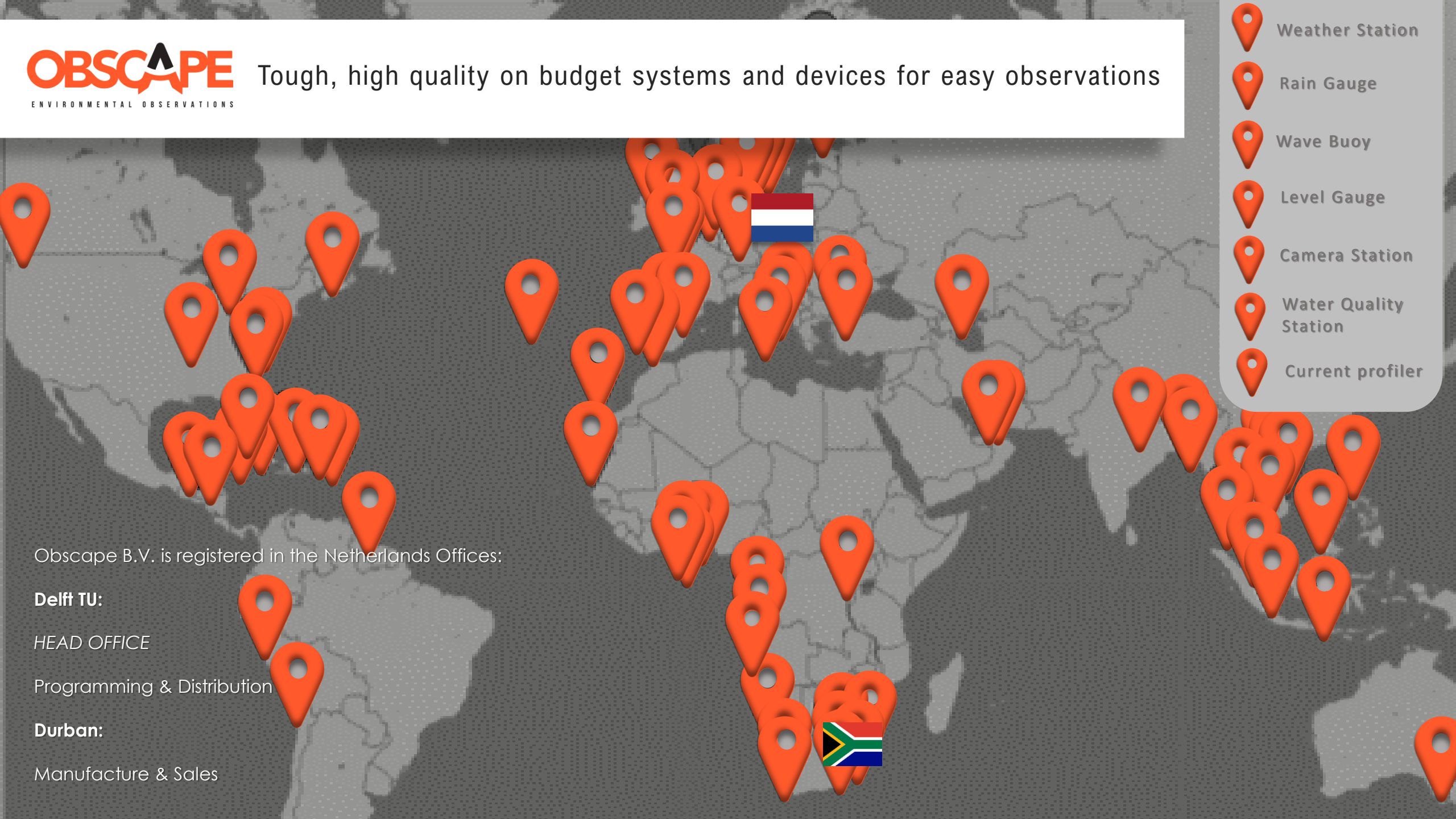
OBSCAPE

PORTFOLIO

OBSCAPE
ENVIRONMENTAL OBSERVATIONS

Tough, high quality on budget systems and devices for easy observations



Obscape B.V. is registered in the Netherlands Offices:

Delft TU:

HEAD OFFICE

Programming & Distribution

Durban:

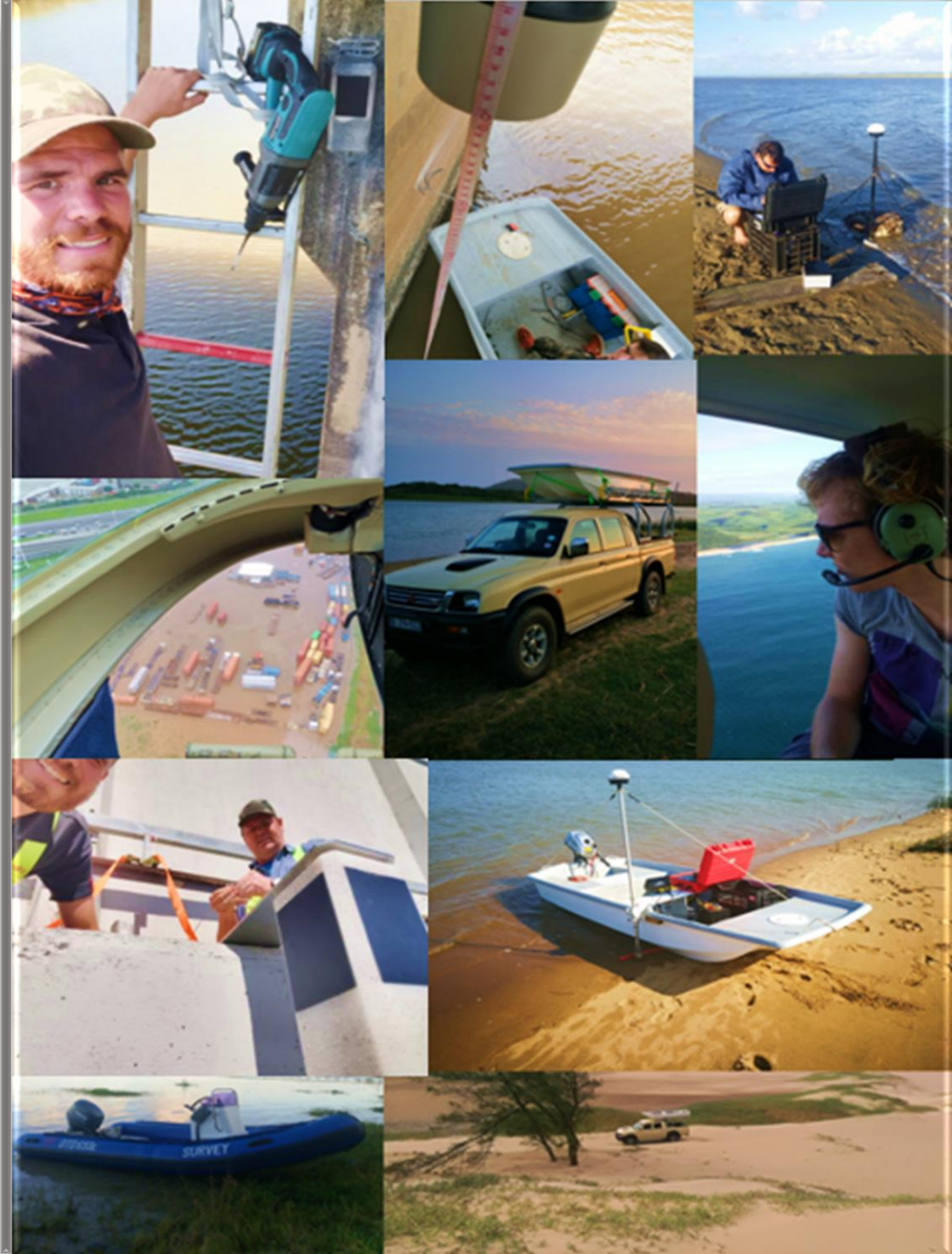
Manufacture & Sales

WE OFFER THE BEST ALL-IN ONE SOLUTION

Our unique Power and Telemetry Modules (PTM), are completely standalone, wireless, remote sensor systems, designed for extreme remote environmental monitoring in your area of interest.

We have been fabricating innovative environmental monitoring solutions for over a decade. We have even deployed them on our monitoring projects in extreme Africa environments, for use as environmental monitoring strategies worldwide.

The data generated from the Obscape Power and Telemetry Modules report valuable information to the Obscape Data Portal and empower you to confirm ground truthing and better understand the influence of environmental factors on the your project and maintain optimal control. With this essential information you can successfully devise targeted strategies for successful outcomes with effective mitigation and control from real time data.



OBSCAPE'S PHILOSOPHY

Affordable, easy-to-use and robust measurement systems

Affordable:

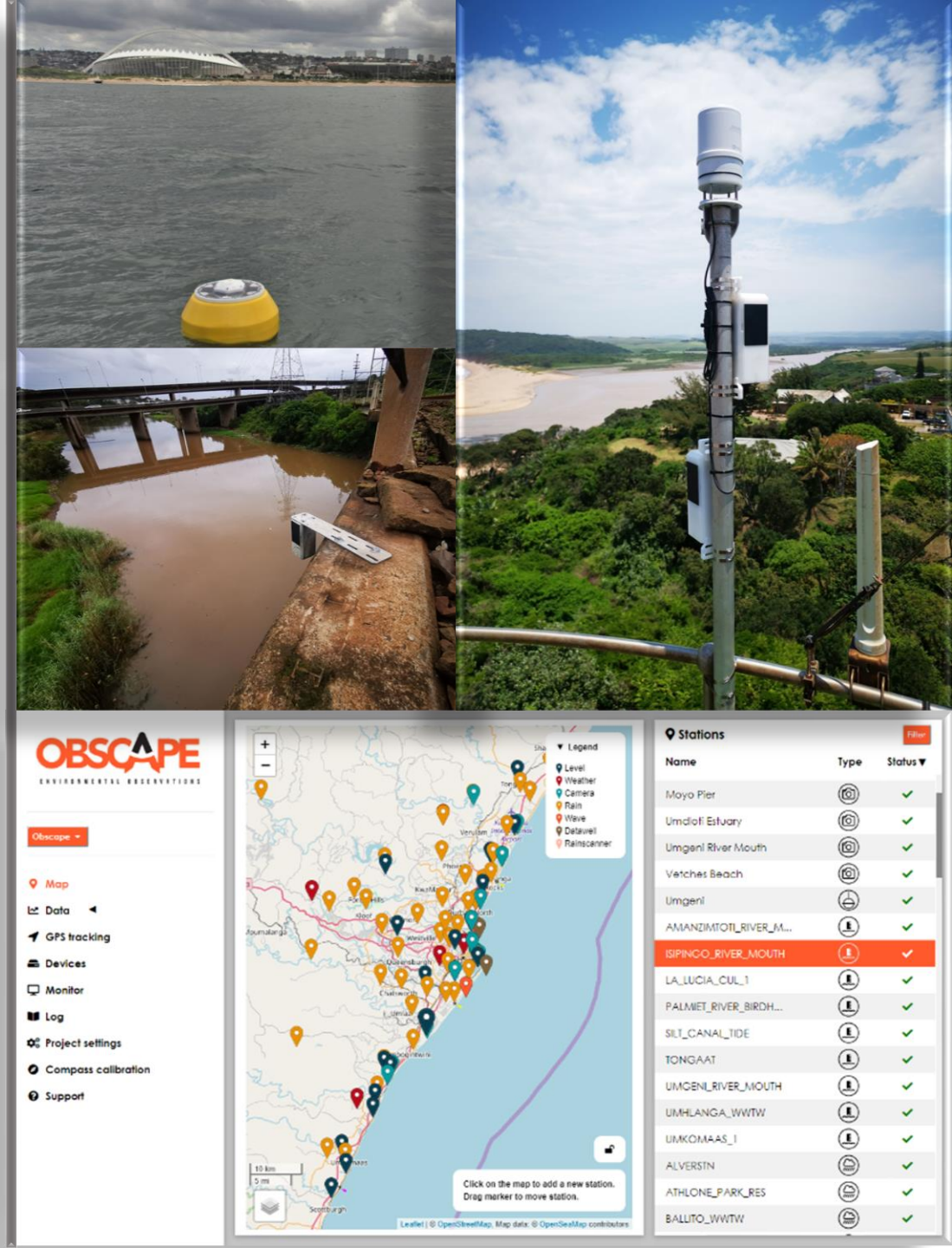
- Competitive purchase price
- Low maintenance
- Free data portal

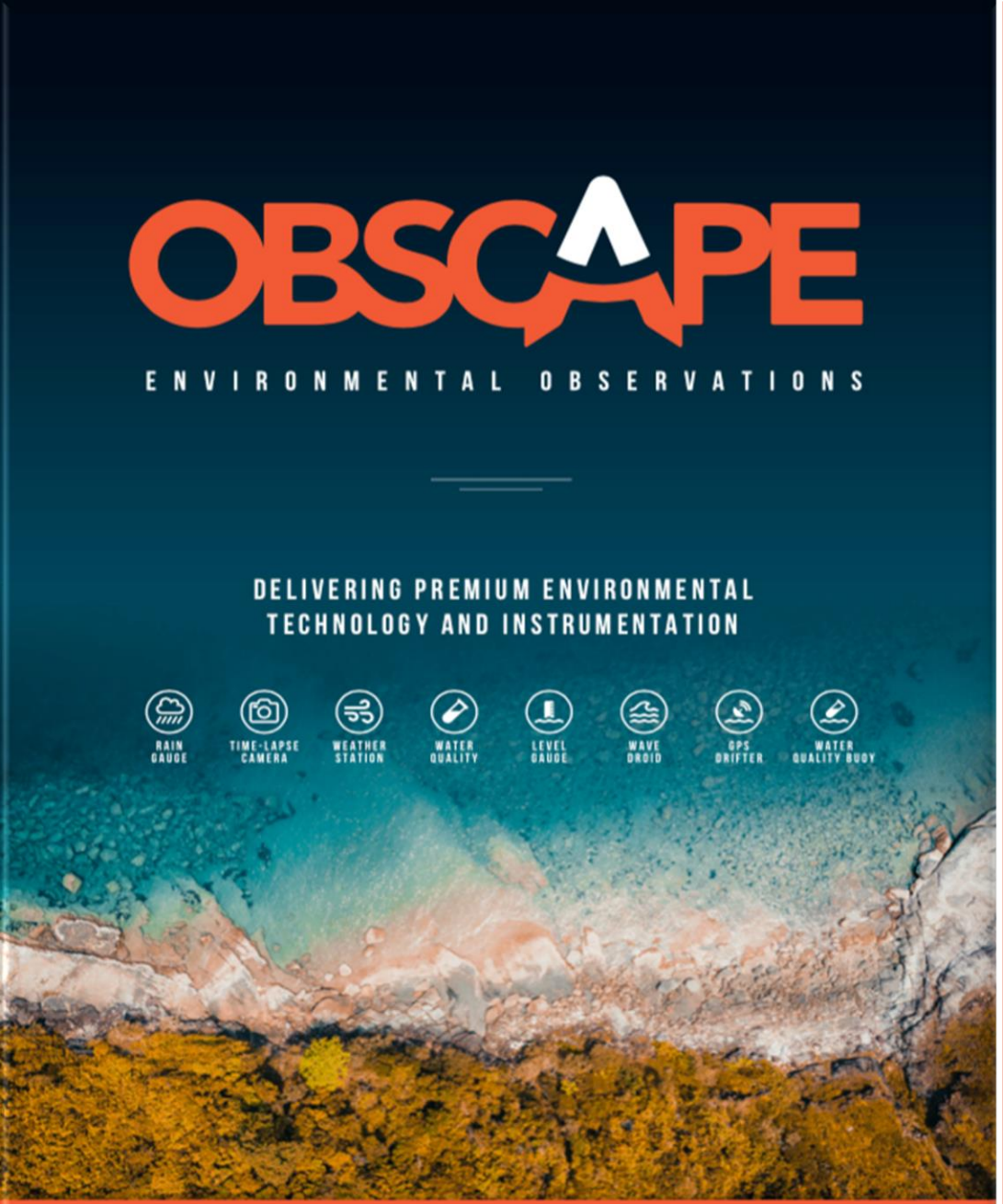
Easy to use:

- Completely wireless
- Simple and intuitive design

Robust:

- Designed for long-term autonomous operation
- Theft-proofing options available





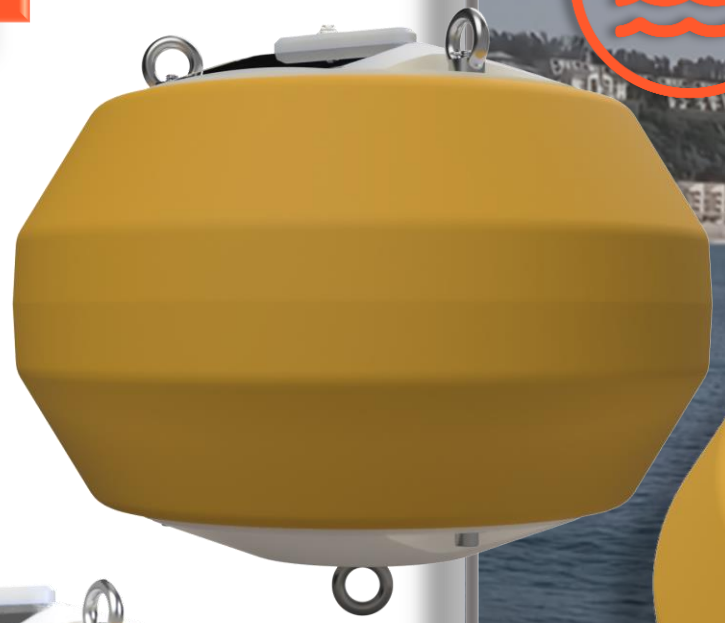
Devices and systems

THE WAVE BUOY

Ocean wave measurements are an indispensable part of any MetOcean project. The Obscape Wave Buoy is based on recent advances in sensor and data technology, ensuring a light-weight, flexible, reliable and affordable wave buoy.

KEY FEATURES

- Affordable operational costs
- Compact & light weight
- Easy to deploy & service
- Bulk wave parameters
- Directional wave spectrum
- GPS position & watch circle



THE PTM

Obscape's Power & Telemetry Module (PTM) is a highly convenient all-in-1 datalogger. Its built-in solar panels and cellular modem (Satellite option available) will turn any 3rd party sensor of your choice into a plug-and-play real-time monitoring solution.

KEY FEATURES

- Completely wireless
- Real-time data
- Solar powered
- Various communication protocols
- Rugged design
- Multiple mounting options
- Versatile data portal included

TIME LAPSE CAMERA

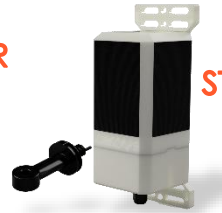
RAIN GAUGE

LEVEL GAUGE

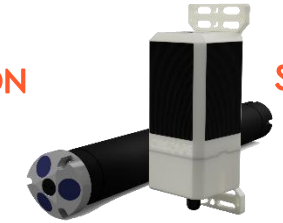
WATER QUALITY STATION

HQ CAMERA

WEATHER STATION



CT STATION



ADCP STATION

WAVE GAUGE

WAVE MODULE

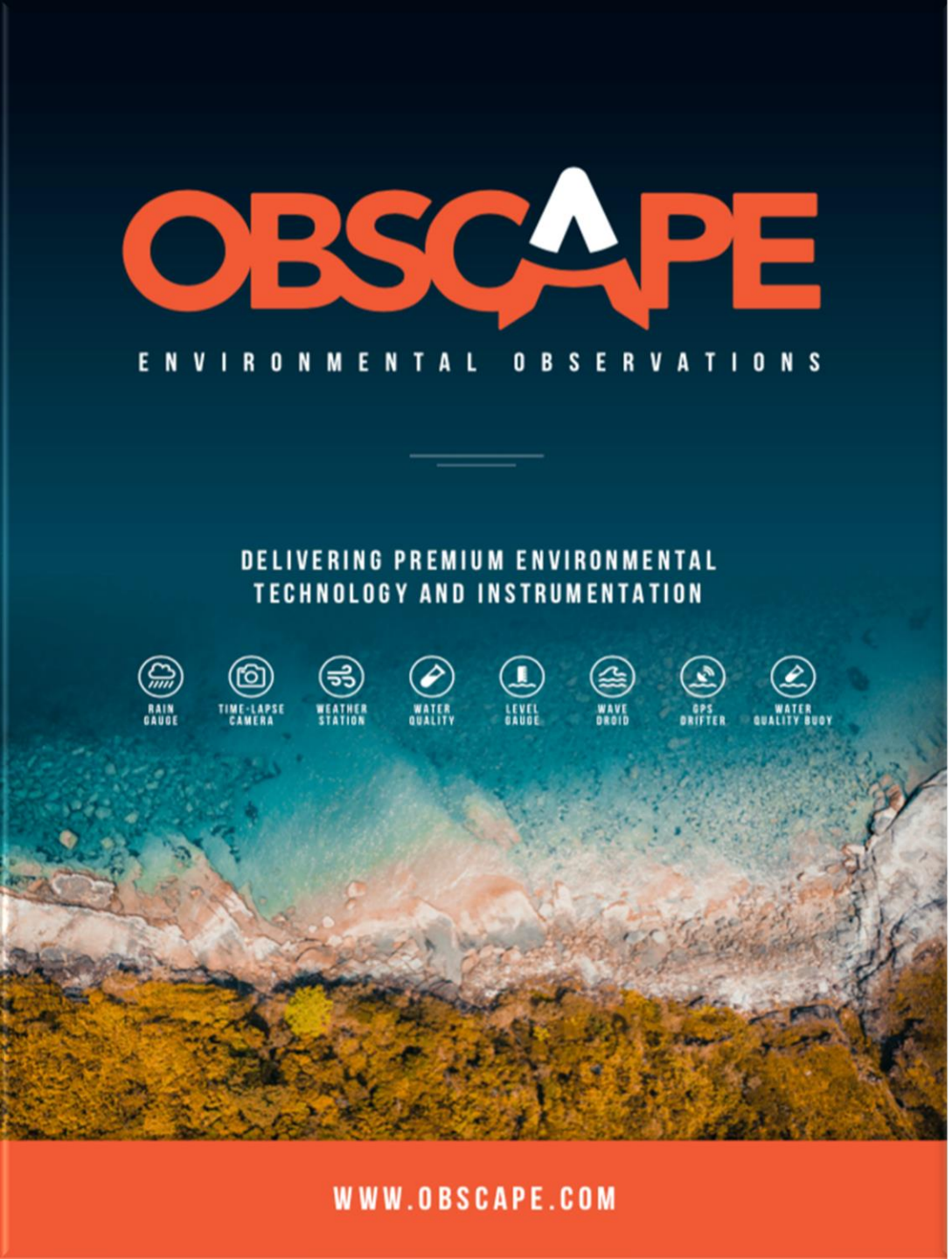
FLOW GAUGE

MANY MORE OPTIONS AVAILABLE!

ALL-IN-ONE DATA PORTAL

Features included *Free-of-Charge*:

- TECHNICAL ASSISTANCE AND BACKUP
- REAL-TIME DATA AND THRESHOLD ALERTS
- ACCESSABLE FROM ANY INTERNET BASED, SMART DEVICE
- AUTOMATIC AND ON DEMAND REPORT GENERATION
- SECURE SIGN IN AND EASY TO USE PORTAL
- AUTOMATED FORWARDING OPTIONS
- YOUR LOGO HERE — WHITE LABELLING
- UNLIMITED DEVICES UP TO 50 USERS PER PROJECT



Past Projects

Past Projects

Van Oord

Our client, an international offshore construction company, has commenced work on the Taranto Offshore Wind Farm in Italy. Their scope of work includes installation of the monopiles, secondary steel and the wind turbines.

An Obscape Wave Buoy has been deployed onsite at the Taranto Harbour to monitor wave heights and direction, which are vital environmental parameters the client needs to monitor throughout the entire construction process.

Building a historical record of accurate real time wave height and direction reporting is very critical to the entire operation. Data Portal graphs and reports are consistently analysed by the Project Engineers during the Initiation, Planning and Assembly Phases, to confirm conditions prior to the installation vessel's jacking operations (up and down), anchor trials and assessing conditions at shallow water construction locations.

Client feedback (sic) "Because the Wave Buoy is versatile and light-weight it has been easy to redeploy several times onsite using the safety craft or similar small boat. In addition, wave data measurements, which report to the Obscape Data Portal have been accurate and consistent throughout the duration of the project".

Click here

Jan De Nul

The coast of Benin is highly susceptible to erosion due to its geographical situation along the Atlantic Ocean. The erosion of the beaches is further enhanced by the construction of paved dikes on land. Consequently, coastal tourism can not develop in this area. For that reason, the Government makes an extra effort in its Government Action Program to protect the Beninese coast.

An international dredging company is active in Benin for the coastal protection works near the coastal villages Avlékété and Djégbadji, part of the town of Ouidah. Our client is building a submerged dike at about 150 meters off the coast and performing beach reclamation works. The works started in February 2018 and will be completed in 2021.

The government's objective is to contain the advance of the sea on the west coast of Benin by 2021, by definitively solving the problem of coastal erosion and the damaging effects of climate change such as floods.

The submerged dike is situated at about 150 meters off the coast. The dike has a wave damping effect, which means that the waves of the Atlantic Ocean are broken before they reach the coast. A wave-free climate develops between the submerged dike and the coast. This will significantly reduce the impact on the beaches, as a result of which the sand will move less, and the erosion will decrease.

Obscape has the great privilege of supplying a network of Wave Buoys for monitoring the building works and the effectiveness of the new Dike. The Obcape Wave Buoy delivers real-time wave measurements to make better informed decisions for our clients' coastal construction works.

Measuring high speed ferry wake wash

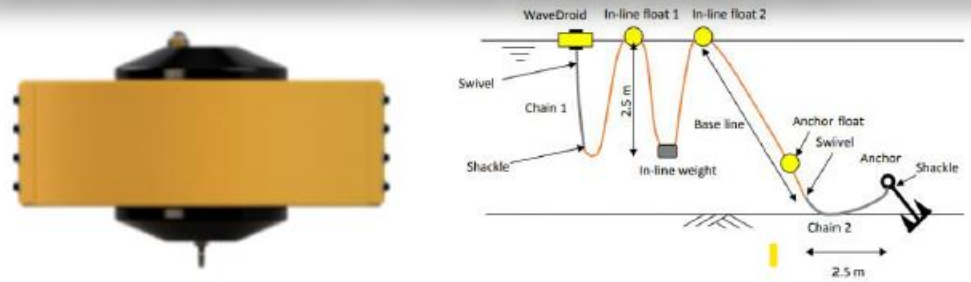
Wake wash from a high speed RO-PAX arriving at a beach. The ferry route is 4 NM offshore from the beach.

WSP Denmark has successfully completed a study of wake wash for an operator of large high speed ferries (RO-PAX) with a cruising speed of more than 35 kn. The study involved continuously and on-line measurement of wave height and period at the 3 m depth contour in front of three popular bathing beaches.

Wakes wash generated by high speed ferries cruising several kilometers away from a shore, can be a real danger to swimmers and beach visitors, especially on calm days, due to their stealthy approach and violent breaking. The long wave length of these swell like waves are producing a powerful undertow which can pull people out into the sea.

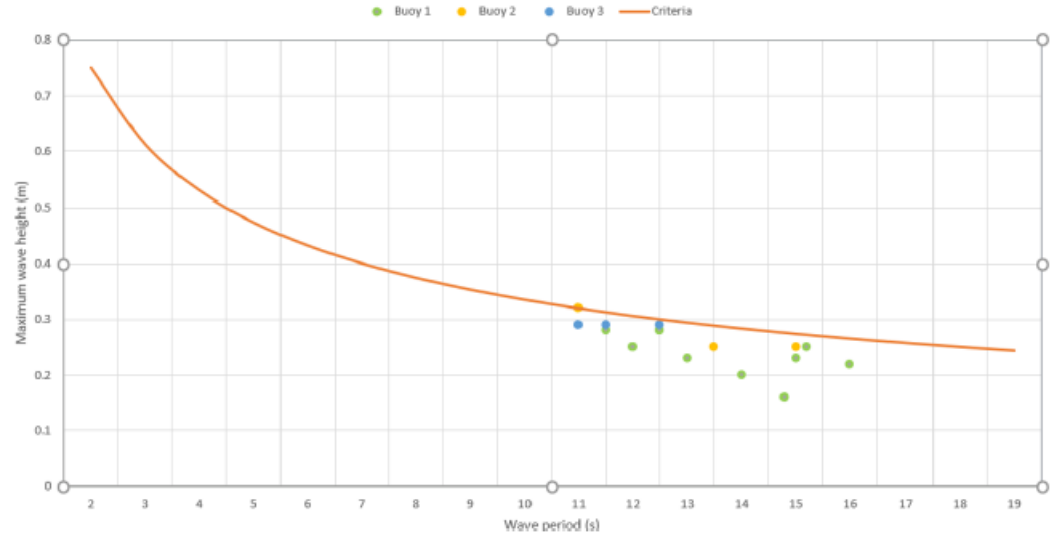
The maritime authorities has set a wave height/period based limit because of the known hazard to swimmers and beach visitors. Operators of the fast RO-PAX must document that wake wash stays below the limit. In dialog with the operator WSP has developed a set of operational standards including a depth depending speed management guideline which keeps the generated wake wash below the limit.

COASTAL EROSION: WAKE WASH CASE STUDY

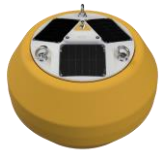


Left: "WaveDroid" block III measurement data hub. Right: Sketch showing equipment deployment.

WSP Denmark measured wave parameters with three new developed light weight accelerometer based Wave Droids from OBSCAPE. These small and light weight buoys performed brilliantly even though they were moored dangerously close to the surf zone.



