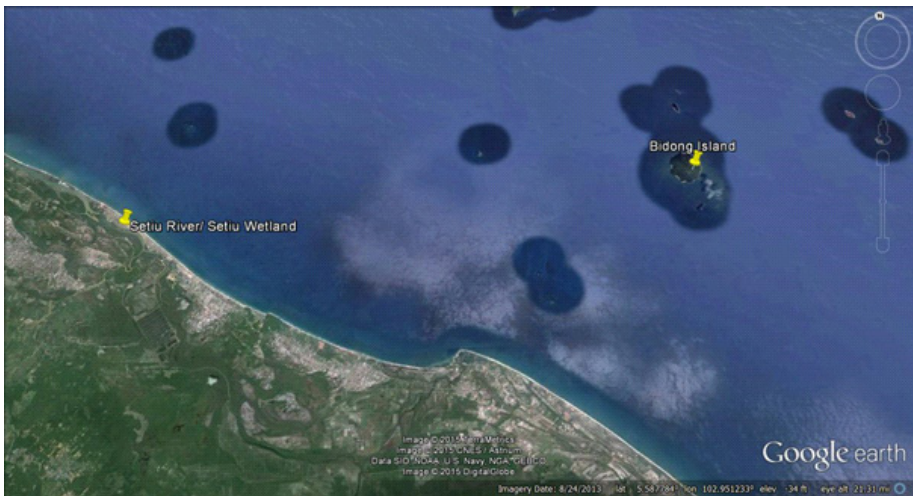

Fig.1. East Coastal Regions, Terengganu

Table 1. Simulation Period :
April 2014 (With Wind Forcing; CFSR)

No	Setup	Remarks	Tidal Station	RMSE (%)	Simulation Time
4	Seaweed_EastCoast_Peninsular_Mesh03_UTM48_CFSR_April2014_Calib01	Resistance Map 32 was used. [5 (m^1/3)/s) at boundaries]	Kuala Dungun	10	16hrs
		Used KMS Boundary Conditions (Wind Driven)	Chendering	12	
		Compared 6 (all) tidal stations	Kuala Terengganu	12	
		Compared Current Velocity and Direction	Setiu	14	
		RMSE : 25% and 36%	Sungai Besut	13	
		Compared U Velocity	Tumpat	15	
		RMSE : 13%			
		Compared V Velocity			
		RMSE : 42%			
5	Seaweed_EastCoast_Peninsular_Mesh03_UTM48_CFSR_April2014_Calib02	Peninsular Map was used.	Kuala Dungun	10	18 hrs
		Used KMS Boundary Conditions (Wind Driven)	Chendering	12	
		Included Tgganu Wind Forcing	Kuala Terengganu	12	
		Compared 6 (all) tidal stations	Setiu	14	
		Compared Current Velocity and Direction	Sungai Besut	13	
		RMSE : 25% & 35%	Tumpat	15	
		Compared U Velocity			
		RMSE : 13%			
		Compared V Velocity			
		RMSE : 44%			
6	Seaweed_EastCoast_Peninsular_Mesh03_UTM48_CFSR_April2014_Calib03	Sbh and Swak Map was used.	Kuala Dungun	10	15 hrs
		Used KMS Boundary Conditions (Wind Driven)	Chendering	12	
		Included Tgganu Wind Forcing	Kuala Terengganu	12	
		Compared 6 (all) tidal stations	Setiu	14	
		Compared Current Velocity and Direction	Sungai Besut	13	
		RMSE : 25% and 35%	Tumpat	15	
		Compared U Velocity			
		RMSE : 13%			
		Compared V Velocity			
		RMSE : 44%			
7	Seaweed_EastCoast_Peninsular_Mesh03_UTM48_CFSR_April2014_Calib04	Resistance Map 32 was used. [10 (m^1/3)/s) at boundaries]	Kuala Dungun	10	17 hrs
		Used KMS Boundary Conditions (Wind Driven)	Chendering	12	
		Included Tgganu Wind Forcing	Kuala Terengganu	12	
		Compared 6 (all) tidal stations	Setiu	14	
		Compared Current Velocity and Direction	Sungai Besut	13	
		RMSE : 25% and 36%	Tumpat	15	
		Compared U Velocity			
		RMSE : 13%			
		Compared V Velocity			
		RMSE : 43%			

& National Center for Atmospheric Research Staff, 2014), Global Sea Level from TOPEX & Jason Altimetry (National Center for Atmospheric Research Staff, 2013),

RESULTS

The following table features the current outline progress of the project.

CONCLUSIONS

The Study investigates the metocean environment for the spatial design and monitoring of a seaweed aquaculture seaweed farm for Eastern Coast near, Terengganu. Historical metocean data (wave, wind and current) of potential sites from reliable sources and metocean data of present conditions of potential sites via measuring

instruments were collected processed and analysed. Then model simulate and calibrate the environment based on the data collected for the potential sites.

ACKNOWLEDGEMENT

The author acknowledges: F. Arina for her direct contribution and DHI for the support and training. Ministry of Higher Education for providing Fundermental Research Grant for the work.

REFERENCES

1. Department of Irrigation and Drainage Malaysia,. (2001). *Guidelines for Preparation of Coastal Engineering Hydraulic Study and Impact Evaluation* (5th ed.). Retrieved from http://www.water.gov.my/images/pdf/pce_hydraulic_study.pdf
2. National Center for Atmospheric Research Staff (Eds),. (2013). *Global Sea Level From Topex & Jason Altimetry*. *https://climatedataguide.ucar.edu*. Retrieved 19 March 2015, from https://climatedataguide.ucar.edu/climate-data/global-sea-level-topex-jason-altimetry
3. Oceanweather.com,. (2015). *Oceanweather Inc: MetOcean Studies: SEAFINE*. Retrieved 19 March 2015, from http://www.oceanweather.com/metocean/seafine/
4. Shaw, C., & Shell Global Solutions,. *Offshore Industry Requirements And Recent Metocean Technology Developments* (1st ed.). Retrieved from http://ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-10-CLIMAR-99/Presentations/session_09/09.1_Shaw.pdf