



FINAL PROGRAM for 2nd COB Seminar

GreenBridge, Oostende - 6th Feb., 2020



Session 3: Experimental modelling experience from Industry

Wave-flume and wave-basin tests for the design of submerged breakwaters combined with beach-nourishments

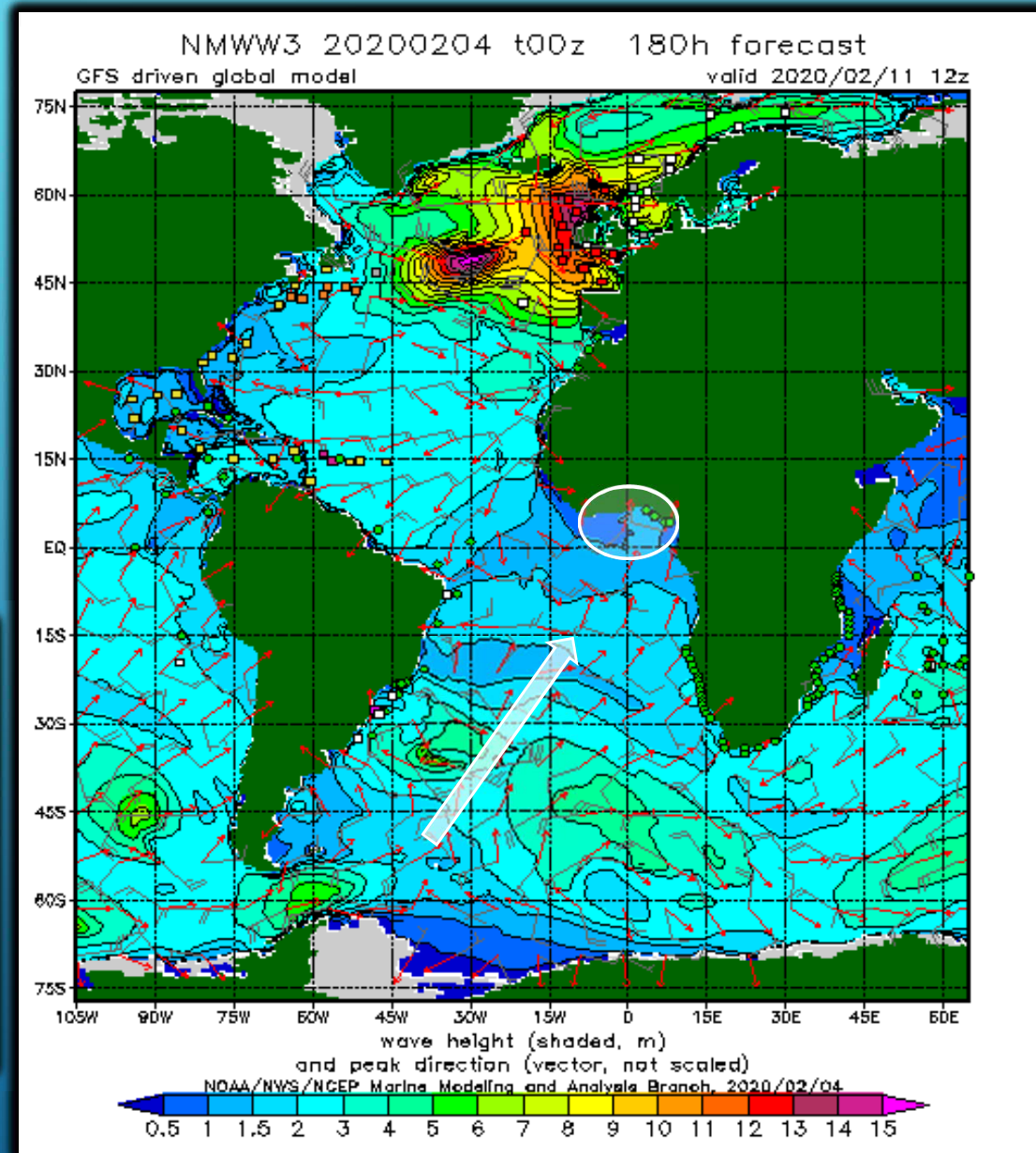
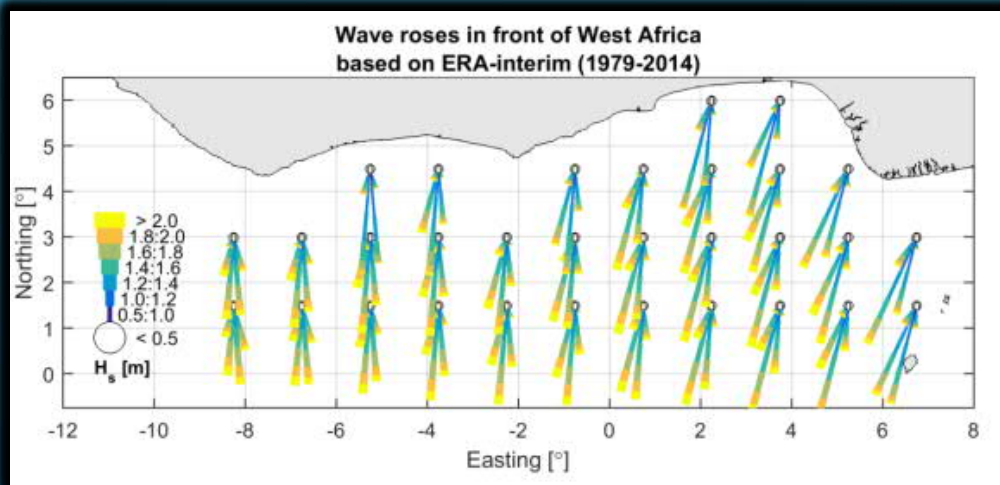
NATURE-BASED SOLUTION FOR SUSTAINABLE COASTAL PROTECTION

