

## DESIGN OF A SAND ENGINE TO PROTECT THE COASTLINE IN PUERTO MORELOS, MEXICO

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### INTRODUCTION

The study site focuses on the coastal zone of Puerto Morelos, in particular in the beach front of Now Jade Riviera Cancun Resort, of around 400 m in length, in the Caribbean Sea of Mexico (Figure 1). Tropical cyclones (normally from June to September), Cold-Fronts (from October to February), eastern storms and frequent non-stormy wave conditions annually affect the littoral of this hotel and produce beach erosion damage. Topographic surveys taken by GPS showed significant loss of dry beach in the period from 2012 and 2017 (in red in Figure 2). Approximately 7 m of width and 0.9 m of altitude were reduced in the most critical beach sections in this period. The gain of sediment observed (in blue in Figure 2) was related to the protection of two breakwaters constructed in 2010 and 2012, at the South and North respectively of the region.

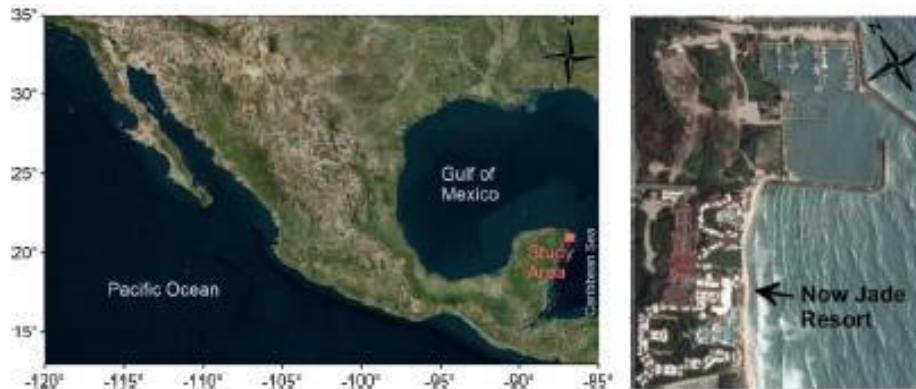


Figure 1. Location of the study area.

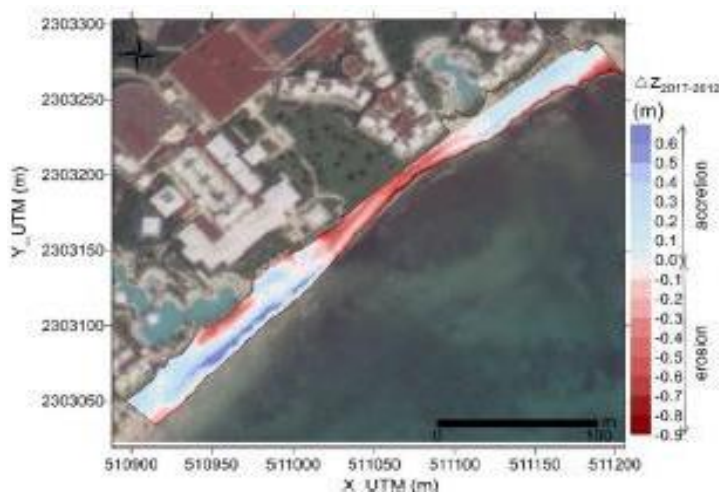


Figure 2. Variation of the altitude in the period from 30 October 2012 to 26 April 2017.

The Netherlands' strategy known as sand engine nourishment was proposed in this project as a sustainable and nature-friendly coastal protection measure (Luijendijk et al., 2017). The total volume of sand required for the initial shape into a bell-shaped salient, 33 m length and 1 m elevation, is 741 m<sup>3</sup> (see Figure 3).

XBeach numerical model (Roelvink et al., 2010) was used to explore the short and long term response of the nourishment, which will be naturally distributed along the coast under the action of waves and currents. Examples of the wave currents and morphological change for frequent wave scenarios are shown in Figure 4, whose magnitude was a function of the wave direction. Monitoring programmes on a monthly basis will be required to maintain the desirable state of the beach.

