1 June 2023

Dear Mr. Muhammad Mazmirul Bin Abd Rahman,

INVITATION AND ABSTRACT ACCEPTANCE FOR THE 6TH WORLD CONFERENCE ON MARINE BIODIVERSITY IN PENANG, MALAYSIA

We are delighted to invite you to participate in the upcoming 6th World Conference on Marine Biodiversity (WCMB 2023), which will be held in Penang, Malaysia on the 2nd to 5th of July 2023. On behalf of the WCMB 2023 Scientific Committee, we are pleased to inform you that your submitted abstract, **"MORPHOLOGICAL RESPONSE OF CHEROK PALOH ESTUARIES TOWARDS THE OCCURRENCE OF TYPHOON RAI",** has been **accepted** for **oral presentation** at the conference.

2. The WCMB is a high-level international meeting that focuses on the conservation and sustainable use of marine biodiversity. The conference provides a platform for policymakers, scientists, conservationists, industry representatives, and other stakeholders to discuss current and emerging marine biodiversity issues and identify ways to protect and sustainably manage marine ecosystems and their resources. The WCMB 2023 conference theme is "***Marine Biodiversity Challenges in the Anthropocene***".

3. We are also pleased to inform you that the registration payment process is now open, and we would appreciate it if you could complete your registration by making the necessary payment within seven (7) working days to secure your spot. Your registration fee is **USD 220 (Early Bird Fee-Student).** To make the payment, kindly transfer the registration fee to the account details provided below:

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4. Once the payment has been made, please email us **a copy of the payment confirmation** or **receipt** at wcmb2023@gmail.com to confirm your registration.

Additional information about the event can be obtained from the conference website (https://www.wcmb2023.org). We appreciate your cooperation and look forward to seeing you at the event.

Yours sincerely,

Prof. Dato' Dr. Aileen Tan Shau Hwai, **FASc**.
Chairperson
info@wcmb2023.org

MORPHOLOGICAL RESPONSE OF CHEROK PALOH ESTUARIES TOWARDS THE OCCURRENCE OF TYPHOON RAI

Abd Rahman MM[1], Ramli MZ[1,2*], Ab Razak MS[3], Hikmatullah Sahib SAT[1] and Azman MA[1]

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ABSTRACT

Erosion is an alarming issue that affects the livelihood of coastal communities and the natural habitat. The permanent loss of land can alter the suitability of an environment for a species to thrive. This study aims to illustrate the effect of extreme conditions induced by Typhoon Rai, that occurred on the 11 to 21 December 2021, along the Cherok Paloh estuaries which is also a known breeding habitat for the Horseshoe Crab *(Tachypleus gigas)*. Both XBeach and Delft 3D were implemented in this study as to simulate the impacts and extreme conditions induced by Typhoon Rai. XBeach, a coastal response model developed to simulate the nearshore and coastal processes as a 2-HD open-source process, which includes shore wave propagation, sediment transport, flow and bathymetry changes. The event is tested using the 1D model, and the sensitivity analysis is done using the error indicator of Brier Skill Score (BSS). The sensitivity was tested using various morphological parameters of facua, wetslp and dryslp, which then has been compared with the final beach profile to calculate the BSS. This in turn, is replicated to the other 1D profile of Cherok Paloh Beach. When the default values of said parameters were used, the simulation indicated an overestimation in erosion volume. As per the result obtained from the BSS, the best model was obtained by changing the calibration parameters of facua and wetslp.

Keywords: Delft 3D, XBeach, Typhoon Rai, Numerical Model, Storm Surge

Themes: Climate Change and Impacts to Biodiversity

Preferred presentation type: Oral presentation

6th World Conference on Marine Biodiversity 2023

OVERVIEW OF CONFERENCE PROGRAMME

Sunday, 2 July 2023

Time	PINANG BALLROOM	RAWA ROOM	PANGKOR ROOM	LANGKAWI ROOM
09:00 AM - 10:30 AM	OPENING CEREMONY (PINANG BALLROOM)			
10:30 AM - 11:00 AM	COFFEE BREAK (30 min)			
11:00 AM - 12:30 PM	KEYNOTE 1 : Prof. Dato' Dr. Zulfigar Yasin KEYNOTE 2 : Prof. Dr. Mark Costello			
12:30 PM - 1:30 PM	LUNCH (1 hr)			
1:30 PM - 3:00 PM		Climate Change & Impact to Biodiversity	Special Session ABC WoRMS	Benthic Ecology
3:00 PM - 3:30 PM	COFFEE BREAK (30 min)			
3:30 PM - 5:30 PM	POSTER SESSION (1hr) Pinang Foyer	Marine Debris & Pollution	Systematics, Taxonomy & Phylogenetics	Special Session MBON
5:30 PM - 8:00 PM	FREE TIME			
8:00 PM - 10:00 PM	RECEPTION DINNER @ JEN HOTEL 8:00 PM - 10:00 PM			

Monday, 3 July 2023

Time	PINANG BALLROOM	RAWA ROOM	PANGKOR ROOM	LANGKAWI ROOM
09:00 AM - 10:30 AM	KEYNOTE 3 : Dr. Silvana N.R. Birchenough KEYNOTE 4 : Dr. Audrey Darnaude KEYNOTE 5 : Prof. Sun Song			
10:30 AM - 11:00 AM	COFFEE BREAK (30 min)			
11:00 AM - 12:30 PM	Special Session ML2030	Benthic Ecology	Special Session AI & MACHINE LEARNING	PLENARY - Prof. Pablo Biodiversity in Coral Reefs
12:30 PM - 1:30 PM	LUNCH (1 hr)			
1:30 PM - 3:00 PM	Climate Change & Impact to Biodiversity	Special Session MARINE ALGAE & ASSOCIATED FLORA	Emerging Technologies for Marine Biodiversity Survey	Biodiversity in Coral Reefs
3:00 PM - 3:30 PM	COFFEE BREAK (30 min)			
3:30 PM - 5:30 PM	Fisheries & Future Food Security	Biogeography & Distribution	OCEAN CENSUS Marine Conservation Areas & Marine Policy	Marine Debris & Pollution
5:30 PM - 8:00 PM	FREE TIME CONFERENCE WORKSHOP: MARINE LIFE 2030 : CATALYSING COLLABORATION FOR CO-DESIGNED MARINE LIFE SCIENCE (3 HRS) 6:30 PM - 9:30 PM LANGKAWI ROOM			

Tuesday, 4 July 2023

Time	PINANG BALLROOM	RAWA ROOM	PANGKOR ROOM	LANGKAWI ROOM
09:00 AM - 10:30 AM	KEYNOTE 6 : Prof. Hiroaki Saito KEYNOTE 7 : Dr. Nicole Yamase KEYNOTE 8 : Dato' Harry Allyn Cockrell			
10:30 AM - 11:00 AM	COFFEE BREAK (30 min)			
11:00 AM - 12:30 PM	Special Session THE HABITAT	Marine Conservation Areas & Marine Policy	Biodiversity in Coral Reefs	Plenary - Prof. Angelika Emerging Technology
12:30 PM - 1:30 PM	LUNCH (1 hr)			
1:30 PM - 3:00 PM	Climate Change & Impact to Biodiversity	Marine Conservation Areas & Marine Policy	Fisheries & Future Food Security	Deep Sea Diversity & Ecosystems
3:00 PM - 3:30 PM	COFFEE BREAK (30 min)			
3:30 PM - 5:30 PM	Marine Debris & Pollution	Biogeography & Distribution	Fisheries & Future Food Security	Deep Sea Diversity Special Session DOSI
5:30 PM - 8:00 PM	FREE TIME			
8:00 PM - 10:00 PM	GALA DINNER @ ST.GILES WEMBLEY *(hosted by Penang State Government)* 8:00 PM - 10:00 PM (Dress Code: Cultural Attire)			

Wednesday, 5 July 2023

Time				
09:00 AM - 10:30 AM	Systematics, Taxonomy & Phylogenetics	Fisheries & Future Food Security	Benthic Ecology	Marine Conservation Areas & Marine Policy
10:30 AM - 11:00 AM	COFFEE BREAK (30 min)			
11:00 AM - 12:30 PM	CLOSING CEREMONY (PINANG BALLROOM)			
12:30 PM - 1:30 PM	LUNCH (1 hr)			
1:30 PM onwards	EXCURSION / FREE TIME			

PARALLEL SESSION #7

4 JULY 2023 (TUESDAY)
TIME SLOT : 1:30 PM - 3:00 PM

TIME	ROOM	THEME	CODE	TITLE OF PAPER	PRESENTER
1:30 pm - 1:45 pm	PINANG BALLROOM	CLIMATE CHANGE & IMPACTS TO BIODIVERSITY	CC-13	Carbon and Nitrogen Emission from Different Categories of Seagrass Beds in Koh Mux Thailand	Muhammad Halim
1:45 pm - 2:00 pm			CC-14	Morphological Response of Cherok Paloh Estuaries towards the Occurrence of Typhoon Rai	Muhammad Mazmirul Bin Abd Rahman
2:00 pm - 2:15 pm			CC-15	Effects Of Synechococcus spp. Growth Following Viral Lysis of Heterotrophic Bacteria In Modified Dilution Experiments	Madeline Olivia
2:15 pm - 2:30 pm			CC-16	Tropical Rocky Shores are Extreme Environments Shaping the Thermal Ecology and Evolution of Physiological Adaptations for Intertidal Ectotherms	Juan Diego Gaitan-Espitia
2:30 pm - 2:45 pm			CC-17	Peninsular Current Effects on the Primary Productivity along the East Coast of Peninsular Malaysia	Afifi Johari
2:45 pm - 3:00 pm			CC-18	Impact of Sea Level Rise Towards Vulnerability and Socio-Economy of Selangor Coastline	Nur Arifah Najihah Ibrahim
1:30 pm - 1:45 pm	RAWA ROOM	MARINE CONSERVATION AREAS & MARINE POLICY	MPA-12	Towards Effective Management of Marine Mammals in MPAs: the Marine Mammals Management Toolkit	Fiona Dyrhauge
1:45 pm - 2:00 pm			MPA-13	Fishers' Knowledge and Attitudes Towards Billfish, Family Istiophoridae (Nelson, 1984) Conservation in Kuantan, Pahang, Malaysia.	Juliana
2:00 pm - 2:15 pm			MPA-14	Comparison of Threats and Vulnerability Factors in Coral Reefs of Semporna, Sabah, Malaysia	Choo Poh Leem
2:15 pm - 2:30 pm			MPA-15	Social-environmental Analysis of Estuary Water Quality in a Populous Urban Area	Hsiao-Chun (Jean) Tseng
2:30 pm - 2:45 pm			MPA-16	Effectiveness of Citizen Science in Responding to Oil Spills in Rayong Province, The Eastern Gulf of Thailand	Makamas Sutthacheep
2:45 pm - 3:00 pm			MPA-17	Recent Multilateral Environmental Agreements (MEAs): Opportunities and Challenges in the Coral Triangle and Asia Pacific	Sharifah Nora Sy. Ibrahim
1:30 pm - 1:45 pm	PANGKOR ROOM	FISHERIES & FUTURE FOOD SECURITY	FF-08	An Overview of the Major Constraints in Scylla Mud Crabs Grow-Out Culture and its Mitigation Methods	Lim Leong Seng
1:45 pm - 2:00 pm			FF-09	Vtg is Essential for Vitellogenesis in *Fenneropenaeus penicillatus*	Tan Kian Ann
2:00 pm - 2:15 pm			FF-10	Mariculture might Increase Aquatic Greenhouse Gases Concentrations	Qiao-Fang Cheng
2:15 pm - 2:30 pm			FF-11	Understanding Decision-Making and Competitive/Cooperative Mechanisms in Northern Taiwan´s Commercial and Recreational Pole and Line Fisheries	En-Jia, Fan
2:30 pm - 2:45 pm			FF-12	Interactions between Cetaceans and Fisheries in the Waters of Eastern Taiwan	Wan-Jung, Lee
2:45 pm - 3:00 pm			FF-13	Molecular Regulatory Mechanism of VgR gene in Fenneropenaeus penicillatus Ovarian Development	Dong Ya Xin

4 JULY 2023 (TUESDAY)
TIME SLOT : 1:30 PM - 3:00 PM

TIME	ROOM	THEME	CODE	TITLE OF PAPER	PRESENTER
1:30 pm - 1:45 pm	LANGKAWI ROOM	DEEP SEA DIVERSITY & ECOSYSTEM	DS-01	In the trench and beyond: Meiofauna and Harpacticoida diversity within and around the Aleutian Trench	Frederic Bonk
1:45 pm - 2:00 pm			DS-02	Comparison of Viral Production and Decay Rates at the Surface and Bottom of the Euphotic Zone in the Summertime in the Southern East China Sea	Patrichka
2:00 pm - 2:15 pm			DS-03	Ecological Patterns of Marine Bacterial Communities in Tropical Extreme Environments	Yuanqiu He
2:15 pm - 2:30 pm			DS-04	Molecular Phylogenetic Reevaluation of Deep-sea Holothurian Genus Pannychia based on COI Gene and Genome-wide SNP Data	Akito Ogawa
2:30 pm - 2:45 pm			DS-05	Deep-sea Isopod Diversity Patterns and Connections from the Aleutian Trench	Andreas Kelch
2:45 pm - 3:00 pm			DS-06	Population Genetic Structure and its Implications for Adaptive Differentiation in Provanna glabra from Deep-sea Hydrothermal Vent and Methane Seep Environments of the Northwest Pacific Ocean	Min Hui

6th World Conference on Marine Biodiversity
WCMB 2023 MALAYSIA

AN INTERNATIONAL AWARD-WINNING INSTITUTION FOR SUSTAINABILITY

MORPHOLOGICAL RESPONSE OF CHEROK PALOH ESTUARIES TOWARDS THE OCCURRENCE OF TYPHOON RAI

Numerical Methods Approached using XBeach

MUHAMMAD MAZMIRUL ABD RAHMAN, IIUM
ASSOC. PROF. DR. MUHAMMAD ZAHIR RAMLI, IIUM
DR. MOHD SHAHRIZAL AB RAZAK, UPM

Deltares
Enabling Delta Life

XB

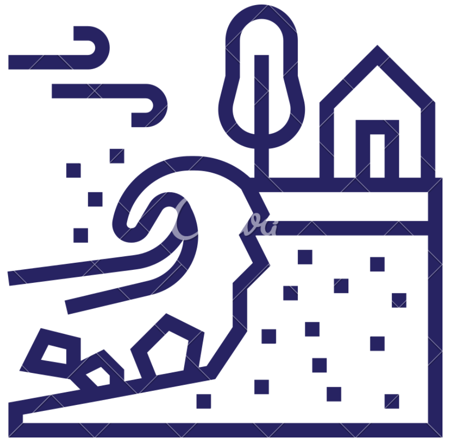
XBeach (eXtreme Beach) is a two-dimensional horizontal (2DH) process-based model developed by Prof. Dano Roelvink.

DELTARES . TU DELFT . UNIVERSITY OF MIAMI

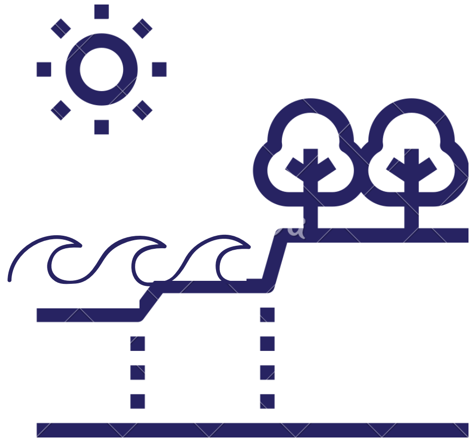
wave propagation, long waves and mean flow, sediment transport and morphological changes of the nearshore area, beaches, dunes and backbarrier during storms

INTRODUCTION

- Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tide.
- Storm surge is caused primarily by the strong winds in a hurricane or tropical storm.

