Flow Pattern in the Estuary of Musi River Using MIKE-21 Flow Model

by Achmad Syarifudin Eka Puji Agustini

Flow Pattern in the Estuary of Musi River Using MIKE-21 Flow Model

Achmad Syarifudin[1], Eka Puji Agustini[1]
[1]Bina Darma University, Palembang South Sumatra, Indonesia,
syarifachmad6080@yahoo.co.id, eka_puji@binadarma.acid

Abstract. Musi river is the largest river in Palembang with a length of more than 750 kilometers and an average width of 540 meters where the maximum width of 1,350 meters is located around the *Kemaro* island. Basically, sedimentation in the Musi river does include sedimentation due to the high level meeting between the Musi river currents and ocean currents in the *Bangka* Strait. The silting condition of Musi river is getting more severe because of the sludge that reaches about 40 cm per month. In fact, the volume of sludge could reach 2.5 million meter^3. There are 13 silting points along the Musi river shipping channel from the *Boom Baru* port to Bangka Strait. Four points are already very vulnerable because of the silting reaches up to 4 meters. The location which is quite compress is from the northern Payung Island to te estuary, while the location of the worst silting among others is on the outside verge of the Jaran strait and the water groove of the southern part of the Payung island sedimentation reaches 7 km, so the boat that crosses the groove of Musi river should be guided against the tide that occurs.
This research was conducted by using the approach of software models MIKE 21 Flow Model and the results obtained from this study is the pattern of movement of the flow between the other directions and speed of currents and hydrodynamic model of the depth of the river starting from the outside verge to the Musi river which affected the down tide.

1 Introduction

Musi river is the largest river in Palembang with a length of more than 750 kilometers and an average width of 540 meters where the maximum width of 1,350 meters is located around the *Kemaro* island and the minimum width of 250 meters is located around the Musi II Bridge. Musi river has two islands, namely Kembaro (Kemaro) and Kerto islands. The three other major rivers are the Ogan river with an average width of 236 meters, Ogan river with an average width of 211 meters and the Keramasan river with an average width of 103 meters (Department of Public Works BM & NRM Palembang, 2012).
Musi river is not only used by people around the course but also by big companies located along the Musi river. They use the Musi river to deliver the products and bring in the raw material through the vessel. There are so many big ships and even very large pacing in the Musi river. Some companies located along the Musi river are *PT. Pertamina, PT. Sriwijaya fertilizer (PUSRI), Wilmar* Group and the Port of *Boom*

Baru, and Port at *35 ilir*. The role of the Musi river is very vital and this so called pulse of Palembang city is now haunted by various problems. One of the problems is the river silting which continue to increase every year. Of course this is very detrimental to the Government of South Sumatra Province, especially at this time of South Sumatra province being intensively attract investors to invest in the business sector. Basically, sedimentation in the Musi river does include a high level of sedimentation caused by the current meeting between Musi river and ocean currents in the Bangka Strait.

The silting condition of Musi river is getting more severe because of the sludge that reaches about 40 cm per month. In fact, the volume of sludge could reach 2.5 million meter^3. There are 13 silting points along the Musi river shipping channel from the *Boom Baru* port to Bangka Strait. Four points are already very vulnerable because of the silting reaches up to 4 meters. The location which is quite compress is from the northern Payung Island to the estuary, while the location of the worst silting among others is on the outside verge of the Jaran strait and the water groove of the sedimentation in the southern part of the Payung island reaches 7 km, so the boat that crosses the groove of Musi river should be guided against the tide that occurs.

2 Methodology

This study was carried out with the modeling and simulation of flow patterns and sediment transport in water area of the Bangka Strait in position 2.07º - 2.38º of South Latitude and 104.85º - 105.17º of East Longitude. The research location is in figure 1.

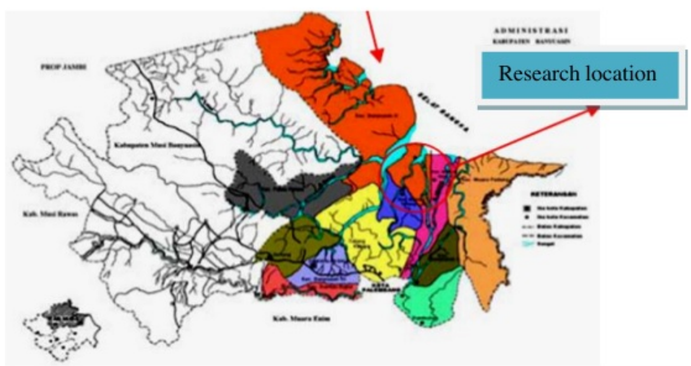

Fig. 1. Map of Research Location (Source: BPSDA, 2010)

