Satellite-Derived Bathymetry:

Industry update for the Southwest Pacific Hydrographic Commission (SWPHC20)

Dr. Magnus Wettle

EOMAP
Germany | Australia | United States | Abu Dhabi
www.eomap.com

The SDB journey so far

- 1980s-2000's: R&D
- 2005: First commercial SDB project: (environmental management)
- 2012: NOAA and UKHO evaluate SDB
- 2013: Used by marine professionals (e.g. SHELL)
- 2014: Pilot project with AHO
- 2015: UK Hydrographic Office puts EOMAP SDB in chart
- 2019: NZ Hydrographic Authority puts EOMAP SDB in charts
- 2019: IHO S-44 updated for SDB
- 2020: 2 hydrographic agencies with commercial SDB software
- 2021 AHO signs extended contract for EOMAP software services
- 2021 IHO HSWG establishes SDBPT, chaired by EOMAP COO
- 2022 UKHO selects EOMAP as primary SDB provider for next 3-5 years
- 2022: SDB part of AGO GeoPanel (5 years)

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SDB Topics

Selected highlights

- SDB across the Pacific
- Monitoring bathymetry

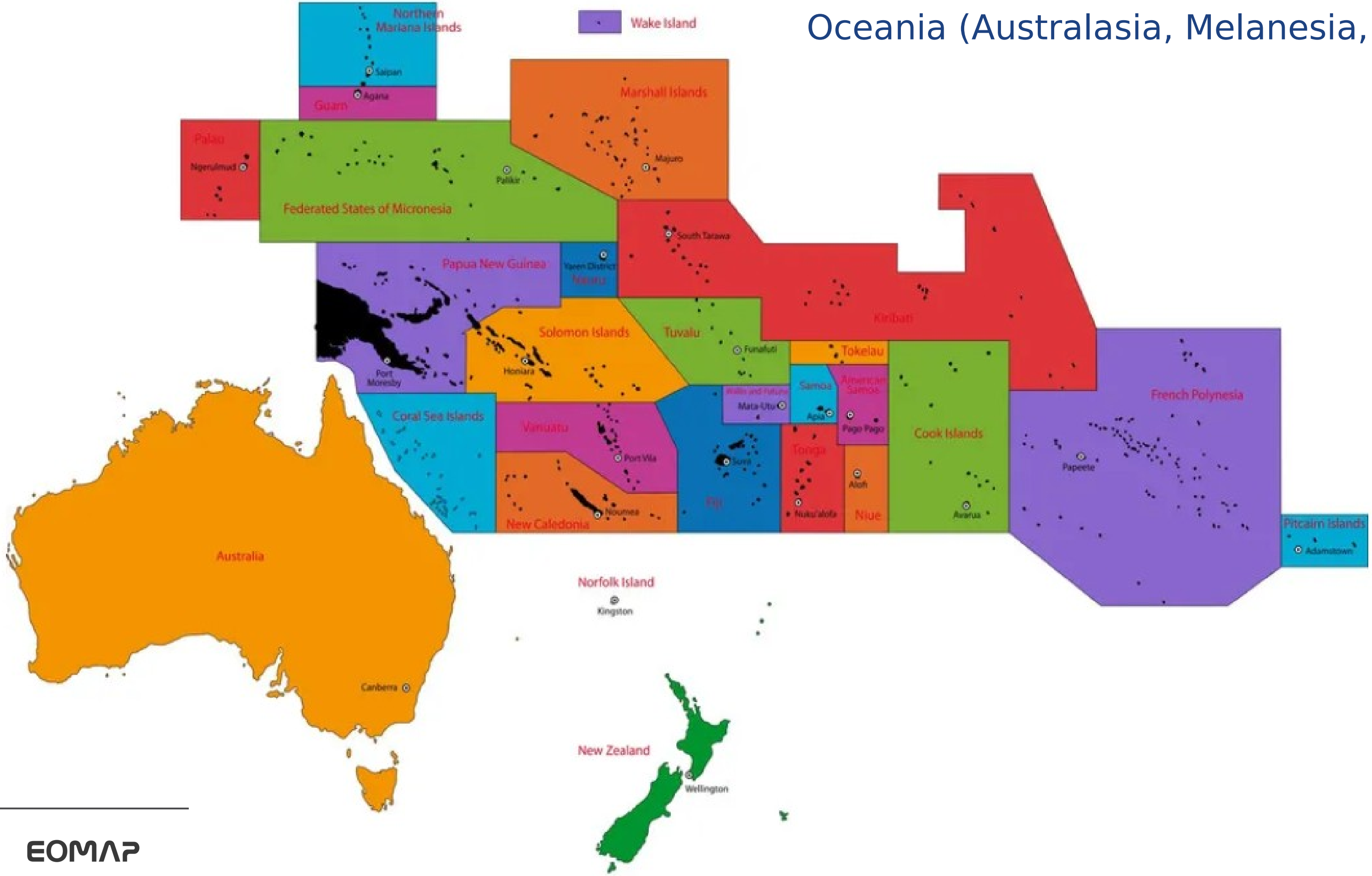
Technology developments

- Multi-image parallel processing
- SDB Online

Capacity Building, Standards and Best Practice

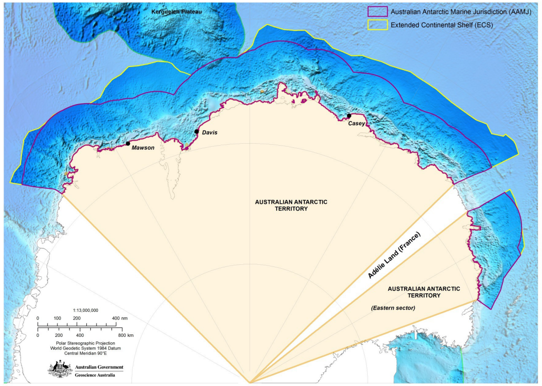
- SDB Training
- IHO SDB Working Group

(EOMAP) SDB across the Pacific



Oceania (Australasia, Melanesia, Polynesia, Micronesia)