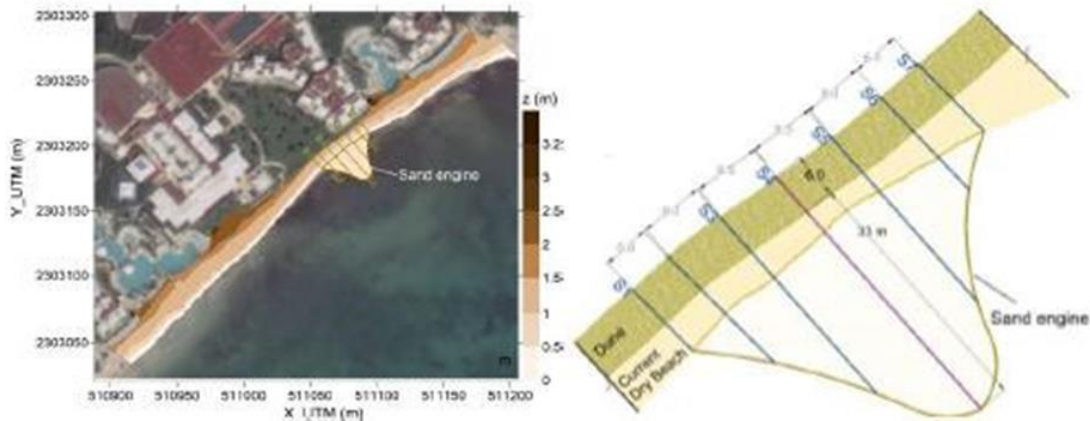


Figure 3. Sand engine shape.