Measured wave heights and periods (dots) compared with the limit (solid line)



For more information contact: anders.a.jensen@wsp.com or joachim.bach@wsp.com

Metocean Buoy

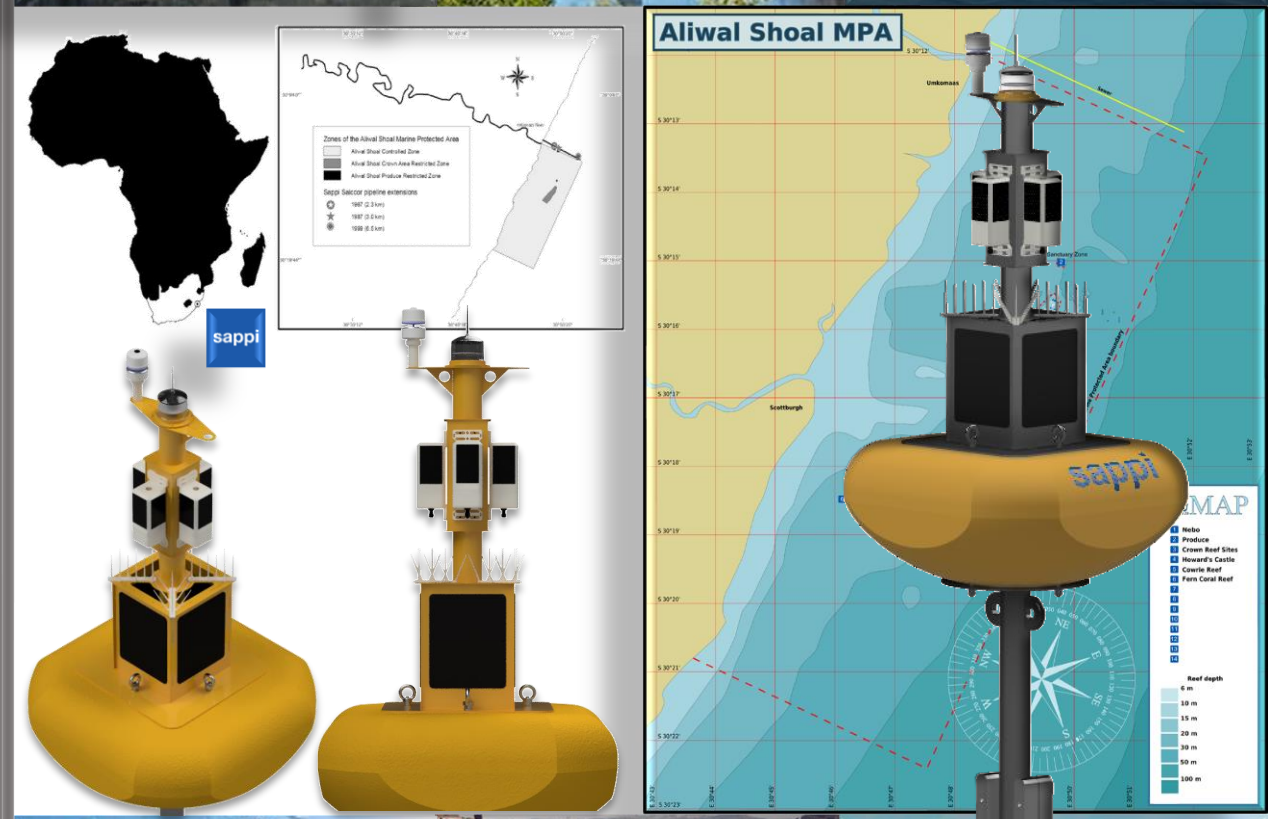
The SAPPI SCAICCOR mill on the South Coast of Kwa-Zulu Natal, produces elemental chlorine free dissolving wood pulp (chemical cellulose). An effluent from this process is discharged into the marine environment via a sea outfall pipeline, which discharges 6.5km out to sea close to the Aliwal Shoal MPA.

The Aliwal Shoal MPA is a Restricted Zone as per regulations contained in the South African Government Gazette No. 42479 of 2019 (No. 781), and the disposal of the effluent via the sea outfall pipeline is an existing authorised activity regulated by the Coastal Water Discharge Permit (CWDP).

When returning water intake safely back to the environment, SAPPI'S eco-effective action protocol is to improve effluent quality with cleaner production processes and pollution prevention measures.

By mounting an array of PTMs integrated with an ADCP sonde, Time Lapse Camera, Wave Module and an offshore Weather Station, and affixing these rugged stations to an offshore buoy's frame and float, Obscape have engineered a versatile, reliable, and affordable method to complement the Sappi floating hull structure and enable the mill to achieve a eco-effective action protocol .

Real Time Data transmitted to the Data Portal confirm offshore current profiling, wave measurements and a full complement of weather conditions at the effluent pipe's offshore point of exit. Automated Reports and Threshold Alerts will confirm environmental effects of treated effluents, and assist the mill to meet regulations which include limits on water intake and effluent quality parameters. This reduces risk and ensures timely management protocols to avert potential environmental disaster.



The Ocean CleanUp

The Great Pacific Garbage Patch (GPGP) is the greatest known accumulation of ocean plastic .

The Ocean Cleanup Foundation has developed floating barrier systems to concentrate and extract buoyant plastic from accumulation zones. To analyze and improve the efficiency of such cleanup systems, access to accurate Metocean conditions was critical.

Between September 2018 and December 2019, TOC completed the first campaign in the Pacific, comprising of Pacific Ocean Systems POS001 and POS001b nicknamed “Wilson”

During the deployment of the first two systems in the Pacific, an experimental campaign was carried out, which included an intercomparison of wave measurements from an unmanned surface vessel (USV) with those from Obscape wave buoys and a vessel based Xband radar.

TOC reported that preliminary comparison suggests that the USV and Obscape wave buoy data compare rather well. Small differences between the GFS and CFSR forced model were observed, and both compared well with the field measurements.

TOC used a total of four customized Obscape Wave Buoys to measure heave, pitch and roll accelerations. TOC deployed the buoys temporarily inside and in the vicinity of the cleanup system. The buoys were free floating without an anchor chain attached and typically recovered after one hour.

The Obscape WaveDroid obtained very good results in cross comparison to other equipment, with a seemingly good agreement of an industry leading wave sensor and the Obscape Wave Buoy.

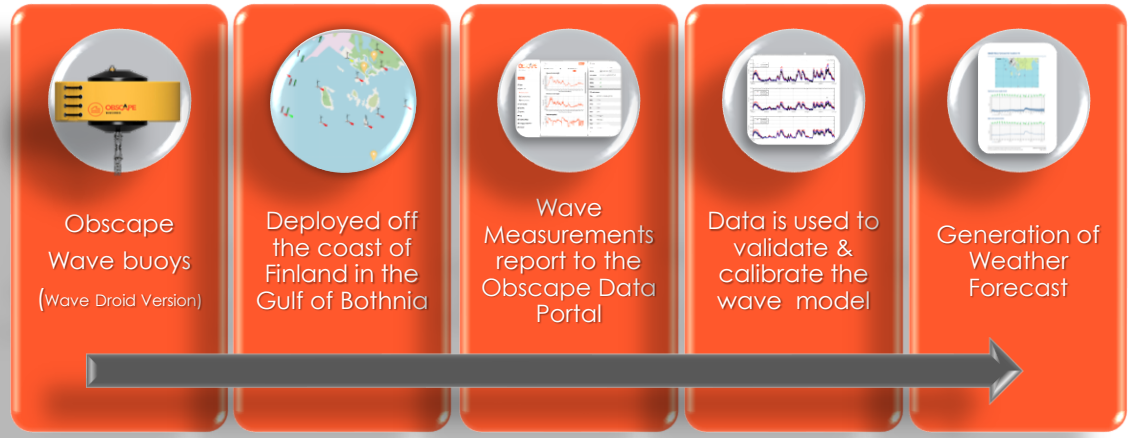
Click here

Offshore Wind Power

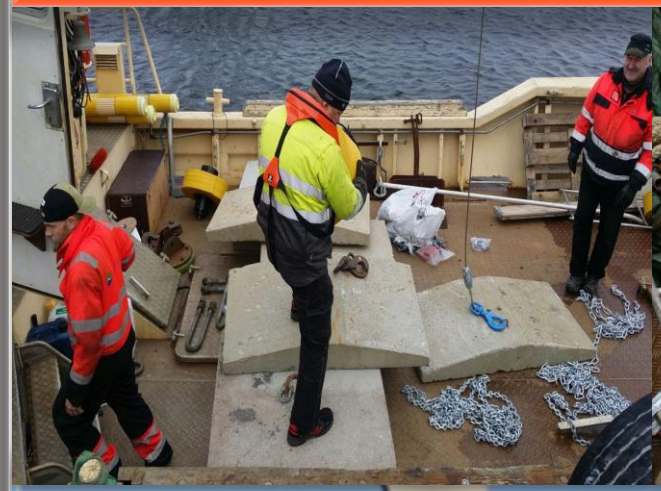
Obscape Wave Buoys have been deployed on a Wind Farm off the Baltic Sea since 2017. The Wind Farm has an Operation and Maintenance agreement in place with the Wind Farm operator.

This O&M Agreement requires our client to provide a Weather report for the operation phase of the wind turbines.

Three Obscape Wave Buoys (Wave Droid version) *were* deployed in the area to gather wave data. This data is then used to calibrate and validate the wave model as part of the Weather forecast report.



ECOLOGICAL MONITORING: OFFSHORE WINDFARM CASE STUDY



Floating Solar Farm

Floating solar farm has been demonstrated as technically and commercially viable in man-made lakes, ponds and in coal-mining subsidence areas. Studies on its environmental impacts are limited and some are still being conducted globally. The use of natural lakes form this kind of renewable energy generation is being explored in the Philippines, particularly in Laguna de Bay. It is considered as a potential development project, but there were concerns on the environmental and social impacts on a multiple-use lake

As an initial step to deal with uncertainties, the Laguna Lake Development Authority allowed the operation of floating solar farms on a pilot scale for one year subject to certain requirements including the monitoring of essential water quality parameters in the pilot sites to determine the impacts.

Laguna Lake is a challenging location for a floating PV solar because of its, winds and waves.

Our customer's floating Solar platform had to withstand wind speeds of up to 275km/h, in typhoon seasons with strong winds and high precipitation without damage or other negative impacts.

The client, utilized advanced sensors to record weather movements, track wind speed, tag wave fluctuations, and monitor water quality changes. One such monitoring device utilized was the Obscape Wave Buoy

The data together with the inputs from the operators of the pilot projects were used in the assessment of the environmental, technical and commercial viability of floating solar farm and was used by the Laguna Lake Development Authority in formulating a policy on this emerging use of the lake and in crafting the implementing rules and regulations.

Click here to view the Wave Action!

CONSTRUCTION: WIND FARM ASSEMBLY CASE STUDY

S.T.S Ingeniería y Construcción Marítima

Mined copper concentrate is transported from a copper mine in the Coquimbo region of Chile; via a pipeline through the Punta Chungo port in Los Vilos. From there the pipeline runs along the mine's *offshore Marine Terminal* and is loaded on to ships destined for the Asian and European markets.

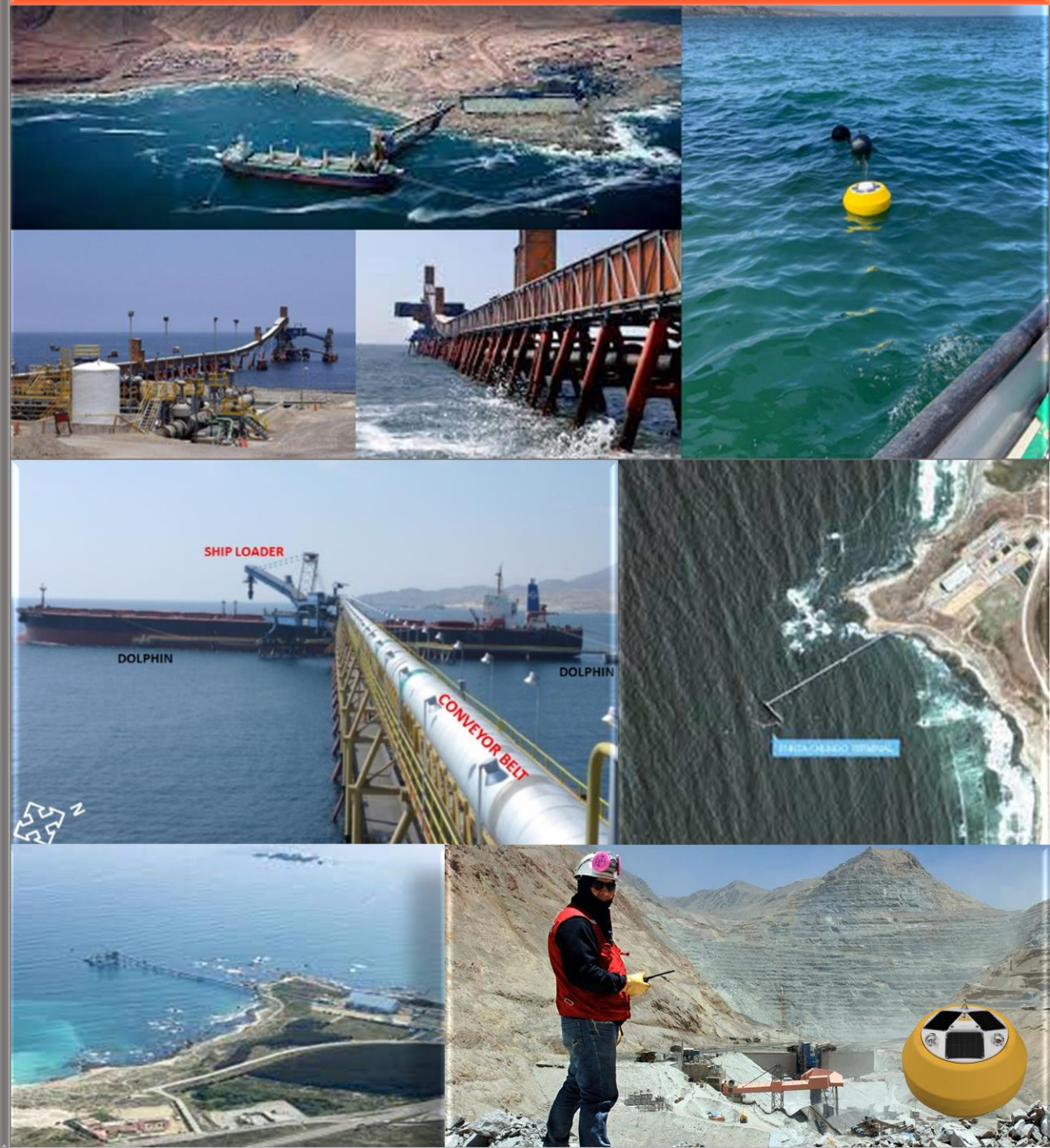
An Obscape Wave Buoy deployed a short distance from the Maritime Terminal, measures the full wave spectrum of this offshore area, which is displayed on their Data Portal in easy to read and accurate graphs.

The Data Portal can automatically send Threshold Alerts when real time swell parameters change from pre-set baseline levels to high energy swell conditions. This empowers the mine operator to act and avoid unsafe docking conditions, reduce possible offshore pipeline damage, and minimise the potential of concentrate entering the water.

The benefits of this rugged, reliable, and versatile monitoring system give the mining company the full confidence to automatically confirm, and record parameters required to meet environmental law, SHEQ and contractual standards.

The Wave Buoy's maintenance free, rugged design and solar powered features are ideal for this remote location. In addition, real time data sent via cellular telemetry to the Data Portal, can be securely accessed from the onshore mining offices, regional Santiago offices, London based head offices, or any other internet based smart device.

CONSTRUCTION: OFFSHORE CASE STUDY



Marsaxlokk Port

The protection of Marsaxlokk fishing port in Malta is now possible with the construction of the Qrejten Breakwater and the deployment of coastal monitoring systems.