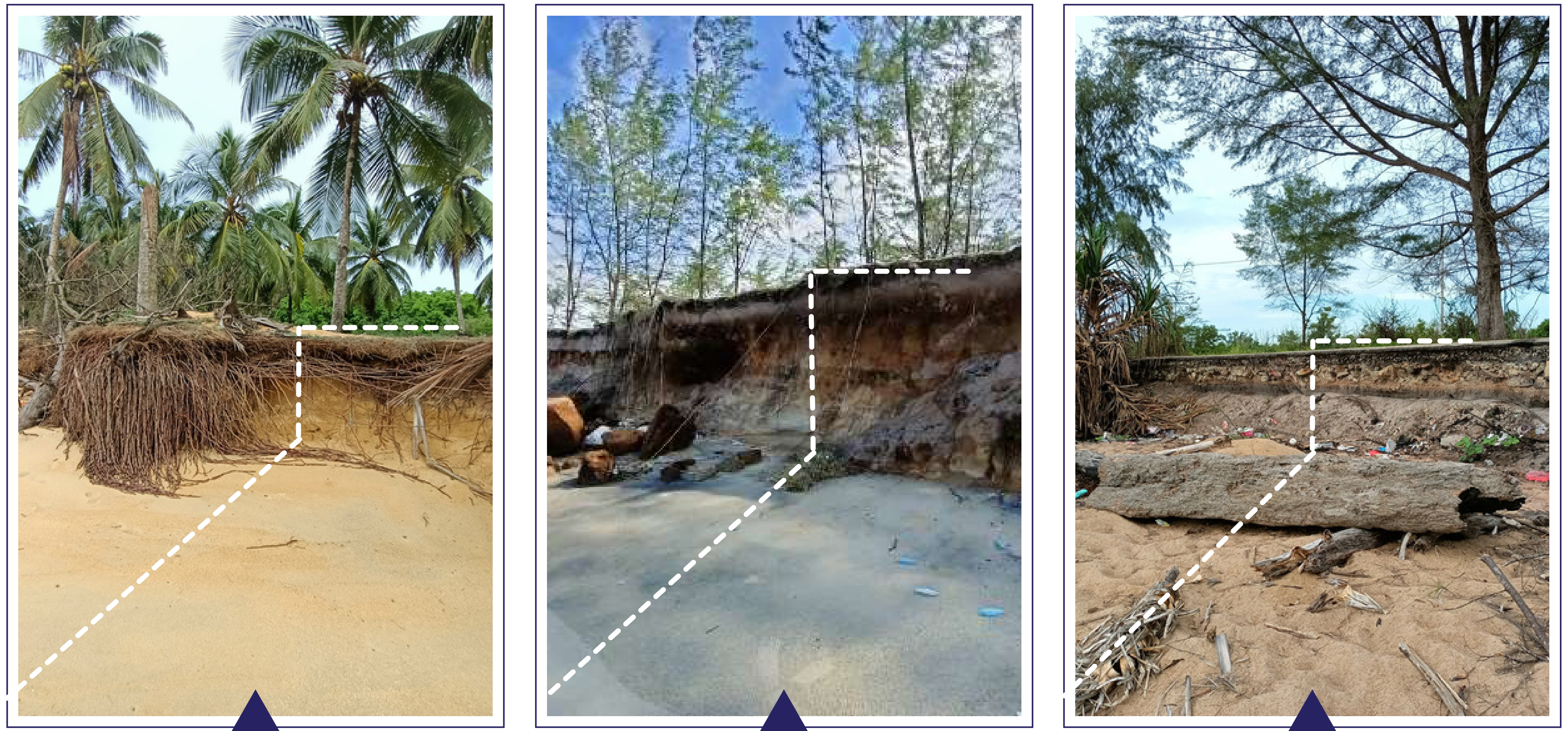


- Coastal erosion is recognized as the permanent loss of land and habitats along the shoreline, resulting in the transformation of coast features.
- It is defined as the physical weathering of surface materials by currents, wave actions, and tidal current.



- The coastal shoreline is the point of interaction between land and sea,
- The changes are basically a response to various factors morphological, climatological, or geological.
- Divided into 3 parts, 5 km from MHWS, Intertidal zone and 3 Nautical miles from MLWS.

PROBLEM STATEMENT



Cherating | Cherok Paloh | Tg. Batu

Pahang beach's condition during the preliminary survey on 25 April 2021

- About 16.33% of Pahang Beach eroded from 378.4 km.
- 2 Areas with a length of 1.5 km fall into Cat 1 (Critical)
- 14 Areas with lengths of 16.9 km at Cat 2 (significant)
- 58 areas with a total of 43.4 km in Cat 3 (Not Serious)
- A total of 61.8 km of erosion

note: NCES report, 2015

Category 1 (Critical)

- Shoreline retreat (rate > 4 m/yr)
- High population density
- Have commercial/industrial activity
- Have public facilities or infrastructure

Category 2 (Significant)

- Shoreline retreat (rate > 1 < 4 m/yr)
- Low population density
- Have low agricultural activities
- Have low public facilities or infrastructure

Category 3 (Acceptable)

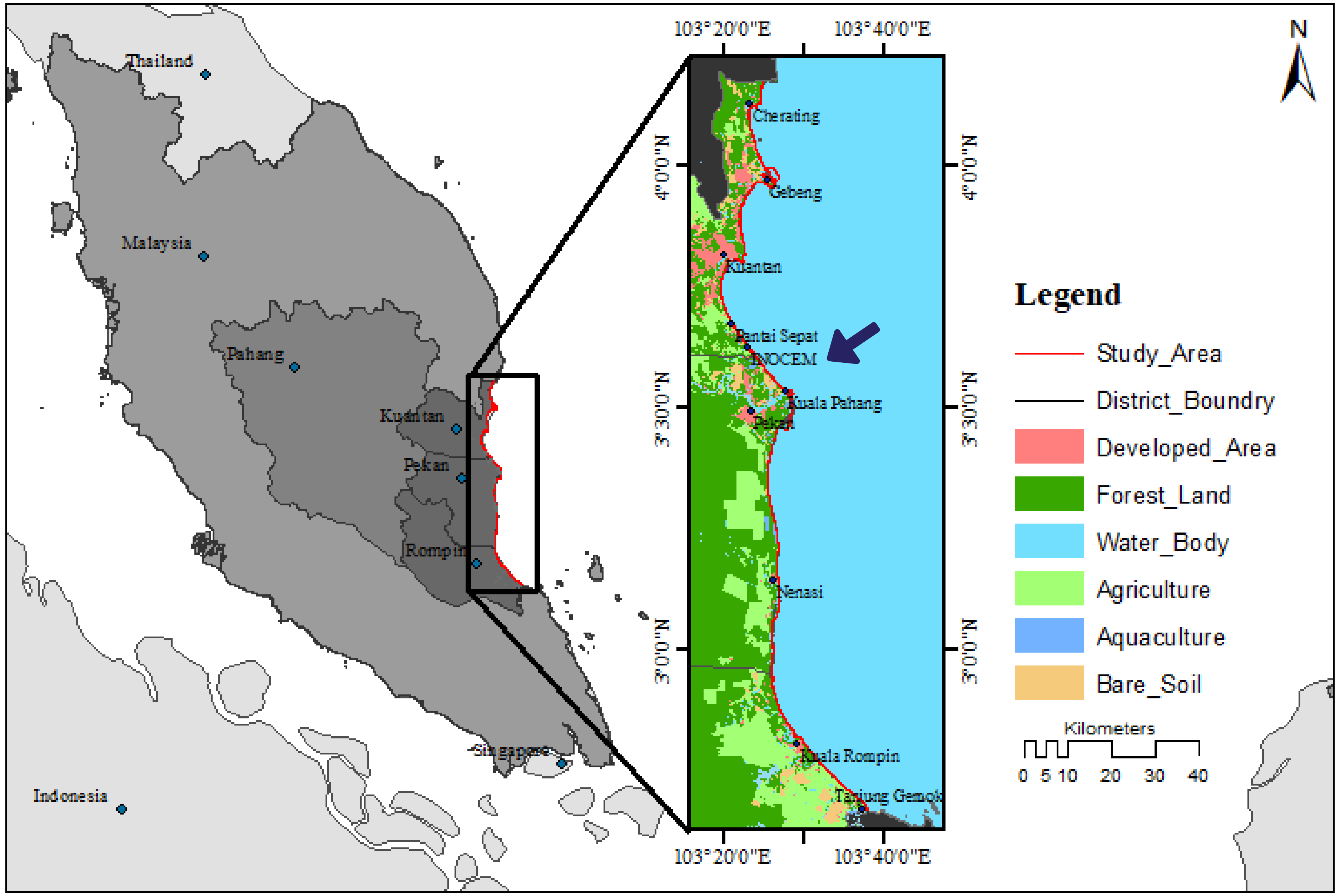
- Shoreline retreat (rate < 1 m/yr)
- Non populated area
- Have minimal agricultural activities
- Have no public facilities or infrastructure

Beach Erosion Category

note: NCES report, 2015

STUDY AREA

Maps of Pahang Coastal District and land use



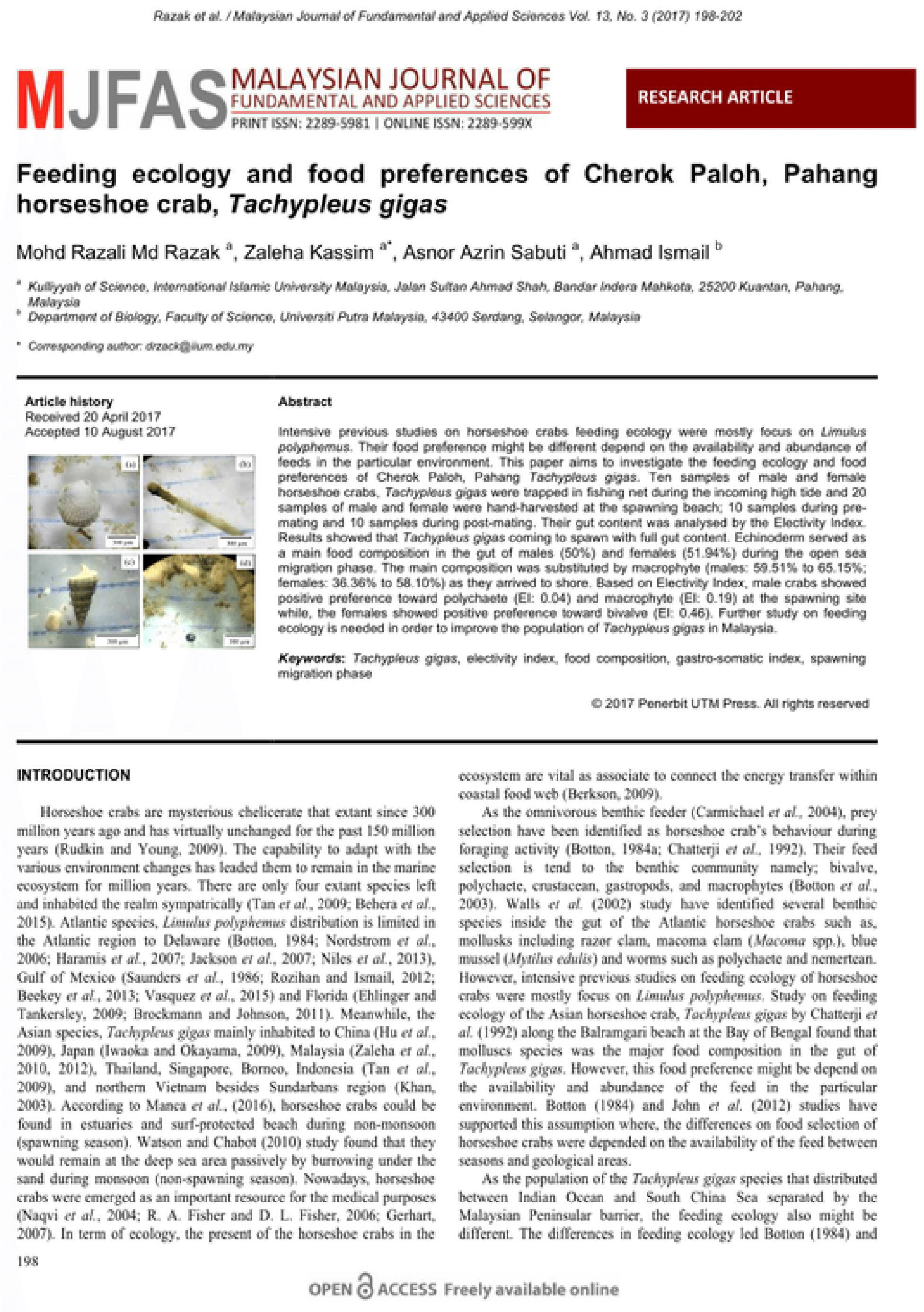
Area lengths = 207 km

Cherok Paloh aligned with shoreline changes

STUDY AREA

Ecological and Biodiversity

- Estimated about 862 Ha of Mangrove forest.
- High importance for fisheries and aquaculture.
- As a bird sanctuary area.
- One of the habitat for horseshoe crab.



MJFAS MALAYSIAN JOURNAL OF FUNDAMENTAL AND APPLIED SCIENCES
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RESEARCH ARTICLE

Feeding ecology and food preferences of Cherok Paloh, Pahang horseshoe crab, *Tachypleus gigas*

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Article history
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Abstract

Intensive previous studies on horseshoe crabs feeding ecology were mostly focus on *Limulus polyphemus*. Their food preference might be different depend on the availability and abundance of feeds in the particular environment. This paper aims to investigate the feeding ecology and food preferences of Cherok Paloh, Pahang *Tachypleus gigas*. Ten samples of male and female horseshoe crabs, *Tachypleus gigas* were trapped in fishing net during the incoming high tide and 20 samples of male and female were hand-harvested at the spawning beach; 10 samples during pre-mating and 10 samples during post-mating. Their gut content was analysed by the Electivity Index. Results showed that *Tachypleus gigas* coming to spawn with full gut content. Echinoderm served as a main food composition in the gut of males (50%) and females (51.94%) during the open sea migration phase. The main composition was substituted by macrophyte (males: 59.51% to 65.15%; females: 36.36% to 58.10%) as they arrived to shore. Based on Electivity Index, male crabs showed positive preference toward polychaete (EI: 0.04) and macrophyte (EI: 0.19) at the spawning site while, the females showed positive preference toward bivalve (EI: 0.46). Further study on feeding ecology is needed in order to improve the population of *Tachypleus gigas* in Malaysia.

