Preliminary Study on River Water Change To Determine Map Datum of Musi River Palembang

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Preliminary Study on River Water Change To Determine Map Datum of Musi River Palembang

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Abstract – On constructing a navigation map of river water, Map Datum Scale that is used will be dissimilar between headwaters and downstream. Map datum is a result of the calculation on water surface height where on the water surface of river water always changes according to the place and time. The changing of the river water surface is influenced by hydrology factors and the characters along the river stream and also a tidal factor. This final task studies the influences of the tide toward the height of river water level using the Admiralty Method. The data used is the data from 4 stations of water surface changing owned by PT. Pelindo II Palembang on the period of September 2019 till August 2020. The data of water surface height used to get the calculation of Harmonic Constant, mid hub, the value of Deficient Constant (Zo), and type of water surface change, by displaying the graphic on the station. The result of a calculation based on Harmonic Constant arises value of mid hub average station of Boom Baru 232 cm, Jaran Strait 283 cm, KampungUpang 310 cm, and TanjungBuyut 138 cm. The type of water surface changing in Boom Baru station is always single daily and in TanjungBuyut station is always mixed daily tended to single. Otherwise in Jaran Strait station and KampungUpang may vary. Water steep relating to the graphic is smaller toward the headwaters that matches with the Zo calculation result which is smaller to the headwaters.

Keywords – Datum Map River, Tides, Middle Sitting, Zo.

I. INTRODUCTION

The study of water advance change is an activity that is useful to support human life, the benefits of the study of water change include scientific research on natural symptoms occurring in the water, forecasting changes in water advance Used for cruise navigation purposes, and the study of water advance changes used for the benefit of the Hydrography engineering (Ahmadi, 2019).

The river water surface is a water surface that is very difficult to predict, the change is very dependent on the situation and location. At the determination of changes in the water face in the river, there are some differences with the determination of changes in seawater (Suharyo, 2017). In determining the change of water face in the river there are hydrological factors of the river and high difference along with the flow from the upstream to the estuary (if not too different, resulting in the effect of changing the water advance from the sea can enter deep into the inside).

The study area was held in the Musi Palembang River South Sumatera, which is one of the gates of water transportation to the city of Palembang. The selection of the study area in the Musi River because of the available data used which is a longtime data. Musi River is also one of the rivers that have quite diverse characteristics and is a long river groove (Arozi, 2000).

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II. PROBLEM FORMULATION

The change in water face is a phenomenon of water, where the high change will always differ in each different time and place. Changes in the water face are influenced by several factors, such as:

1. Astronomic factors are mainly caused by the moon and the sun.

2. The meteorological factor, the main meteorological element is rain (especially on river waters).

3. The land period and the basic shape of the waters that can block water movement.

In the calculation of water advance changes, the above factors are used as parameters to obtain harmonic constants. The determination of the change of water in the sea and the river will differ in its treatment (Astika, 2020). Determination of change of water face in the river with its water input base can be divided into three areas:

1. Area upstream, which is only influenced by river hydrology.

2. The area is downstream, partly influenced by hydrology and partly influenced by a change in seawater advance.

3. Estuary area, is the area Mix.

By looking at the factors that affect the change of the water advance and its hatchery area, it is possible to calculate the change in water in the river has different characters from the change of water in the sea (Bandono, 2019).

Purpose and Objectives

The study in this final task intends to obtain the calculation of Datum Peta along the Musi River. The objectives of the study conducted in this final assignment include:

1. To know the nature of the change of water in the Musi River so that it can be known how the influence of the seafront changes to the creation of map Datum.

2. Strengthening the information of the existing river water change, so that it is a change in the face of reliable river water, can be used in navigation activities and can be used as a basis for the implementation of other studies.

Scope

The scope of this task is a study of the Musi River because of the influence of the change in seawater, the research area of Tanjung Buyut estuary up to the port of new Boom Palembang. In conducting the study using harmonized analysis with the Admiralty method. The data that is used in this study is data on the change of river water on the four fixed stations that belong to PT. Pelindo II Palembang Branch. To complete the analysis on the impact of the water face change, using meteorological data from BMKG station of SBA Airport. Palembang, period 2000 to 2010. The bathymetry data used in the study is data from the results of the survey conducted by PT. Lapi Ganeshatama Bandung in 2008 and a thorough painting of the survey results in the Indonesia Navy year 1971.

Benefits of study

Generally expected with this study, can be used as a discourse or reference in the implementation of surveys and mapping in the river. In particular, this study can be used as a reference in improving the determination of the Datum map of the Musi River and the correct information change of river water, with consideration at the time of manufacture, data used using data with period Observation of 12 (twelve) months.