CASE OF WEST COAST IN REPUBLIC OF BENIN, WEST AFRICA

Ir. Bernard Malherbe



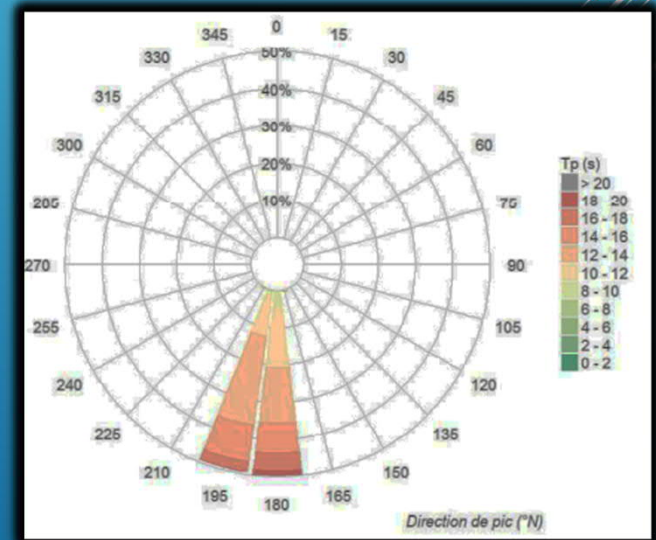
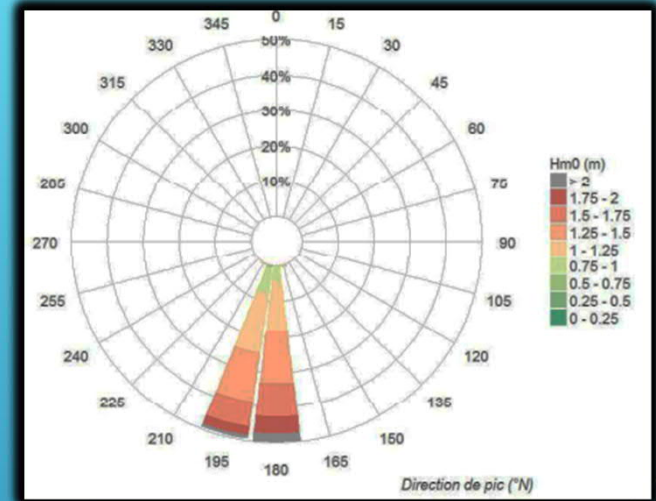