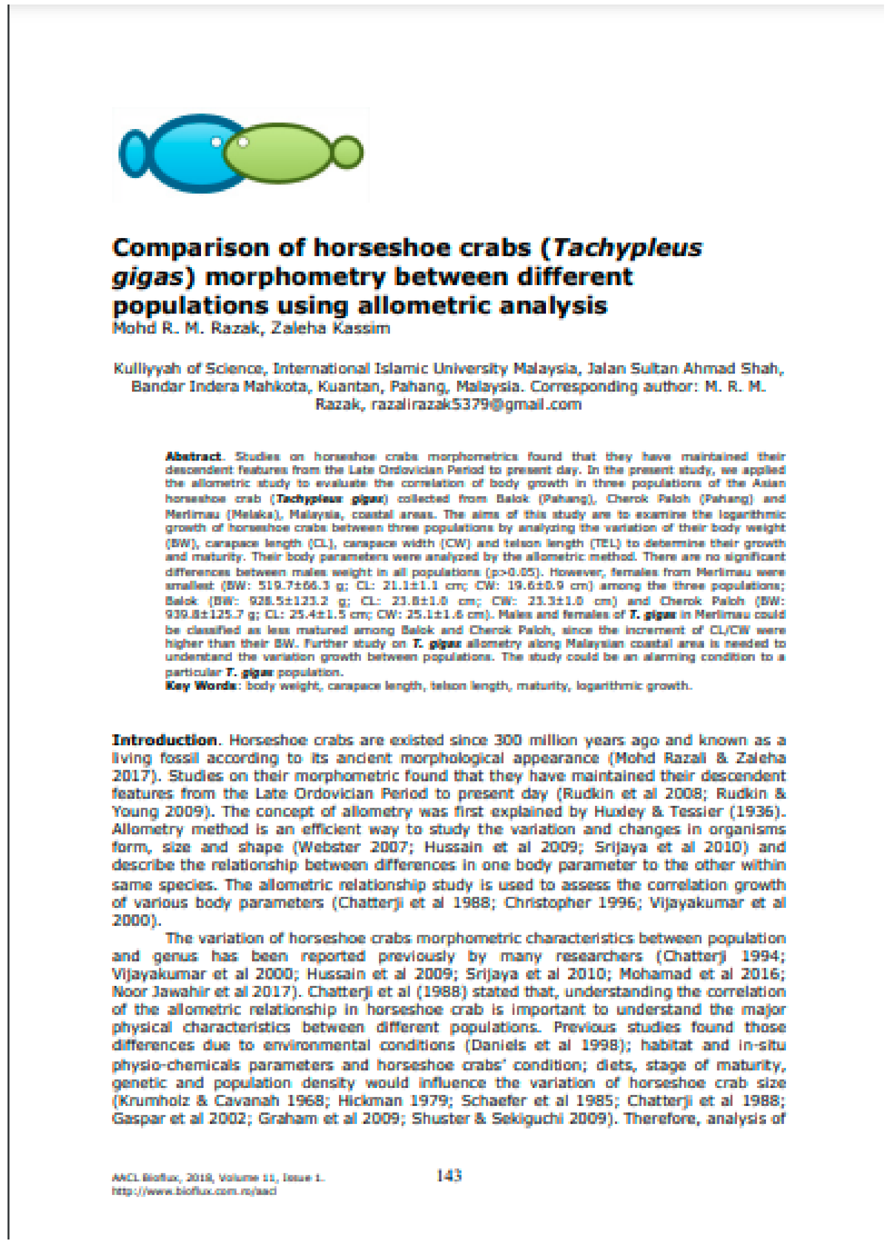
Keywords: *Tachypleus gigas*, electivity index, food composition, gastro-somatic index, spawning migration phase

INTRODUCTION

Horseshoe crabs are mysterious chelicerate that extant since 300 million years ago and has virtually unchanged for the past 150 million years (Rudkin and Young, 2009). The capability to adapt with the various environment changes has leaded them to remain in the marine ecosystem for million years. There are only four extant species left and inhabited the realm sympatrically (Tan *et al.*, 2009; Behera *et al.*, 2015). Atlantic species, *Limulus polyphemus* distribution is limited in the Atlantic region to Delaware (Botton, 1984; Nordstrom *et al.*, 2006; Haramis *et al.*, 2007; Jackson *et al.*, 2007; Niles *et al.*, 2013), Gulf of Mexico (Saunders *et al.*, 1986; Rozihan and Ismail, 2012; Beekey *et al.*, 2013; Vasquez *et al.*, 2015) and Florida (Ehlinger and Tankersley, 2009; Brockmann and Johnson, 2011). Meanwhile, the Asian species, *Tachypleus gigas* mainly inhabited to China (Hu *et al.*, 2009), Japan (Iwaoka and Okayama, 2009), Malaysia (Zaleha *et al.*, 2010, 2012), Thailand, Singapore, Borneo, Indonesia (Tan *et al.*, 2009), and northern Vietnam besides Sundarbans region (Khan, 2003). According to Manca *et al.*, (2016), horseshoe crabs could be found in estuaries and surf-protected beach during non-monsoon (spawning season). Watson and Chabot (2010) study found that they would remain at the deep sea area passively by burrowing under the sand during monsoon (non-spawning season). Nowadays, horseshoe crabs were emerged as an important resource for the medical purposes (Naqvi *et al.*, 2004; R. A. Fisher and D. L. Fisher, 2006; Gerhart, 2007). In term of ecology, the present of the horseshoe crabs in the ecosystem are vital as associate to connect the energy transfer within coastal food web (Berkson, 2009).

As the omnivorous benthic feeder (Carmichael *et al.*, 2004), prey selection have been identified as horseshoe crab's behaviour during foraging activity (Botton, 1984a; Chatterji *et al.*, 1992). Their feed selection is tend to the benthic community namely; bivalve, polychaete, crustacean, gastropods, and macrophytes (Botton *et al.*, 2003). Walls *et al.* (2002) study have identified several benthic species inside the gut of the Atlantic horseshoe crabs such as, mollusks including razor clam, macoma clam (*Macoma* spp.), blue mussel (*Mytilus edulis*) and worms such as polychaete and nemertean. However, intensive previous studies on feeding ecology of horseshoe crabs were mostly focus on *Limulus polyphemus*. Study on feeding ecology of the Asian horseshoe crab, *Tachypleus gigas* by Chatterji *et al.* (1992) along the Balramgari beach at the Bay of Bengal found that molluscs species was the major food composition in the gut of *Tachypleus gigas*. However, this food preference might be depend on the availability and abundance of the feed in the particular environment. Botton (1984) and John *et al.* (2012) studies have supported this assumption where, the differences on food selection of horseshoe crabs were depended on the availability of the feed between seasons and geological areas.

As the population of the *Tachypleus gigas* species that distributed between Indian Ocean and South China Sea separated by the Malaysian Peninsular barrier, the feeding ecology also might be different. The differences in feeding ecology led Botton (1984) and


Comparison of horseshoe crabs (*Tachypleus gigas*) morphometry between different populations using allometric analysis

Mohd R. M. Razak, Zaleha Kassim

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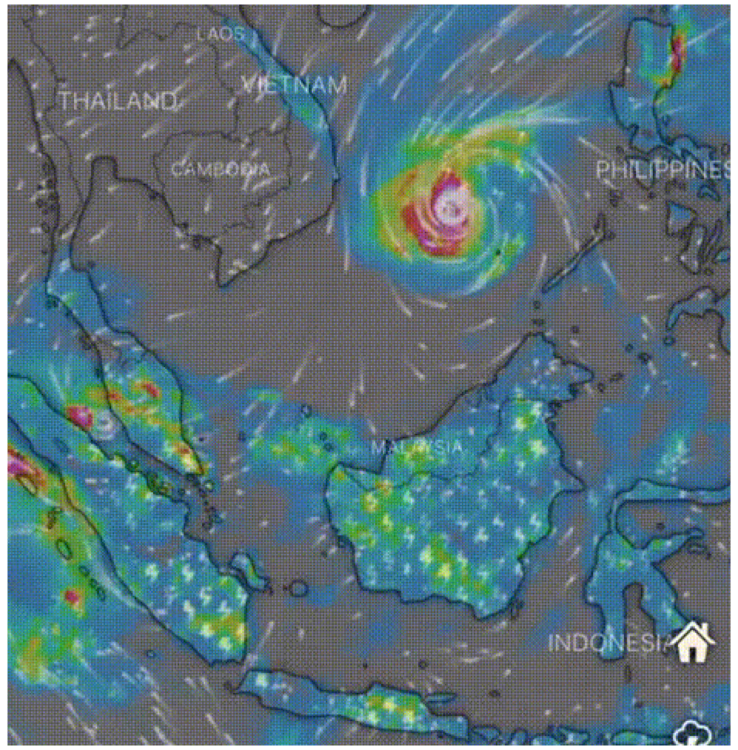
Abstract. Studies on horseshoe crabs morphometrics found that they have maintained their descendent features from the Late Ordovician Period to present day. In the present study, we applied the allometric study to evaluate the correlation of body growth in three populations of the Asian horseshoe crab (***Tachypleus gigas***) collected from Balok (Pahang), Cherok Paloh (Pahang) and Merlimau (Melaka), Malaysia, coastal areas. The aims of this study are to examine the logarithmic growth of horseshoe crabs between three populations by analyzing the variation of their body weight (BW), carapace length (CL), carapace width (CW) and telson length (TEL) to determine their growth and maturity. Their body parameters were analyzed by the allometric method. There are no significant differences between males weight in all populations ($p>0.05$). However, females from Merlimau were smallest (BW: 519.7±66.3 g; CL: 21.1±1.1 cm; CW: 19.6±0.9 cm) among the three populations; Balok (BW: 928.5±123.2 g; CL: 23.8±1.0 cm; CW: 23.3±1.0 cm) and Cherok Paloh (BW: 939.8±125.7 g; CL: 25.4±1.5 cm; CW: 25.1±1.6 cm). Males and females of ***T. gigas*** in Merlimau could be classified as less matured among Balok and Cherok Paloh, since the increment of CL/CW were higher than their BW. Further study on ***T. gigas*** allometry along Malaysian coastal area is needed to understand the variation growth between populations. The study could be an alarming condition to a particular ***T. gigas*** population.
Key Words: body weight, carapace length, telson length, maturity, logarithmic growth.

Introduction. Horseshoe crabs are existed since 300 million years ago and known as a living fossil according to its ancient morphological appearance (Mohd Razali & Zaleha 2017). Studies on their morphometric found that they have maintained their descendent features from the Late Ordovician Period to present day (Rudkin et al 2008; Rudkin & Young 2009). The concept of allometry was first explained by Huxley & Tessier (1936). Allometry method is an efficient way to study the variation and changes in organisms form, size and shape (Webster 2007; Hussain et al 2009; Srijaya et al 2010) and describe the relationship between differences in one body parameter to the other within same species. The allometric relationship study is used to assess the correlation growth of various body parameters (Chatterji et al 1988; Christopher 1996; Vijayakumar et al 2000).

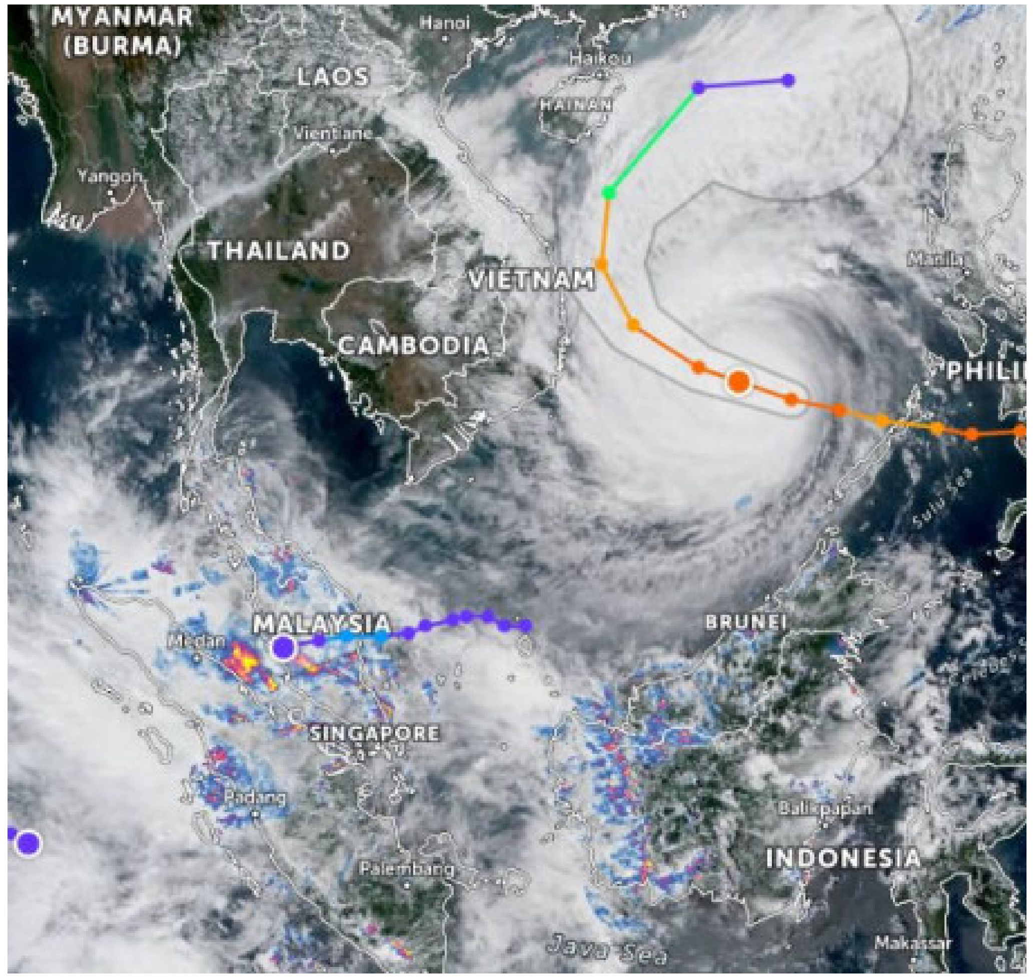
The variation of horseshoe crabs morphometric characteristics between population and genus has been reported previously by many researchers (Chatterji 1994; Vijayakumar et al 2000; Hussain et al 2009; Srijaya et al 2010; Mohamad et al 2016; Noor Jawahir et al 2017). Chatterji et al (1988) stated that, understanding the correlation of the allometric relationship in horseshoe crab is important to understand the major physical characteristics between different populations. Previous studies found those differences due to environmental conditions (Daniels et al 1998); habitat and in-situ physio-chemicals parameters and horseshoe crabs' condition; diets, stage of maturity, genetic and population density would influence the variation of horseshoe crab size (Krumholz & Cavanah 1968; Hickman 1979; Schaefer et al 1985; Chatterji et al 1988; Gaspar et al 2002; Graham et al 2009; Shuster & Sekiguchi 2009). Therefore, analysis of

CASE STUDY

SUPER TYPHOON RAI
(ODETTE)
11 DEC 2021 - 21 DEC 2021
(16 DEC 2021)



Wind Speed : 267km/h
Diameter: 185km/h
Eye: 56km
Air pressure : below 915mbar
Saffir-Simpson scale : Cat 5



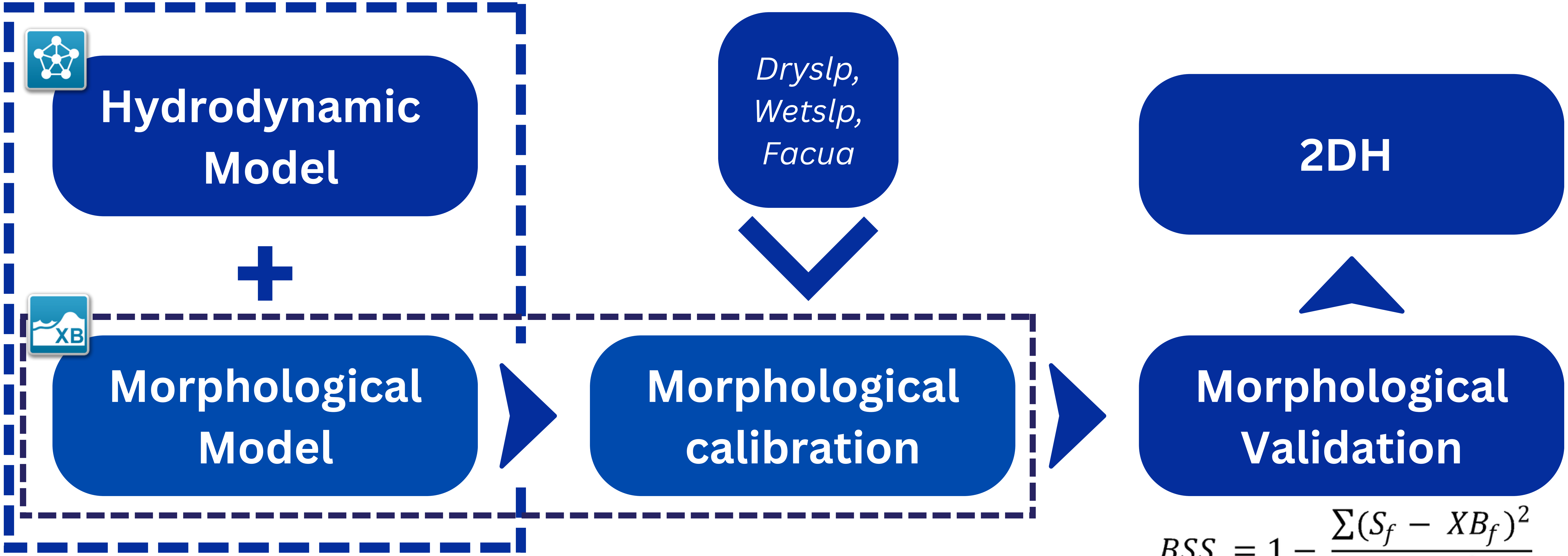
TROPICAL DEPRESSION 29

Categorized as a **rapidly rotating storm** system commonly referred to as a **tropical cyclone**

