



OCEAN COLOUR SCENE

HIGH-RESOLUTION, CURRENT BATHYMETRIC DATA IS IMPORTANT TO AN INCREASING NUMBER OF APPLICATIONS AND STAKEHOLDERS. IT'S ALSO QUITE RARE. **MARIE-LUISE WILHELM** EXPLAINS HOW DIFFERENT SATELLITE TECHNIQUES, COMBINED WITH CROWD-SOURCING, ARE BEING USED TO SOLVE THE PROBLEM

Suitably up to date, high-resolution bathymetric data is increasingly important for a large number of applications, such as safe navigation, reconnaissance surveys, offshore construction as well as geomorphological studies, coastal zone management, habitat mapping and hydrodynamic modelling. Different stakeholders have different needs for their bathymetry datasets, and its availability is key to understanding the characteristics of the marine environment and developing long-term sustainable management plans. However, there is a lack of available data that is recent and of sufficiently high quality.

Base Platform, which started running commercially in January, offers cost-saving instant access to bathymetric products for an

area of interest or for customised solutions, using the efficiencies of remote sensing of bathymetry and the benefits of crowd sourcing and tidal modelling. It began as an EU Horizon 2020 project to demonstrate, validate and integrate different bathymetric technologies, including optical and synthetic aperture radar (SAR) satellite-based techniques and crowd-sourced bathymetry. While all these techniques existed individually before, Base Platform merges them and their respective applicable depths, allowing for a wider coverage and highly accurate data. Furthermore, it takes existing, proven algorithms and automates

them much further than had previously been achieved, making the data-processing faster and reducing the cost of the end product.

From above

Optical bathymetry from satellite data obtains the water depth by analysing the spectral changes of the seafloor – the technique can cover from the high-water mark to about 30m depth in the clear waters of the Caribbean, but in less clear waters such as the North Sea, it can go down to 10m or less. The challenge of strongly variable recordings is overcome by highly sophisticated correction algorithms, which remove atmospheric and adjacency effects, sun glint on the sea surface, and water refraction.

SAR covers medium depths. It detects changes to the wavelength of ocean waves, indicating changes in the underlying bathymetry, using the shoaling effect of waves. As it uses radar, it is unaffected by cloud or weather effects. New improvements

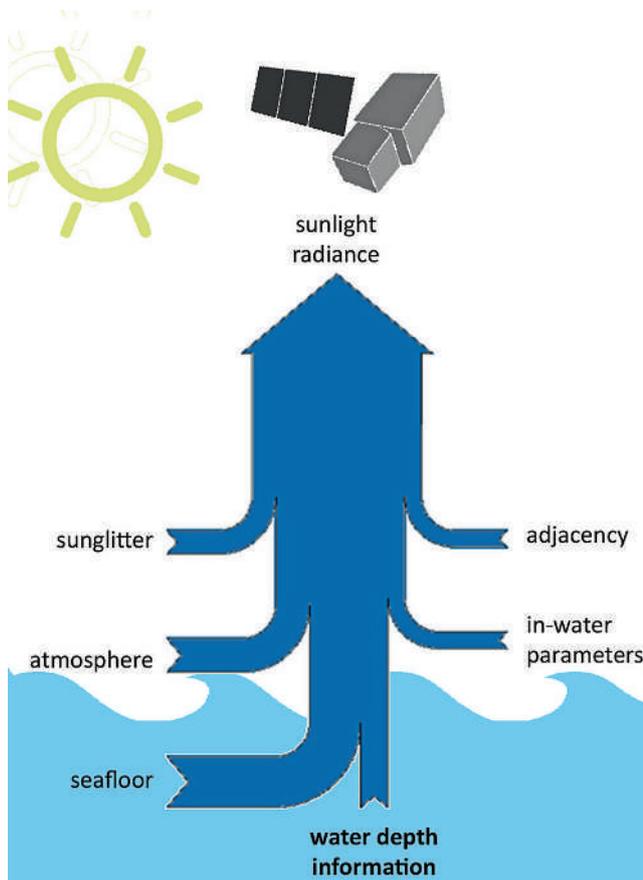
DETAILED BATHYMETRIC DATA IS IMPORTANT FOR MANY COASTAL AND OFFSHORE APPLICATIONS



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The diagram shows the relative amount of measured light energy that contains water depth information

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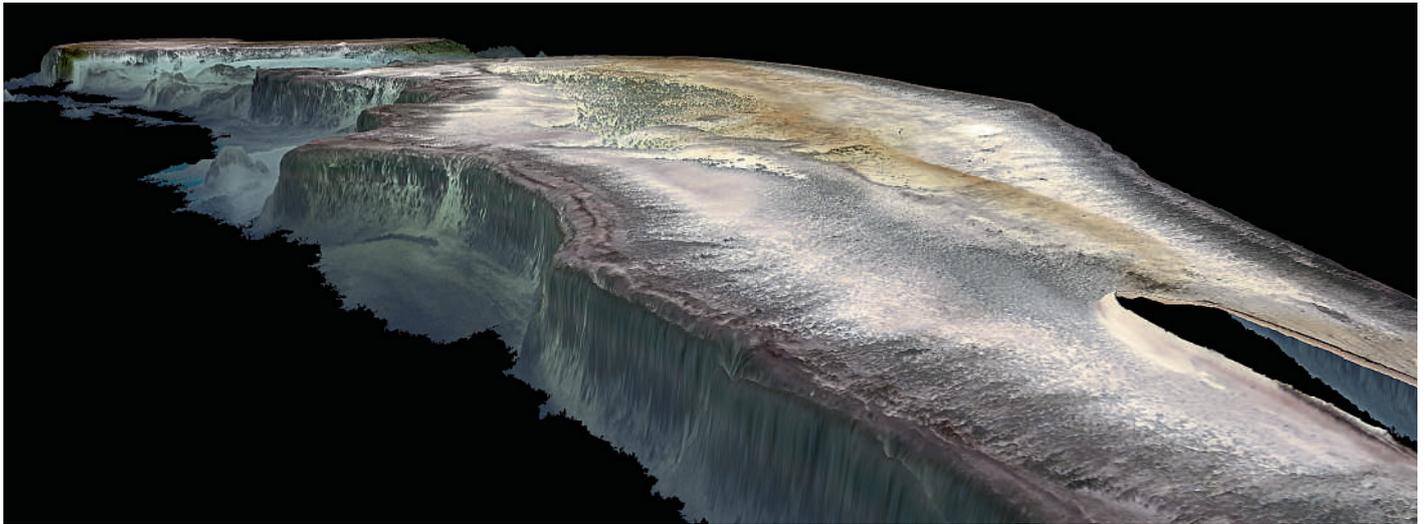
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Seafloor reflectance draped over shallow water bathymetry derived out of optical satellite image data. © EOMAP 2017