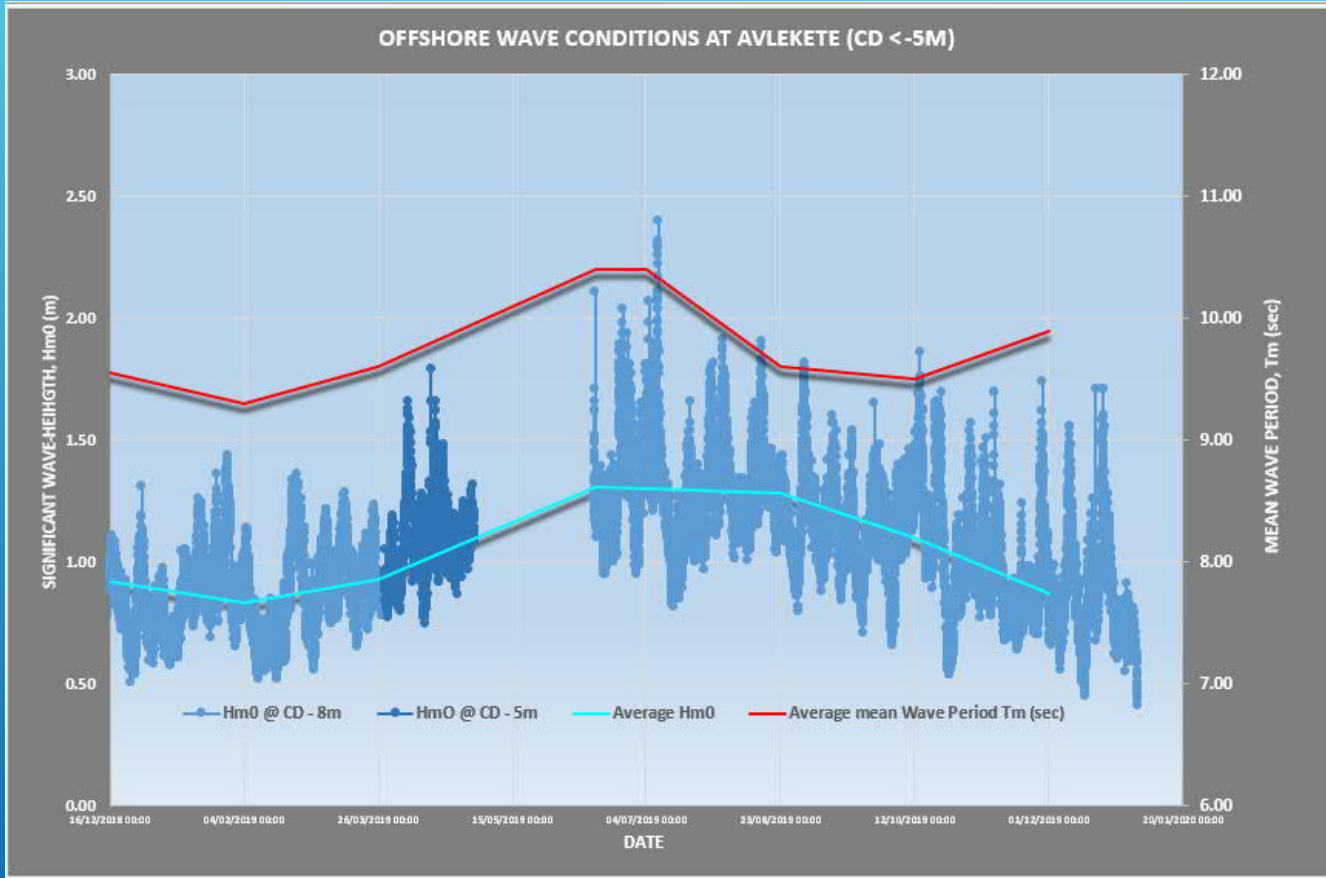
“Roaring Forties” depressions migrating south of Cape Horn generate periodic bursts of transoceanic swells, pounding the Guinea coasts in West Africa