PATHWAYS

Make landfall at **Terengganu coast** and move to Straits of Malacca

METHODOLOGY

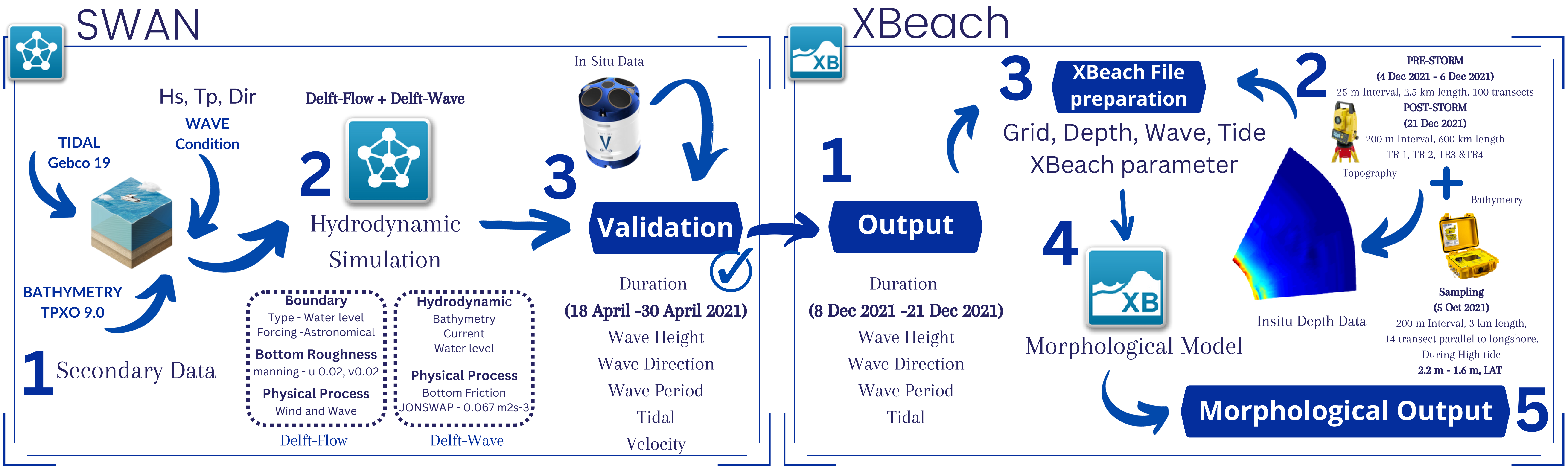


SWAN-XBeach Couple Model

$$BSS = 1 - \frac{\sum (S_f - XB_f)^2}{\sum (S_f)^2}$$

proposed by van Rijn et al

METHODOLOGY



SWAN - XBeach Coupling Model

METHODOLOGY

1 D

- Calibration of XBeach numerical model
- Calibrated parameter are analised using Brier Skill Scoring Analysis
- BSS Value Closer to 1 are best fitted.

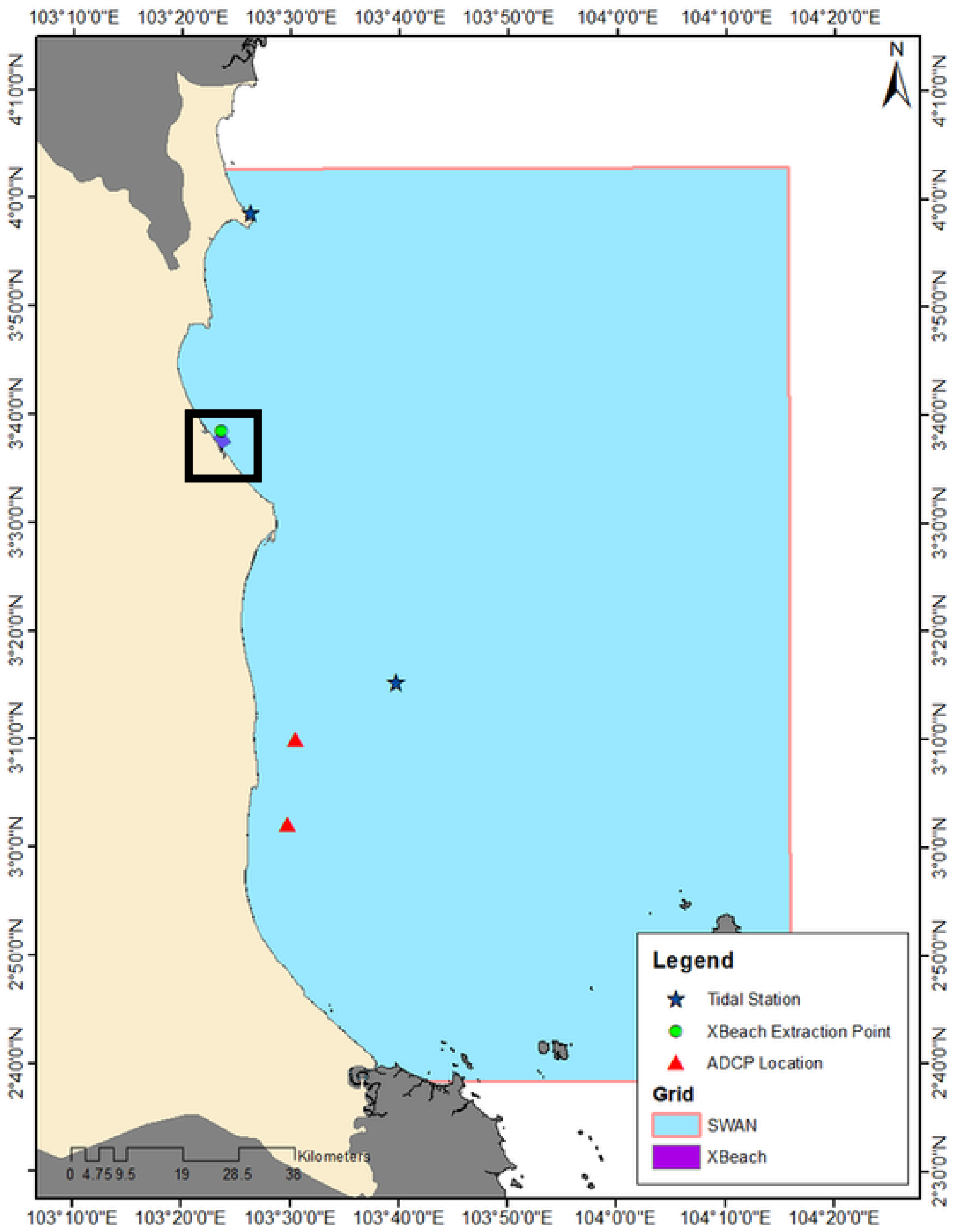
$$BSS = 1 - \frac{\sum(S_f - XB_f)^2}{\sum(S_f)^2}$$

Geomorphology Parameter

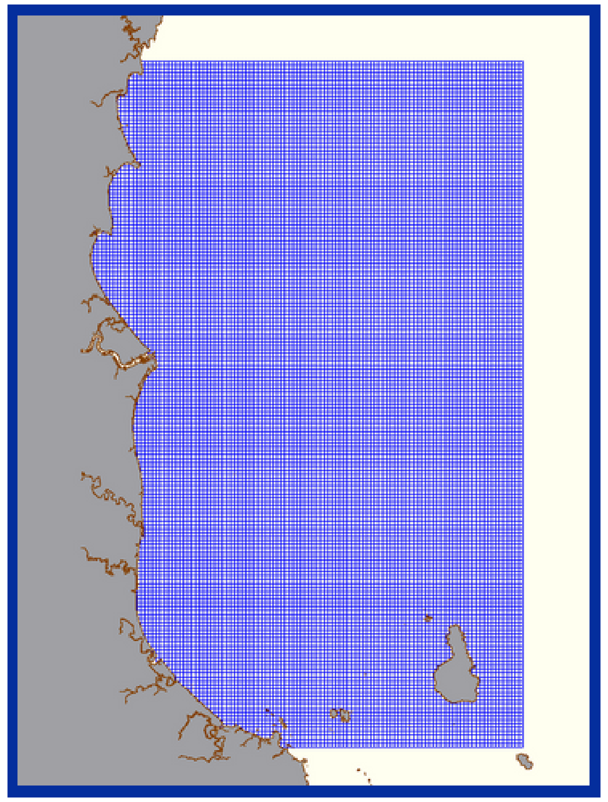
Parameters	Description	Default Value	Range Value
Dryslope	Critical avalanching slope above water	1.0	0.1 – 2.0
Wetslope	Critical avalanching slope under water	0.3	0.1 – 1.0
Facua	Calibration factor time averaged flows due to wave skewness and asymmetry	0.1	0.0 – 1.0

- Calibrated value for 1D is used in 2D

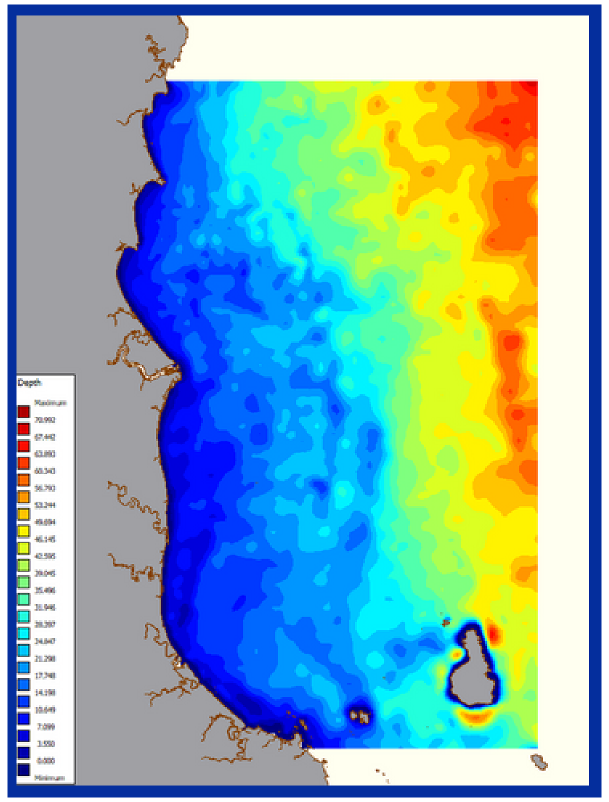
METHODOLOGY



Location of SWAN and XBeach, ADCP, Tidal and XBeach Data Extraction point

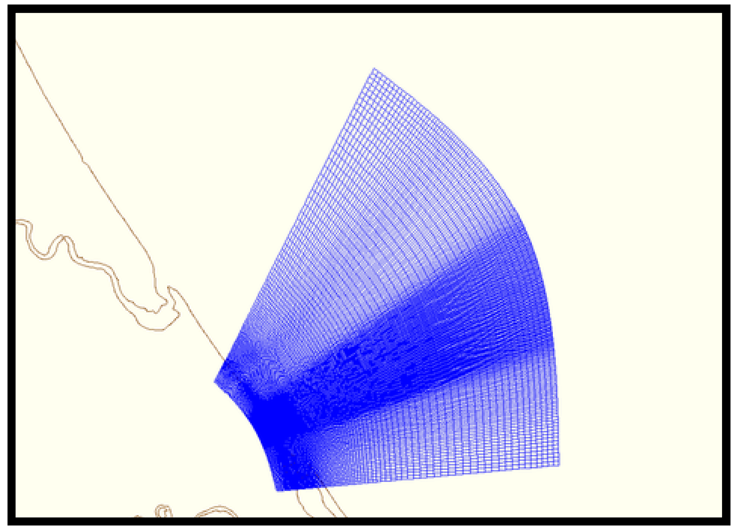


SWAN Grid
- Grid Size (1000 x 1000 m)
- Size of (97800 x 176400 m)

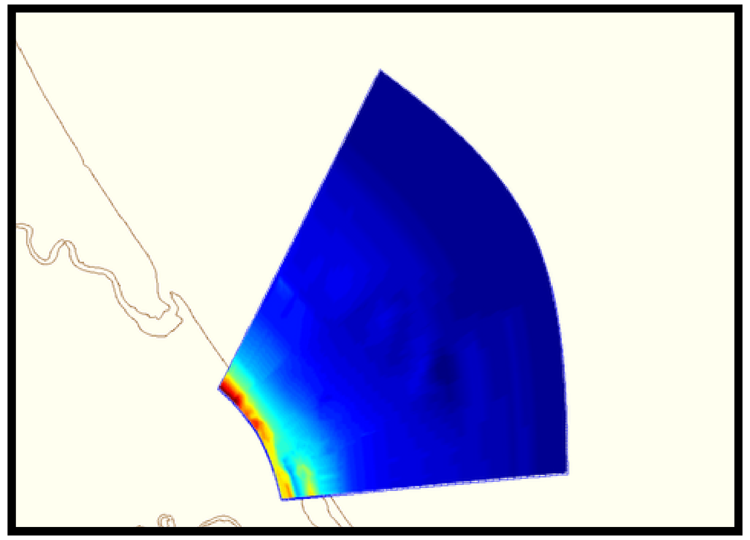


SWAN Bedlevel
- Bedlevel (0m to -80m)
- Taken using Delft Dashboard.
- TPXO 9.0
- Resolution 1/30 (deg)

SWAN Grid and Bedlevel Setup



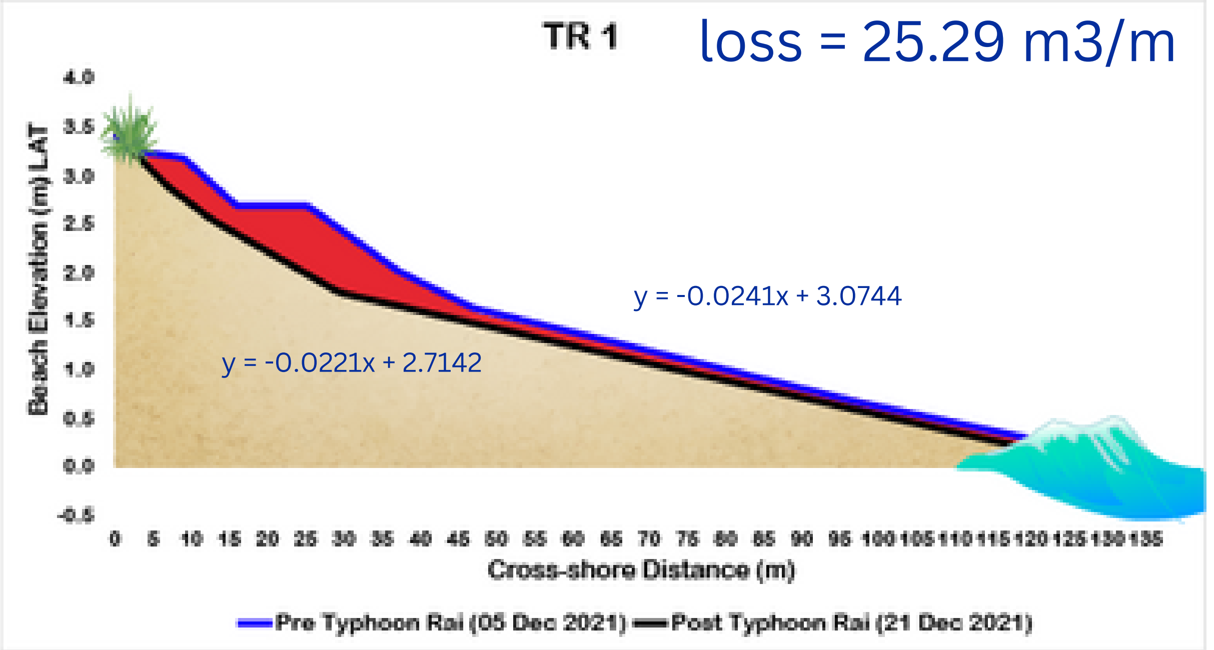
XBeach Grid
- Grid Size varying (5m to 100 m)
- Finer at the study area.

