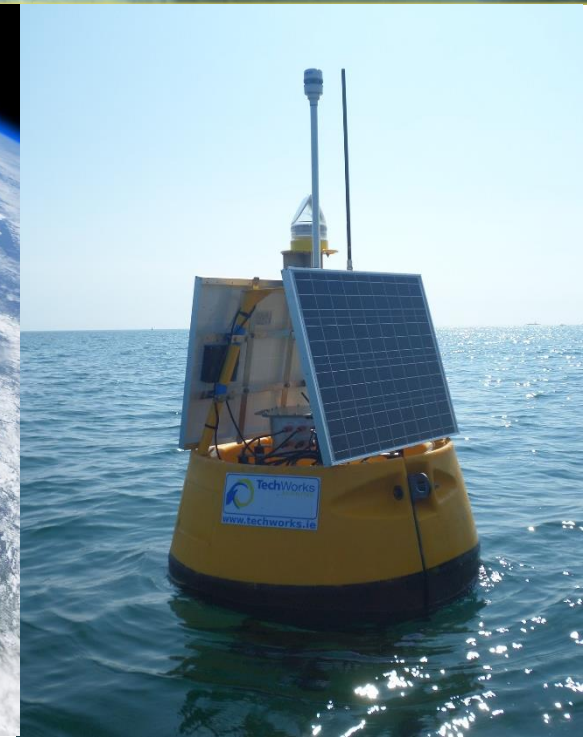


CoastVal

Ocean Colour Validation in Coastal and Inland Waters

Jenny Hanafin
TechWorks Marine
Dublin, Ireland

February 22nd 2017
Vicarious Calibration Meeting
ESA-ESRIN, Frascati, Italy



Outline

- Company introduction
- CoastVal Phase 1
- CoastVal Phase 2
- Issues for consideration
- Outlook



End-to-end Metocean data provision



**Integrated Data
Buoys**



**Data Management
and Delivery**



**Value-added Products &
Services**

Integrated Metocean Data Buoys

- Meteorological: wind speed/direction, pressure, temperature
- Oceanographic: chlorophyll, dissolved O₂, currents, spectral wave, temperature
- TechWorks Marine Black Box (TMBB)
 - Logging, analysis and two-way data transmission
 - Developed in-house



CODAS Network - Sweden

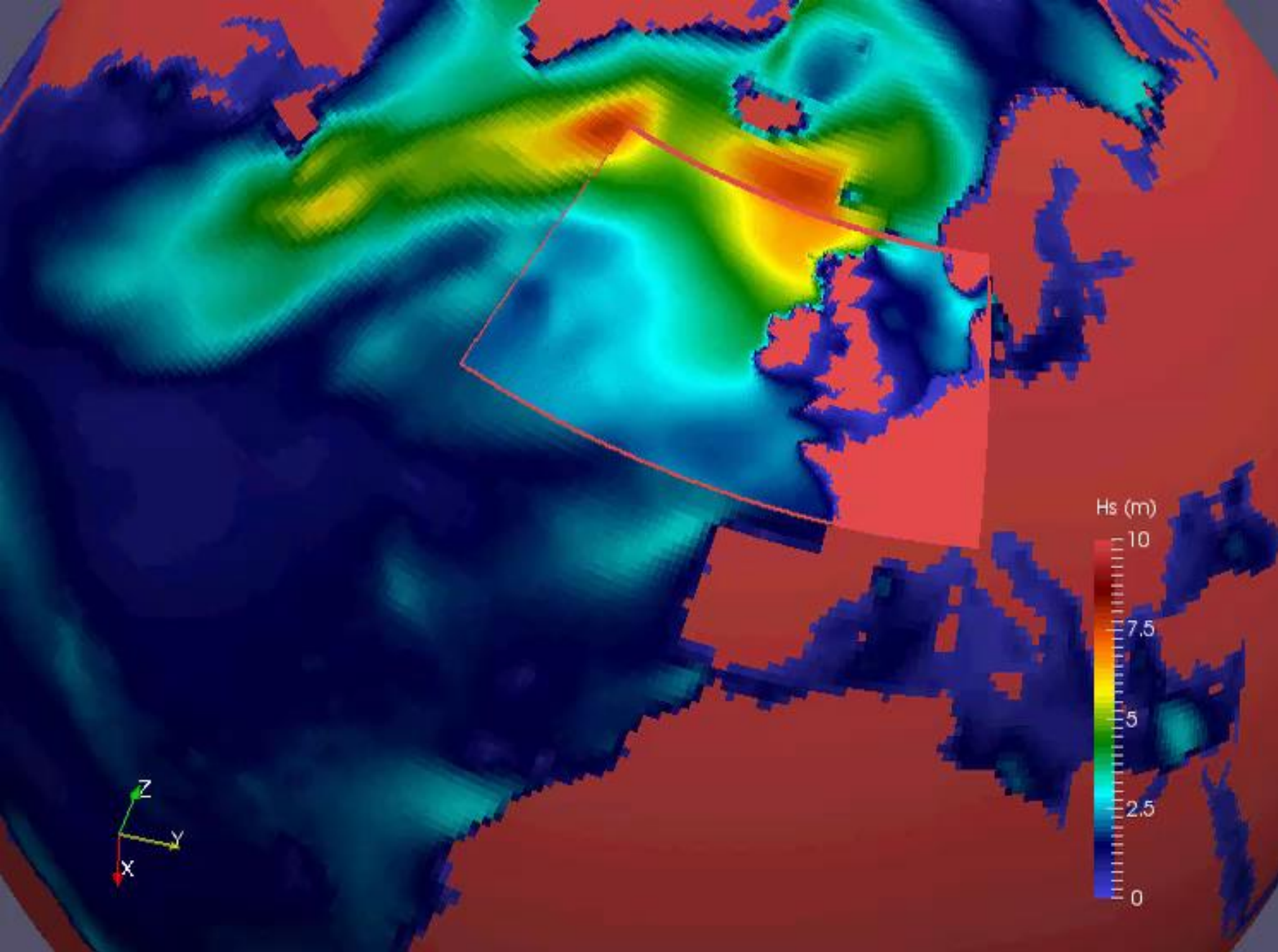
- Delivered an initial 8 integrated data buoys 2013-14.
 - Project running until 2021
 - State of the art in terms of sensors, data acquisition and telemetry
 - TechWorks Marine providing live two way data portal (CoastEye) to SMHI (Swedish Meteorological and Hydrographic Office).