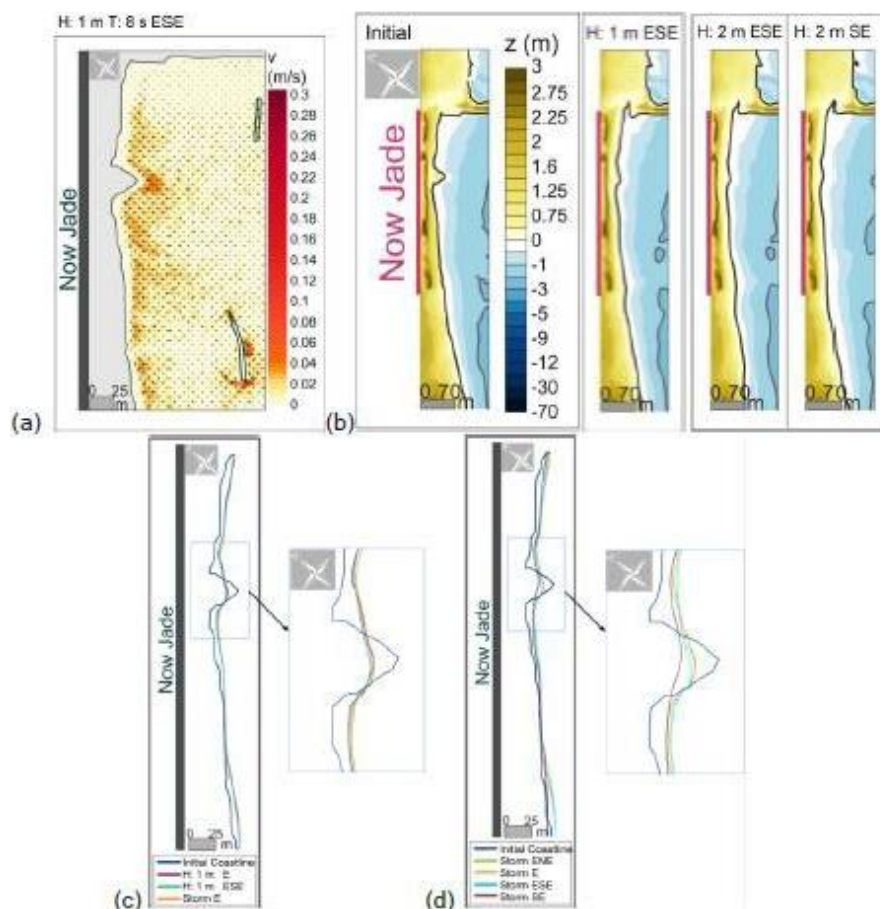


Figure 4. Results from numerical modeling: (a) Wave currents for a frequent non-storm scenario; (b) morphological change of sand engine for calm and storm conditions; (c) comparison of coastline change for calm wave events and eastern storms; (d) coastline change for the storm wave scenarios.

## REFERENCES

Luijendijk, Ranasinghe, de Schipper, Huisman, Swinkels, Walstra, Stive (2017): The initial morphological response of the Sand Engine: A process-based modelling study. *Coastal Engineering*, vol. 119, pp. 1-14.

Roelvink, Reniers, Van Dongeren, Van Thiel de Vries, Lescinski, McCall (2010): XBeach model description and manual, Unesco-IHE Institute for Water Education, Deltares and Delft University of Technology. Report June, 21, 2010..

# EXCEED - SWINDON Conference 2019

## THE FUTURE OF WATER RESOURCES

October 13<sup>th</sup> - 16<sup>th</sup>, Mérida, Mexico



# Programme and Book of Abstracts

# PROGRAMME

Sunday, 13 <sup>th</sup>		Arrival	
19:00	-	21:00	Welcome cocktail

Monday, 14 <sup>th</sup>		Conference Day 1	
08:30	-	09:00	Registration
09:00	-	09:30	Opening Ceremony <ul style="list-style-type: none"> <li>• Norbert Dichtl</li> <li>• Andreas Haarstrick</li> <li>• Rodolfo Silva</li> <li>• Local authority</li> </ul>
09:30	-	10:00	Keynote speech <ul style="list-style-type: none"> <li>• Norbert Dichtl</li> </ul>
10:00	-	10:10	Break
<b>Session 1: The impact/performance/role of SDGs</b> Chairman: Valeria Chávez			
10:10	-	10:30	Exploring some ocean energy possibilities in Latin America (Jassiel Hernández)
10:30	-	10:50	Water energy nexus in the MENA region (Abbas Al-Omari)
10:50	-	11:10	Ocean energy and marine biodiversity affectations: a life cycle assessment review (Dora Ruiz-Méndez)
11:10	-	11:40	Coffee Break
<b>Session 2: Water-Energy-Nexus (I)</b> Chairman: Dwi Andreas Santosa			
11:40	-	12:00	Wastewater/waste to energy in MENA region: A review for opportunities (Zeinab Abou Elnaga)
12:00	-	12:20	Water-energy nexus in a wastewater treatment plant: Energy efficiency and recovery (Wang Hongtao)
12:20	-	12:40	From wastewater treatment plants to a resources recovery facility (Marcelo Nolasco)
12:40	-	13:00	Seasonal assessment of the energetic potential associated with salinity gradient: Champoton River, Mexico (Gregorio Posada Vanegas)
13:00	-	14:30	Lunch
<b>Session 3: Water, ecosystem and socio-economic integrating aspects (I)</b> Chairman: Germán Rivillas			
14:30	-	14:50	Decolourization and mineralization of acid green 25 dye through single and catalytic ozonation (Liliana Amaral Féris)