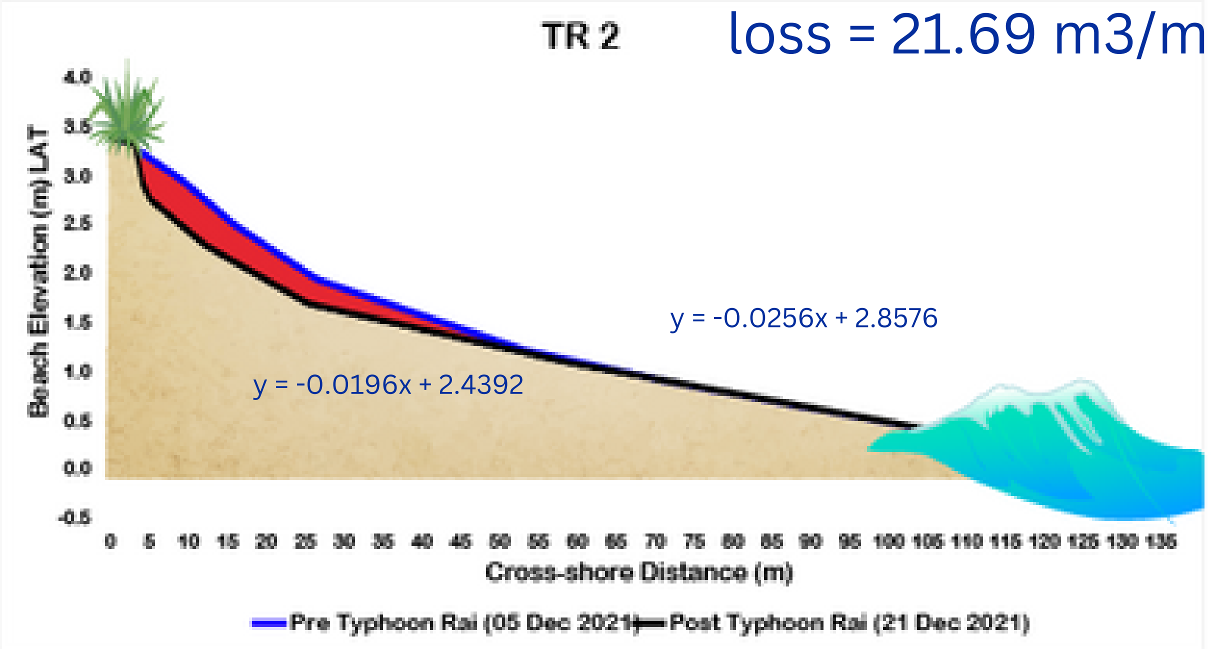


XBeach Bedlevel
- Bedlevel (7m to -11m)
- Water depth at boundary required more than 10 m