Ref NOAA Wavewatch III model, 2020

The coastline of West Benin- Province of Ouidah – and the morphologic features







Scenes from
the site



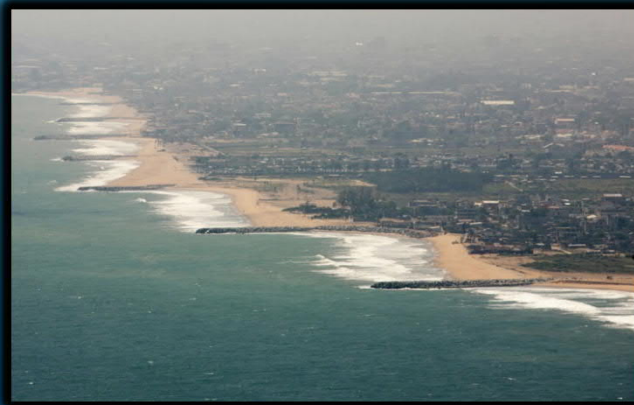
The “old-tech” approach of groyne-fields has proven to be non-efficient, non-sustainable, non-ecosystem service providing, non- attractive,....

“ Les ‘épis’ (= groyne) tuent la plage...! ” – quote from Mr President Mr Patrice Talon.

Erosions



Dangerous turbulences & rip-current inductions

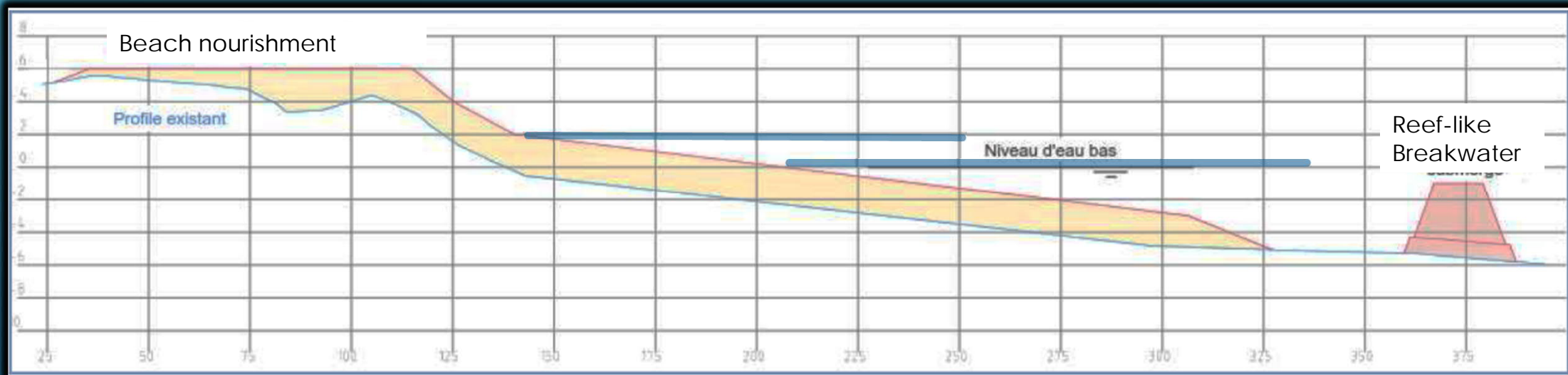


NATURE-BASED CONCEPT OF COASTAL PROTECTION: A SUBMERGED REEF-LIKE BREAKWATER COMBINED WITH A BEACH-NOURISHMENT

Client: Gouvernement de la République du Bénin – Ministère du Cadre de Vie et du Développement Durable

Contractor: Jan De Nul NV

Contract : Design & Build (2017-2020)



Scope of Services:

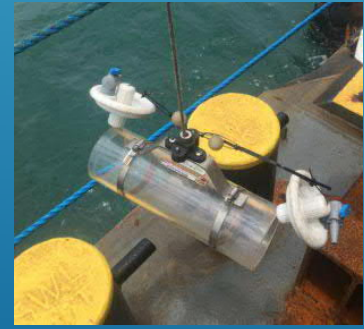
- Preliminary design
- Site investigations (geotechnical, sedimentological, bathymetry/topography, environmental baseline, waves-currents,...)
- Socio-Environmental impact assessment
- Assistance to Client for Environmental Building Permit
- Project Finance
- Detailed engineering (numerical modelling, physical modelling, geotechnical & dynamic stability assessment, morphological studies,...)
- Sourcing of building materials
- Construction of breakwater
- Beach nourishment
- Monitoring of morphological evolution and wave transmission & performance assessment