3 Tools and Materials

The tools used in this research are as in Table 1 below

Table 1. List of tools used in the study

No	Name of Tools	Number of Uses
1	Stationery 2 pieces	Writing to recording data
2	Computer (RAM 2 GB) 1 unit	Performing general modeling
3	Printer 1 unit	Displaying form of report
4	Software MIKE-21 Model, MS-Excel	Performing modeling and data processing
5	Dongle (licensed program) 1 pieces	Activating the software MIKE-21 FM
6	Laptop and Printer 1 pieces	Assisting to preparing reports

The data used in the analysis are as shown in Table 2.

Table 2. Types and Sources of Data Required

No	Data properties	Data type	Sources	Units
1	Tidal	Primary	Field	m
2	Bathymetry	Secondary	Bakosurtanal/Pelindo	m
3	The direction and speed of current	Primary	Field	(°) & m/s
4	River capacity	Primary	Field	m^3/s
5	The direction and speed of wind	Secondary	BMG	(°) & m/s
6	Base of Sediment	Primary	Field	mm or ø
7	The concentration of suspended sediment	Primary	Field	mm/l
8	Discharge of sediment from the river	Primary	Field	gram/s

4 MIKE-21 FM Simulation

MIKE-21 Hydrodynamic Module (HD Module) is a mathematical model to calculate the hydrodynamic behavior of the water against a wide variety of styles functions, for example, certain wind conditions and water levels are specified in the open model of the boundary. HD module simulates the water level and the current differences in the various styles function in lakes, estuaries, and beaches.

5 Results and Discussion

Output Model Hydrodynamics

After all the boundary condition is discussed in the modeling, the results of global model output on the outside verge of the Musi river are as in figure 2, figure 3 and figure 4 below.

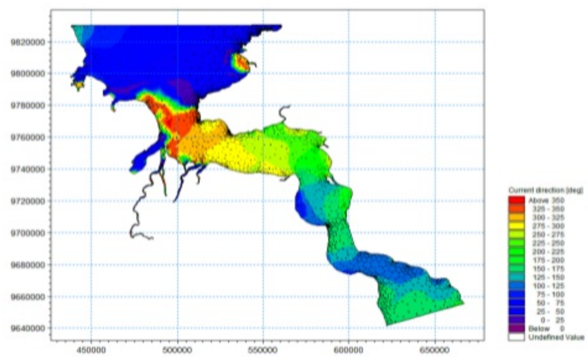

Fig. 2. The hydrodynamic model of the river water velocity direction

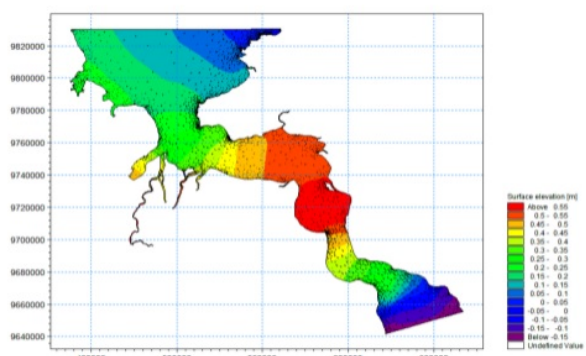

Fig. 3. Model hydrodynamic surface elevation watersheds

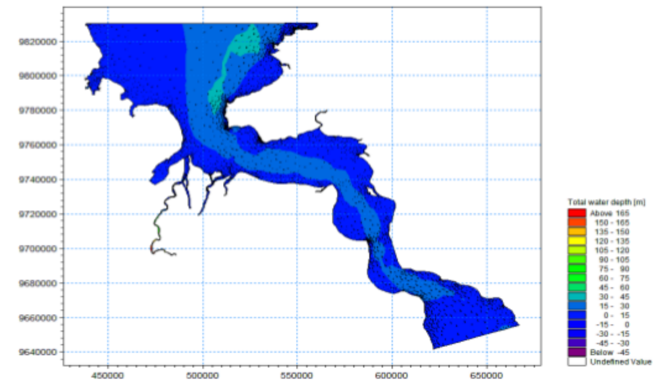

Fig. 4. The total depth of the hydrodynamic model of river flow

6 Conclusions and Recommendations

From the analysis of the study, it can be summarized that:

1. Greatest speed direction occurred on the Musi river bank ranges between 300-350 degrees.
2. Thresold elevation of the outer surface of the Musi river ranges between 0.20 m - 0.40m will affect the free area for ships to perform well and safe movement.
3. The total depth of water occurs at 15-30 m and therefore contributes to the flow of the ship movement into the Musi river as a whole.