Australia’s Antarctic Marine Jurisdiction



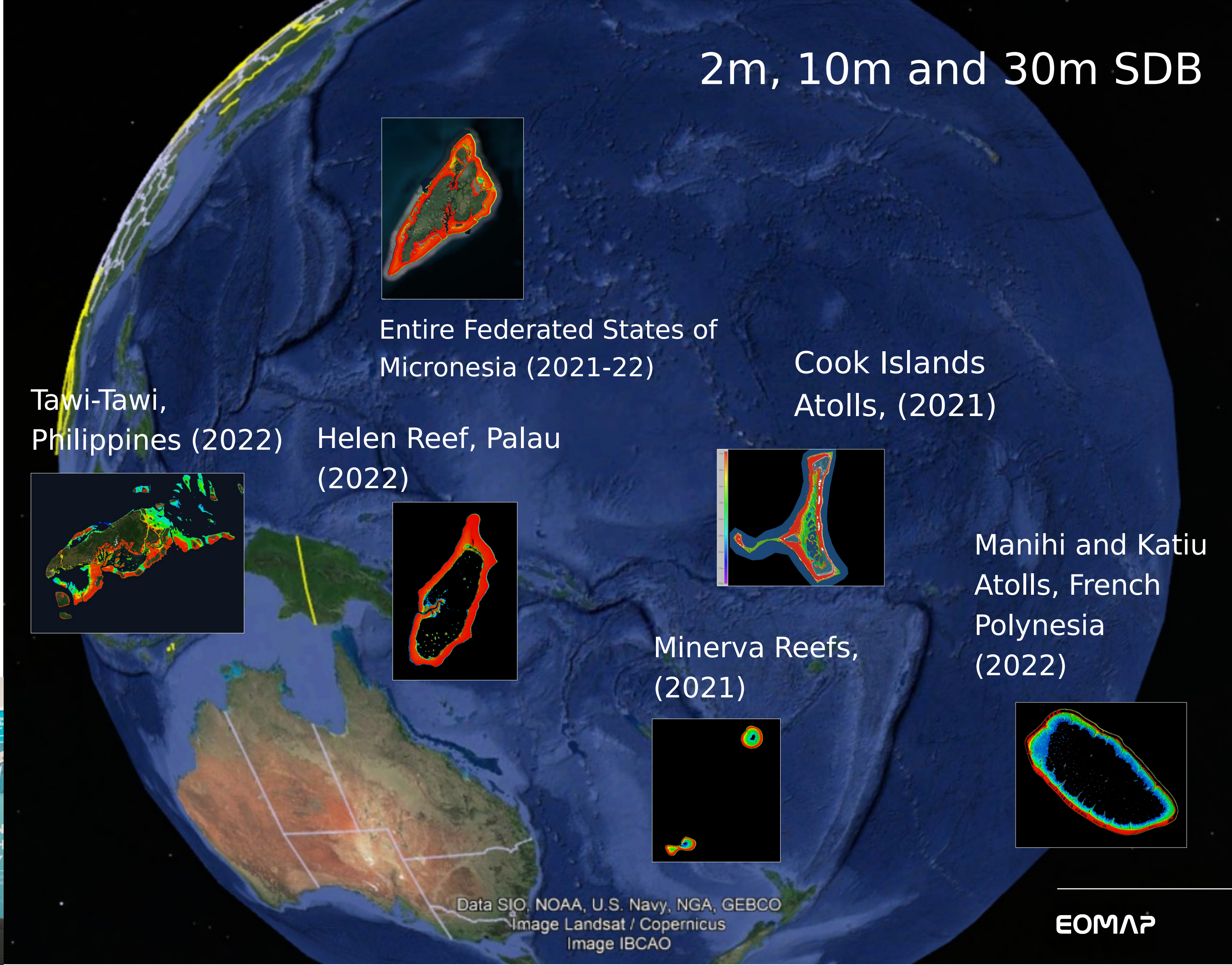
MAPPING THE GAPS

THE NIPPON FOUNDATION-GEBCO
SEABED 2030

NIWA
Taihoro Nukurangi

South and West Pacific Ocean Regional Centre

Land Information New Zealand
Toitū te whenua



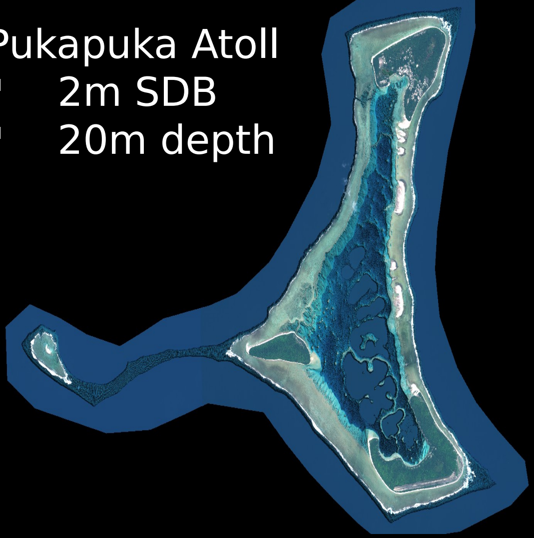
MAPPING THE GAPS

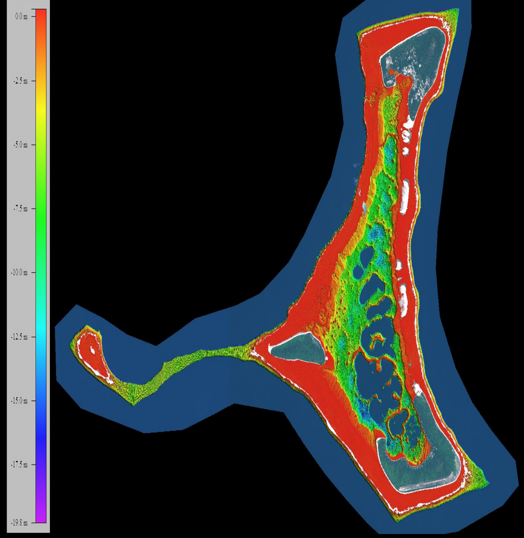
Seabed 2030 and Charting

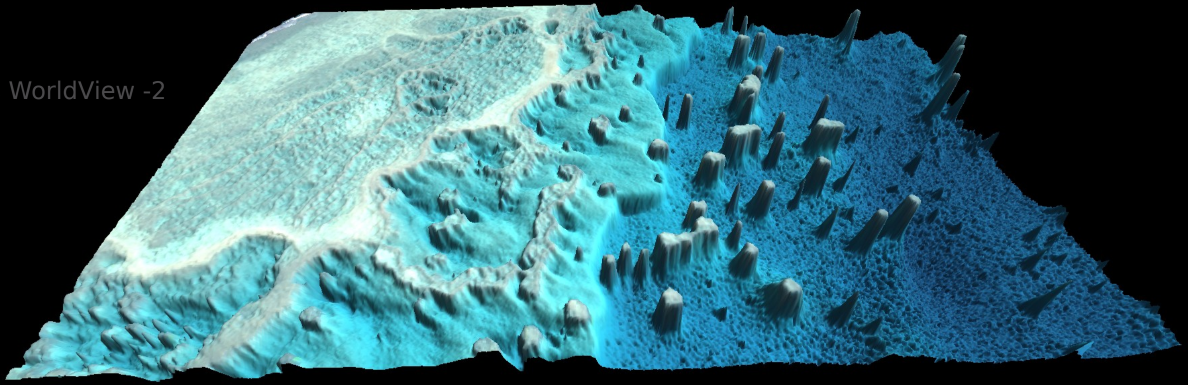
- 2018 - 6,500 km² (Tonga, Tokelau, Niue and Cook Islands) for the Pacific Regional Navigation Initiative (PRNI) via LINZ