XBeach Grid and Bedlevel Setup

MONITORING





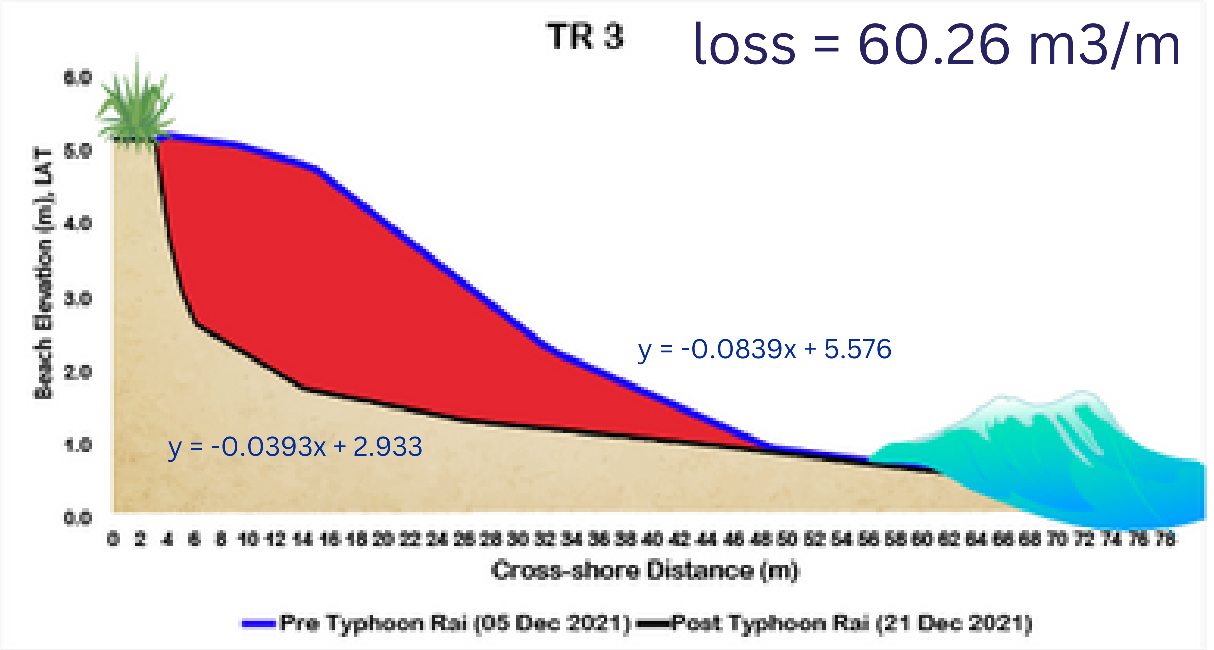
Before

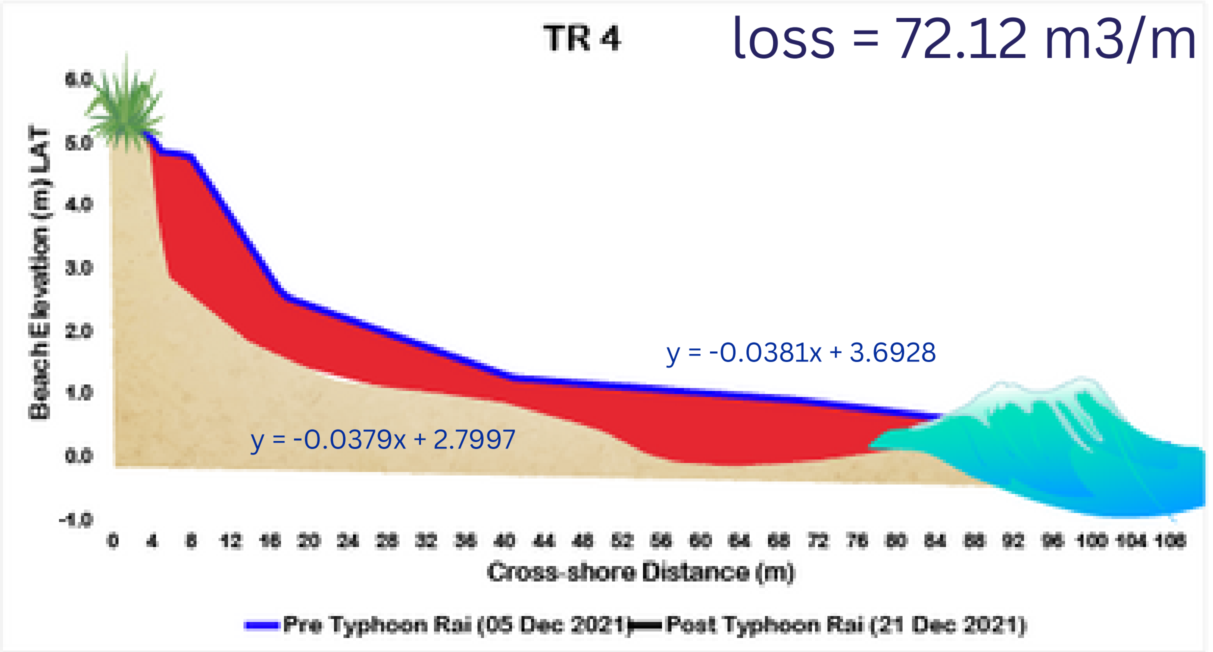
After

MONITORING

Before

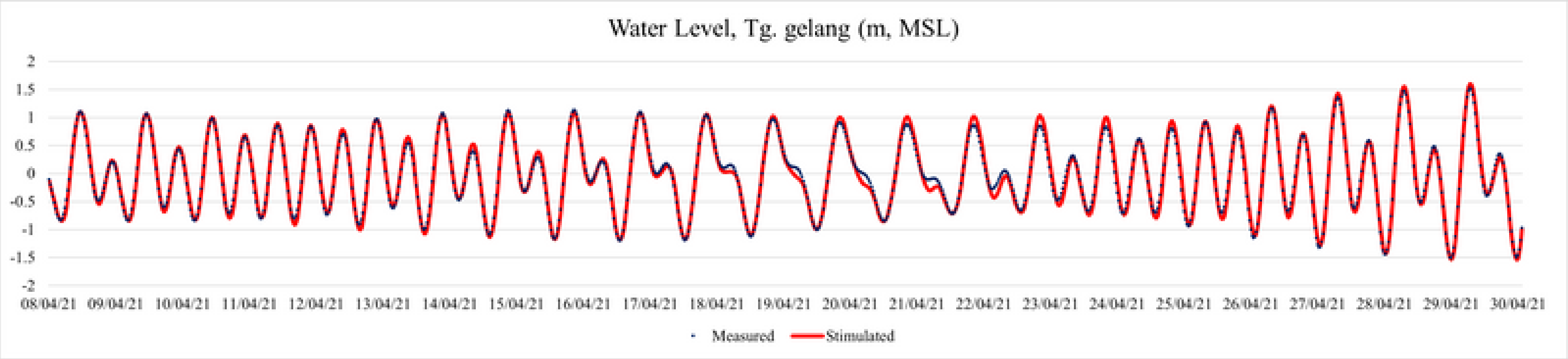
After





RESULT

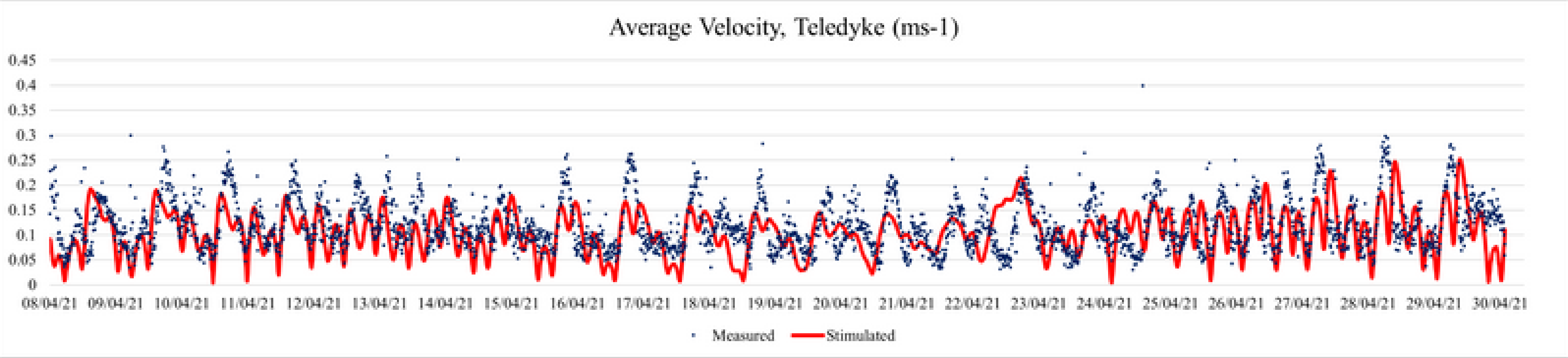
Flow Validation



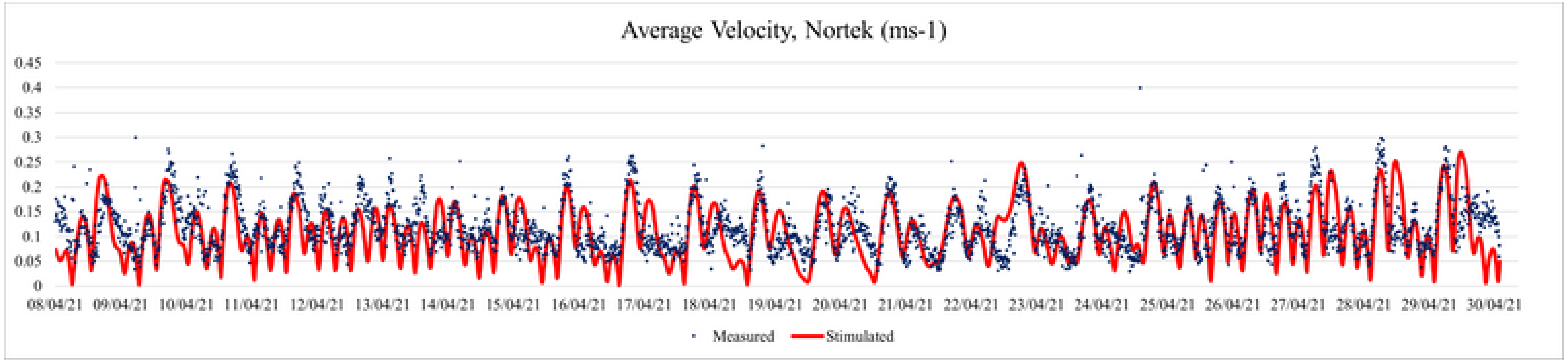
RMSE= 0.07
d= 0.99

RESULT

Flow Validation



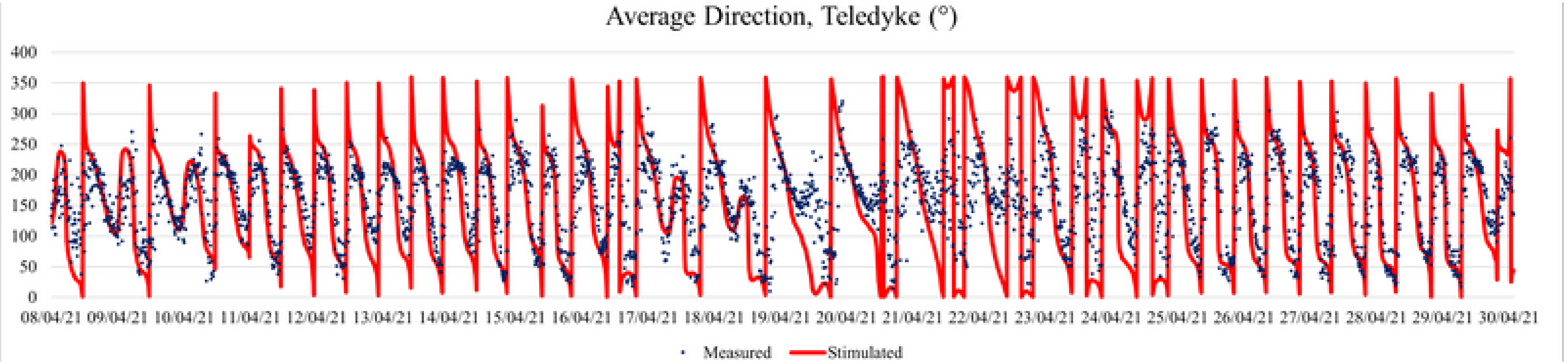
RMSE= 0.05
d= 0.69



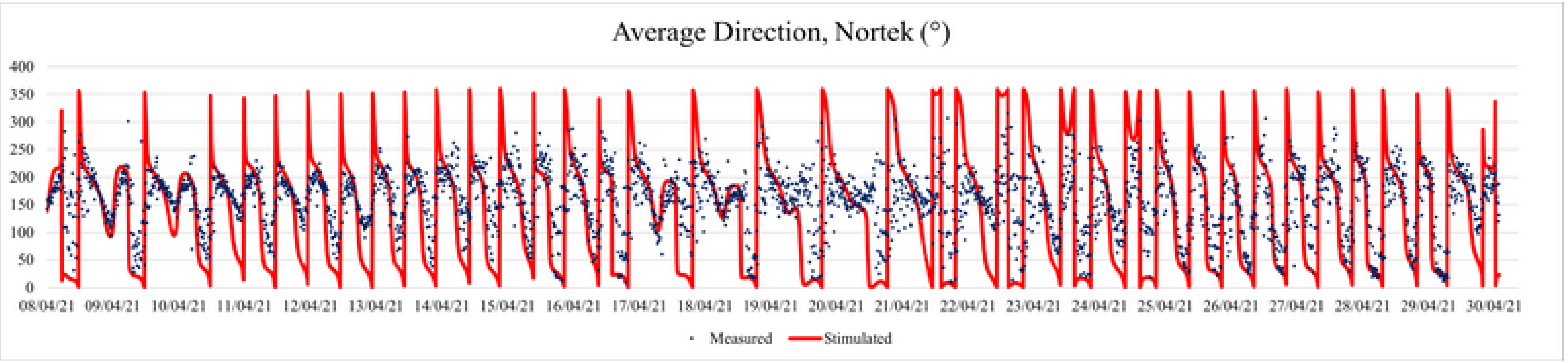
RMSE= 0.05
d= 0.69

RESULT

Flow Validation



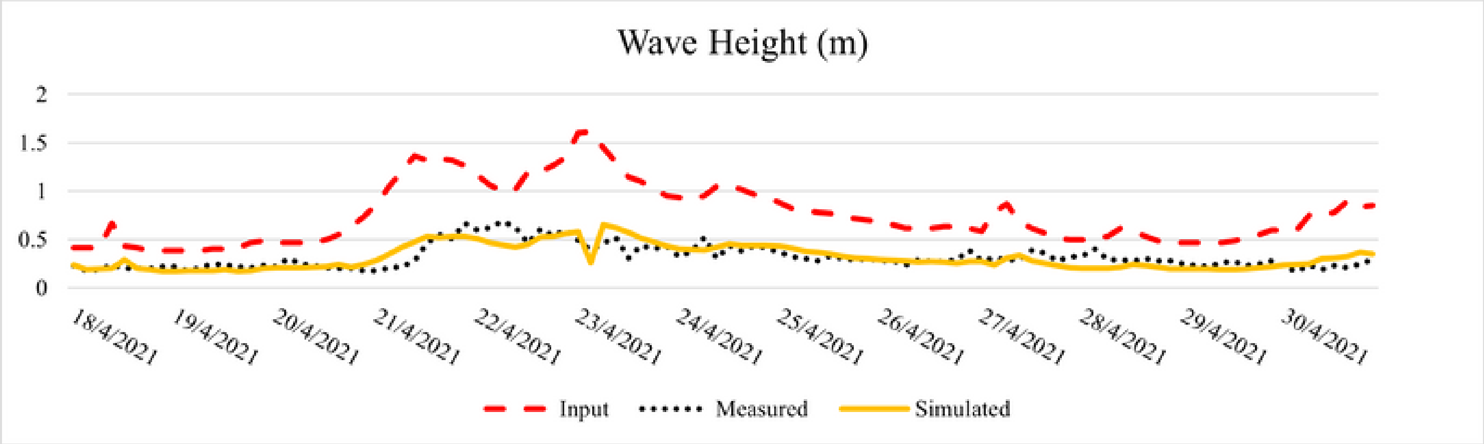
RMSE= 88.36
d= 0.63



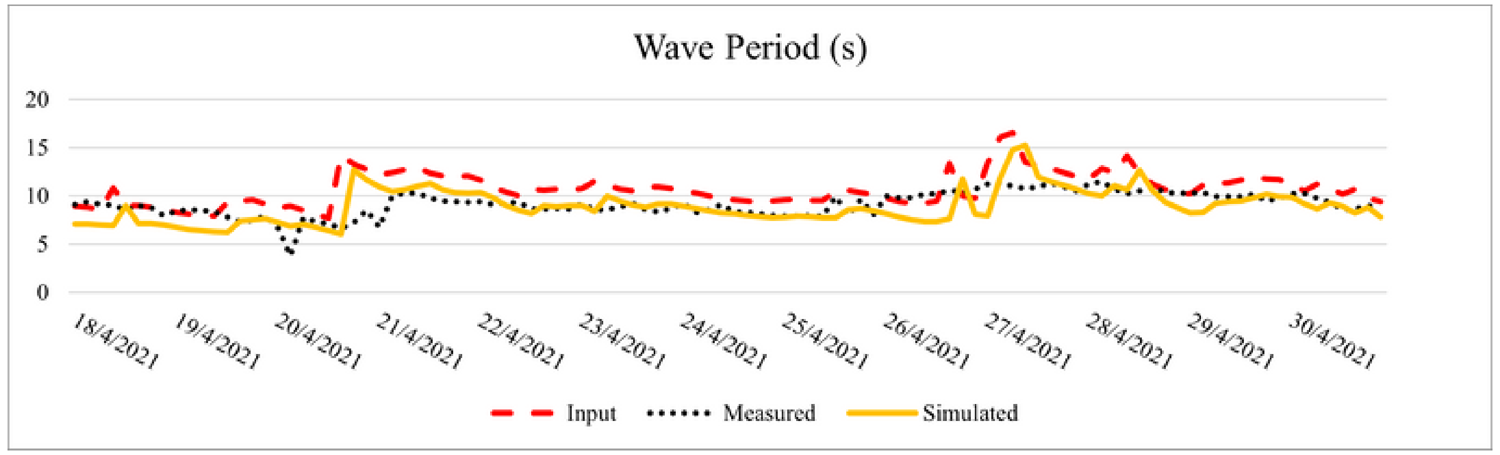
RMSE= 90.73
d= 0.58

RESULT

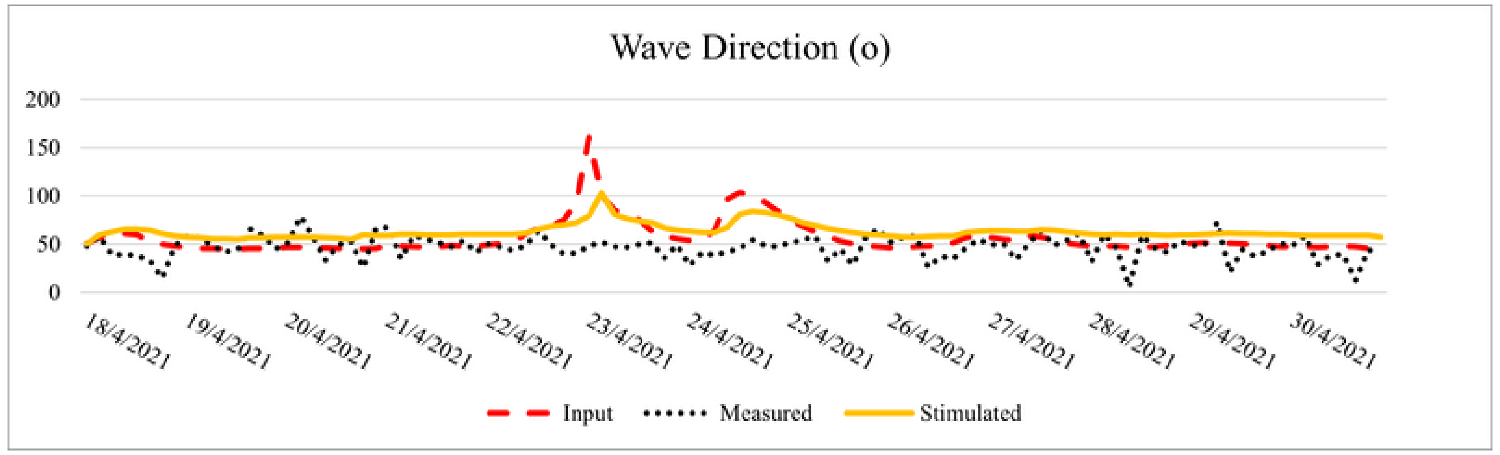
Wave Validation



RMSE= 0.08

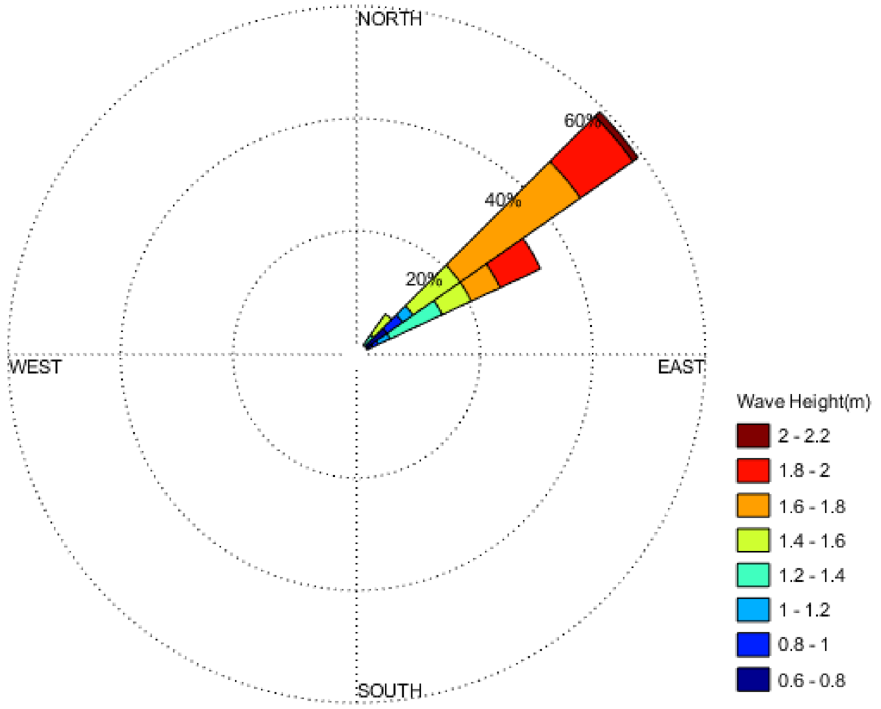


RMSE= 1.55



RMSE= 21.45

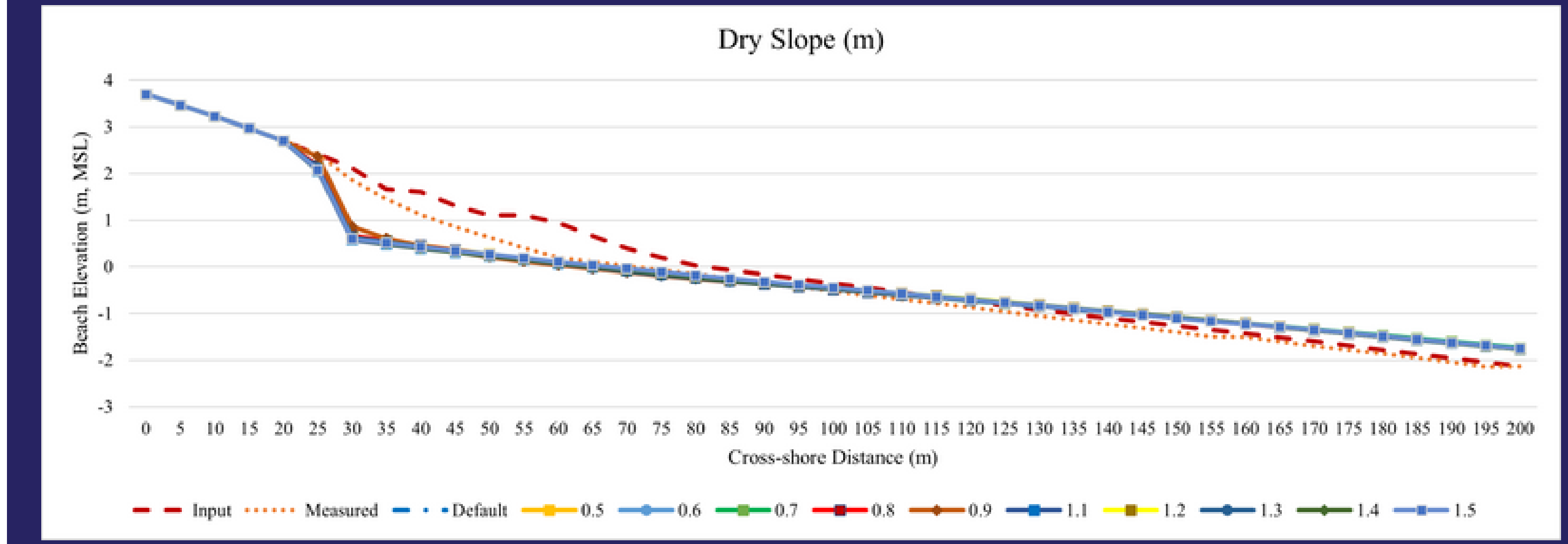