For many years, Marsaxlokk fishers have been calling for a new breakwater and offshore wave monitoring solution to protect and observe the inner harbour area including rough seas and storm events to prevent damages to their anchored vessels and shore-based equipment.

The solution was to construct a breakwater to prevent high waves entering the harbour, monitoring offshore conditions, and reducing the impact on Marsaxlokk port operations, buildings and business operations in addition to the promenade, one of Malta's principal tourism zones.

The project was completed within 18 months. This included the installation of lighting, power systems and environmental monitoring systems like that of Obscape's Wave Buoy.

Obscape had the great privilege of supplying two Wave Buoys for monitoring the new Breakwater. The Obscape Wave Buoy uses real-time wave measurement and directional data to make better informed decisions for our clients' coastlines and coastal infrastructure.

Kelp Forest

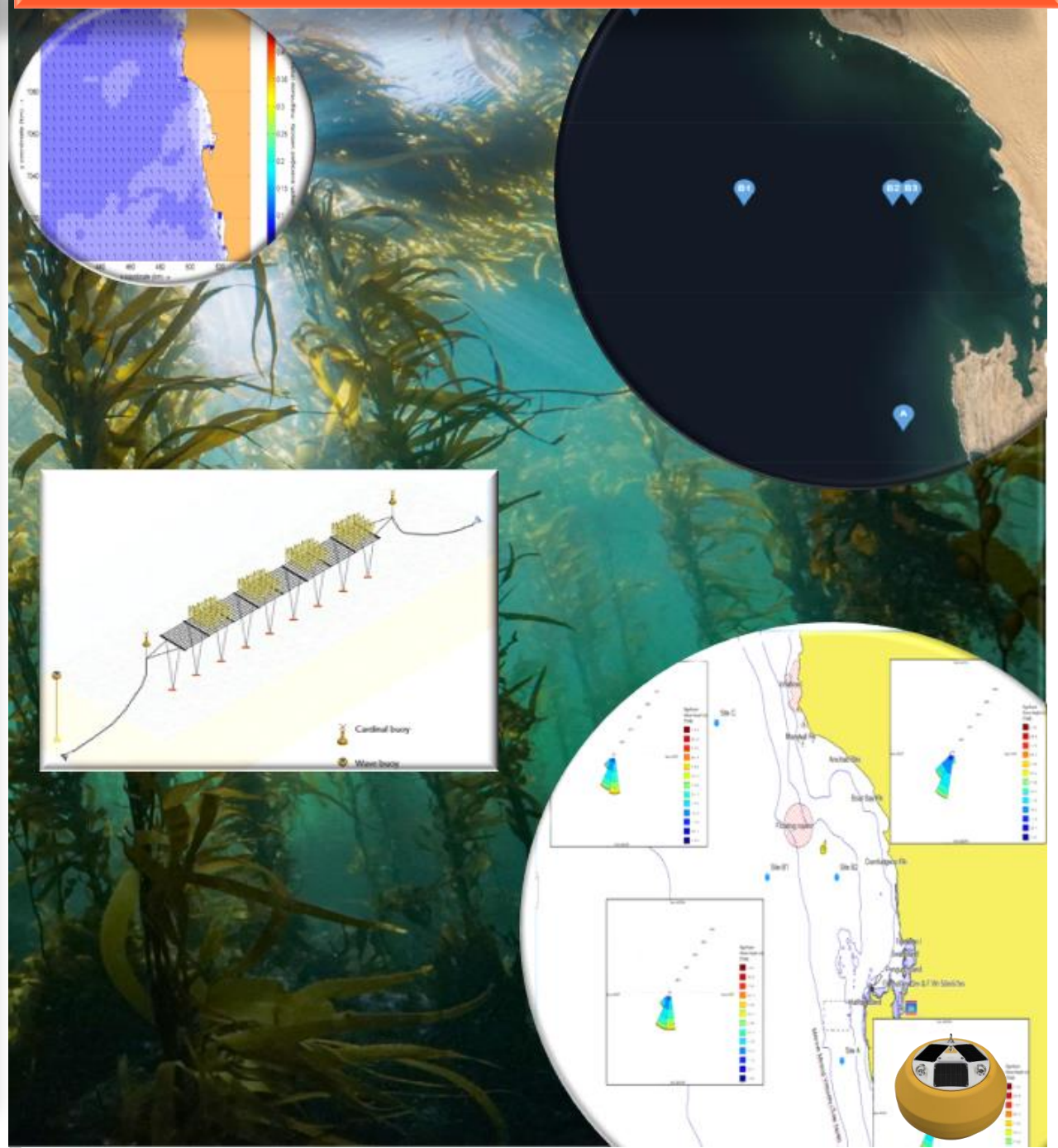
On the South West Coast of Africa our client launched a pilot operation in 2021 to research the successful cultivation of macrocystis to confirm the viability of this area for large-scale kelp farming.

Kelp is a fast-growing seaweed which is highly effective at sequestering CO2. It generates positive ecological benefits to surrounding ecosystems in the form of water filtration, nitrogen removal and habitat provision, which in turn boosts marine biodiversity and improves fish stocks. Kelp also plays a role in counteracting the acidification and de-oxygenation of the ocean.

The client used a mix of methods to monitor the pilot scheme , from acoustic sensing to monitoring swell conditions which confirm farm health and offshore conditions.

The lightweight Obscape Wave Buoy was deployed, at the pilot site, by hand from their refurbished Pleasure craft vessel.

Obscape also provided the customer with a Mooring Guideline, which is based on an affordable and simple design. Floats, swivels, line, chain and anchor were locally sourced and assembled onsite, according to the guideline and without much fuss.



SpaceX

Proposed retrieval and communication process

Higher update rate on satcom (5 to 10 min)

EASY TO USE

EASY TO DEPLOY & RETRIEVE

RELIABLE & RUGGED

A simple seamless switching between primary and backup buoys

SPACEX

Field Trial: Wave Gauge

Obscape has been commissioned to supply a Wave Level Gauge to monitor swell height and periods for a high-profile Wave Farm operator.

After successful field trials, the Wave Level Gauge has been shipped to the client for installation on a quay close to the clients Wave Power Generation Floaters. This placement will empower the client with highly accurate confirmation of wave heights and wave periods.

In addition, the Wave Level Radar Gauge will measure, report to the Data Portal, on a 15 Minute sample period and 1 – 5-minute processing and transmission.

By utilising a Wave Level Gauge mounted above the water surface. The client can confirm real time accurate measurements of wave height and period in the exact location of their wave energy power station, thereby providing the client with the possibility to perform a highly accuracy comparison between the wave characteristics measured by Wave Level Gauge and the energy produced by the Wave Power Generation Floaters.

Tidal study

King Island, in the Bass Strait, is 50 miles (80 km) off the north western coast of Tasmania, Australia.

Bass Strait is a relatively narrow and shallow stretch of water jammed between the Australian mainland and Tasmania.
The shape of the landmasses involved, the prevailing weather patterns and ocean currents, all combine to make Bass Strait a very challenging place, and therefore has a well deserved reputation as one of the most treacherous bodies of water in the world. A combination of shallow seas, currents and weather systems has brought many a sea voyage to an untimely end, and King Island sits at the western end of this stormy stretch of water

Our customer, EGS a world leader in geophysical survey for over 45 years, was commissioned by their client, for a Geotechnical evaluation and shoreline evolution of King Island's north coast.

The benefits of the Level Gauge's rugged, reliable, and versatile monitoring system gave EGS the full confidence to confirm and record real time data of tidal fluctuations as part of the projects remit.

Wireless, maintenance free, rugged design and solar powered features are ideal for this remote location. In addition, real time data sent via cellular telemetry to the Data Portal, can be securely accessed from the EGS offices in WA, the customer's Hydrographic Offices, or securely on any internet based smart device.

COASTAL EROSION: LEVEL TIDE GAUGE CASE STUDY

EARTH SCIENCES & SURVEYING

Mining

An International Mining Operator with a West African mine required rugged, solar powered water level monitoring systems, with the capacity to detect flash floods in dry river beds and road culverts, water level inside the basin of an open pit and a fully off the grid weather station to be positioned at the mine offices

The intent was to monitor for metweather changes in the environment with the capacity to alert the relevant onsite stakeholders in the event of a major rain storm.

It was thus very crucial that real time measured parameters displayed on the Obscape Data were readily available via the JSON API, as they are essentially needed to match the data transmission frequency of every 5min to ensure the stakeholders do not miss an alert, and can avert a potential catastrophe or disaster.

The Ocean CleanUp

Supporting Action on Rivers

Did you know the Obscape B.V. HQ Time-Lapse Camera was developed particularly for monitoring debris/litter on water surfaces?

Obscape B.V. are proud to be a part of The Ocean Cleanup's #1000riverscleanup, targeting 1000 rivers around the world for clean-up!

Obscape's HQ Time-Lapse Camera is ideally suited for long-term visual monitoring of gradually evolving processes, such as beach and river morphology, littering of surface waters or construction works.

The superior image quality of the HQ Camera is preferred when used as input for operational computer vision algorithms. The ability of the device to collect image bursts at a known framerate yields a whole range of unique applications, such as litter detection.

By pairing the HQ Camera with the The Ocean Cleanup's automatic litter detection software, the camera will keep a close watch on debris pollution rates of the river surface over time.

Click here to find out more about the HQ Camera, #1000riverscleanup and monitoring of other plastic pollution projects: **https://lnkd.in/dazWctth**

Specifire

A Time Lapse camera was mounted on a construction site pillar by our customer, Specifire.

The Time Lapse Camera enabled the project managers to monitor the construction site for visual confirmation of HSE conditions and correctly installed civil operations.

The benefits of the Time Lapse Camera's rugged, reliable, and versatile monitoring system gave Specifire the full confidence to remotely confirm correct the mounting and record real time installation of 6 000 fire suppression sprinkler systems and 20,000m of pipe. This empowered Specifire to ensure HSE assembly operations, on time project progress and protection against possible liability claims.

Wireless, maintenance free, rugged design and solar powered features are ideal for this remote location. In addition, real time data sent via cellular telemetry to the Data Portal, can be securely accessed from Specifire's offices back in Durban or securely on any other internet based smart device world wide.

To view the onsite images that Specifire's Time Lapse camera captured click here: **Specifire construction site**

To view the Specifire onsite installation, at height on a pillar, please click here: **Specifire onsite installation**

Offshore Terminal

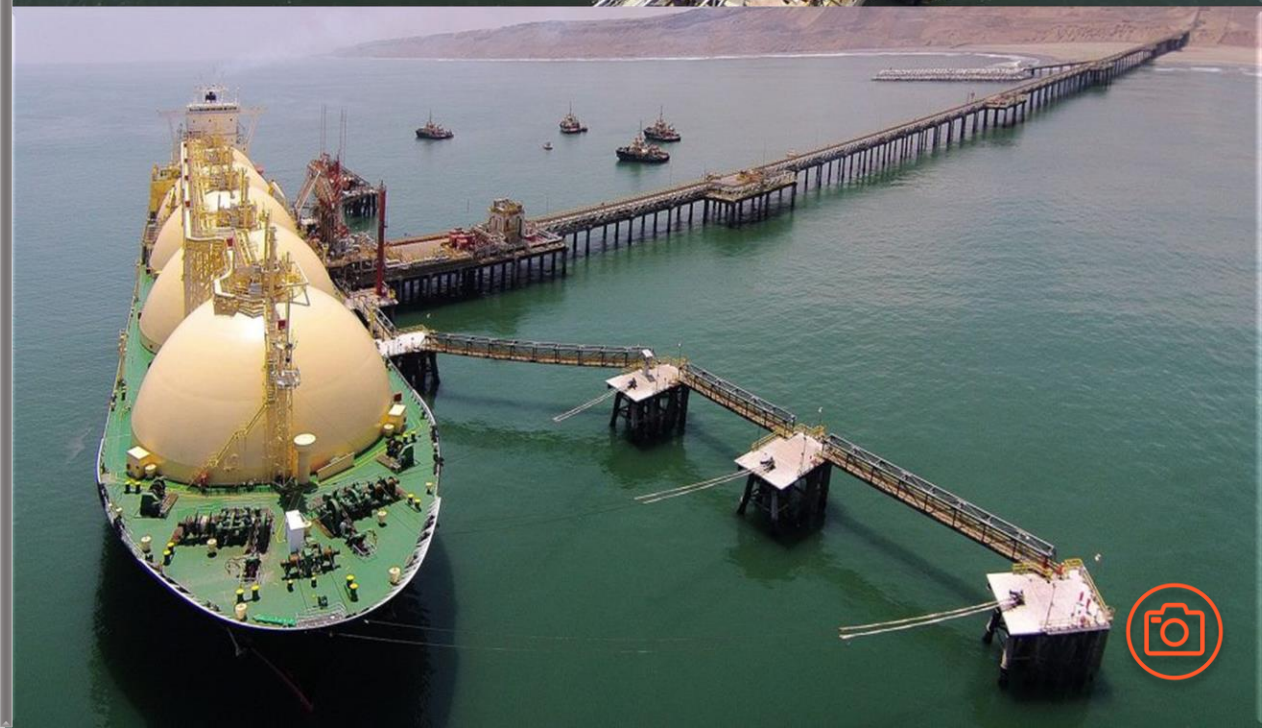
An LNG Plant and export facility is based on the Peruvian coast, which includes a marine terminal, breakwater, and temporary rock quarry.