- Sites not previously covered including 2 atolls, Pukapuka and Suwarrow
- 2m and 10m SDB, archived and tasked WorldView-2
- Very remote and at-risk reefs
- Etc...

Pukapuka Atoll

- 2m SDB
- 20m depth







Maxar's WorldView -2

NIWA Taihoro Nukurangi

Land Information New Zealand Toitū te whenua

THE NIPPON FOUNDATION-GEBCO SEABED 2030

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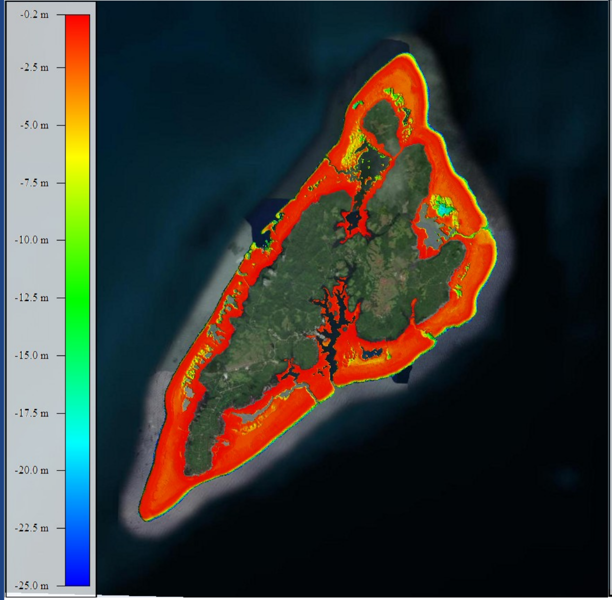
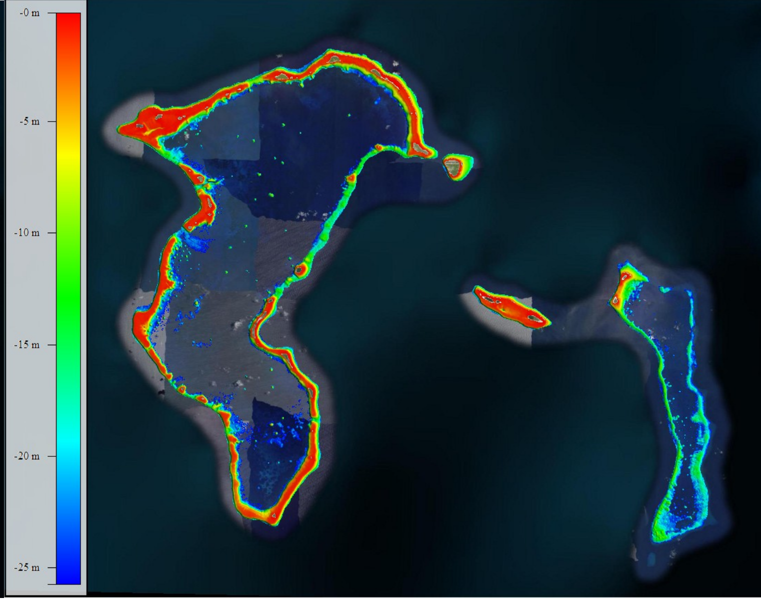
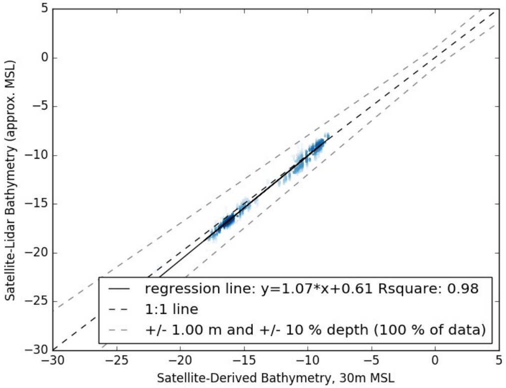
MAPPING THE GAPS