Wave Condition

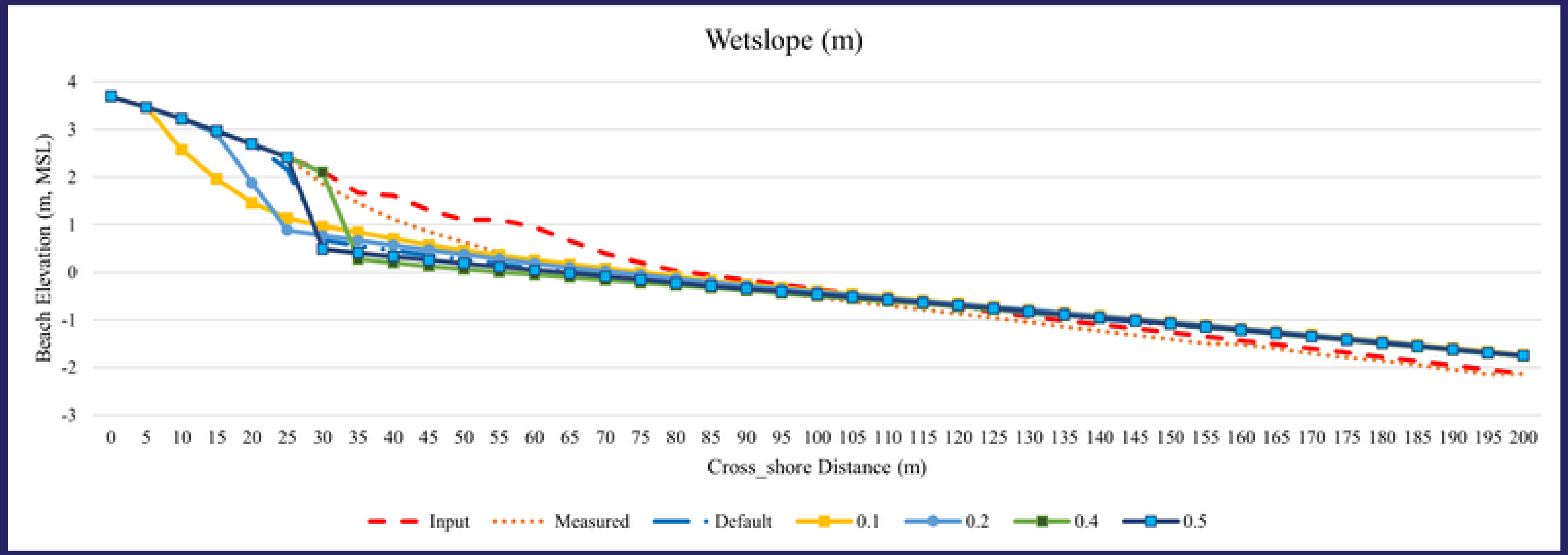


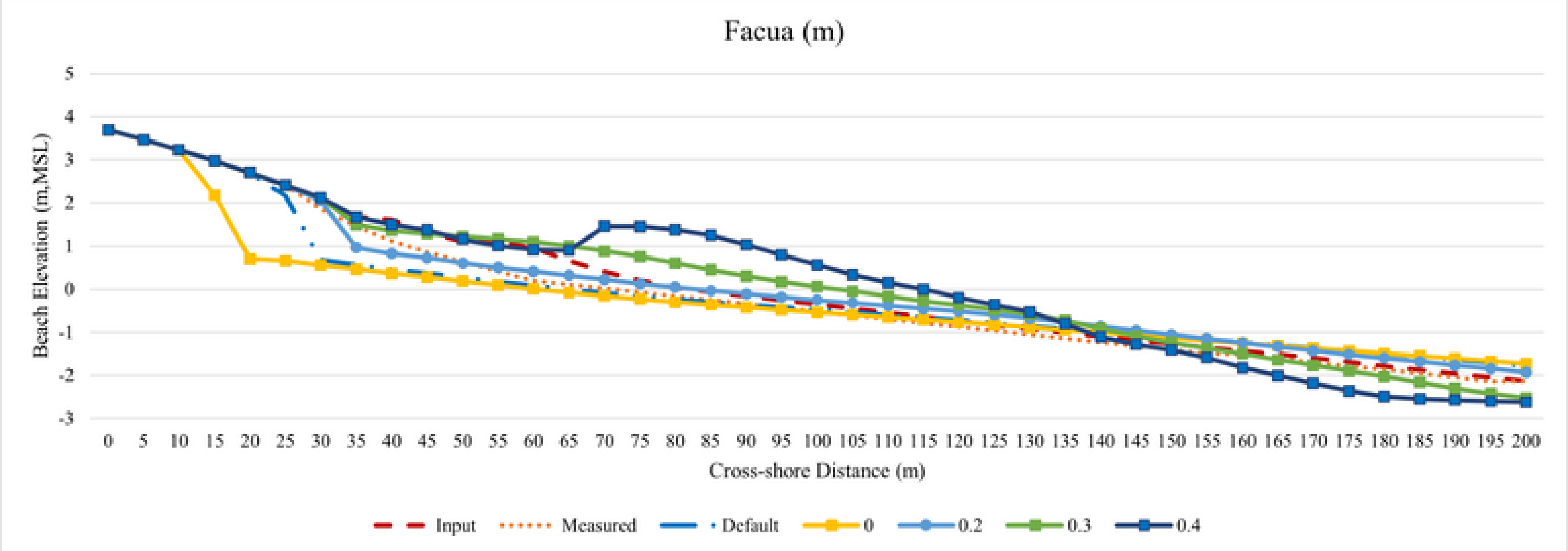
Wave Condition during Typhoon Rai, Tropical Depression 29

RESULT

XBeach morphological parameters calibration







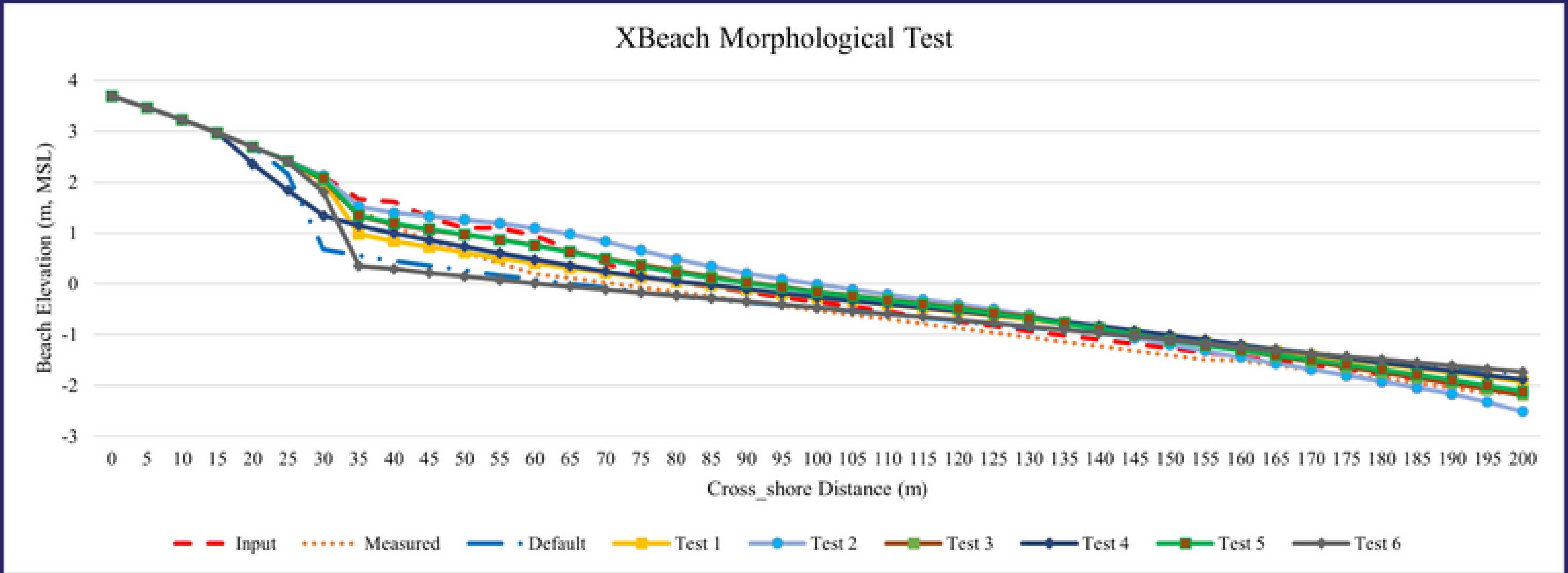
Parameters	Description	Default Value	Range Value	Used Value
Dryslope	Critical avalanching slope above water	1.0	0.1 – 2.0	0.9
Wetslope	Critical avalanching slope under water	0.3	0.1 – 1.0	0.4
Facua	Calibration factor time averaged flows due to wave skewness and asymmetry	0.1	0.0 – 1.0	0.2

RESULT

XBeach morphological parameters calibration

Test	Morphological parameters			BSS Score
	Dryslope	Wetslope	Facua	
Defult	1.0	0.3	0.1	0.956
1	0.9	0.4	0.2	0.976
2	0.9	0.4	0.3	0.931
3	0.9	0.4	0.5	0.965
4	0.9	0.1	0.2	0.967
5	0.9	0.15	0.25	0.967
6	1.0	0.4	0.2	0.959