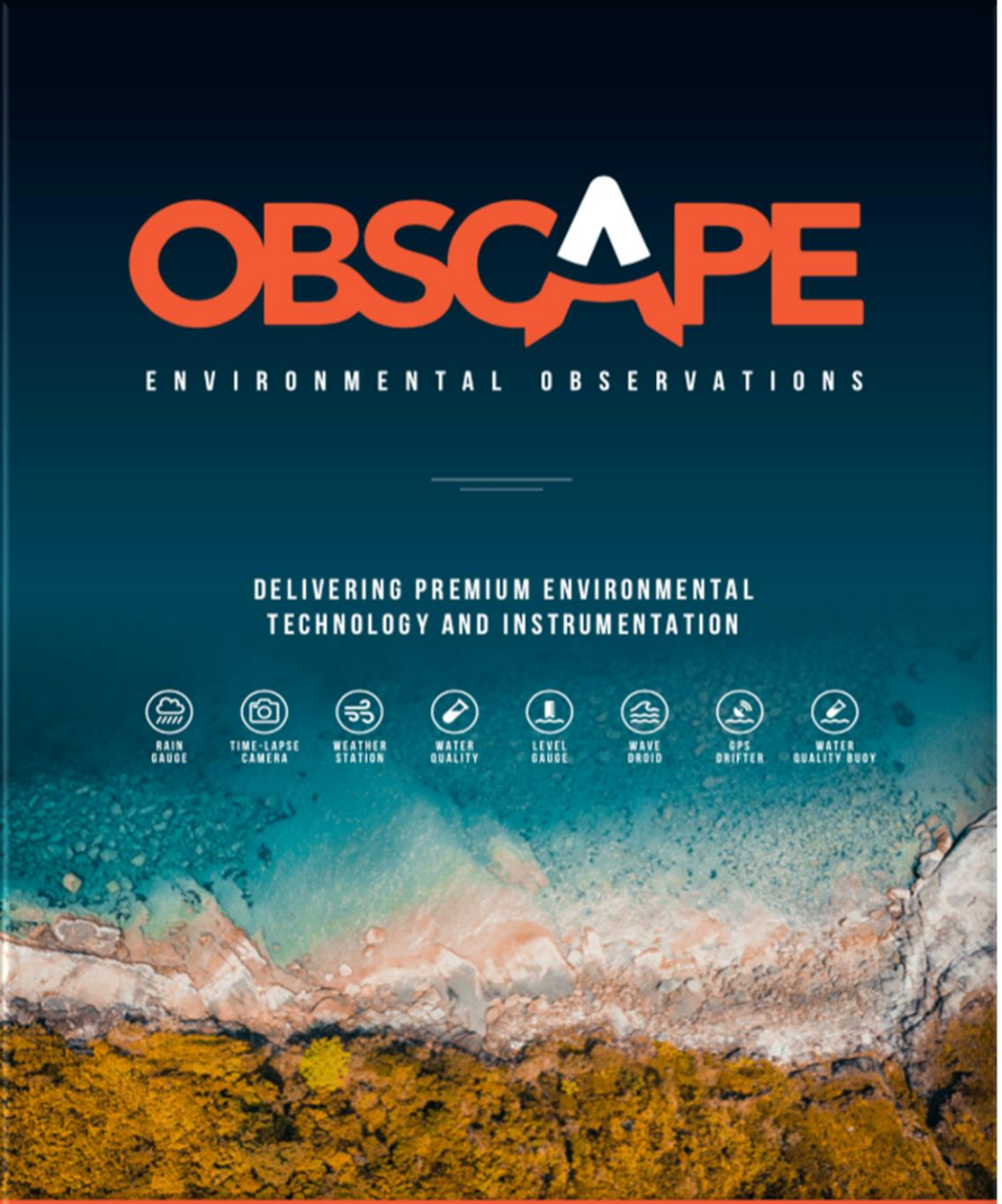
A 34 inch diameter transportation pipeline will be constructed to bring feed natural gas to the LNG Plant. The pipeline is approximately 408 kilometers (km) in length, stretching from the Chiquintirca community in the Ayacucho Region of the Andes mountains to the LNG Plant at Pampa Melchorita on the coast

Our customer, a Global Maritime Agency monitors the Terminal and the Breakwater with 2 x Obscape Time Lapse Cameras for visual confirmation of Terminal Environmental conditions and LNG loading operations.

The benefits of the Time Lapse Camera's rugged, reliable, and versatile monitoring system give the maritime agency the full confidence to confirm and record real time data of docking and shipping operations.

Wireless, maintenance free, rugged design and solar powered features are ideal for this remote location. In addition, real time data sent via cellular telemetry to the Data Portal, can be securely accessed from the onshore mining offices, the Maritime Agency's offices in the Callao District, or securely on any other internet based smart device world wide.




OBSCAPE
ENVIRONMENTAL OBSERVATIONS
DELIVERING PREMIUM ENVIRONMENTAL
TECHNOLOGY AND INSTRUMENTATION
RAIN GAUGE
TIME-LAPSE CAMERA
WEATHER STATION
WATER QUALITY
LEVEL GAUGE
WAVE DROID
GPS DRIFTER
WATER QUALITY BUOY
WWW.OBSCAPE.COM

References

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Letter of Recommendation

Van Oord was the Transport and Installation Contractor for the installation of Foundations and Turbines at Taranto Offshore Wind Farm. The peculiarity of this project is to be in very shallow waters (<4m) and near shore (within the Harbour jurisdiction).

Generally, companies such as Van Oord, would engage two independent companies to perform Site-Specific Weather Forecasts. However, the results of the forecasts in such shallow water and influenced by near-shore concrete structures (such as quays and breakwaters) was not accurate and reliable enough to plan the marine operations. Therefore, Van Oord decided to deploy two Wave Buoy system to better understanding of the environment.

Obscape delivered in record-time two full wave buoy system along with a good customer support. The advantage of this system are:

- The price is low compared to fancier solution in the market (e.i. wave rider buoy).
- The system is simple to set-up and does not require specialist surveyors.
- The weight and size of the Buoy makes it simple to deploy and flexible to move in a field.
- The data are reliable so it become a good tool for decision-making.

Van Oord is looking into expanding the use of such buoys for future projects (even when offshore and not impact by any structures)

Your sincerely,

Cesare Meinardi
Project Engineer

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TO WHOM IT MAY CONCERN

Our réf. :
(Tél. M. Ch. Timmermans : +229 69 08 03 60)

Cotonou, June 20th 2021

RECOMMENDATION LETTER

Over the course of 3 years from 2018 until 2021, Jan De Nul Benin SA has successfully used multiple Wave Buoys supplied by Obscape.

These devices were deployed in ocean conditions at very remote locations and have performed as per expectations and specifications. The lightweight installation system in combination with the online monitoring/follow up platform, has allowed an efficient management of deployment and intervention, as well as data analysis. The performant telemetry, both through satellite and 3G communication has allowed close follow up of sea conditions through continuous data streams.

Overall, the devices have outperformed previously used systems in both efficiency and cost, which would make the Wave Buoys the choice of preference for future needs.

Respectfully yours

JAN DE NUL BENIN SA
Project Manager

Christophe TIMMERMANS

THE OCEAN CLEANUP

The Ocean Cleanup Projects B.V.
Batavierenstraat 15
3014 JH ROTTERDAM

Rotterdam, March 2022

Letter of Recommendation

For the purpose of river plastic debris transport research, The Ocean Cleanup is relying on Obscape's technology and services since 2021. Deployed technology includes HQ cameras, time lapse cameras, rain gauges, water level gauges and other devices. The technology and services have currently become the selection of choice for many of our river investigations at The Ocean Cleanup. The technology as well as the support and services, ranging from consulting to trouble shooting and installation and maintenance support have been to our full satisfaction. In my observation Obscape applies highest technical expertise with a dedication to scientifically oriented and sound performance. I fully recommend the services of Obscape.

Thomas Mani, Ph.D.
Lead River Field Scientist
The Ocean Cleanup

Date: 25/03/2022

VISITING ADDRESS

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The Netherlands

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THE OCEAN™ CLEANUP

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32 Jessie Lee Street, Henderson,
WA 6166, AUSTRALIA
Tel: +61 (0) 8 9479 6188
+61 (0) 8 9437 4713
Web: www.egssurvey.com

To: PAUL GROVES
PAUL@OBSCAPE.COM
+27 83 2156265
WWW.OBSCAPE.COM

12 March 2022

Dear Paul Groves,

Re: Recommendation Letter

EGS purchased and operated an Obscape Tide Gauge for tidal data acquisition during the survey period for Australian Hydrographic Office project: SI 1013 – King Island (North) Bass Strait. Tidal data was successfully recorded for the project over a period of 3.5 months. Since this date, the sensor has been used successful on several other projects.

The equipment provided was fit for purpose and provided additional cost/time saving features not available on previous equipment i.e. online web app, internal solar power etc.

Technical support was effective and available in a good time.

EGS are currently in discussion with Obscape regarding the purchase of additional equipment.

Kind Regards,

Charles Collins
Chief Surveyor | CPHS1 | Msc.

EGS Survey Pty Ltd
32 Jessie Lee Street
Henderson, WA 6166,
Australia
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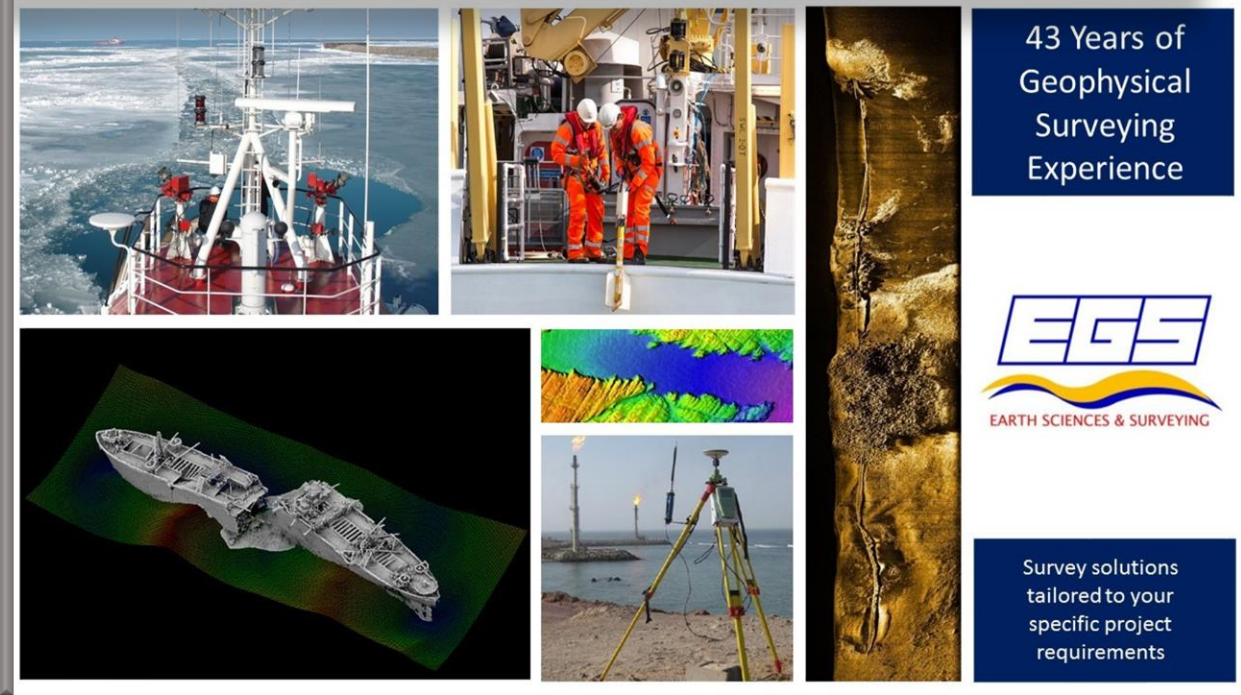
EARTH SCIENCES & SURVEYING



Little Environments PLLC
PO Box 6388
Raleigh, NC 27628
www.littleenvironments.com

LETTER OF RECOMMENDATION

This is to confirm that I am writing to recommend the services of Obscape B.V.

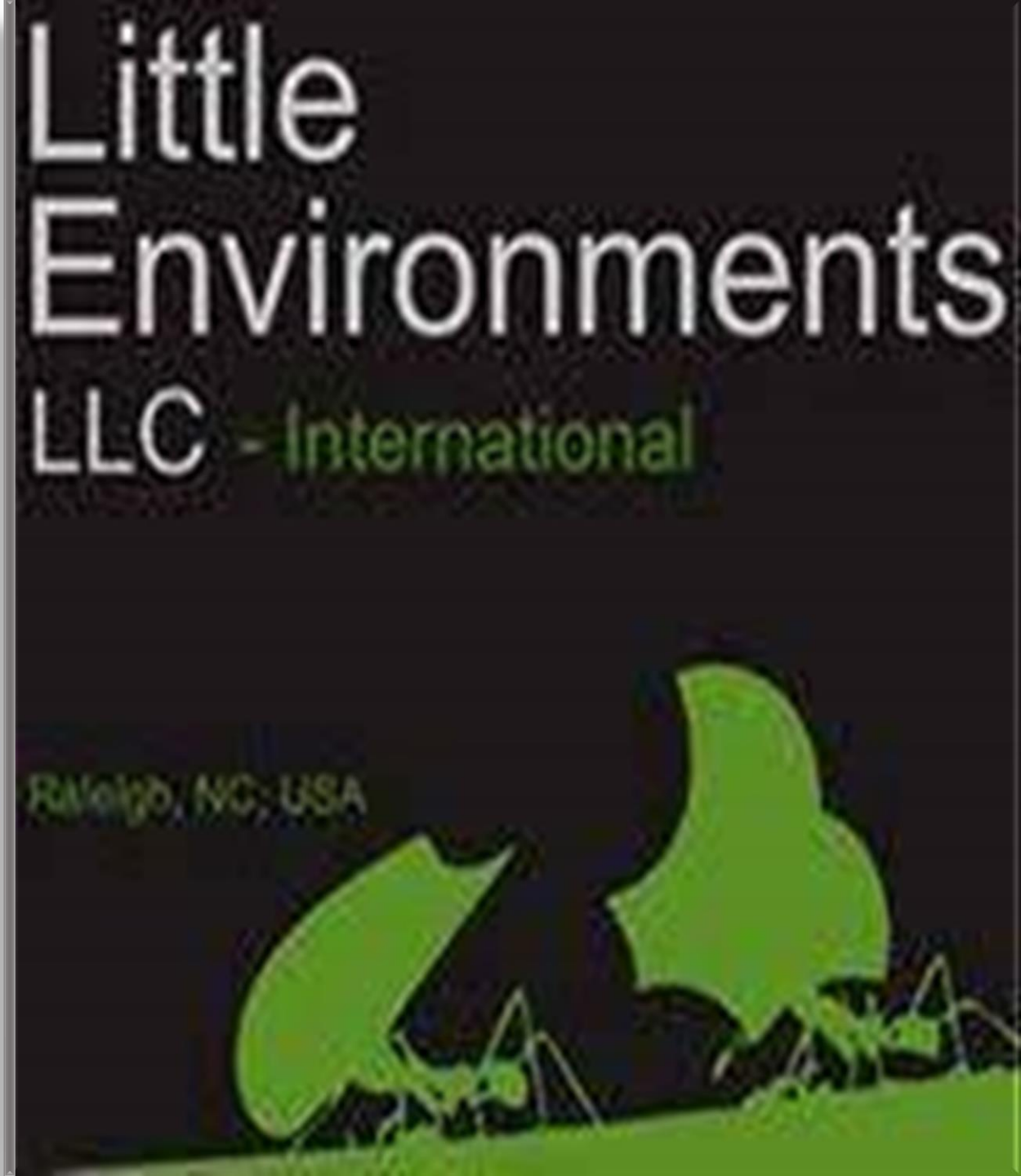
Our firm has been using Obscape for the past few years and have always been satisfied with both the performance and quality of their devices and systems.