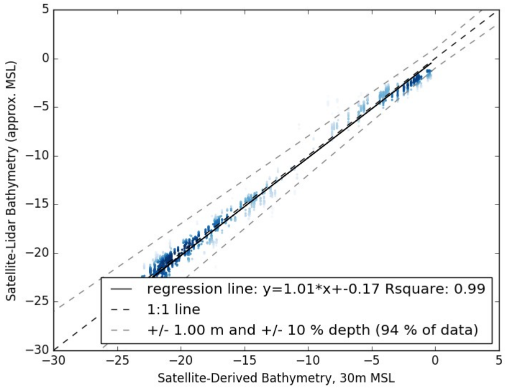
Federated States of Micronesia, Seabed 2030 (2021-22)

- Shallow waters down to a depth of ~25m (depending on clarity)
- ~7,500km²
- Sentinel-2 (10m) and Landsat-8 (30m) bathymetry grids depending on coverage
- Multiple images 2015-2021









THE NIPPON FOUNDATION-GEBCO SEABED 2030

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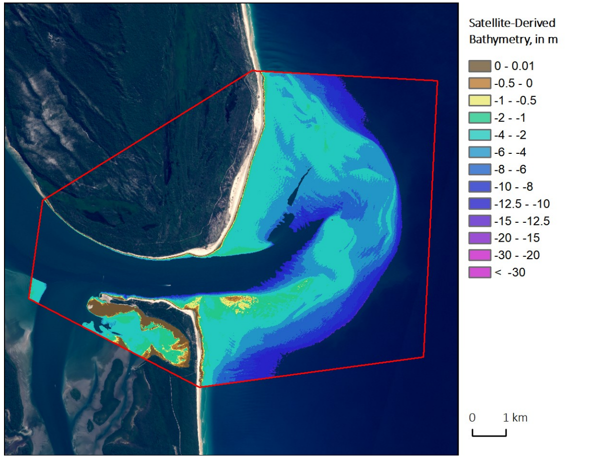
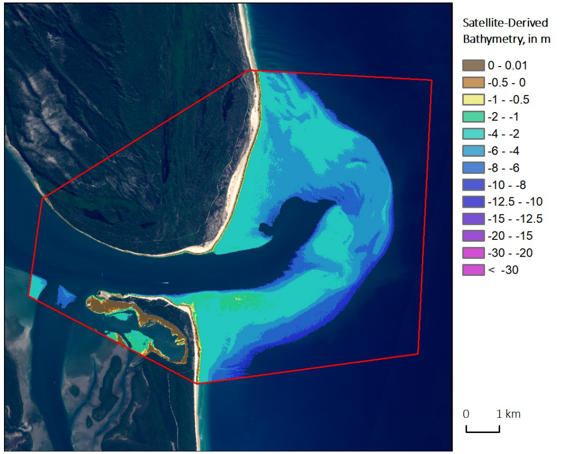
Monitoring Bathymetry for Navigation, WideBay Bar, QLD