Mini CPT geotechnical investigations



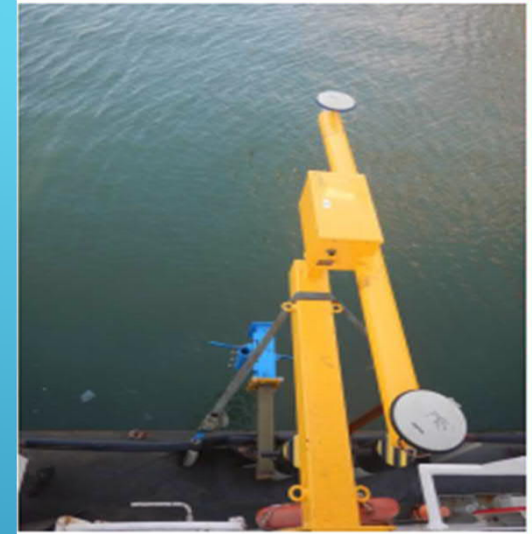
Vibrocoring



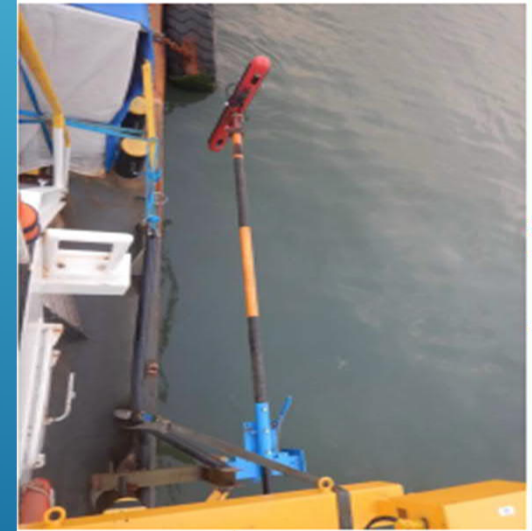
Environmental baseline surveys



Wave & current measurements frames



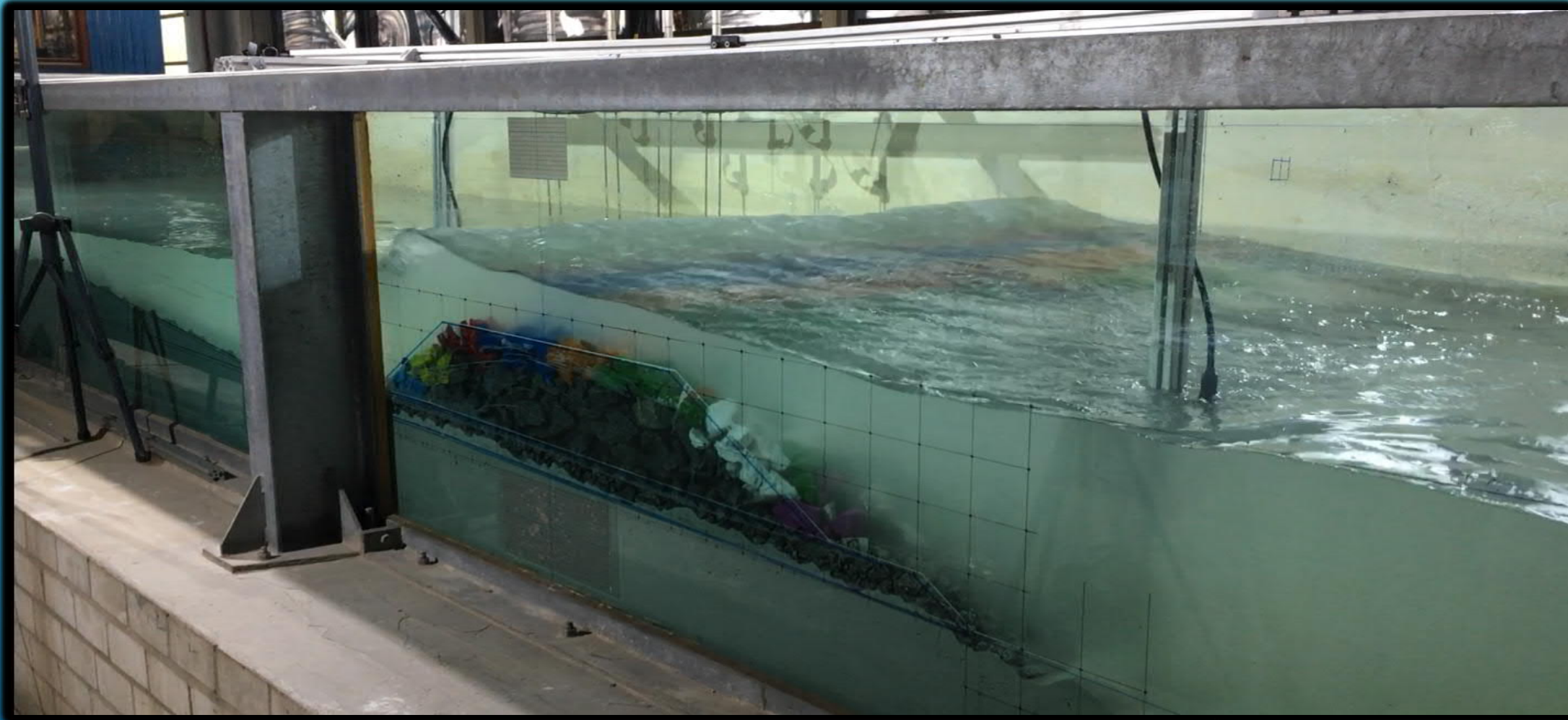
Combined multibeam echosounding & shallow reflection seismics



Wave-flume tests (scale 1/25 & Dean similitude for sediment-bed) of submerged breakwater (SMB) & Beach nourishment