Subsea deployments

- Acoustic Deployments:
 - Cetacean monitoring
 - Noise characterisation and monitoring
- ADCP
 - Wave
 - Currents
 - Turbulence
- Underwater Video
 - CARIBSAVE - Jamaica
 - ROV activities





Numerical wave modelling

- Assimilation of altimeter wave heights for 20 year wave climatology
- Running on Irish Centre for High-End Computing parallel system

Ocean Energy Resource Assessment



- Member of IEC Marine Energy TC114
 - Resource assessment: wave and tidal energy
 - Noise characterisation
- Numerous site resource assessment projects:
 - Raz de Blanchard
 - Torr Head
 - Wave and tidal device test site monitoring

CoastEye Data Platform

Data Portal:

- Data acquisition, processing & management system
- Sensor configuration management & control
- Automated real time data delivery or archive access

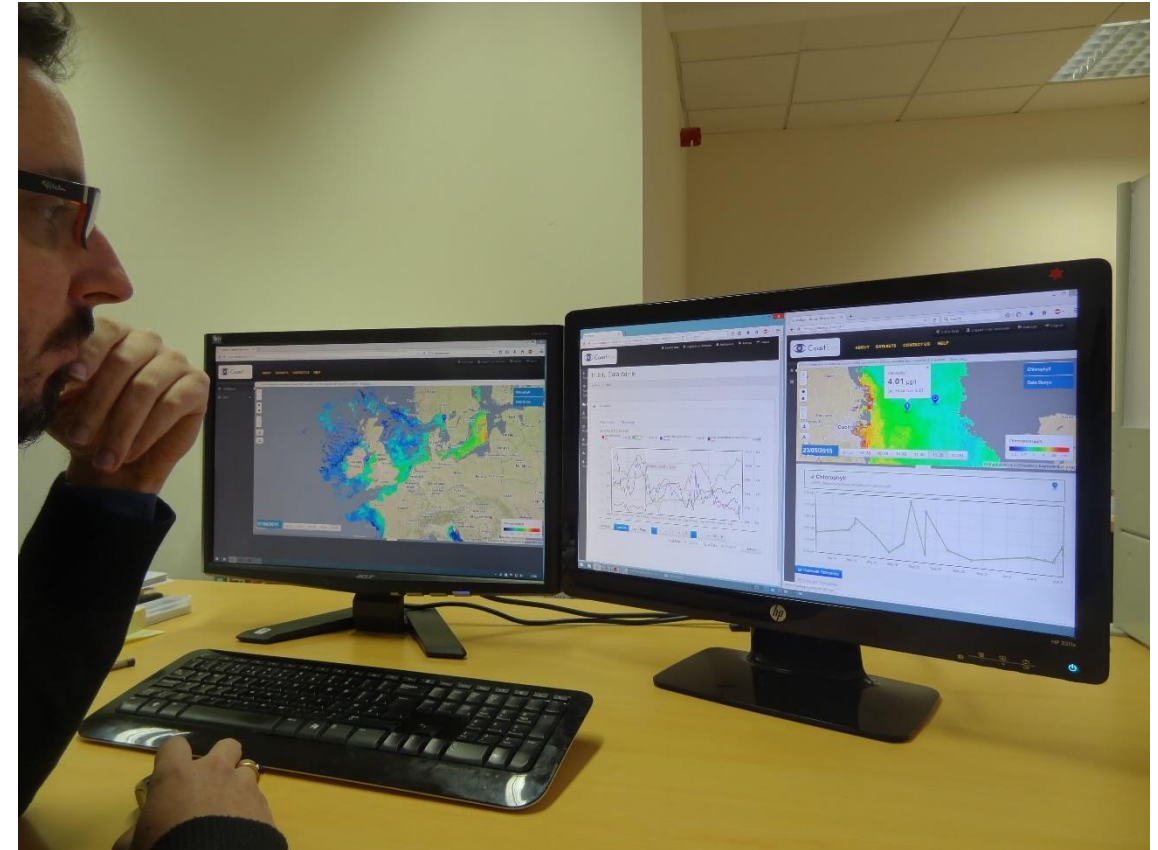
Web-based or stand-alone

Multi-modal data:

- In situ timeseries, ADCP profiles, etc
- Satellite data
- Model data
- User data upload possible

Features:

- Flexible
- Scalable
- Secure



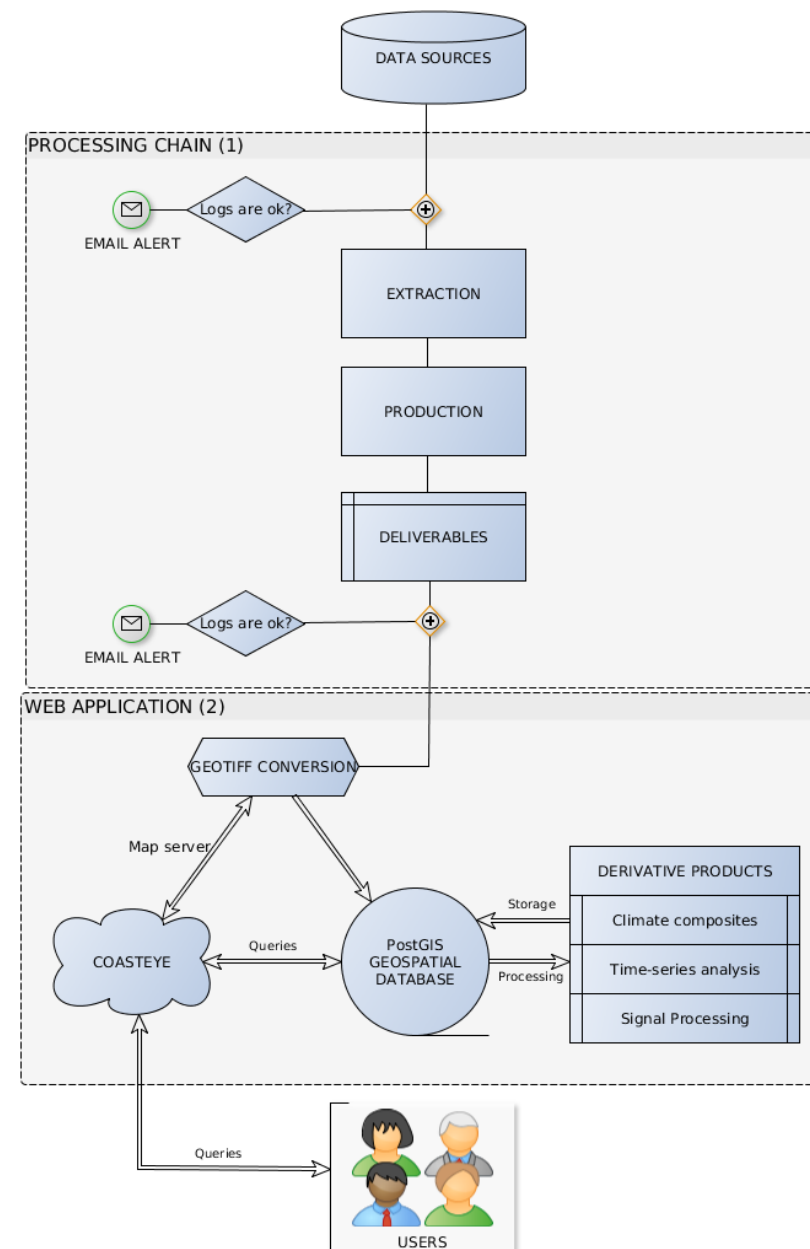
CoastEye System

Server Infrastructure

- Spatial Database – stores raster and vector data
- Spatial API – interface to the spatial database
- Processing scripts and chain management
- Map file storage for raster and vector layers
- Map Server – serves maps to web application users.

Web application

- Spatial module for satellite/model datasets
- In-situ module: data acquisition and platform management & monitoring.
- Core services: user management, access control and configuration.
- Database for visualisation



CoastEye satellite data applications

- Automatic update of realtime data
 - VIIRS
- Access to archives
 - Landsat thermal plumes
 - Sentinel 2 data
- Processing of satellite datasets
 - MERIS monthly means
- GIS features:
 - Timeseries
 - Spatial statistics



Satellite-derived Bathymetry

- SFI Industry Postdoctoral Fellowship 2014-2016
- Maynooth University, GSI & TechWorks Marine
- Using spatially driven statistics to improve satellite bathymetry accuracy
- Article in Hydro International January 2017