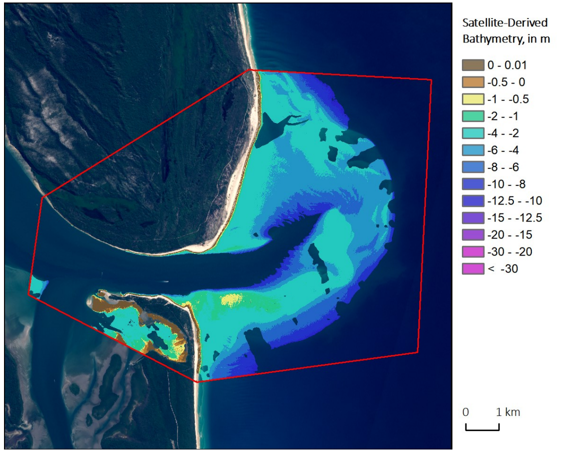


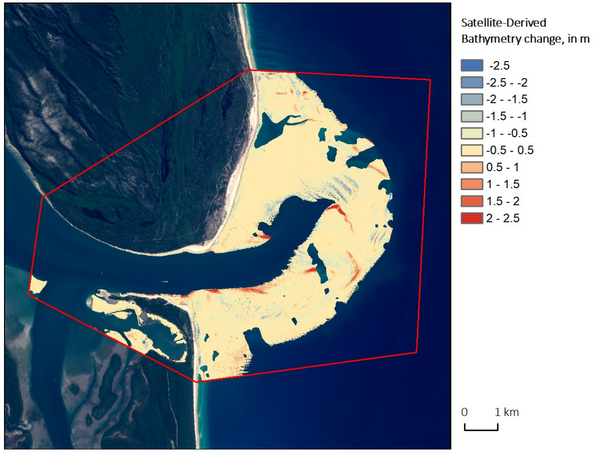


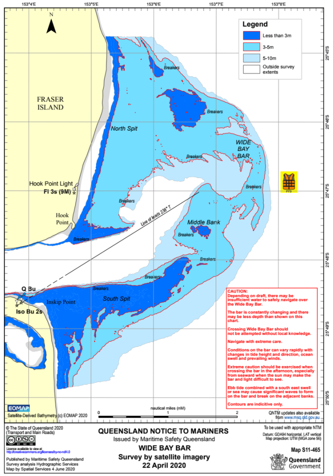
Commissioned by Marine Safety Queensland (State Government)

Cost effective and fast in rapidly changing environment

Renewed for 2 more years







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Monitoring Bathymetry for Coastal Resilience

COASTS

Coastal Change Observation Analytics
(multi-)Source (multi-)Technology System

Satellite data: bathymetry, shoreline change, turbidity

+

Drone Data: terrestrial topography

+

Hydrodynamic modelling

+

Web-based delivery system with fit-for-purpose analytics

=>

erosion, deposition, storm events, forecasting, planning

=>

Near-real time management, coastal hazards, coastal resilience, beach safety, inundation, climate change

SMARTSAT Cooperative Research Centre

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

USC AUSTRALIA

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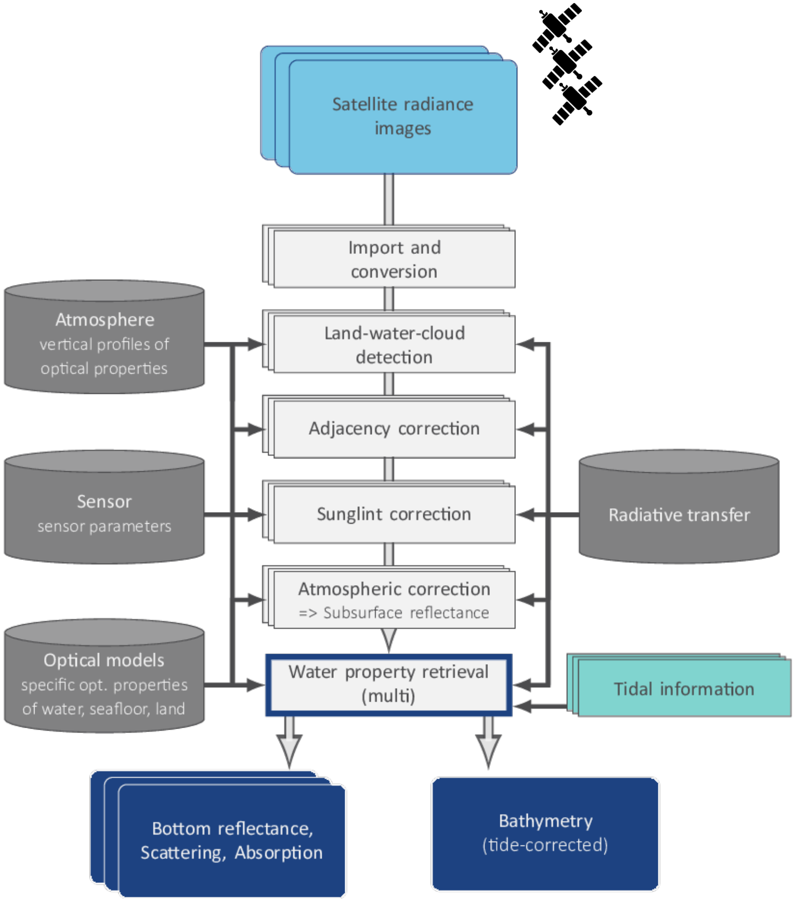
Physics-based multi-scene processing: SDB 2.0