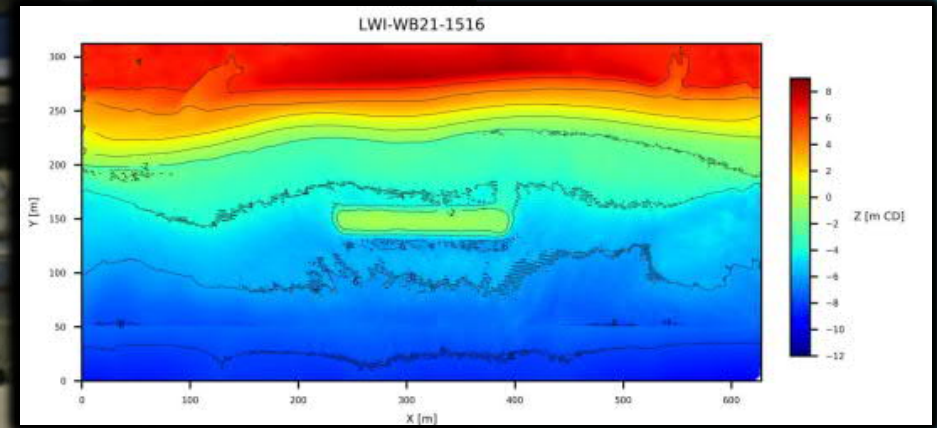
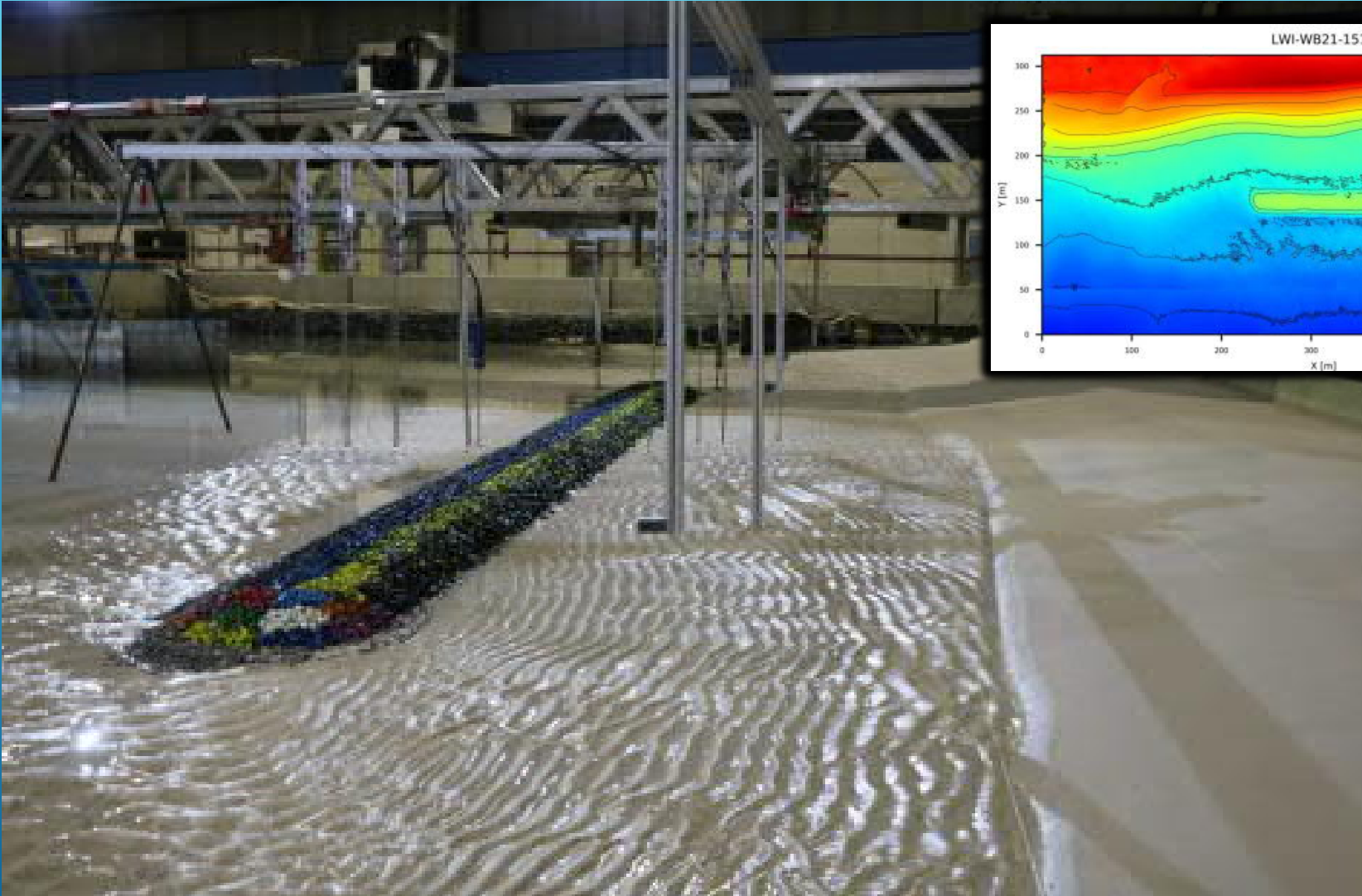