III. MATERIALS AND METHODS

Model count in Datum determination Map of the River

There is some work to be done to calculate the Datum map along this river, namely:

1. High-water interpolation along the river

2. High harmonics analysis of water face

3. Map Datum Determination

Interpolation

This study only used a linear interpolation way. In this linear interpolation of a highwater face there are several variables to be known, among others:

1. High face water observation in two high observer water Advance (T) stations.

2. Distance along the river (d).

Interpolation using formulas:

$$Ti = (TB - TA) \times (\frac{da}{db}) + TA$$

Ti : High-rise water interpolation results
TB : High waterfront on station B.
TA : High water advance on station A.
da : Station distance A to B.
db : Interpolation distance

This linear interpolation can be used if:

1. Slope of the river is assumed to be relatively equal along the river.

2. The flow is considered uniform/no water acceleration.

Harmonics Analysis

The calculation of harmonic constants in this study uses assumptions, which changes in water advances that occur, assumed to be the influence of changes in water advances in the sea. The calculations used using the Admiralty 29 Piantan method correspond to the calculation of the Admiralty method at sea (Djunarsjah, 1999).

Determination of River Map Datum

After all the amplitude of the component changes water advance in all segments of the river water is obtained, then the determination of Datum River Map can be determined. Rawi (1985) in oceanographic teaching materials explained, for the calculation of Datum Peta using the addition of Zo parameters which is a constant Calculation of the map Datum is:

$CD = DT - Zo$
CD : The face value (Datum map).
DT : Sit middle.
Zo : Constant reducer

Face value calculation (Zo)

Zo is a field derived from the count of several components of the beach, in which each component has a reduced nature of its value (Dronkers, 1964)

Calculation of Middle Seated

Middle sitting is the average level of seawater. In this study the calculation of sitting is implemented by calculation for 39 hours (Herdiawan, 2019).

Type of water advance change

According to Wyrtki (1961), it is divided into 4 types: Single daily (Diurnal Tide), double daily (Semi diurnal). Mixed Tide, Prevailing Diurnal (Nugroho, 2020).

$$F = \frac{{}_A K_1 + {}_A O_1}{{}_A M_2 + {}_A S_2}$$

1. F has a value of $0 < F < 0.25$ then it is double.
2. F has a value of $0.25 < F < 1.5$ then double-leaning.
3. F has a value of $1.5 < F < 3$ hence the single leaning.
4. F has a value of $3 < F$ then a single.

Data Processing

Processing data using Microsoft Excel. The data processing step in the writing of this final assignment, among others (Nugoho, 2019):

1. The high data interpolation of the water face, with the reference of four major water advance change stations.
2. Calculation sits center on each main station and the interpolated nodes.
3. Calculation of harmonic constants on each main station and interpolated nodes.
4. Calculation of the reducer (Zo) constant value on each main station and the interpolated nodes.
5. Map Datum calculations.

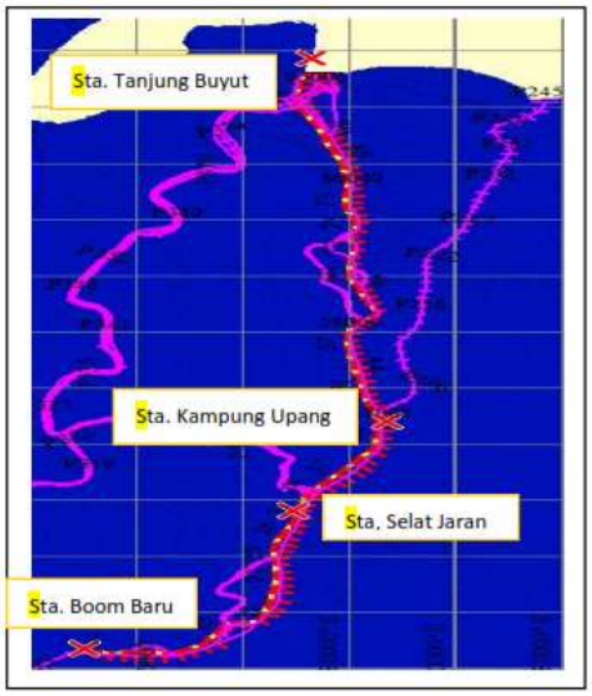

Figure 1. Areas of Study

High-water Data interpolation

In carrying out interpolation, between the stations, the water advance change is divided into three segments, on each specified segment of the node, the number of nodes adjusted to the distance of each segment (Setiadji, 2019).