Fully physics-based

pixel = *f(aerosol properties, adjacency, sunglitter, water surface, absorbers and backscatterers of the water column, full bidirectionality from sun and sensor geometry)*

pixel = *f(**depth**, absorbers and backscatterers of the water column, seafloor reflectivity, full bidirectionality from sun and sensor geometry)*

condition: depth $z_i = z$

US Patent 2017, No 9613422
Realization fundet by BMVI

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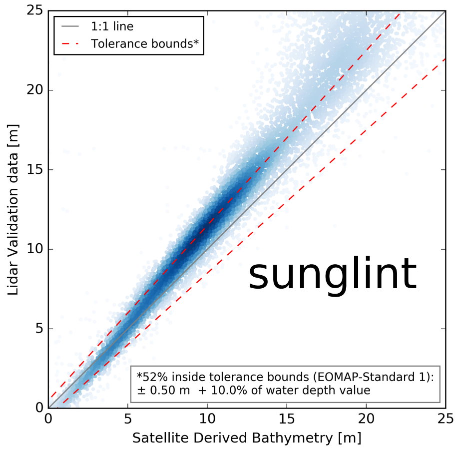
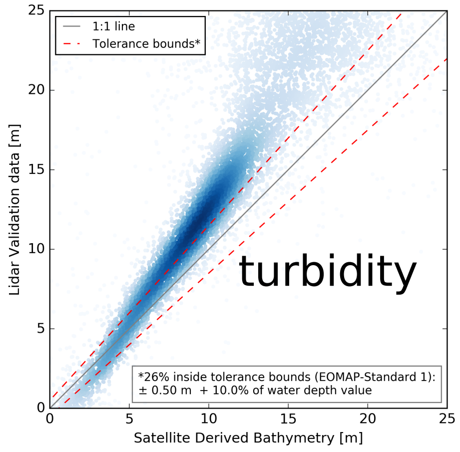
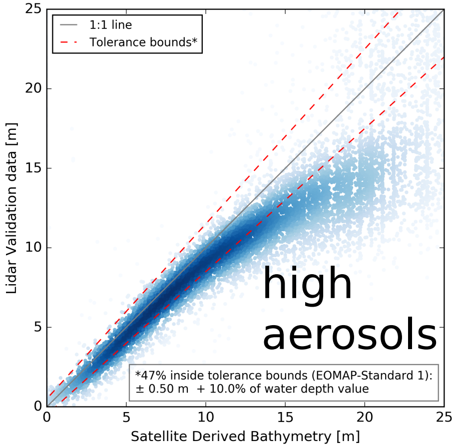
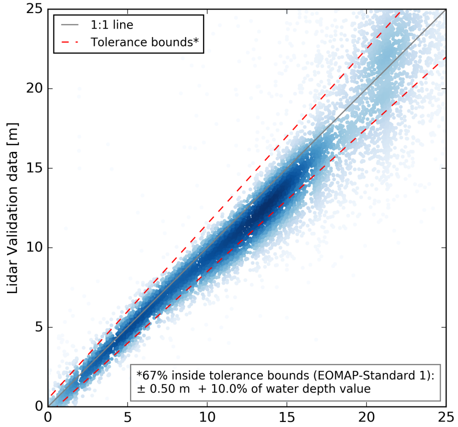
Physics-based multi-scene processing