As a recommendation of this study, it is necessary to study more detail about the correlation of sediment movement and move of the ship to the amount of sediment in the Musi river.

Acknowledgments

I would like to say thank you to Prof. Ir. Bochari H. Rachman, M.Sc, Rector of Bina Darma University, Prof. Dr. H. Zainuddin Ismail, MM, Vice Rector I and Dr. Sunda Ariana, MM, M Ed, Vice Rector II of Bina Darma University who are pleased to give permission and assistance to the author, especially in the preparation of the data so that the paper can be completed.

References

1. Hartayo Suprianto, Sumarjo Gatot Irianto, Robiyanto H. Susanto, and FX BartSchult. Suryadi 2006, Potential and constrains of water management measures for tidal lowlands in South Sumatra. Case study in a pilot area Telang I. In proceedings of the 9th Inter-Regional Confrence on the water environment. Enviro water, Concept for Water management and multifunctional land uses in lowlands, Delft, the Netherlands.

2. Harinaldi 2005, Principles of Statistics for Engineering and Science, Erland Jakarta, Indonesia.
3. Indarto 2010, Hydrology, Basic Theory and Application Example Model Hydrology, PT. Earth Literacy, Jakarta, Indonesia Joint Working Group, Ministry of Public Works and Rijkwaterstaat., 2005. Technical Guidelines On Tidal Lowland Development. Volume II: Water Management.
4. Munir, S 2010, Role of sediment transport in operation and maintenance of supply and demand based irrigation canals, PhD Thesis UNESCO-IHE, Delft, The Netherlands.
5. Paudel, 2010, Role of sediment in the design and management of irrigation canals, Sunsari Morang Irrigation Scheme, Nepal, PhD Thesis, UNESCO-IHE, Delft, The Netherlands.
6. Schultz, B and Vries, WS, 1993. The 15th Congress on Irrigation and Drainage: Water Management in the Next Century: Q.45 R.17: Some Aspects of Maintenance Typical Drainage Systems in Flat Areas. The Hague.
7. Schultz, E. 1993. Land and Water Development: Finding a balance between implementation, management and sustainability. IHE Delft. Netherlands.
8. Schultz, B, Zimmer, D, and Vlotman, WF, 2007. Drainage under Increasing and Changing Requirements. The Journal of the International Commission on Irrigation and Drainage. John Wiley and Sons Ltd.
9. Supriyanto, H., 2004. Where do We Stand on Swamplands Development. Regional Seminar on Teaching Tidal Lowlands.
10. Supriyanto, H, Irianto, SG, Susanto, RH, Suryadi, FX, Schultz, B., 2006. Potentials and Constraints of Water Management Measures for Tidal Lowlands in South Sumatra. Case Study in a Pilot Area in Telang I. In Proceedings of the 9th Inter-Regional Conference on Environment-Water. Delft.The Netherlands.
11. Suryadi, FX, October 1996. Soil and Water Management Strategies for Tidal Lowlands in Indonesia. Netherlands, A.A. Balkema, Rotterdam. The Netherlands.
12. Suryadi, FX, 2004. Development of Tidal Wetlands in South Sumatra Swamp Experience Regional Development and O & M Telang I.Land and Water Management Tidal Lowlands.
13. Suryadi, F.X, 2007. Lecture Notes. Unsteady flow. Unesco IHE. The Netherlands.
14. Djajamurni 2008, policy development and management of swamp (now and in the future), Papers in the Workshop on the Strengthening of Tidal Lowland Development (STLD), Jakarta. Indonesia

Flow Pattern in the Estuary of Musi River Using MIKE-21 Flow Model

ORIGINALITY REPORT

10%	8%	5%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	vdocuments.site Internet Source	6%
2	Submitted to The University of the South Pacific Student Paper	2%
3	www.ijrer.com Internet Source	1%
4	Submitted to UNESCO-IHE Institute for Water Education Student Paper	1%
5	www.tandfonline.com Internet Source	1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		