1. Segment I between the new Boom station up to the Jaran Strait, segment length 16.85 miles (31,206 meters). There are 31 nodes with a distance between the nodes 1000 meters, the nodes located at the meter 1000 up to the 31,000 nodes (Suharjo, 2019).

2. Segment II between Jaran Strait station to Kampung Upang station, segment length 7.87 miles (14,575 meters). There are 15 nodes with a distance between the nodes 1000 meters, the nodes located at the meter 1000 up to the 14,000 nodes (Sumantri, 2019).

3. Segment III between Kampung Upang station and Tanjung Buyut station, segment length 29.42 miles (54.485 meters). There are 54 nodes, the distance between nodes 1000 Meters, the nodes are located at meters 1000 up to the 54,000 nodes (Susilo, 2020).

Data Analysis

Analysis discussion, among others:

1. Analysis of changes in water advance pattern.

2. Analysis of the size of the middle sits, the reducing constants, and the map Datum.

3. Analysis of the extreme form of diagram processing results.

Supporting Data in this study include:

1. Rainfall Data from Palembang Airport Meteorological station from 2019 to 2020.

2. Data characteristic of Musi River. Visualization of the Kararteristic River Musi.

High Water Advance analysis

The basis for conducting high water advance analysis is; The high-water face chart of the four stations that were attached to the same middle sit, as a reference is to sit in the middle of Tanjung Buyut station (Thornburry, 1954)

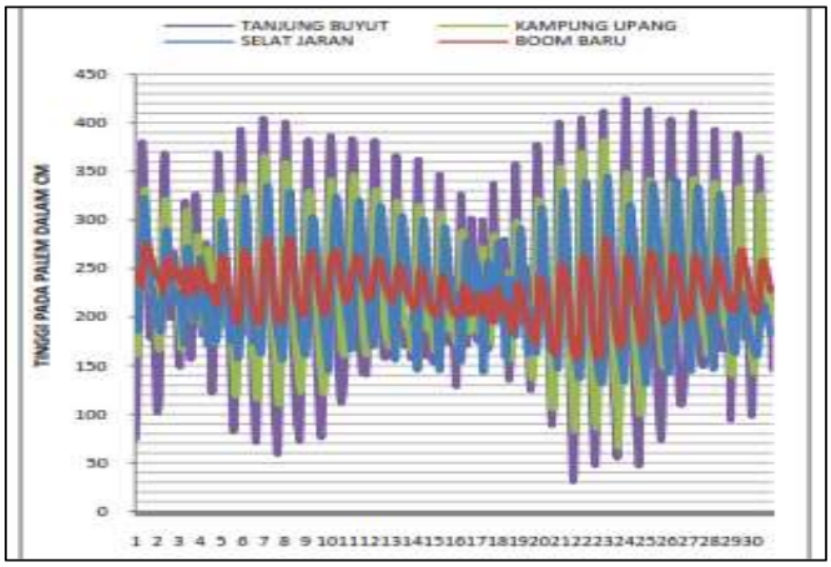

Figure 2. Chart Analysis

Chart analysis for November 2019.

1. There is a difference in the height of the lowest water position and highest water per day. It can be seen on the chart, while the lowest or highest water that falls on the next day does not form a sinusoidal graph. This incident was seen in the upstream station.

2. The similarity of patterns on the Strait of Jaran station, Kampung Upang, and Tanjung Buyut.

3. Different water rides on each station, which is the biggest Tanjung Buyut station.

4. At the time of entering the post die there is a change in the beach pattern and will return to normal when heading to the full tide.

5. There is a delay in the change of water from Tanjung Buyut Station, village Upang, Jaran Strait, and new Boom.

Analysis of the value of central sitting

The middle seated value will be reduced in the segment I, then enlarged again in segment II, entering the III segment of the seated value will decrease again. The value of sitting in the calculation results using 39 hours, the average result of one month will have the same value as So from the calculation of the water advance for 29 Pyantan using the Admiralty method.

Zo value Analysis

Zo values increased from segment I to segment III. The increasing value of Zo will be apparent after entering segment II. The value of Zo in segment I due to the impact of tidal constants of the sea may have decreased. In April and September an increase in the value of Zo occurred after entering the III segment, when associated with images 4.4 and 4.9 on the high-rise appearance of the new Boom station, Jaran Strait and Kampung Upang, it can be seen that the value of Zo Synergize in the form of graphs in April and September, where the value of Zo is the same in segments I and II, as well as the graph of the high appearance of the water face has the same pattern and type. Following sub Chapters 4.2 in Analysis Number 1 and 8 it is possible because in September is the month with the lowest intensity of rainfall, so that changes in water advances are more influenced by the beach than the sea, but because the position of station A considerable distance and the energy of the Sea beach has met some of the various characteristics of the river, causing the change of its type. This is related to the size of the water-in-segment I and II, where the size of the water-mount in the segment I and II will have a smaller value than segment III.