IMG0503 00:15 – 00:45



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REPUBLICQUE DU BENIN
 MINISTÈRE DU CADRE DE VIE ET DU DÉVELOPPEMENT DURABLE (MCDVD)
 DIRECTION DE LA PROTECTION DES BERGES, DES CÔTES ET LA PRÉSERVATION DES ÉCOSYSTÈMES (DPRCPÉ)



PROTECTION ET VALORISATION DES SEGMENTS DE CÔTE À OUIDAH,
 REPUBLICQUE DU BÉNIN

ÉTUDE D'IMPACT ENVIRONNEMENTAL ET SOCIAL
 RAPPORT FINAL

Ce rapport a été réalisé par Antea Belgium et ACL




Janvier 2018

Jan De Nul GROUP Travaux de Protection Côtière à Ouidah- Bénin
 Evaluation du Bon Fonctionnement du Brise-Lames Submergé

Projet: TRAVAUX DE PROTECTION ET DE VALORISATION DU SEGMENT PRIORITAIRE DE CÔTE D'AVLEKETE ET DJEGBADJI DANS LA COMMUNE DE OUIDAH

Titre du Document: Evaluation de Performances et Bon Fonctionnement du Brise-Lames Submergé

Client: Ministère du Cadre de Vie et du Développement Durable – République du Bénin


Revision: A

Date: 31/01/2018

Pays: République du Bénin

Document Ref.: JDN-PDCD-BriseLames-Cote-Ouidah-18.0001-B

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STATUS	ORIGINATOR	REVIEWER	APPROVED
INTERNAL REVIEW	SEM	IMO	
REVIEW WITH CLIENT			

Ouidah- Bénin- Travaux - 18.0001-BEN-A

Project: Protection Côtière à Djegbadji et Avlekète

Document Title: République du Bénin
 Phase I – Avant Projet Détaillé: Rapport Final


Client: Gouvernement du Bénin
 Ministère du Cadre de Vie et du Développement Durable

Revision: 1

Submission Date: 22/01/2018

Country: Benin

Document Ref.: PDCD-BEN-18.0001-PDG-1



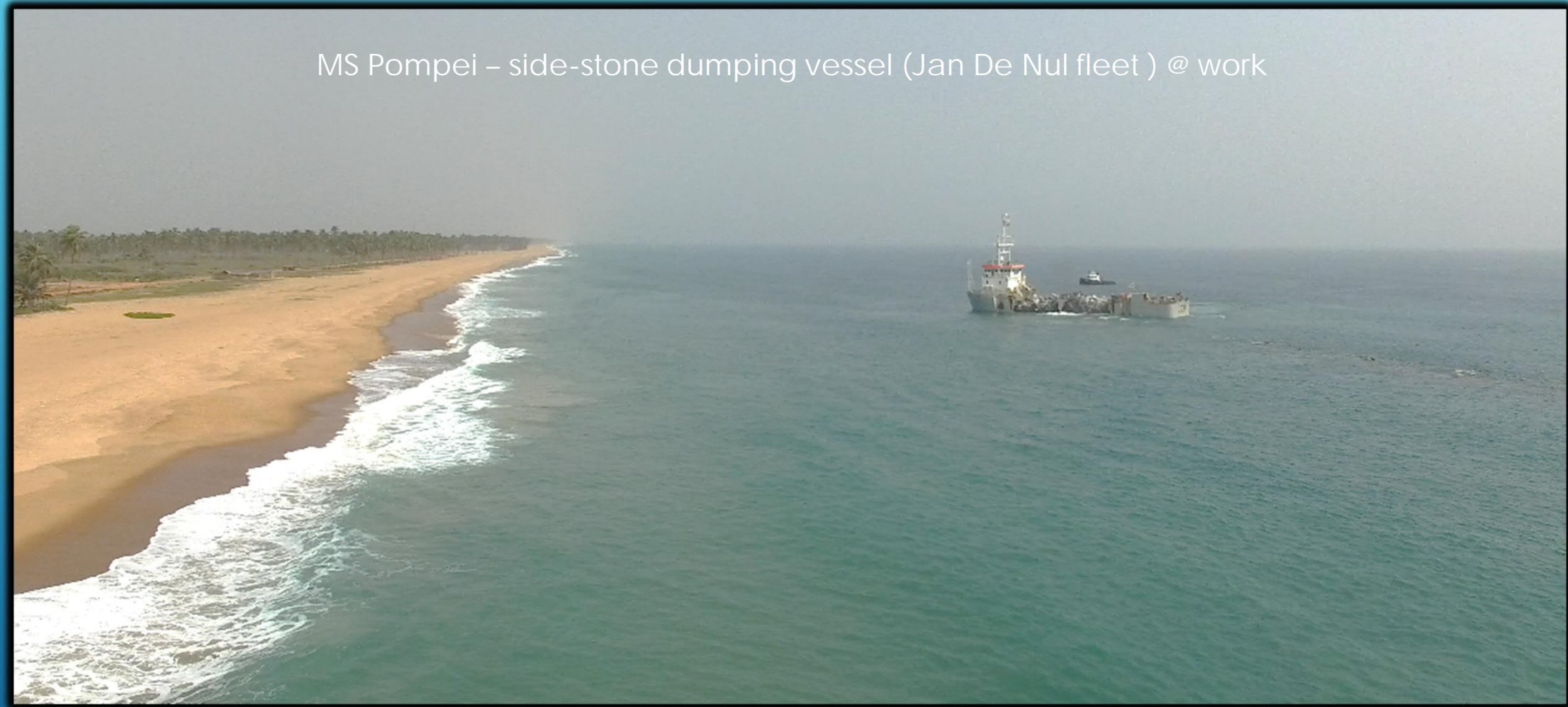
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Jan De Nul GROUP