THE CHANNEL ISLANDS

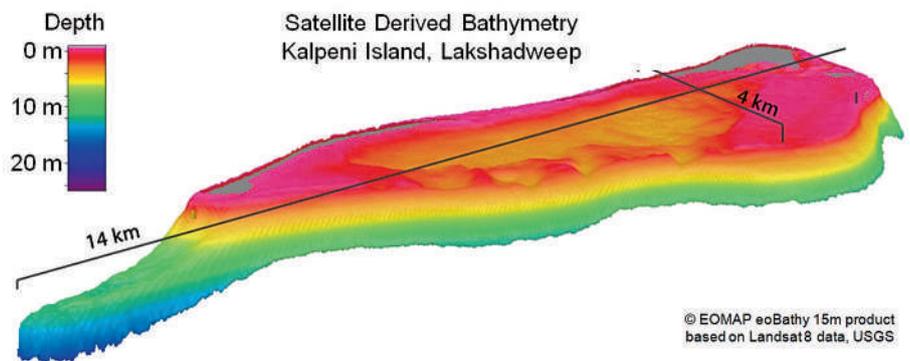
The English Channel is possibly the world's busiest seaway, with more than 400 commercial vessels passing through every day. The Channel Islands – a group of islands in the English Channel off the French coast – are virtually self-governing, with constitutional independence from the UK and France.

However, the Channel Islands have no hydrographic survey programme for their territorial waters. Most have not been surveyed by either the UK or France since GPS became available and virtually no surveys have been carried out using modern methods. Users must rely on old, sparse, single-beam echo sounder surveys, not meeting the end-users' needs for easily accessible, up-to-date bathymetry. So, there is considerable interest in improving the bathymetry.

For the Channel Islands, Base Platform has generated and merged bathymetric data in the region, using optical and SAR satellite data as the waters are too shallow for satellite altimetry derived bathymetry. Crowd sourced bathymetry data from TeamSurv has also been used, with recruitment drives have been undertaken to motivate more local vessels to participate in crowd-sourced bathymetry.

enable an automatic and consistent analysis of the scenes, with artefacts such as sandbanks and ships filtered out.

Satellite altimetry-derived bathymetry covers the deepest depths. Altimetry bathymetry relies on the fact that the topography of the sea bed creates gravity anomalies that tilt the ocean surface in ways that are measurable with a radar altimeter. By measuring the height of the ocean's surface, the underlying changes of bathymetry



Satellite-derived bathymetry product based on Landsat 8 imagery for Kalpeni Island, Lakshadweep, India. © EOMAP 2017

can be calculated. Tracks from vessels are used to provide in-situ measurements, improving the accuracy of the result.

From the crowd

Whereas regular seafloor mapping campaigns are expensive, crowdsourcing builds on citizen science initiatives. With some 10 million seagoing vessels globally, increasing numbers are collaborating in improving underwater topography mapping and participate in crowd sourced bathymetry. Base Platform automatically ingests and processes tracks from a number of crowd sourcing schemes, carrying out the normal survey processing automatically in the cloud. Updated datasets are released monthly, both for use as in-situ ground truth data for the satellite bathymetry, and also as a bathymetric product in its own right.

The core processing of crowd sourced data is carried out by the TeamSurv engine, which also has its fleet of vessels. The other main sources of vessel tracks are OpenSeaMap, a software project collecting freely usable nautical information and geospatial data to create a worldwide nautical chart, and the Data Center for Digital Bathymetry (IHO DCDB) set up by the International

Hydrographic Organization, archiving and sharing tracks contributed by mariners.

High-quality bathymetric products

Water depth is strongly influenced by tidal and meteorological variations, particularly in shallower waters. As there is an insufficient number of permanently installed tidal gauges for global tidal interpolation, Base Platform relies on a high-resolution global numerical hydrodynamic model. As well as using numerical predictions, it also uses tide gauge and satellite altimetry data to optimise its accuracy. From this, bathymetry can be generated to whatever chart datum is required, with mean sea level (MSL) and lowest astronomical tide (LAT) offered as standard.

The up-to-date bathymetry data meets the levels of accuracy needed by users, and contributes significantly to successful topography mapping. Working with trusted, proven partners to ensure data quality, Base Platform provides a wide range of off-the-shelf data sets, as well as the ability to order bathymetry for areas not yet available online.

Marie-Luise Wilhelm is marketing and communications manager at Base Platform (www.base-platform.com)

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