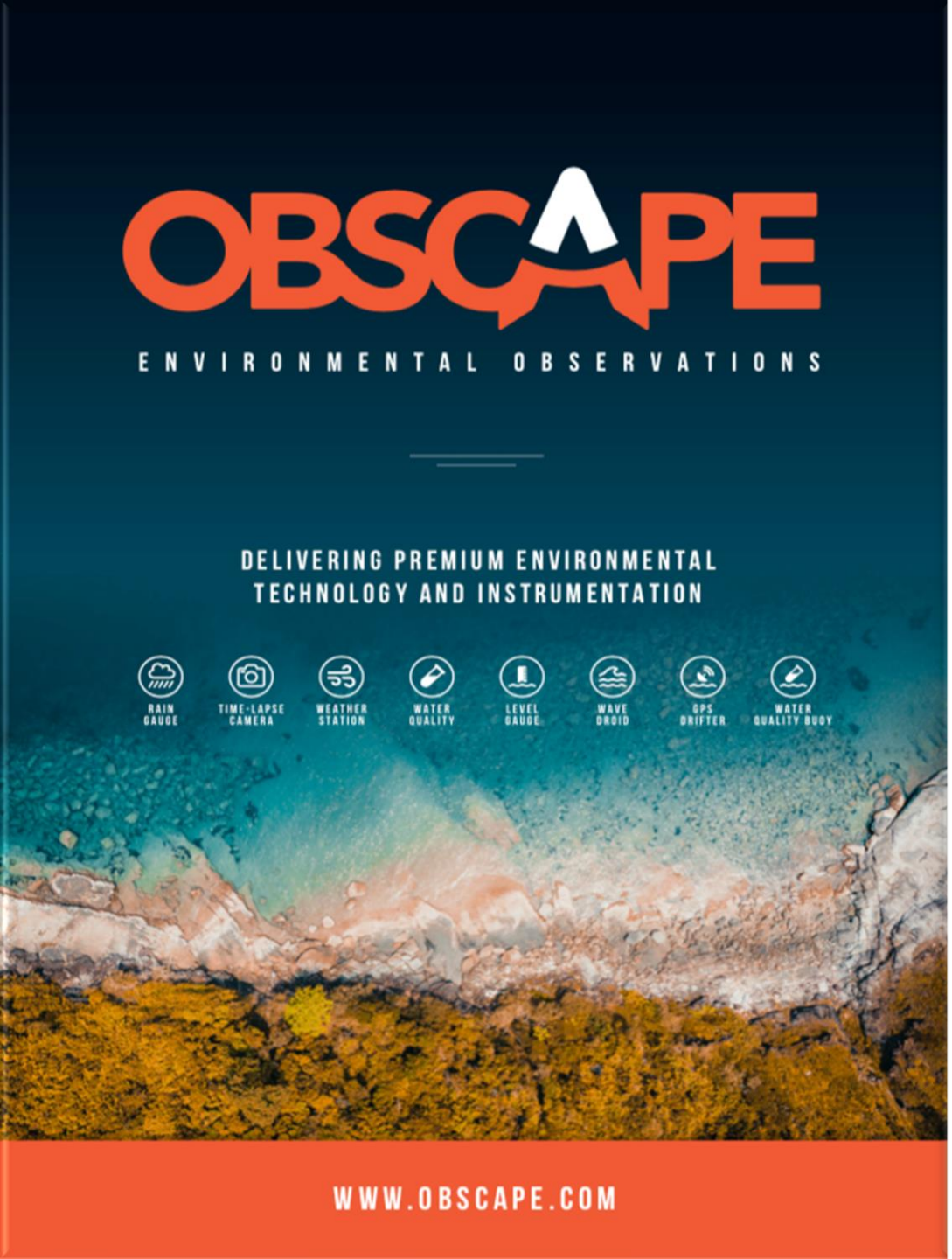
We have purchased their devices a few times and have found them to reasonably priced and of dependable quality. Any issues we have encountered, the Obscape team has rectified them amicably and provided a good level of backup service and warranty cover on all devices supplied.

I'm happy to recommend the services of Obscape. If you have any questions, please feel free to contact me directly.

Sincerely,

Meredith McLaurin, M.B.A
Business Manager
meredith@littleenvironments.com
+1 919.757.2175





Validations

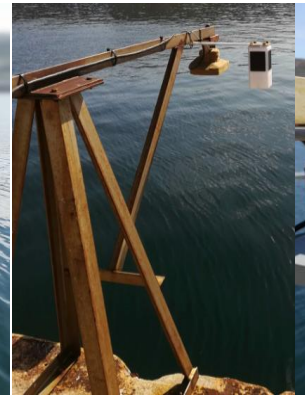
Tide Level Gauge validation

In September 2020, a radar-based Obscape Level Gauge was deployed inside the Simon's Town harbour in South Africa. It was installed next to a validation instrument, being an OTT radar-based water level sensor. Over November 2020, water levels returned by the two devices were compared.

After inspection of the raw data comparison (Figure 1), it was found that tidal levels reported by the Obscape Level Gauge have a bias of 1.6 cm compared to the validation instrument. As this is most likely the result of inaccuracy in the vertical reference level of the devices rather than inaccuracy in the distances measured by the devices, it was decided to subtract the bias from the raw Obscape Level Gauge data in order to arrive at a cleaner comparison of the two datasets.

Both datasets contain short-term fluctuations as a result of wind-driven surface waves entering the harbour. Therefore, the two datasets were low-pass filtered with a Butterworth filter that had a cut-off period of 30 minutes. Finally, the OTT dataset was interpolated to the timestamps of the Obscape dataset to allow for calculation of error statistics (Table 1).

Error statistics of the shifted and filtered datasets reveal a root-mean-squared error of 1.4 cm between the two devices. It is thought that the largest portion of this remaining difference can be explained by the limited averaging period of both devices, which might be insufficient to average out the effect of wind-driver surface waves completely. The Obscape Level Gauge has a sampling rate of 5 Hz and uses an averaging period of 40 seconds to determine the water level. The averaging period of the OTT radar sensor amounts 20 seconds.



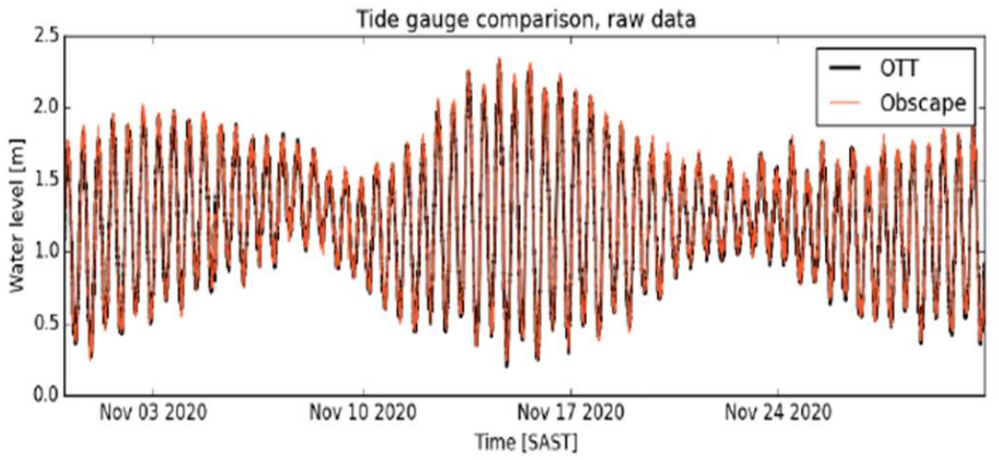


Figure 1: comparison of raw water levels

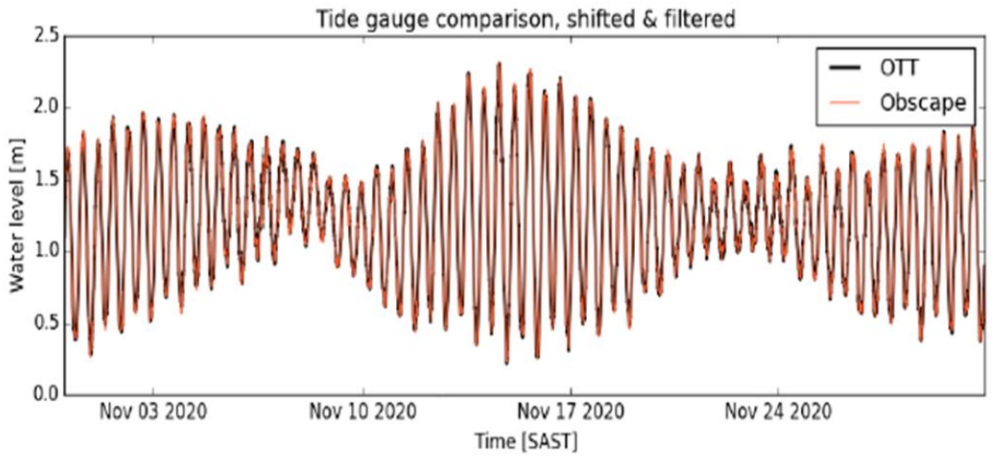


Figure 2: Comparison of shifted, filtered and interpolated water levels

Table 1: Error statistics

	Raw	Shifted & filtered
Bias	1.6 cm	0.0 cm
Root-mean-squared error	3.1 cm	1.8 cm
Mean absolute error	2.4 cm	1.4 cm

VALIDATION STUDY	
AUTHOR	Dr. Max Radermacher (Obscape)
DATE	21 April 2021
SUBJECT	Obscape Wave Buoy validation

Validation of the Obscape Wave Buoy

In August 2018, the predecessor of the Obscape Wave Buoy (WaveDroid Block III) was deployed at the northern North Sea at 120 m of water depth. A Datawell Waverider mark 4 buoy was co-located with the WaveDroid to provide a validation dataset. In this report, a comparison of the directional wave data measured by both instruments is made. During the 12-day measurement period, a moderate storm occurred.

The bulk wave parameters obtained from both instruments are presented in Figure 1, while the associated root-mean-squared error (RMSE) values and correlation coefficients are given in Table 1. Generally, good correlation between the WaveDroid and Datawell data is found.

The peak wave period and peak wave direction reveal the presence of a double-peaked wave spectrum during the first half and last days of the measurement campaign, as the peak values jump back and forth between two spectral components. Furthermore, the peak wave direction wraps around the 0 / 360 degree mark regularly. This volatile behaviour, which is inherent to peak-related parameters like T_p and Dir_p, has a slightly negative influence on the presented RMSE values and correlations. Nonetheless, the small error and high correlation of the mean wave period T_{m01}, which has a more continuous character, shows the good ability of the Obscape buoy to measure wave periods.

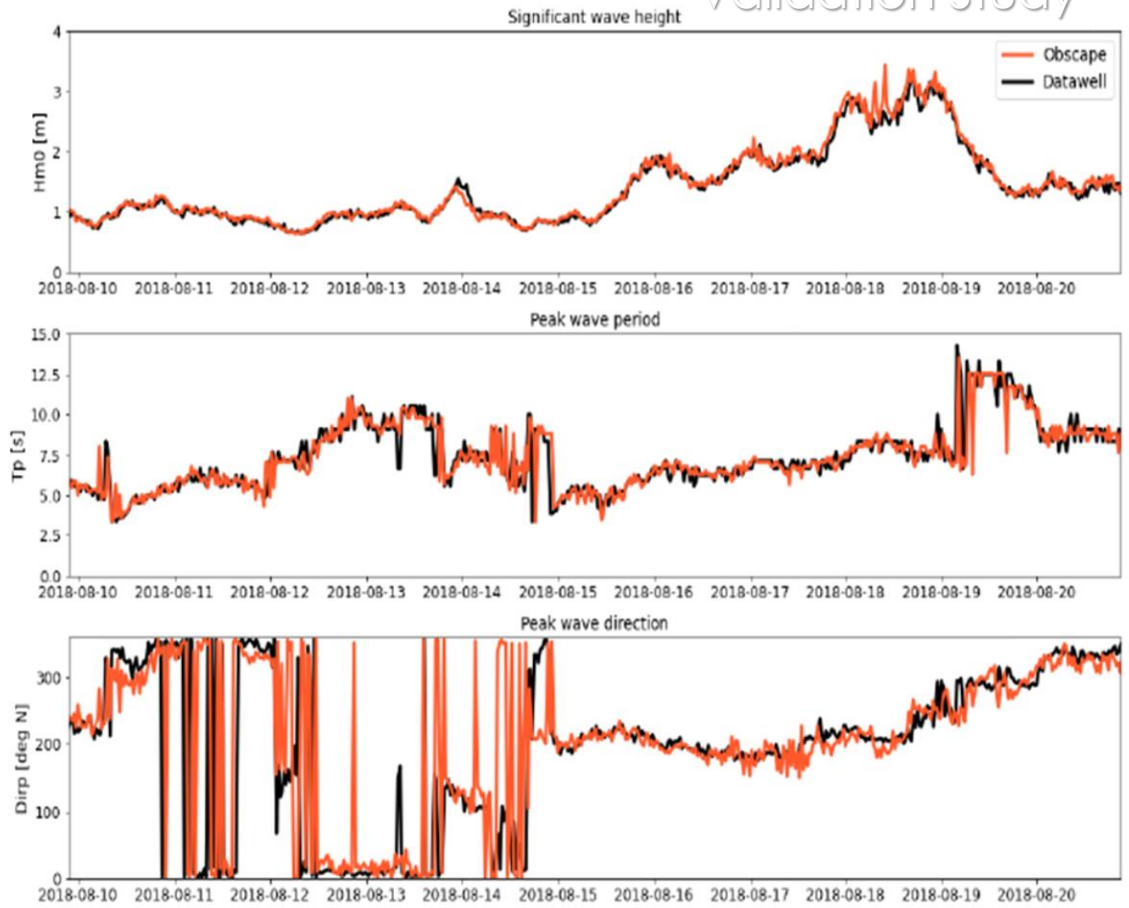
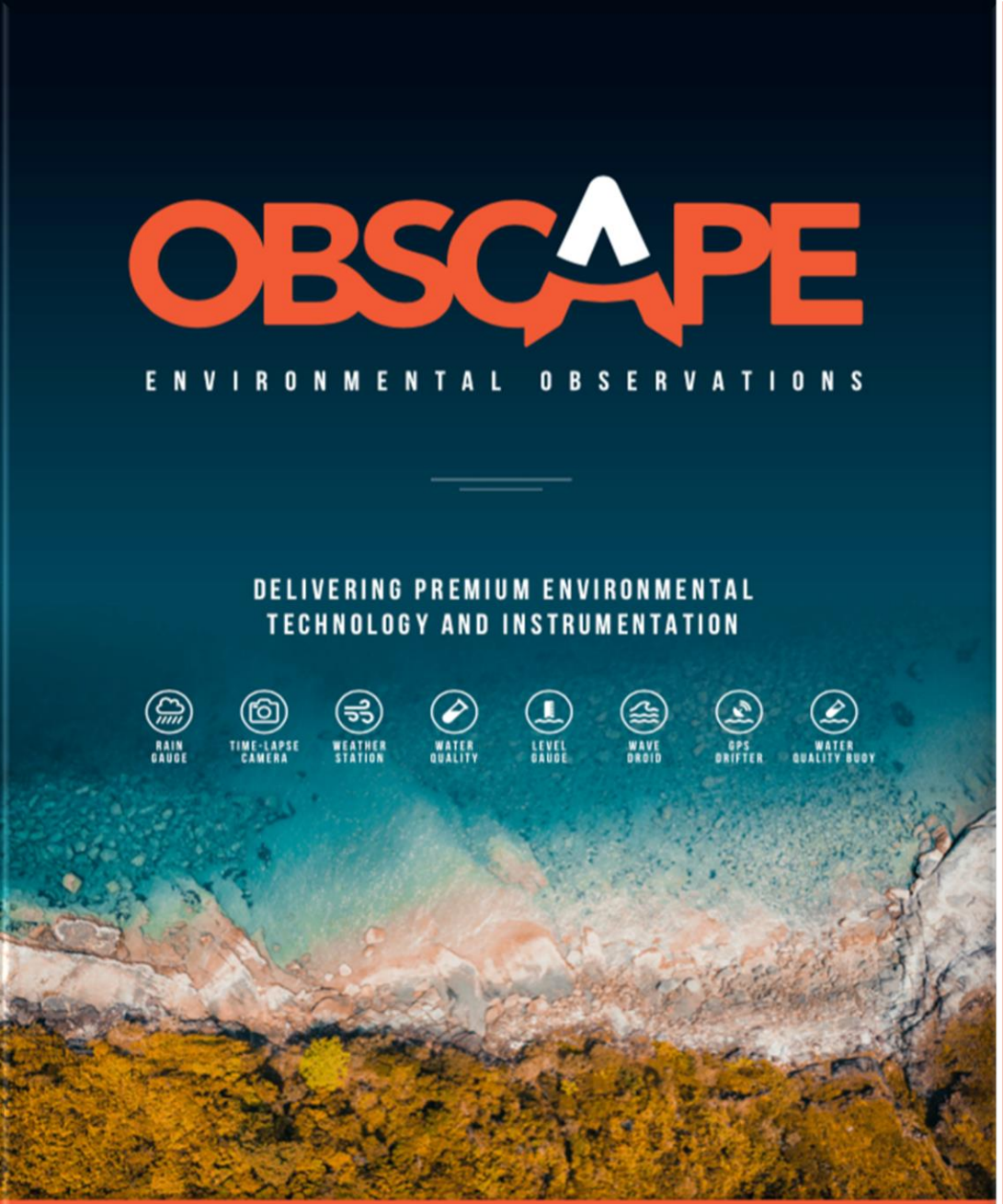