Surveying in all waters

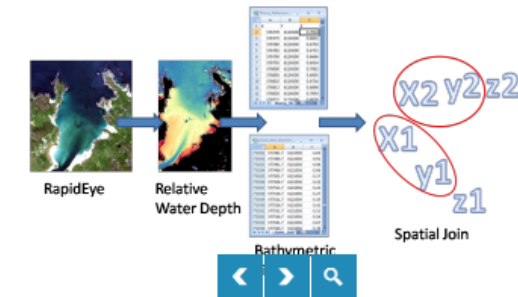


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Article

Improving Satellite-derived Bathymetry - 21/12/2016

Using Spatial Regression Algorithms



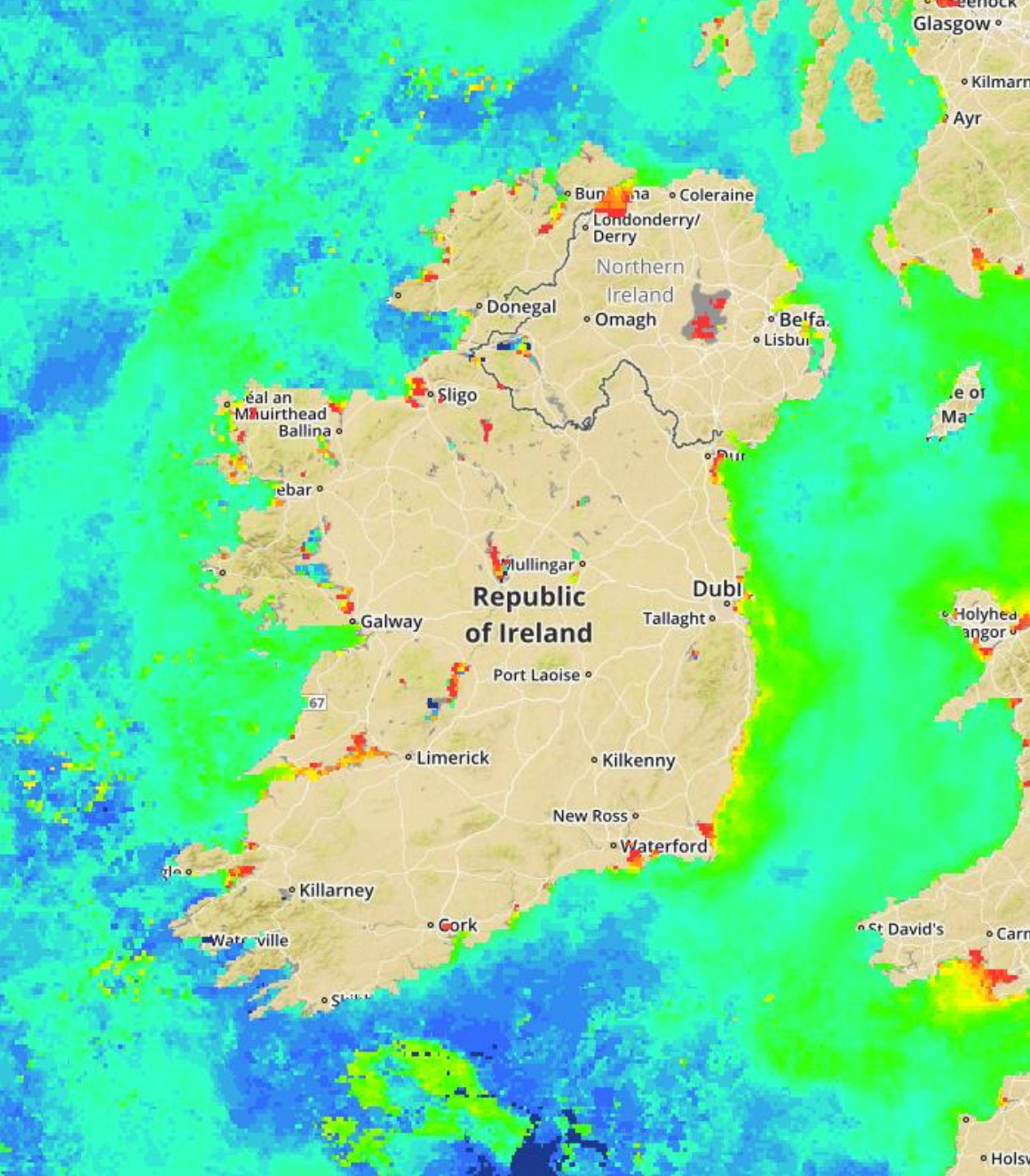
Bathymetry is traditionally acquired using singlebeam or multibeam echosounders. This method produces accurate depth measurements along transects but is constrained by operating cost and an inability to survey in very shallow waters. Airborne Lidar is able to produce accurate bathymetric information over clear waters at depths up to 70m, but can be costly and is limited by a relatively coarse bathymetric sampling interval. Experience in Irish waters has

resulted in very poor seabed detection along the east coast and limited penetration on the west coast. An efficient and cost-effective alternative is satellite-derived bathymetry.

By Conor Cahalane National Centre for Geocomputation; Maynooth University, Jenny Hanafin, Techworks Marine and Xavier Monteys, Geological Survey of Ireland, Ireland.

Calculating Depths by Satellite

Satellite Derived Bathymetry (SDB), which has been used since the 1970s, can be implemented through either analytical or empirical methods. Empirical methods explore the statistical relationships between image pixel values and field measured water depths. Analytical approaches rely on the general principle that sea water transmittances at near-visible wavelengths are functions of a general optical equation dependent on the intrinsic optical properties of sea water. A number of external factors affect the accuracy of the depth



Coastal Water Attribute Monitoring from Space

- 2 year ESA-funded project
- Aim: develop water quality products from satellite data for commercial and public agency users
- Waste water treatment plants: Veolia
- Desalination plants: UAE EPA
- Water quality monitoring: Irish EPA