Analyze Map Datum Value

Map datum will be reduced from segment I to segment III. The reduced value of Datum Peta is the opposite type of the decrease in the value of Zo but equal to the reduced type of middle seated value. The smallest value occurs in March, especially in segments II and III, whereas for the segment I took place in January which is the average small value. The largest value occurred in September especially in segment III, while for segments I and II occurred in June.

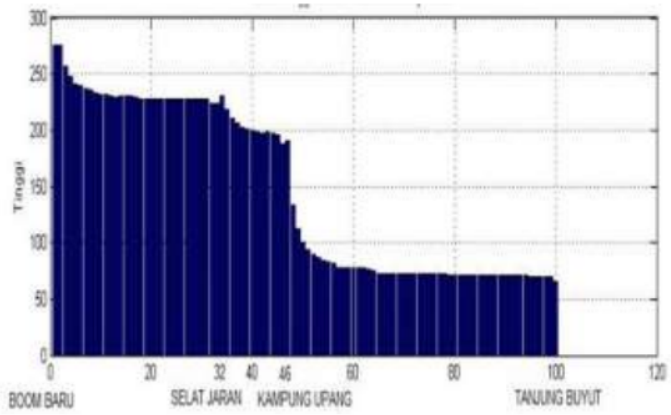

Figure 3. Datum Diagram Map in November 2019

There are several forms of graphs that change in an Ectrim, which also happens in other months. The decrease in this extreme occurs on the initial nodes of segment II and III, where the initial nodes of segment II and III are the branches, which are located after the station:

1. Jaran Strait. At the branching of the Waterway strait will split into the Telang River, this branching is expected to cause: at the time of receding the water will be divided into Telang River and at the time of tide there is water input from the river Telang to the river Musi, so it will be Extreme water ascent and decline occur. This water also occurs at a high level of sedimentation, which causes shallow bathymetry.

2. The village of Upang, where the water will be separated towards the Upang river. In this branch, when there is a seawater input from the mouth of Musi and the River Upang, as well as the reverse water will be divided. As per data from the LAPI Ganeshatama bathymetry survey results, the broad cross-section of Musi River and Upang River is relatively similar. This is what causes an Extrim face, proven with the highest high water value and lowest low water happening at Kampung Upang Station.

IV. CONCLUSIONS

After the count and analysis of the calculated result, can be withdrawn some conclusions, among others:

1. In the interpolation count, the more tightly the distance between the interpolated nodes will get the map Datum value with small changes so that the difference in value can be visible.

2. The size of the middle seat, Zo, water, and the change type.

   a. Average value sitting center for one year, new Boom station 40 cm; Jaran Strait 41 cm; Upang Village 41 cm and Tanjung Buyut Station 138 cm. Above the palm of each station.

   b. Zo's smallest value for one year, new Boom station 317 cm; Jaran Strait 272 cm; Upang Village 311 cm and Tanjung Buyut station 248 cm.

   c. The average water value in one year, the new Boom station 127 cm; Jaran Strait 150 cm; Upang Village 317 cm and Tanjung Buyut Station 393 cm.

   d. F value which is the value to set the water change type in new Boom station 3.9; Jaran Strait and Upang village vary; Tanjung Buyut Station 1.8.

3. The average sit-down of the system calculation 38 hours for one month, has the same value as the value of So calculation result with the Admiralty method.

4. From the calculation result shows Zo's value from upstream to downstream, it is following the size of the water, which occurs in the downstream area the water is larger than the upstream.

V. FUTURE WORK

The study on the making of river Bathymetry maps is still not widely implemented, especially in the environment Dishidros especially STTAL technique Hydros, which can be more deepening about the study of the next river map Datum, among others:

1. The mathematical count Model interpolated the high-water front of the river. The use of more varied models allows for more maximum interpolation of the river water. The calculation variables include river discharge, river current, different topography between the observer station, the depth and width of the channel along the river as well as the coefficient of wind friction and topographical friction coefficient.

2. Completeness of meteorological data along with DAS. Meteorological data can be obtained from the local DPU BWS or BMKG.

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