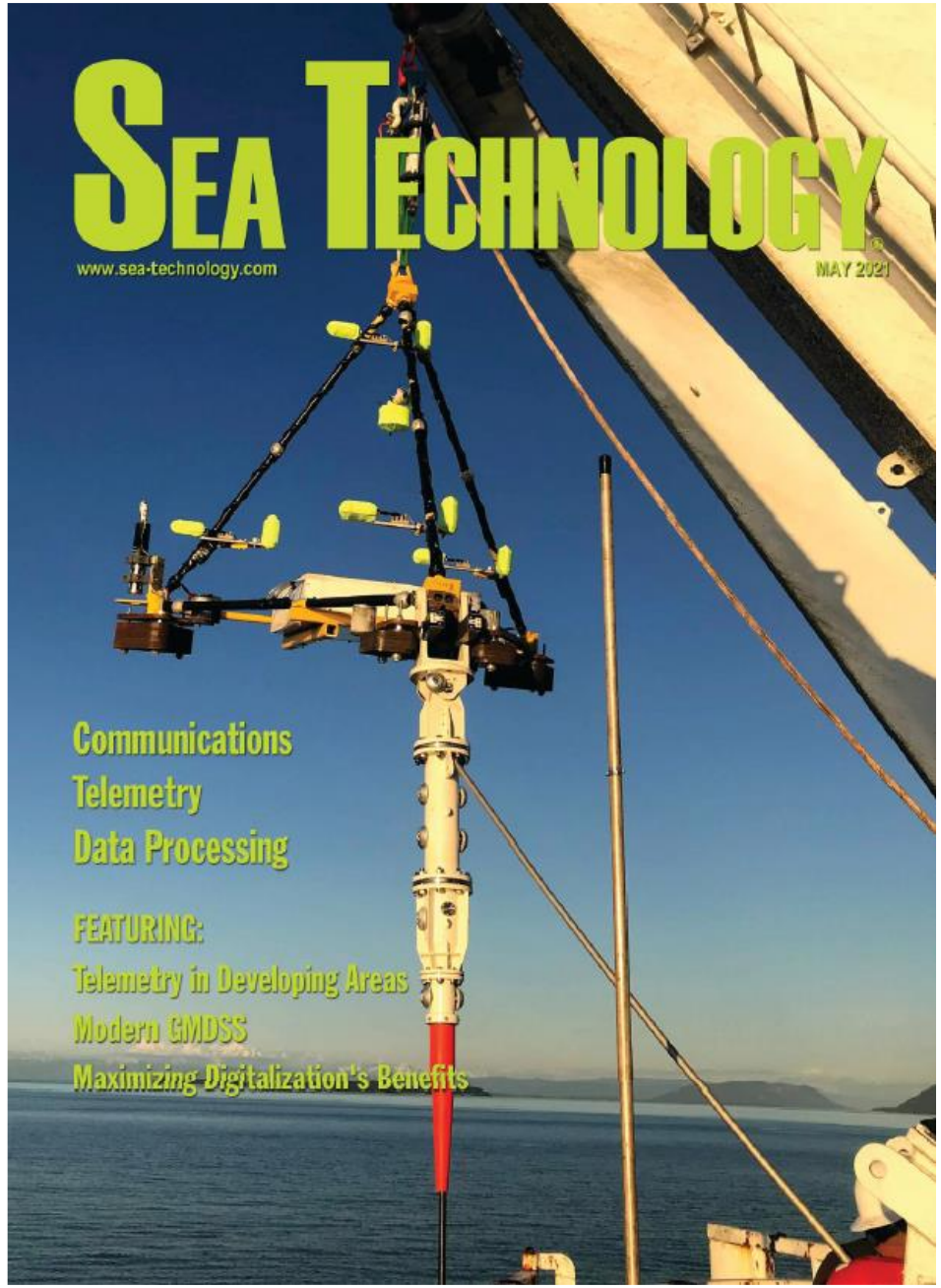
Figure 1: Bulk wave parameters. WaveDroid observations are shown in orange, observations from the reference buoy are shown in black.

Table 1: Root-mean-squared errors and correlation coefficients of observed parameters

Parameter	RMSE	Correlation
H_{m0}	0.10 m	0.99
T_p	1.08 s	0.85
T_{m01}	0.21 s	0.98
Dir_p	19°	0.94



Publications



Rethinking Design for Monitoring

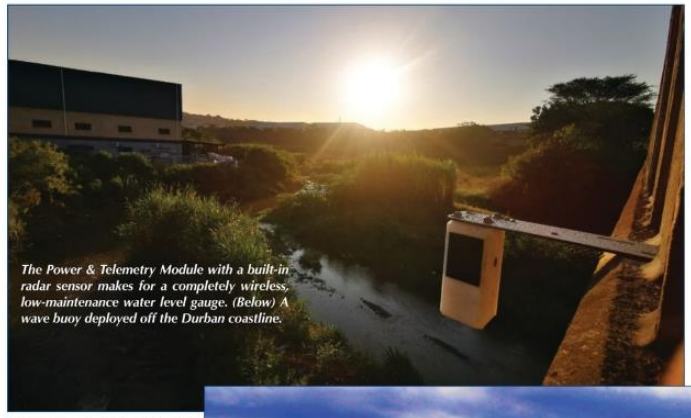
Addressing Coastal Monitoring Challenges in Developing Areas

Dr. Max Radermacher • Zane Thackeray • Godfrey Vella

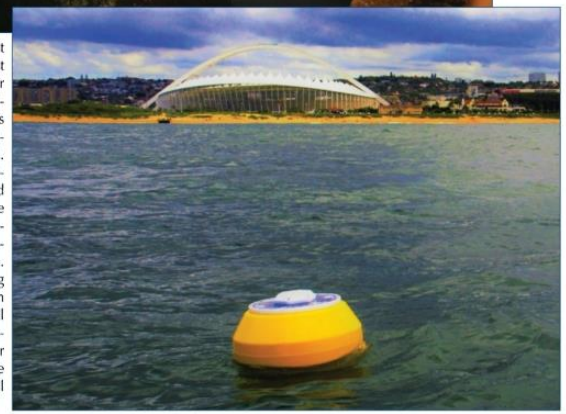
The majority of the world's population lives in low-lying river deltas. The great fertility and good accessibility of these areas has historically led to the rise of the most important settlements, which have evolved into today's metropoles. Ongoing urbanization adds to this trend. At the same time, these low-lying cities at the mouth of large river systems are prone to natural disasters, mostly originating from their large exposure to water. Storms and heavy rainfall can lead to flooding of the built environment and result in economic damage, human displacement and loss of life. While this exposure to the forces of nature exists naturally in delta areas, it is aggravated by climate change, accelerated sea level rise and human-induced land subsidence.

Our ability to understand and deal with these threats is undergoing impressive development. Levees and barriers are safeguarding areas that would otherwise suffer from frequent flooding. Sand nourishment schemes

Flooding around Amanzimtoti Estuary in April 2019 as a result of intense rainfall and high river discharge.



The Power & Telemetry Module with a built-in radar sensor makes for a completely wireless, low-maintenance water level gauge. (Below) A wave buoy deployed off the Durban coastline.



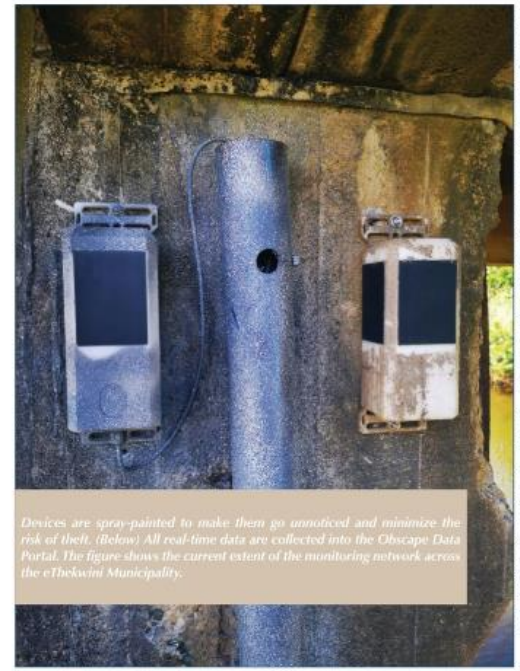
create stable coastlines that would otherwise be subject to rapid erosion. Computer models can forecast hazardous conditions multiple days ahead, enabling us to anticipate and take precautions. However, design and construction of flood defenses and the development of accurate forecasting models heavily depend on the availability of environmental observation data. Especially in the developing world, collection of long-term operational environmental data sets receives little attention. Its importance is either overlooked, or it cannot be achieved for various practical and economic reasons.

The highly specialized nature of conventional environmental monitoring equipment leads to a high price level in this market. The number of manufacturers is limited, and the products are the result of a long-running, costly R&D trajectory that, especially in the past, involved highly skilled specialists in the fields of electronics, oceanography, chemistry, etc. Due to the complexity and vulnerability of the equipment, skilled and experienced staff are required to keep it operational in the field over long periods of time. This strongly limits the possibilities to collect environmental data where they are most needed: coastal areas in the developing world.

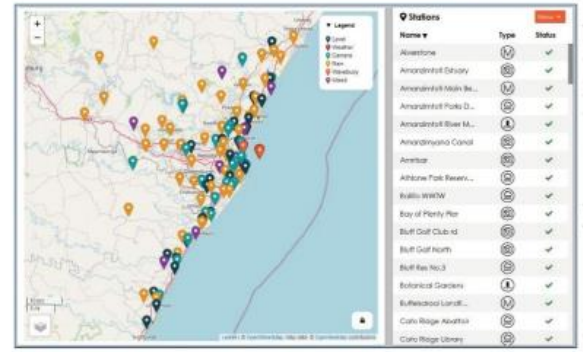
Obscape, a Netherlands-based environmental monitoring equipment manufacturer, has identified and experienced the issues discussed above during its long-standing collaboration with the eThekwini Municipality (city of Durban) in South Africa. It inspired them to come up with a new design philosophy for their products, which is aimed at the development of affordable, robust and easy-to-use environmental monitoring equipment. The company aims to remove existing barriers for the collection of long-term environmental data sets, making environmental observations available to anyone who needs them.

Challenges of Environmental Monitoring in Durban

Zane Thackeray (co-author of this article) and Rio Leuci started a local survey company in Durban, South Africa, in 2006. Soon after, they were contracted by the eThekwini Municipality to conduct beach surveys in order to keep track of structural erosion of local beaches.



Devices are spray-painted to make them go unnoticed and minimize the risk of theft. (Below) All real-time data are collected into the Obscape Data Portal. The figure shows the current extent of the monitoring network across the eThekwini Municipality.



Coastal erosion is just one out of many complexities that local coastal engineers and water managers are faced with. The city of Durban is set in hilly terrain along the Indian Ocean coastline. The municipality comprises no less than 17 separate catchment areas, all of which discharge directly into the Indian Ocean. Estuaries with complex morphodynamics have formed at the mouth of each river. Seasonal closing and breaching of the estuaries are associated with flooding and water quality issues. Furthermore, the humid subtropical climate in Durban is associated with intense rainfall events. Given the hilly, paved urban environment, this regularly triggers flash flooding. During these events, river water levels rise rapidly, inundating infrastructure and informal settlements at the riverbanks. Additionally, Durban's beaches are inundated by high swells on a regular basis. Besides eroding the beaches, this has caused damage to properties along the beachfront.

The eThekwini Municipality is responsible for flood defense and disaster management. This task creates a strong need for real-time environmental observations and forecasts. Thackeray and Leuci aimed to expand their activities for the municipality by installing and maintaining a network of monitoring stations. They soon concluded that this could not be done using off-the-shelf equipment, since the budgetary constraints of the project did not allow for the number of sensors required to achieve sufficient spatial coverage.

In addition, they experienced that several practical disadvantages of existing equipment made field operations difficult and time-consuming. First and foremost, theft rates were unacceptably high. Instrumentation is often given a high-tech, aesthetically pleasing look. Solar panels, which in itself are an important feature if one wants to reduce the maintenance level by omitting regular battery swaps, are often placed on an external bracket, making them clearly identifiable. These factors make monitoring equipment look attractive and valuable and therefore substantially increase the risk of theft in many countries. Second, the use of multi-channel data loggers with several wired external sensors made instrument assembly cumbersome and had an adverse effect on robustness of the system. The latter

especially holds for the case of submerged equipment, e.g., a pressure sensor-based water level gauge or a water quality sonde.

Finally, data management was far from trivial. Since no single manufacturer offered a full product suite that matched the project's constraints and requirements, data had to be pulled into a central database from different portals with large variations in user-friendliness and functionality. Furthermore, most portals were associated with a substantial license fee after the initial trial period had expired.

A New Design Philosophy

These drawbacks made Thackeray and Leuci realize that they had to start developing their own real-time monitoring equipment. With input and guidance from Godfrey Vella (senior manager of the Coastal Engineering Division of eThekwini Municipality and co-author of this article), they deployed their first prototypes in 2014. This drew the attention of Max Radermacher (co-author of this article), who was looking for affordable sensors to collect field data for his Ph.D. research at Delft University of Technology in the Netherlands. Thackeray's knowledge of electronics and material processing, Leuci's field experience, and Radermacher's software skills and access to the European market were exactly the right ingredients to start an equipment manufacturing company: Obscape.

The company's design philosophy revolves around three core aspects: affordability, robustness and ease of use. This has condensed into the PTM: the Power & Telemetry Module. In essence, it is a single-channel data logger with integrated solar panels, power management, control and telemetry. Shaped like a 1-L milk carton, it is not necessarily the biggest eye-catcher, but that is exactly what its designers wanted to achieve. Three 1-W solar panels are mounted flush on the vertical faces of the PTM, avoiding the typical theft-sensitive solar panel look. Whenever possible, sensors are integrated into the PTM housing, e.g., a camera module (creating a general purpose time-lapse camera) or a radar sensor (creating a water level gauge). This leads to very compact and robust devices without external cables. Real-time telemetry is taken care of by a built-in cellular modem or an optional satellite modem, ensuring worldwide compatibility and coverage. Paired with a global SIM card, the PTM-based products become truly turnkey environmental monitoring solutions: simply press the power button, close the housing, and mount the device to a wall, pole or tree with the versatile mounting bracket.