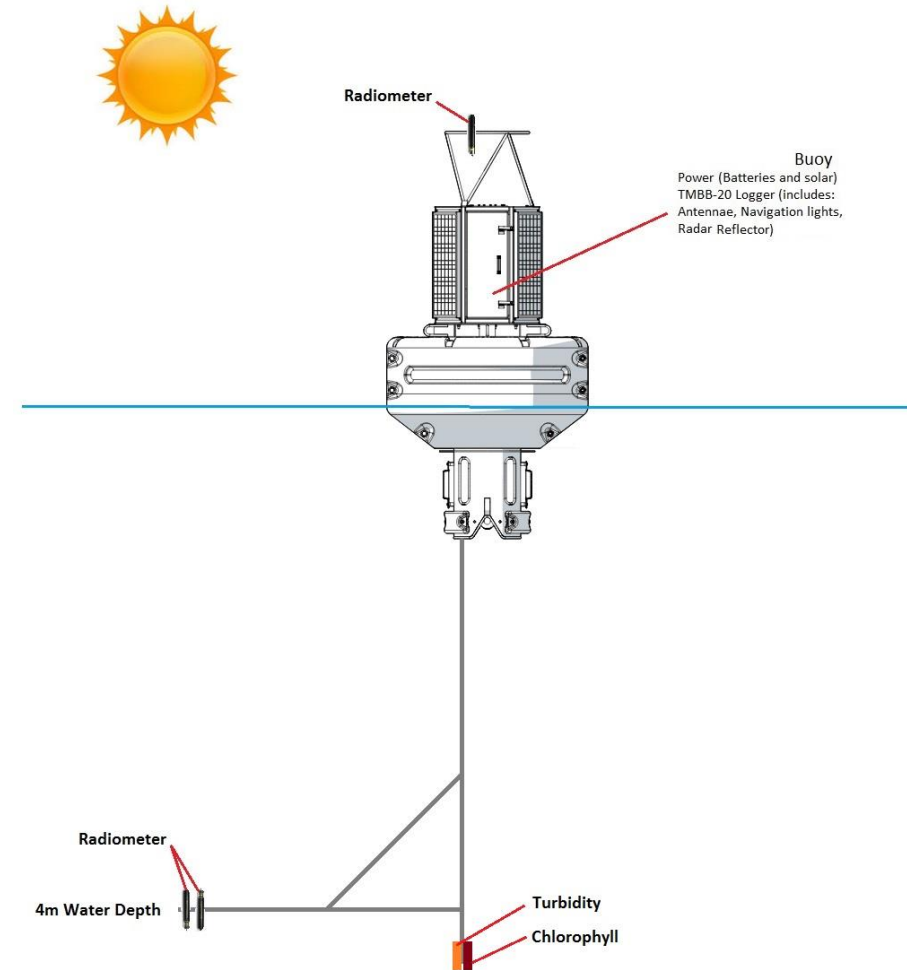
CoastVal project

- 2 year ESA-funded project
- Part of Sentinel 3 Validation Team activities
- Started September 2016
- Aim: develop a dedicated coastal colour observation platform for validation studies
- Potential to establish long-term coast colour observatory infrastructure