- Absolute accuracy increases



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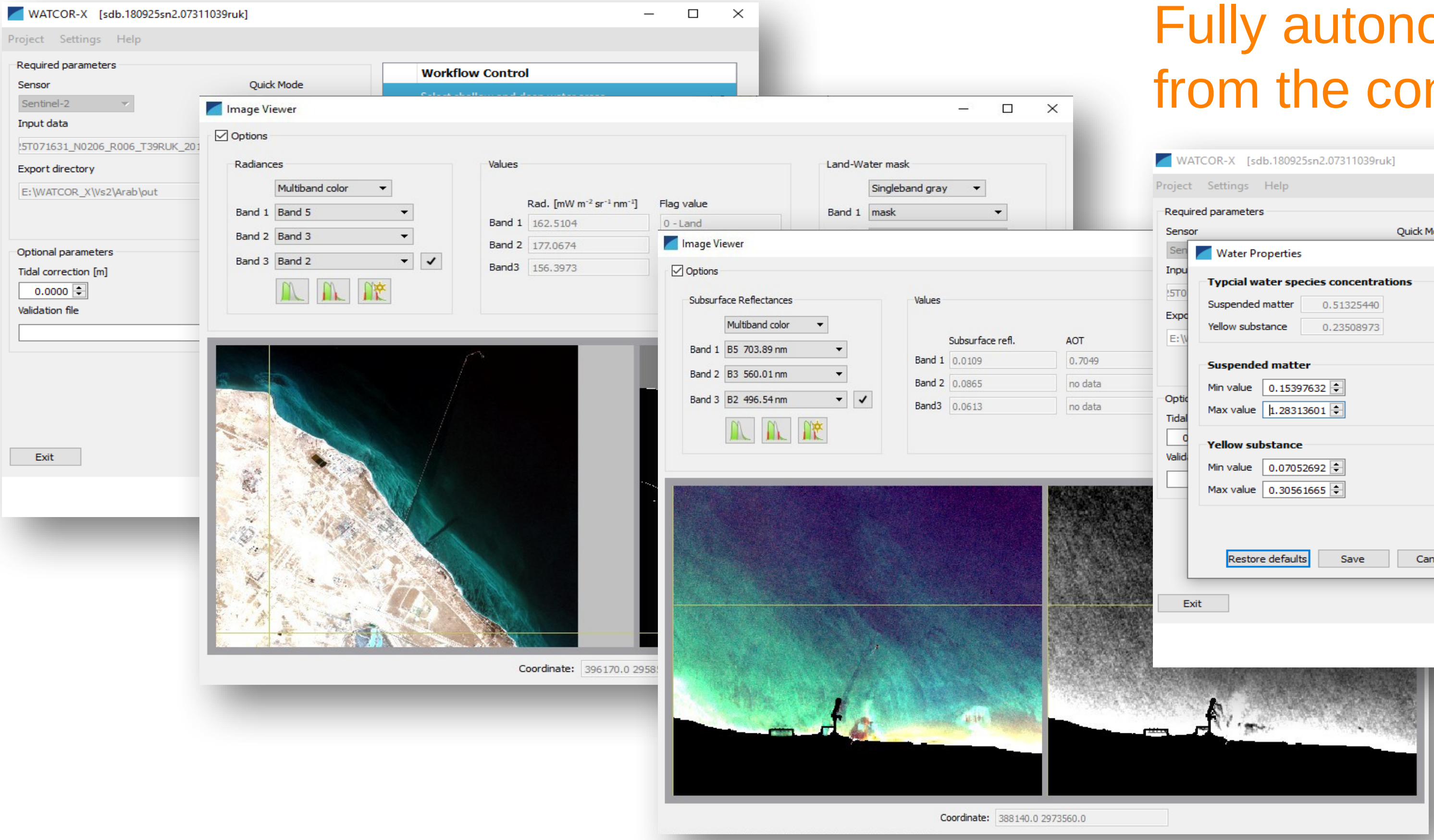
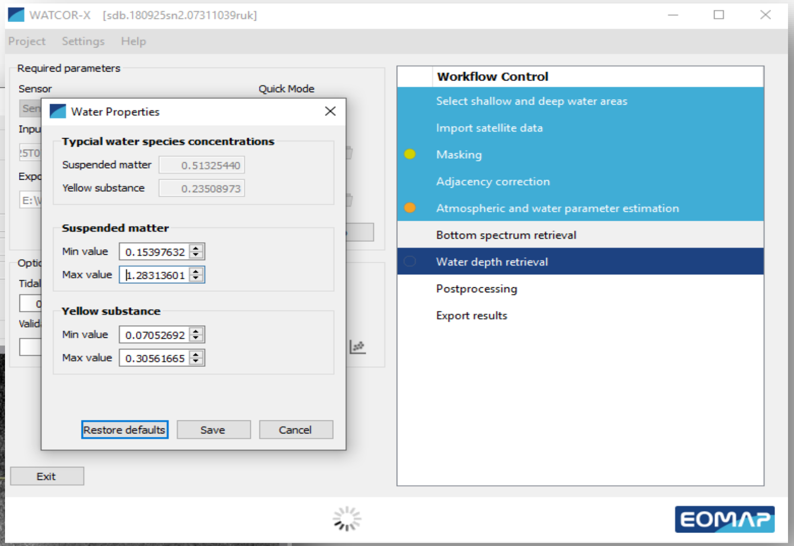
WATCOR-X: sophisticated, stand-alone SDB software



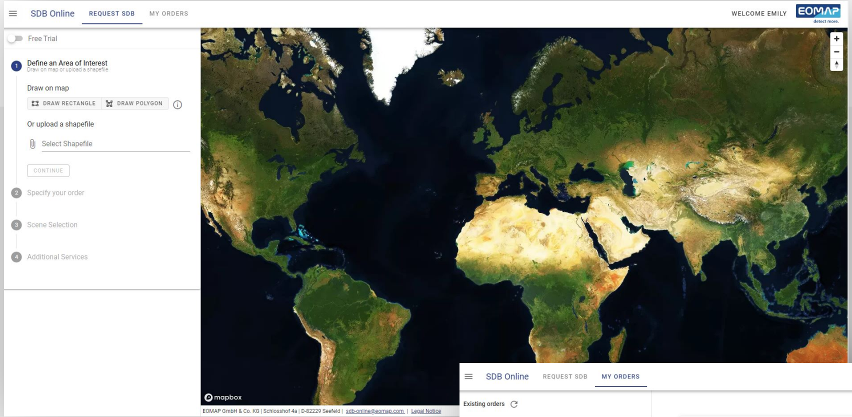
Fully autonomous SDB capability from the comfort of your desk



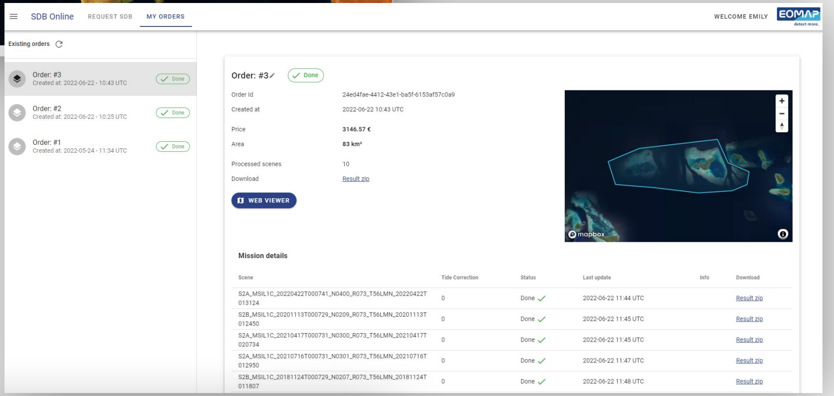
SDB SaaS:

SDB-ONLINE

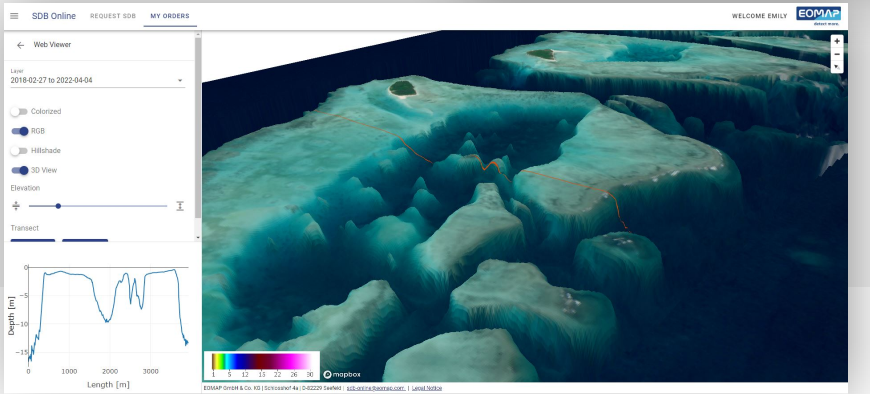
- **Powerful cloud backend**, fully **scalable**
- **Ultra easy to use**
- **Physics-based SDB** concept (radiative transfer inversion)
- **Coupled** with satellite archives (currently Sentinel-2)
- **Automatic** mode (image selection, full processing workflow)
- **Cailbration/validation:** optional fine tuning with own survey data
- **Multi-image** mode (US patent)
- **Webapp** user interface, any browser
- **Pay-per-use**
- Machine-to-machine (**API**)



Define your site



Download data



Visualise data online

EOMAP detect more.

SDB Capacity Building

4th International SDB Day (October 2022)

2 day conference

SDB training at EOMAP HQ

- Image selection and pre-processing
- Creating SDB
- Post-processing and quality control
- Handling and interpreting SDB data
- SDB software and GIS, etc.

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SDB Best Practice Project Team (SDBPT) - IHO

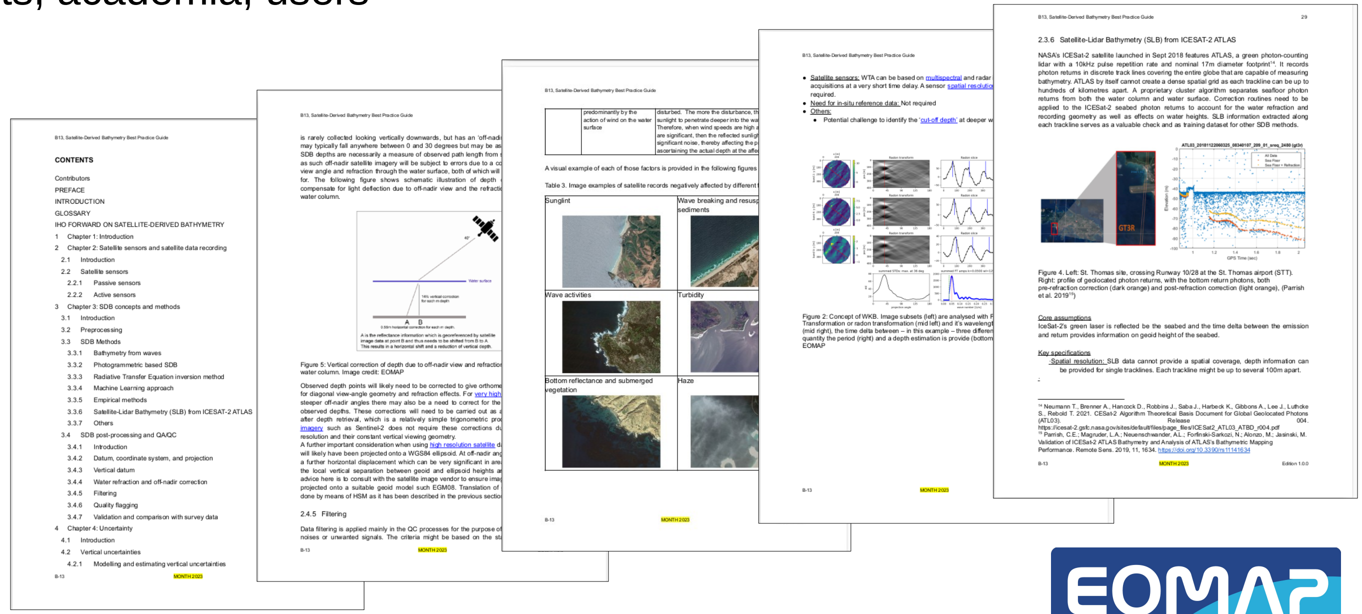
SDBPT is a supporting body of IHO HSWG (Hydrographic Surveys Working Group)

Commenced in April 2021, chaired by EOMAP

40+ members: member states, experts, academia, users

SDB Standards and Best Practice

Proposed as a ‘B-13’ document to HSSC (Hydrographic Services and Standards)



SDB Topics Summary

Selected highlights

SDB across the Pacific - continues with Seabed2030 et al
Monitoring bathymetry - hydrographic data with temporal dimension: navigation, coastal resilience

Technology developments

Multi-image parallel processing - accuracy and autonomy
SDB Online – SaaS and AWS power

Capacity Building, Standards and Best Practice

SDB Training – all welcome
IHO SDB Working Group – document in progress

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Thank you

wettle@eomap.com
www.eomap.com