The intention is to arrive at a broad but coherent PTM-based product range that includes all commonly required equipment for coastal, estuarine and catchment monitoring. This allows the user to work with a single supplier and have all real-time observation data available under one roof. As it currently stands, Obscape offers a radar-based water level gauge (no submerged parts, thus, robust and low maintenance); a time-lapse camera; a weather station; a rain gauge; a conductivity and temperature sensor (toroidal design, limiting biofouling and maintenance); and a directional wave measurement buoy (lightweight, deployable by hand). While the wave buoy obviously has a different look than the standard PTM, the technical concept and resulting user experience are identical.

Device purchase comes with unlimited access to the Obscape Data Portal, where all real-time data across all different device types are collected and displayed. While most suppliers have made the shift to a business model that revolves around selling periodic data portal licenses, the company has a strong belief that users should not pay for access to their own measurement data. Instead, a freely available portal with extensive functionality for viewing, downloading, managing and analyzing real-time environmental data combined with affordable instrumentation pricing creates a healthy business model with happily returning clients.

Application in Durban

The environmental monitoring network in the eThekwini Municipality currently entails around 125 stations, which will expand to 200 sites over the current contract period. Among others, the network contains four wave buoys, 25 water level gauges, 55 rain gauges, 28 time-lapse cameras and seven weather stations. The large amount of real-time data that are returned by the network are used by the municipality for coastal, stormwater and catchment management purposes.

For example, the aforementioned cycles of estuarine closing and breaching are closely monitored with a combination of a time-lapse camera at the estuary mouth, water level gauges along the course of the river and upstream rain gauges. This yields a complete overview of upstream rainfall causing rising water levels in the river and the closed-off estuary, while the actual breaching event is captured by the camera.

Alongside the monitoring network, the eThekwini Municipality runs an operational forecast model train, which is capable of forecasting potential disasters several days ahead. It consists of atmospheric, oceanic, coastal and riverine models, as well as stormwater runoff models. The existence of the extensive monitoring network is of critical importance for the value of the model forecasts. On the one hand, observation data are used for calibration and validation of the computer models, while on the other hand the real-time observations provide the ground-truth data for the disaster management team during severe storm events.

The design philosophy has proved its value when installing and operating the monitoring equipment. The compact devices require minimal preparation, and installation has been made easy. The radar-based water level gauges are mounted above water, typically on a bridge deck. The lightweight wave buoys are deployed from a RIB. Maintenance has been low since the first PTM-based devices were installed at the start of 2020. None of the devices experienced serious fouling of sensors or solar panels, and data transmission has been stable. Any settings adjustments or firmware upgrades that were needed could be installed over the air via the built-in cellular modem. Due to the low maintenance level, the field technicians can focus all their attention on further expansion of the network this year.

Future Developments

Over the years to come, the existing product range will expand with a number of new sensors. Based on confirmed requests from existing and potential clients, Obscape has entered into R&D trajectories for water quality monitoring and current monitoring, both buoy-based and mounted to a rigid structure. It is aimed to tackle existing problems in the field of water quality monitoring, such as limiting biofouling and making water quality instrumentation available to projects with a limited budget.

Furthermore, global advances in AI and computer vision are expected to yield a whole new range of applications for the time-lapse camera. Alongside the qualitative time-lapse imagery, this will provide ways to extract all sorts of quantitative information from the images.

Conclusion

In response to practical issues with existing measurement equipment, a new range of instrumentation for environmental observations was developed. The new products were designed to be affordable, robust and easy to use. Deployment of 125 devices across the eThekwini Municipality in South Africa has demonstrated the simplicity of instrument deployment and the robustness of the equipment when it comes to minimizing the need for maintenance and the risk of theft. These efforts make environmental observations easier to conduct and available to a wider community.

Acknowledgments

We gratefully acknowledge eThekwini Municipality for its continuous support and collaboration, as well as for making its measurement data available for demonstration purposes. **ST**

Dr. Max Radermacher obtained his M.S. in coastal engineering from Delft University of Technology in the Netherlands. While pursuing his Ph.D. with the same institute, he partnered with Zane Thackeray and Rio Leuci to establish Obscape. Radermacher heads the Dutch offices of Obscape and leads software development and sales.

Zane Thackeray obtained his honors degree in geology from the University of Kwazulu-Natal in Durban, South Africa, and is a registered professional natural scientist. Together with Rio Leuci, he established Enviromap, continuing as Obscape after the entry of Max Radermacher. Thackeray heads the Durban offices of Obscape and leads R&D and production.

Godfrey Vella has worked in the coastal engineering field for over 30 years and is a registered professional technologist. As senior manager of the Coastal Engineering branch for the last 17 years at the eThekwini Municipality (city of Durban), Vella is responsible for all coastal engineering design, implementation and maintenance of coastal infrastructure within the 97 km of coastline, as well as for all monitoring of coastal processes together with Obscape, plus numerical modeling.

Environmental monitoring made affordable

Dr. Max Radermacher
Director at Obscape

The collection and availability of observation data is key to understanding and addressing the challenges that climate change poses. Yet at the same time, there is a lack of environmental observation data in many places around the world, especially in those places that will be hit the hardest by the effects of climate change and accelerated sea level rise. This is definitely not because governments and researchers fail to appreciate the value of collecting such observations, but rather due to the fact that many existing monitoring solutions are cost-prohibitive. Whether that is due to high initial purchase costs, labour-intensive operation and maintenance or annual license fees to access the data, many scientific projects are lacking the budget to collect all the data they require when working with conventional environmental monitoring solutions.

Figure 1: Flooding around Amanzimtoti estuary in April 2019

This problem was recognised by the eThekwini Municipality (city of Durban) in South Africa. The municipality is faced with a multitude of environmental challenges. Powerful swell waves are hammering the Durban coastline year-round, causing persistent beach erosion and occasional flooding of the city's famous Golden Mile beach front. The municipality comprises no less than 17 rivers, each with their own estuary that flows out directly into the Indian Ocean. Intense rainfall events combined with the hilly terrain lead to rapid stormwater runoff, landslides, sudden rising of river water levels and flooding of settlements on the river banks.

Figure 2: A radar-based water level gauge, deployed on a bridge deck above the water surface

In order to address these problems and mitigate their impacts, an extensive environmental monitoring network would have to be established. Long-term observation datasets would yield valuable insights into the occurrence and effects of extreme weather events, allowing the municipality to adapt its infrastructure and make the city more resilient. Furthermore,

the availability of real-time observation data would help the city's disaster management team to rapidly identify inundated areas.

Figure 3: A wave buoy deployed off Durban's iconic football stadium

Soon the municipality realised that the creation of such a monitoring network would not be financially feasible using conventional equipment. Therefore they entered into a collaboration with the Dutch / South-African equipment manufacturer Obscape. The aim was to arrive at an affordable environmental monitoring solution, in terms of both purchase cost and maintenance cost. The latter posed the biggest challenge, since low maintenance costs are strongly tied to the ease-of-use, robustness, longevity, security against theft and autonomy of the monitoring equipment.

The product resulting from this collaboration is Obscape's Power & Telemetry Module (PTM). It is essentially a simple, single-channel, real-time data logger that can take on a wide range of sensors. Power is supplied by three solar panels, that have been discretely integrated into the faces of the housing. Real-time transfer of measurement data to the Obscape Data Portal is taken care of by a built-in cellular modem or an optional satellite modem for more remote monitoring locations.

The PTM has been turned into the following devices by pairing it with different sensors: a radar-based water level gauge, a rain gauge, a weather station, a time-lapse camera, a wave buoy and a water quality buoy. Access to the versatile data portal is included free of charge for the lifetime of the equipment. Due to the wireless nature of these devices, installation in the field is as easy as pressing the power button and bolting the instrument to a bridge deck or strapping it to a tree.

Figure 4: Blending devices in with their environment turned out to be a highly effective theft prevention method.

Subsequently, an extensive real-time monitoring network was deployed throughout the eThekwini Municipality territory. Among others, the network features 4 wave buoys, 55 rain gauges, 25 water level gauges, 28 time-lapse cameras and 7 weather stations. Towards the end of 2021, the network is to be expanded even further. Installation and incidental maintenance are carried out by a small team of 2 persons. Since the deployment of Obscape's first sensors in 2017, only a single device was stolen, proving the value of the robust, simple and discrete design of the PTM.

In addition, the eThekwini Municipality partnered with the Dutch knowledge institute Deltares to set up a suite of computer models, which forecast water levels, rainfall and waves. While the monitoring network provides long-term observation datasets and provides ground truth comparisons to the computer models, the forecasts allow the municipality to identify potential extreme weather events several days ahead and take the necessary precautions. An software interface was created to automatically share data between the Obscape Data Portal and the FEWS software package, thus establishing a seamless environmental monitoring and forecasting solution.

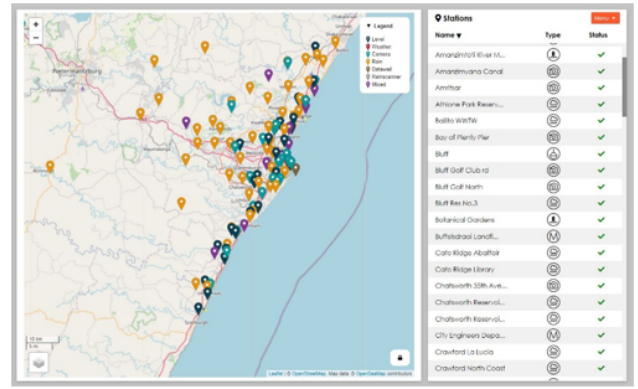


Figure 5: Snapshot of the Obscape Data Portal, showing an overview of the monitoring network in Durban. Access to the data portal is included free of charge with device purchase.

The lack of affordable monitoring solutions and the resulting lack of observation data have been slowing down the adaptation of our most vulnerable infrastructure for a long time. The monitoring network deployed in Durban demonstrates how this barrier can be lifted, such that the world's cities can be made more resilient to the growing threats of climate change and sea level rise.

NWP | Netherlands Water Partnership

NEWS

South African activity opens way to ocean pollution project for Obscape

Africa | South Africa | Water Technology

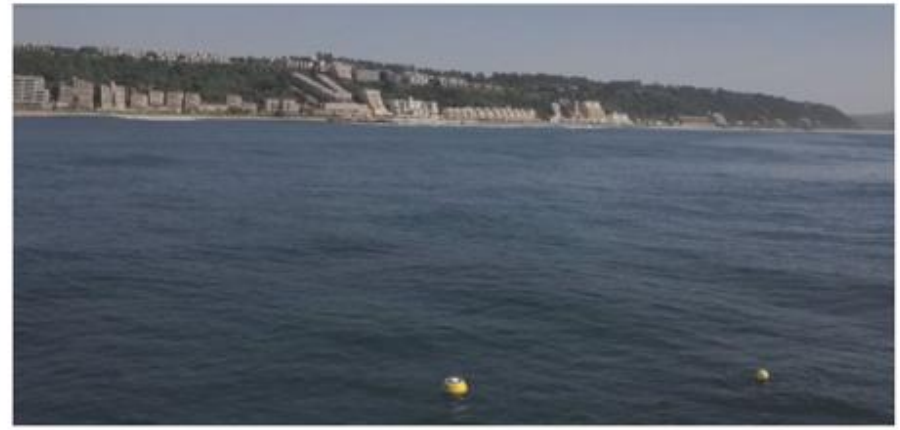
Monitoring technology company Obscape, a recent NWP member, has expanded its presence in South Africa with the help of NWP connections. This has opened the way for their involvement in a global project to reduce ocean pollution from plastics and other litter coming from rivers.

Obscape co-founder Max Radermacher

"We are aiming to make environmental observations available to anyone who needs them," says Max Radermacher, co-founder of Obscape, which recently joined NWP. He describes the company's devices as being affordable, robust and completely wireless. "They are intended for long-term autonomous deployment in the field," he says, explaining that they have built-in solar panels and telemetry and are completely self-sustaining

Flood protection for Durban

One country in which Obscape is particularly active is South Africa. Its presence there stems from the company's other co-founder, Zane Thackeray, who brought Obscape sensors into survey work he was carrying out for Durban Municipality.
"Over the years, that has developed into an operational monitoring network mainly focused on flood prevention," explains Radermacher. This involves measuring aspects such as water levels, rainfall, and wave height. "It is mainly focused on whether or not flooding is likely to occur."
"That is really our main presence in the South African market," he ~~adds~~..."



Obscape Buoy at Umdloti, KZN, South Africa

A link with litter

Thanks to its presence in Durban, Obscape was able to connect to another aspect of water - concerns about river pollution by litter, especially plastics. Durban is the base of non-profit organisation The Litterboom Project, whose founder and CEO is Cameron Service.

Radermacher explains that The Litterboom Project places pipes as barriers in rivers to catch litter, mainly plastics, and that it has teams who then collect the litter.

"The timelapse camera we developed at Obscape turned out to be very suitable for that," says Radermacher. It provides a way to track litter accumulation remotely. "We started out by installing one near one of the Litterboom sites in Durban."

The NWP connection

This link with litter then opened the way to involvement in a further project, assisted by NWP connections. A 'Living Lab' project was set up by the University of Cape Town, TU Delft, the University of Applied Sciences Rotterdam, CEW Leeuwarden and the World Water Academy on redesigning the ~~Liesbeek~~ River in Cape Town. This work is continued through the 'Bridging the Water' programme of the Orange Knowledge Programme (OKP).

"Our involvement arose because of our involvement with The Litterboom Project," explains Radermacher. "NWP and the OKP project came onto our path and, together with Cameron Service at The Litterboom Project, we started talking to see if it was possible to have another Litterboom site in the Cape area that we could monitor using Obscape devices."

This led to funding for two ~~Litterbooms~~ on the ~~Liesbeek~~ River. These include equipment to provide automatic detection of litter accumulation using timelapse camera imagery that is evaluated using Artificial Intelligence. Radermacher explains that this takes place within a project carrying out research and progressing new developments. For example, Dr Kevin Winter and students from the University of Cape Town will analyse the data as part of research looking at what to do with collected litter, as well as how to control sources and prevent creation of litter in the first place.

Obscape camera monitoring waterway pollution

Supporting action on oceans

This work is opening up other opportunities, as Obscape's Paul Groves, who is responsible for sales and marketing, explains.

"Thanks to what we supplied to Durban Municipality, and particularly what we have done with The Litterboom Project and OKP, we have had other large entities such as The Ocean Cleanup approach us," he says.

Paul Groves, Business Development Consultant at Obscape

Obscape is now getting involved with The Ocean Cleanup's 1000 Rivers initiative, targeting rivers around the world for clean-up.

"We are going to be providing monitoring equipment," says Groves. "The project is still in its infancy. They have just started putting in monitoring devices and systems to identify plastic debris, pollution and rubbish that flows down from the streams or main tributaries into areas where there is a large amount of pollution of oceans. One of those monitoring devices will be an Obscape monitoring device."
"It is a big project that we are very proud to be associated with," adds Groves.

Support and success

Groves sees there are good opportunities to do business around water sector needs in South Africa. "People are very willing to accept new technologies," he says.

He also sees the clear value of support - both the support Obscape has received to date, and more generally for others looking to work in the region. "We are continually impressed and amazed by the amount of support that the Dutch give to businesses, especially Small and Medium Enterprises. Coming from a developing country, it is really amazing to see the backup and support that they give."

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ENVIRONMENTAL OBSERVATIONS