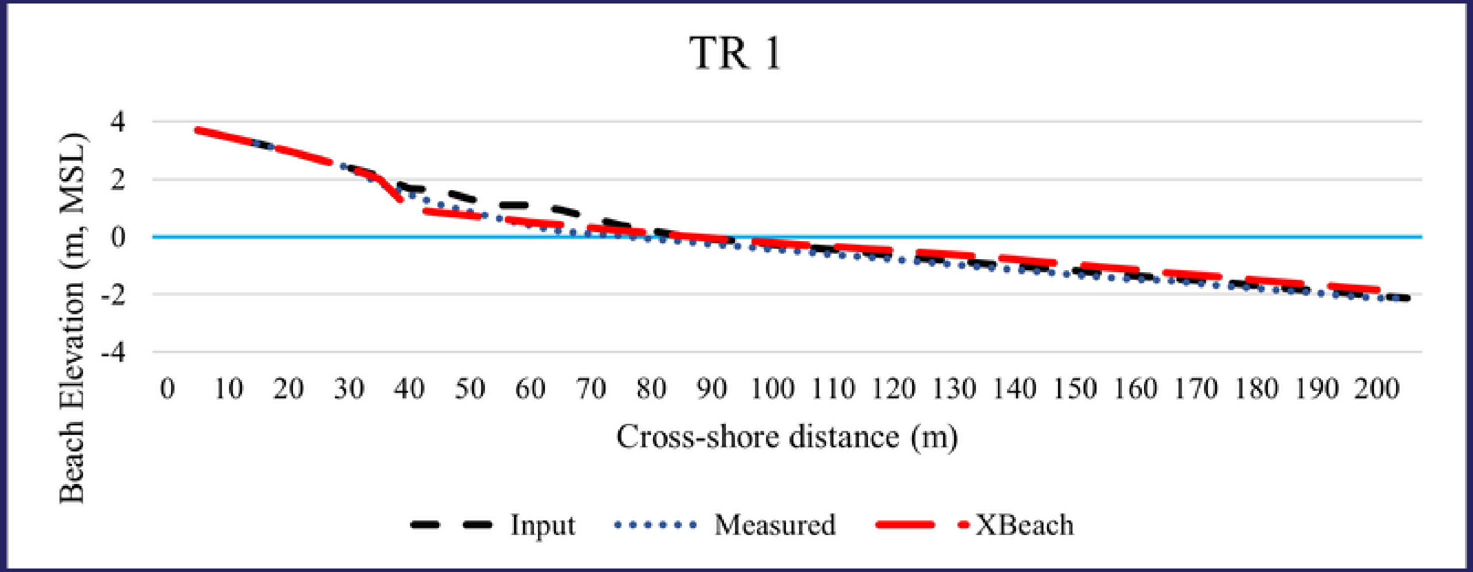
XBeach Morphological Calibration



RESULT

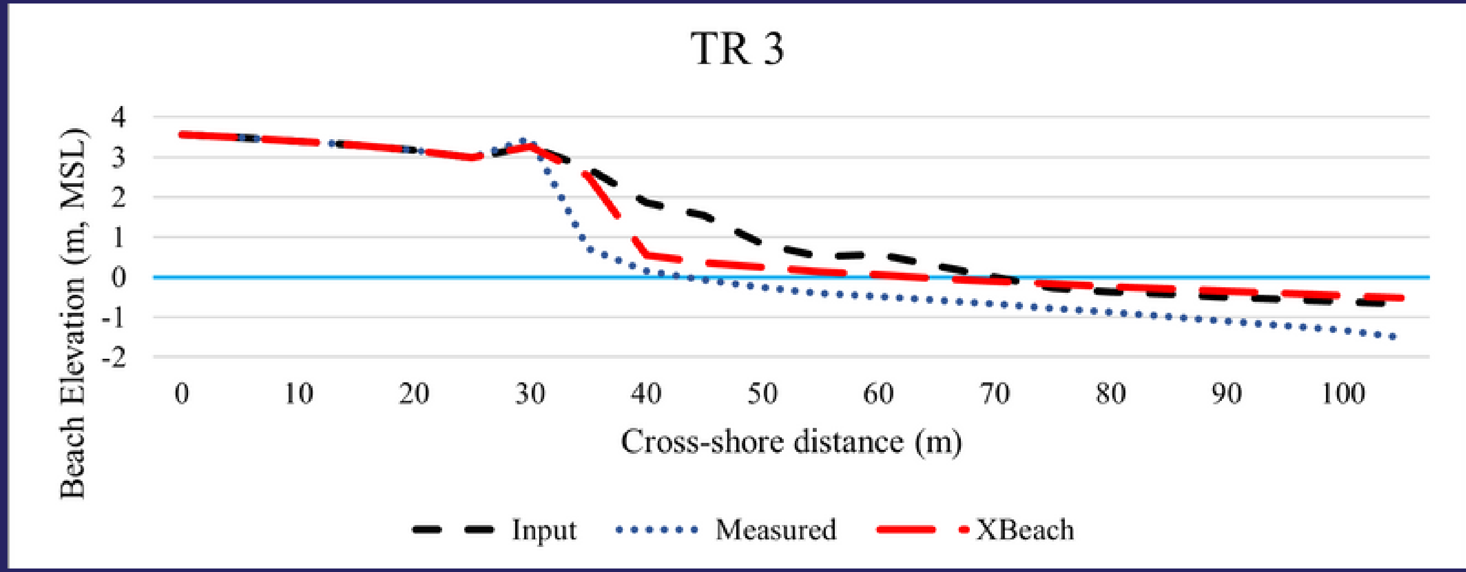
TR 1

BSS = 0.976



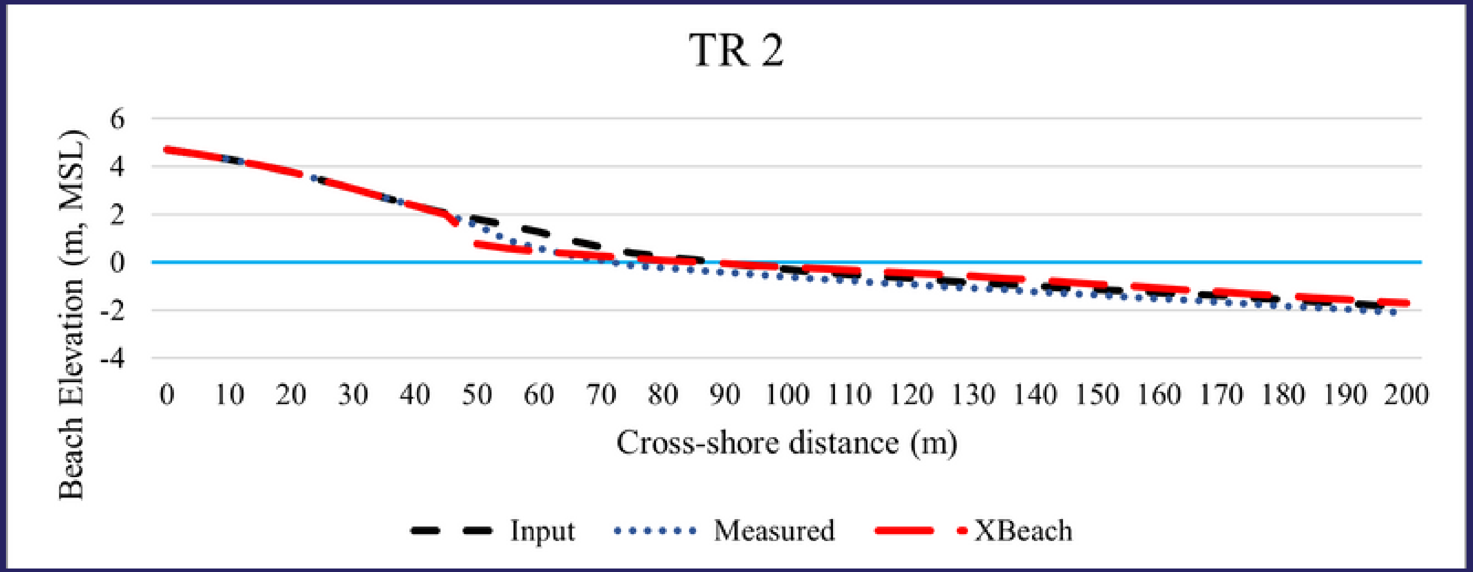
TR 3

BSS = 0.825



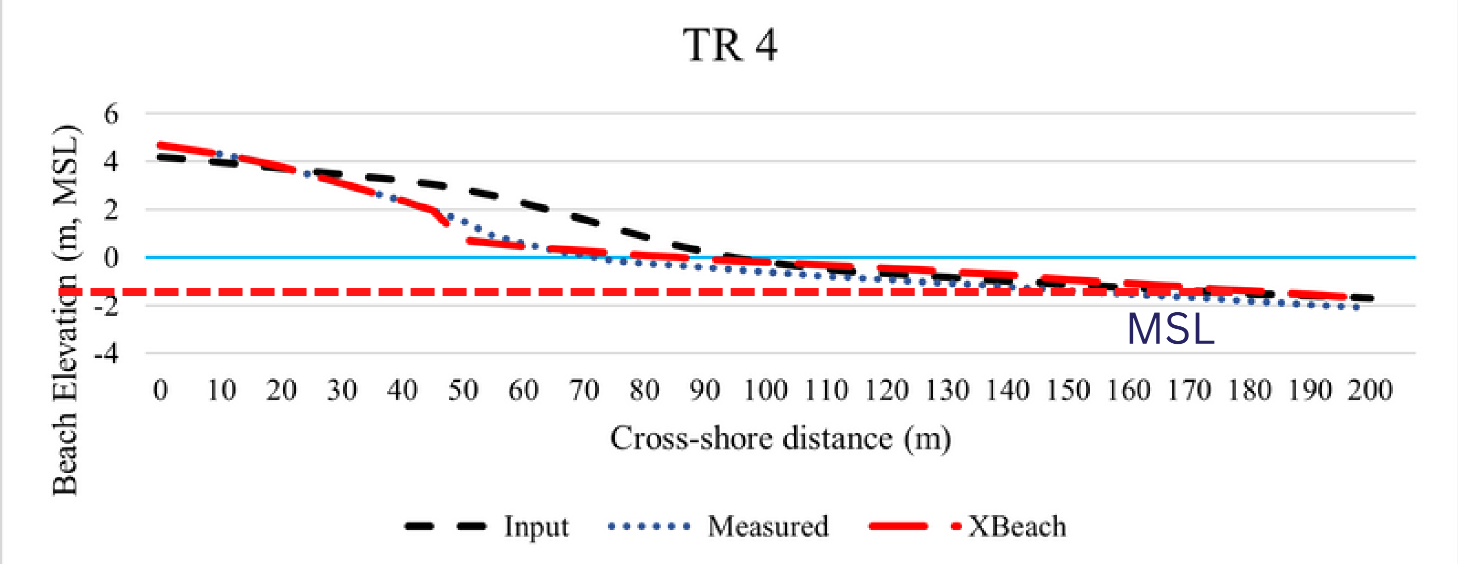
TR 2

BSS = 0.968



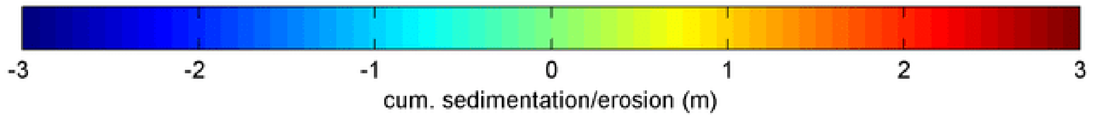
TR 4

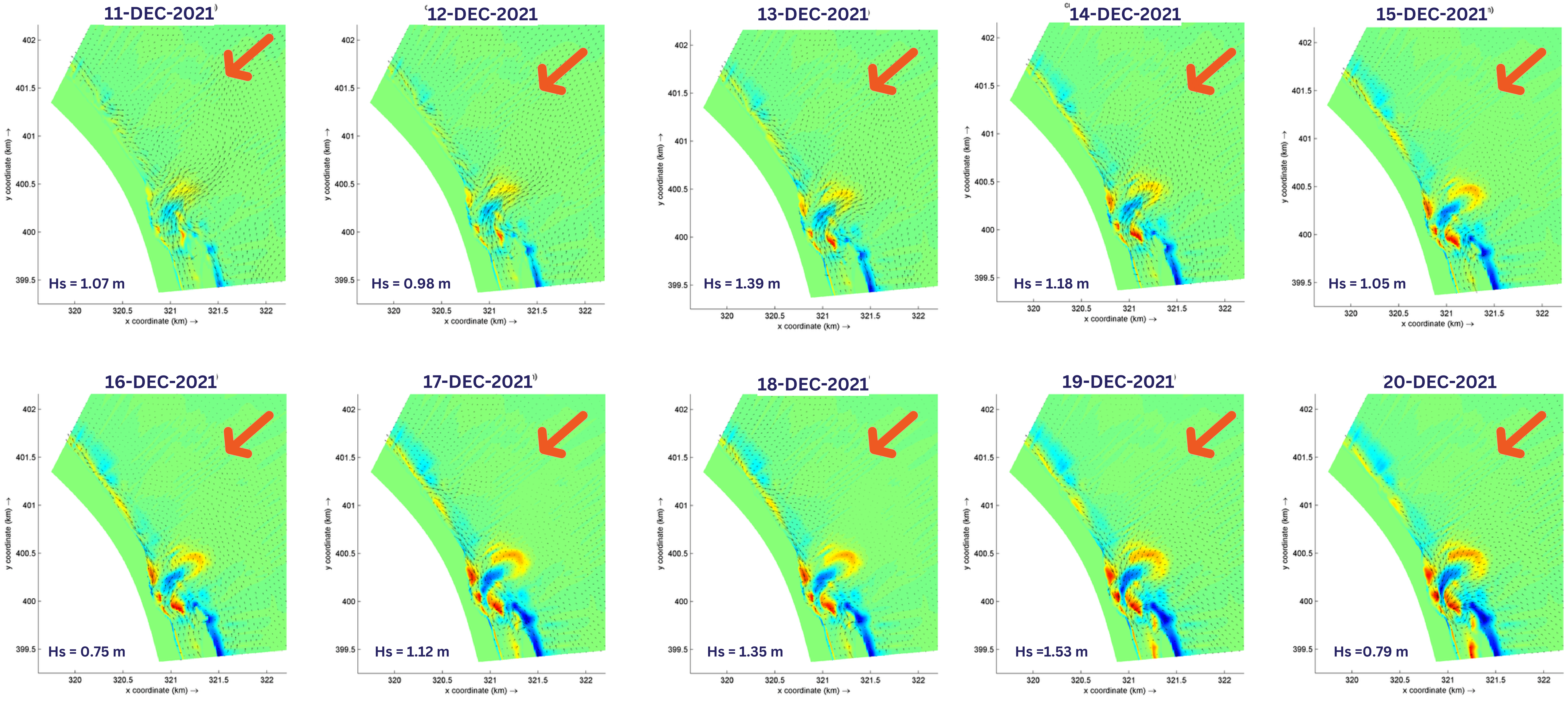
BSS = 0.968



RESULT

EROSION SIMULATION





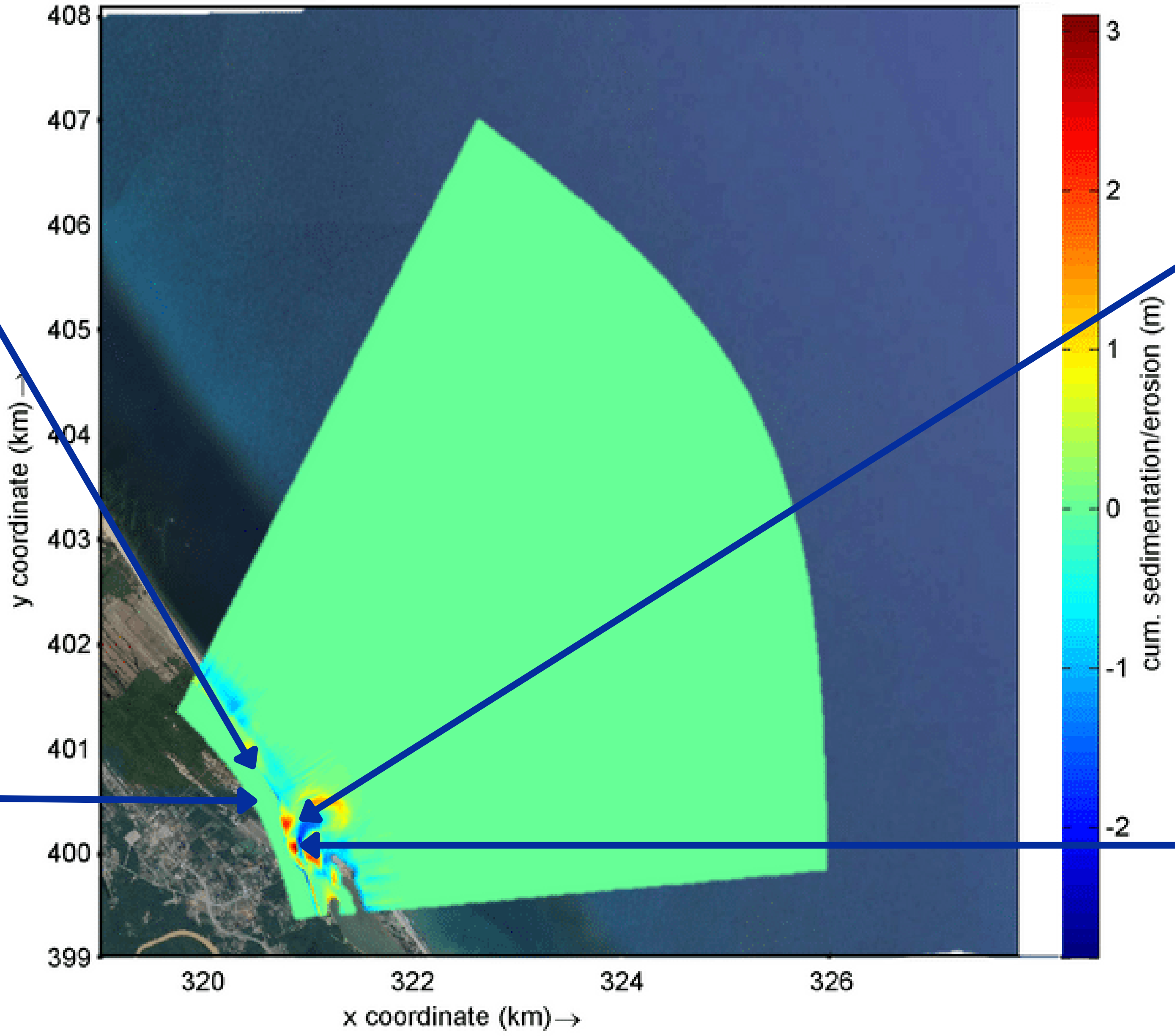
6th World Conference on MARINE BIODIVERSITY
WCMB 2023 MALAYSIA

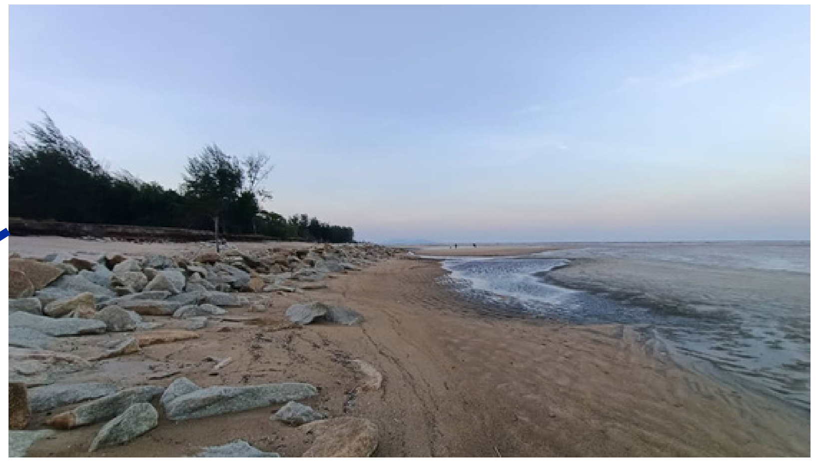
RESULT

23 Dec 2021 TR 2

23 Dec 2021 TR 3

20-DEC-2021



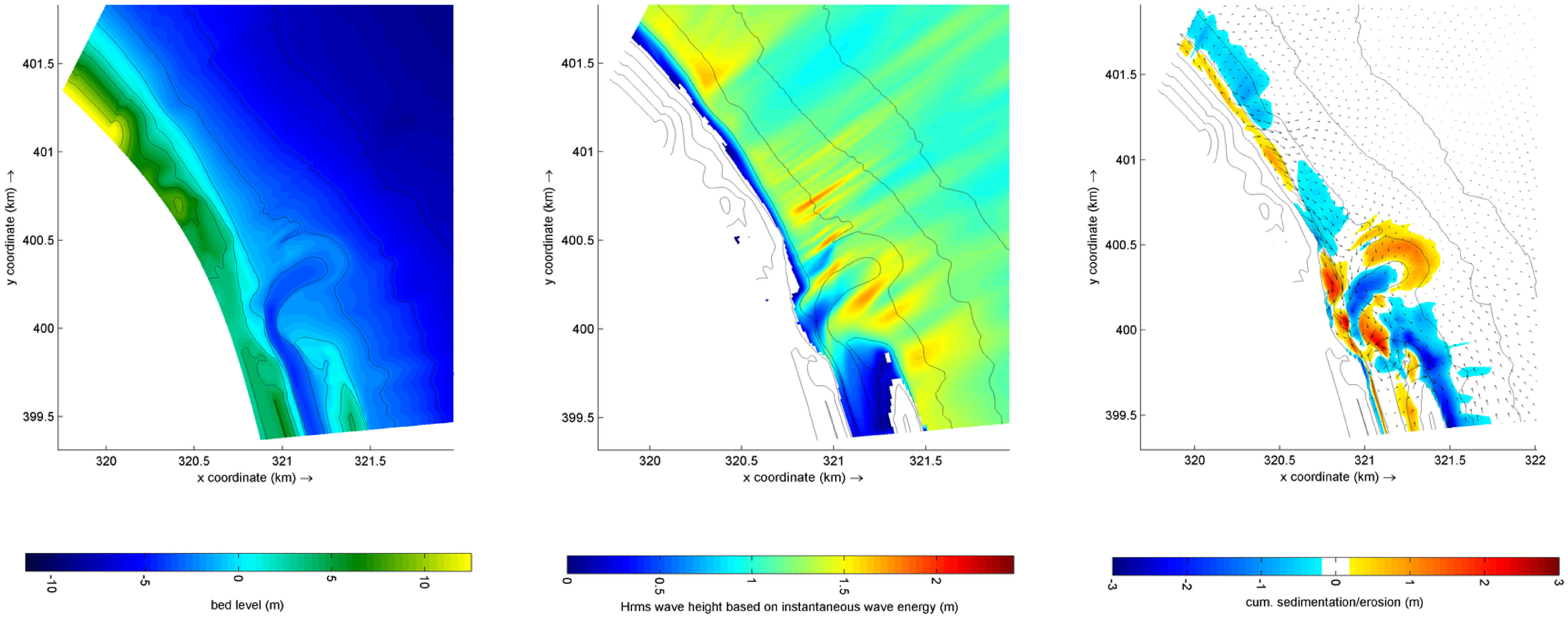


3 Jan 2022

3 Jan 2022

RESULT

CRITICAL TIME 18-DEC-2022 12:00:00



CONCLUSION

WCMB 2023 MALAYSIA

- Provide better understanding on morphological respond toward storm surge
- Act as early warning tools for extreme event or local long term morphological process
- Further acknowlage for policy maker and goverment for intermediate actions

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Thank You

MUHAMMAD MAZMIRUL ABD RAHMAN, IIUM
ASSOC. PROF. DR. MUHAMMAD ZAHIR RAMLI, IIUM
DR. MOHD SHAHRIZAL AB RAZAK, UPM