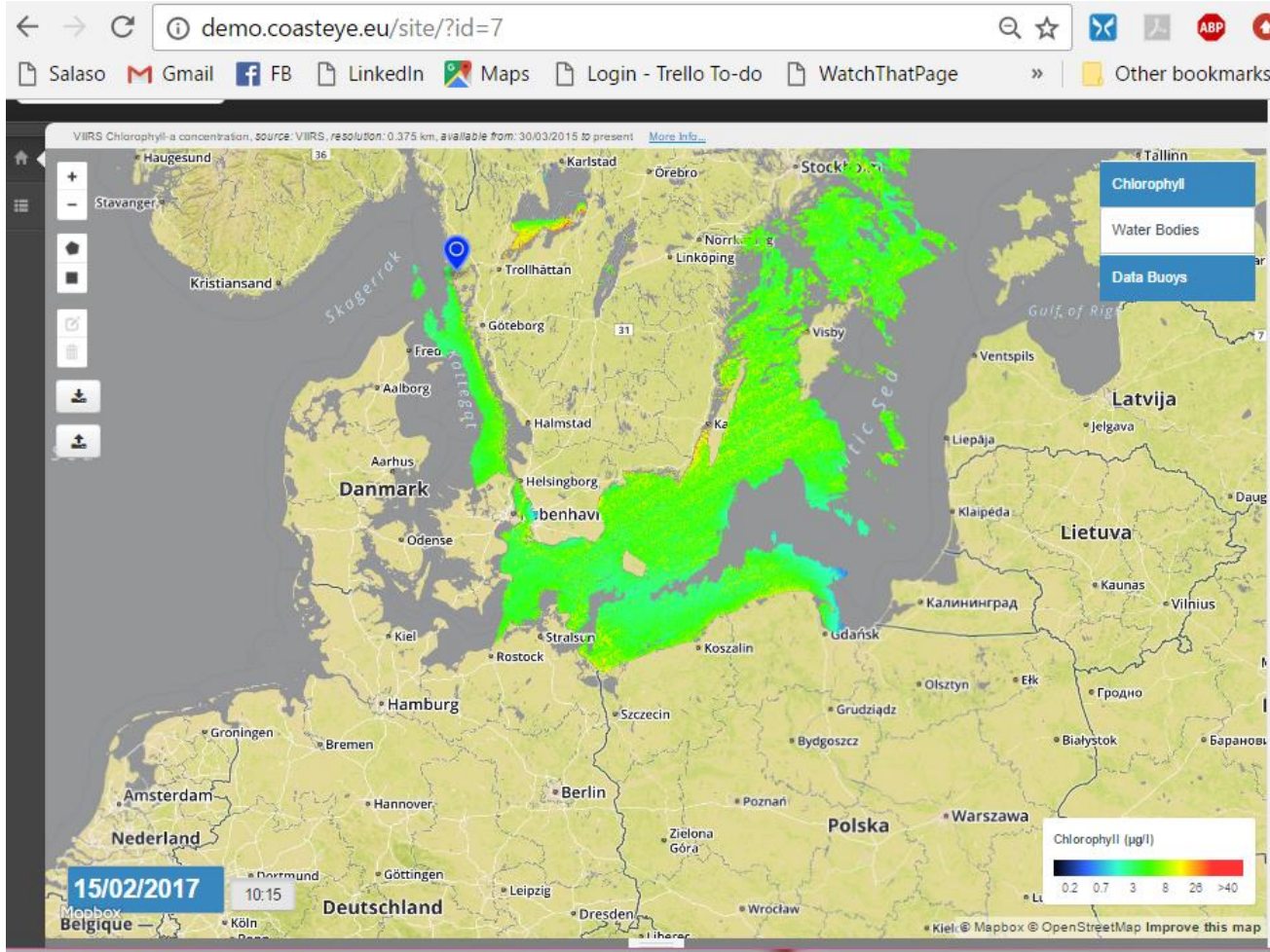


CoastVal activities – Phase 1

- Developing and testing a buoy platform for coastal colour observation
 - Review of existing systems & protocols
 - Sensor suite
 - Engineering solutions
 - Integration of sensors and data to TWM systems
 - Test deployment
- Developing in situ data processing platform