14:50	-	15:10	Adsorption of naphtholate-as dye in wastewater of batik industry using green synthesized zn layered hydroxyl salts (Sri Juari Santosa)
15:10	-	15:30	Adsorption of hexavalent chromium in coal beneficiation tailing in fixed bed column (Liliana Amaral Féris)
15:30	-	15:50	Kinetics of the adsorption of anionic and cationic dyes in aqueous solution by low-cost activated carbons prepared from sea cake and cotton cake (Ibrahim Tchakala)
15:50	-	16:10	Distribution of microplastics in water and sediment in a Biosphere Reserve (Cecilia Enriquez)
16:10	-	16:30	Evaluation of microplastics contamination in the margins of the Patos Lagoon in south of Brazil (Eduardo Saldanha Vogelmann)
16:30	-	17:00	Coffee Break
<b>Session 4: Water, ecosystem and socio-economic integrating aspects (II)</b> Chairman: Rodolfo Silva			
17:00	-	17:20	Hydrodynamic modelling of the Huave Lagoon System, Oaxaca (María Fernanda González Amador)
17:20	-	17:40	Impact effects of hard infrastructure in Salamanca Natural Park (Juan Carlos Caez-Perez)
17:40	-	18:00	The decision-making in face to coastal squeeze, analysis between social and economic impacts: Case study of Campeche, Mexico (Debora L. Ramírez-Vargas)
18:00	-	18:30	Keynote speech • Elvis Carissimi
20:00			Dinner

<b>Tuesday, 15<sup>th</sup></b>		<b>Conference Day 2</b>	
<b>Session 5: Water, ecosystem and socio-economic integrating aspects (III)</b> Chairman: Arwa Naser Damen Hamaideh			
09:00	-	09:20	Dispersion of submarine groundwater discharges in reef lagoons and associated environmental effects (Arlett Rosado Torres)
09:20	-	09:40	Salt intrusions into a freshwater spring in a tropical coastal lagoon, Yucatán, Mexico (Xaní Malagón)
09:40	-	10:00	Variability of the saline gradient in a hypersaline coastal lagoon (Brenda Natalia Fitch Geymonat)
10:00	-	10:20	Sedimentation and water quality status of lake Tana, the headwaters of the Blue Nile, Ethiopia (Seifu A Tilahun)
10:20	-	10:40	An innovative approach to mitigate risks on the existing iron tailings dams in Brazil (Jose Araruna)

10:40	-	11:00	Urban sustainable water management and water efficiency improvement for buildings – a case study for Istanbul (Ahmet Baban)
11:00	-	11:30	Coffee Break
<b>Session 6: Water-Energy-Nexus (II)</b> Chairman: Eduardo Saldanha Vogelmann			
11:30	-	11:50	Reverse electrodialysis for energy and water: coupled systems based in salinity gradients (Mateo Roldan-Carvajal)
11:50	-	12:10	Development of graphene oxide membranes for its use in reverse electrodialysis systems (Eddie López Honorato)
12:10	-	12:30	Development of graphene oxide based materials for water treatment (Ana Cecilia Reynosa Martinez)
12:30	-	12:50	Laboratory experiences on marine energy conversion devices for supplying electricity demand of remote coastal communities (Jassiel Hernández)
12:50	-	13:10	Plate type obstacles used for coastal protection and power generation (Luis Eduardo Pérez Paez)
13:10	-	14:40	Lunch
<b>Session 7: Water, ecosystem and socio-economic integrating aspects (IV)</b> Chairman: Thi Thanh Van Ngo			
14:40	-	15:00	Evaluating combinatorial water treatment by locally available materials (Chrispin Kowenje)
15:00	-	15:20	Desalination by capacitive deionization as a tool to provide drinkable water to small communities in the Brazilian semiarid (Luis Augusto Martins Ruotolo)
15:20	-	15:40	Fluoride ions removal from groundwater by alumina adsorption (Elvis Carissimi)
15:40	-	16:00	Bio-refineries: A new concept towards green energy production from agroindustrial wastewater (Víctor Alcaraz)
16:00	-	16:20	The importance of water and nutrients management in paddy fields as an effort to increase crop yields and producing an electrical energy through microbial fuel cells (Dwi Andreas Santosa)
16:20	-	16:50	Coffee Break
16:50	-	17:20	Keynote speech • Klaus Fricke
16:50	-	18:00	Panel discussion Moderators: Edmilson Santos de Lima and Norbert Dichtl
20:00			Gala dinner