Date: 22/01/2018

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MS Pompei – side-stone dumping vessel (Jan De Nul fleet) @ work

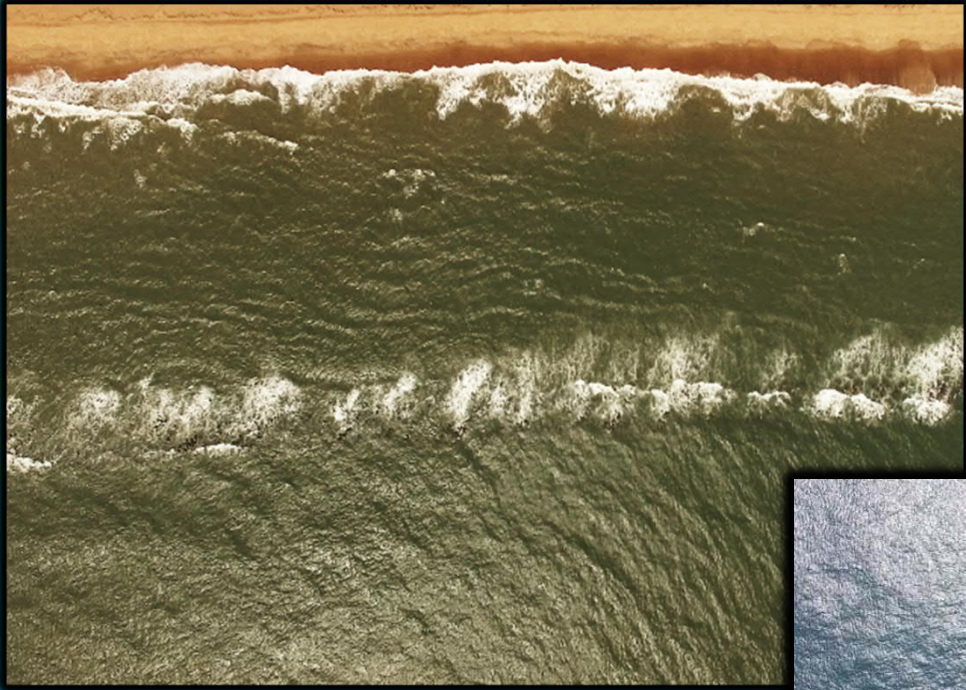


MS Pompei – side-stone dumping vessel (Jan De Nul fleet) @ work



SUBMERGED BREAKWATER AT WORK DJI0018 02:15 – 03:10





The reef-ecosystem is developing fast on the Submerged Breakwater: one year after completion of Stage 1 biologist-diving revealed a high sessile benthic growth (anemones, algae, barnacles, sea-grass,...) on the rocks with associated shell-fish, fish and molluscs. Bio-diversity and bio-abundancy are larger on the ocean-facade and lesser on lagoon-facade.



Take-home messages:

Movable bed physical model-tests – flume and basin- are a valuable tool in conjunction with numerical simulations for the conceptual engineering and design of coastal protection measures. Working in the coastal and marine environment means working with uncertainties.

All modelling tools however – both numerical and physical alike – have also serious uncertainties & error margins because they simplify to a large extent the real processes. The result is a rough approximation of reality with substantial margins of uncertainties. The same is, inevitably, valid for many engineering equations that are based on physical model tests.

It is important , for correct interpretation of model-results, to gain a better knowledge in these error-margins and limitations. This can only be achieved by adequate field-monitoring, feedback and, eventually , rethinking of some of the engineering procedures.

I hereby want to advocate, for the success of COB, a close cooperation between hydraulic experts and contractors, field engineers and scientists. This will make the difference for COB.

Thank you

Bernard Malherbe
Project Development



Jan De Nul Group