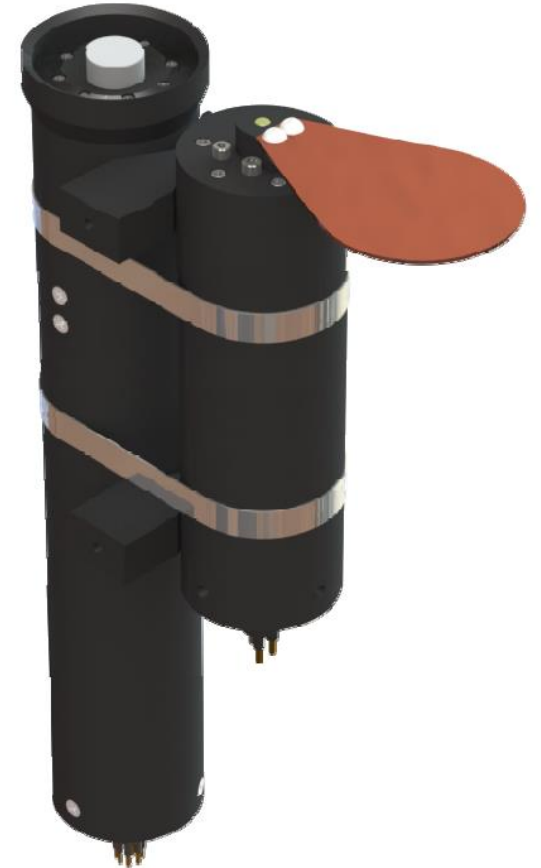
CoastVal activities – Phase 2

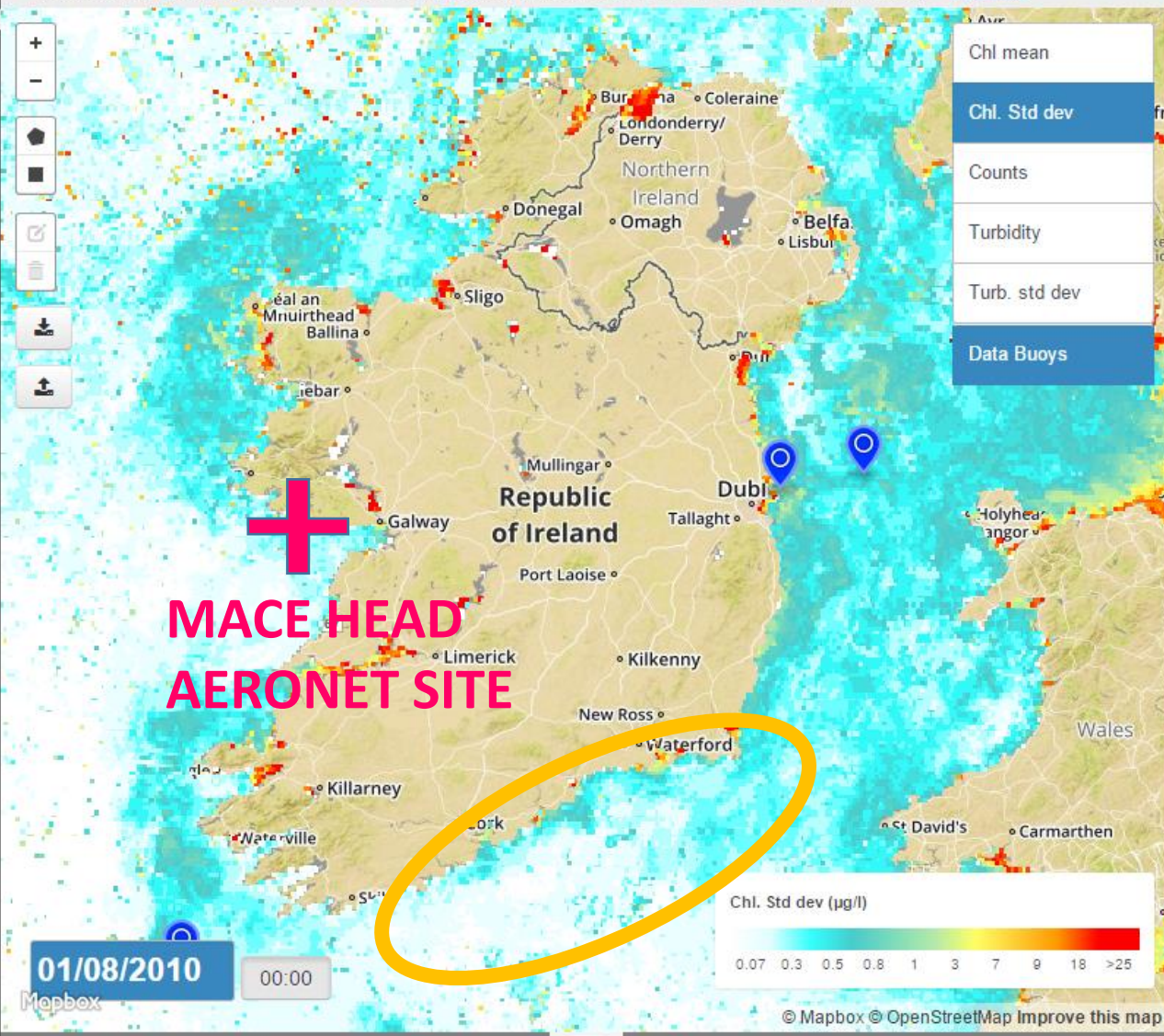


- Deploying buoy platform for coastal colour observation
 - Site selection
 - Data collection
- Developing satellite data processing platform
 - Automated download, extraction and processing
 - Satellite - in situ match-up generation
- Validation study

Issues for consideration – observations

- Initial focus on water-leaving reflectances
- Hyperspectral radiance
 - Satlantic HOCR (agents)
- Bio-fouling
 - bioshutter II
- Stability of platform
- Sun-glint
- Shadowing
- Ground 'truth'
 - Ongoing FRM4SOC intercalibration activities
 - FRM4SOC meeting next week



Monthly means of MERIS Chlorophyll-a concentration, source: Envisat, resolution: 300 m, available from: 01/05/2005 to 01/07/2005 [More Info...](#)

Issues for consideration – site selection

- Cloud cover
- Subpixel spatial variability
 - Ocean
 - Atmosphere
- Water depth
- Sea states

Outlook

- Investigating prospects for continued deployment of CoastVal beyond 2018
- Develop validation proposals around buoy deployment
- Looking for post-doc (industrial placement) to work on CoastVal project and data, starting mid-2017.

TechWorks Marine: a potential partner

- In situ deployments are our core business
- Quality observations are key
- In-house expertise in sensor integration
- In-house technology for data acquisition and transmission systems
- In-house system for data management and access
- Developing expertise with ocean colour measurement through CoastVal

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