IMARDIS - A Marine Data Infrastructure Serving the Needs of the Welsh Marine Sector

David Mills (Director IMARDIS) d.mills@bangor.ac.uk

Michael Roberts, Cathy Blakey, Guy Walker-Springett, Gwyn Roberts, Sudha Balaguru, Martin Austin, Vahid Seydi

Centre for Applied Marine Science
Marine Centre Wales
Bangor University, UK

Overview

- SEACAMS EU funded collaborative research focused on Welsh marine renewable sector
- IMARDIS – concept, implementation and current status
- Smart Efficient Energy Centre (SEEC) Cyberinfrastructure
  - Data science platform
- New products and services
- Summary and next steps

SEACAMS – Industry Led Collaborative Research

- Goal to drive Blue Growth in the Welsh maritime sector
- Collaborative industry led research at its core
- 88 collaborative projects with 42 commercial bodies
- Research and data of direct and demonstrable benefit to sector

SEACAMS (2010-2015), SEACAMS2 (2016-2022)

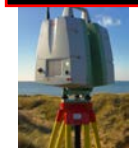
IMARDIS – from data to decision

Data

Intertidal

Spatial offshore survey

Moorings








Data transmission

Delayed mode

Delayed mode

Real-time

Real-time

Data upload interface

Data management

NRW

Crown Estate

BODC

IMARDIS

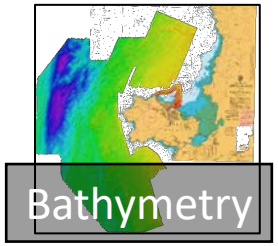
EMODnet

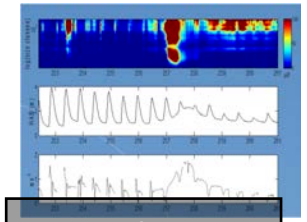
Copernicus

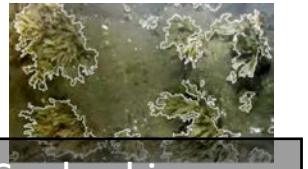
Model results

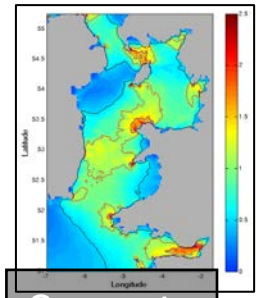
Analytics and visualisation

Information


Bathymetry


Particle size


Seabed image


Currents

User Query

Application

Strategic planning (MSP, strategic env assessment, sectoral planning

Site selection & optimisation

Leasing and licensing (EIA & HRA)

Detailed design (operations)

Compliance (monitoring & management

Development phase

Decision taker

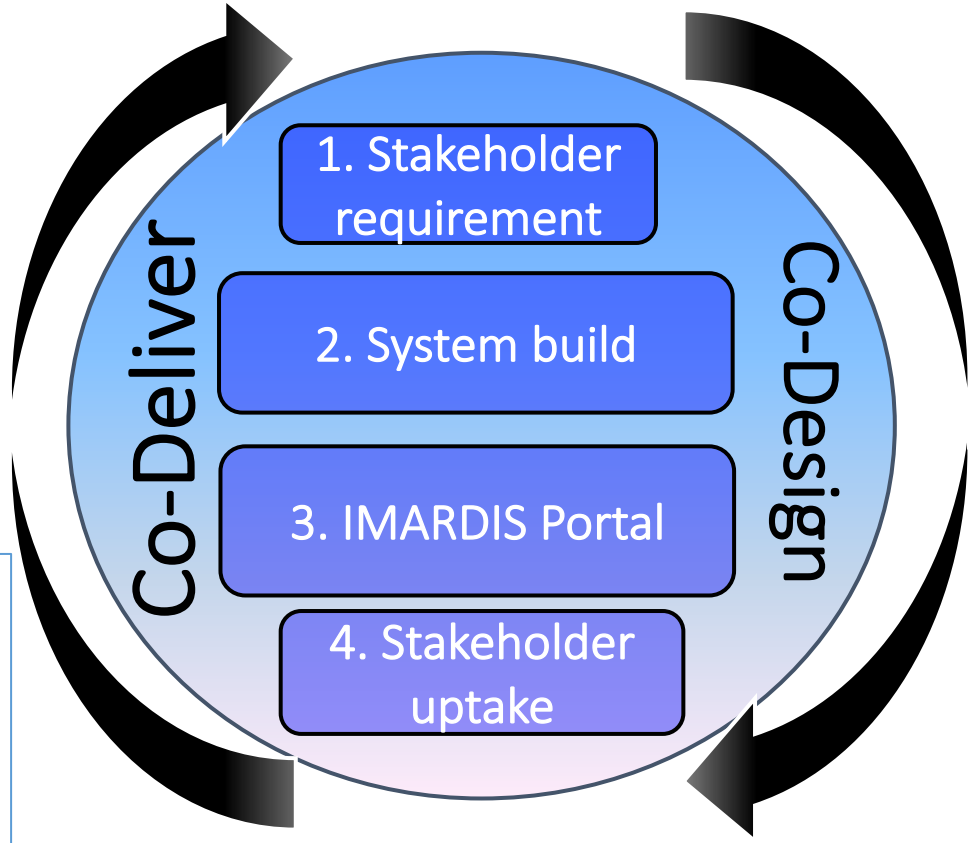
Decision

ACTION

IMARDIS – Stakeholder Driven Design and Stakeholder Uptake

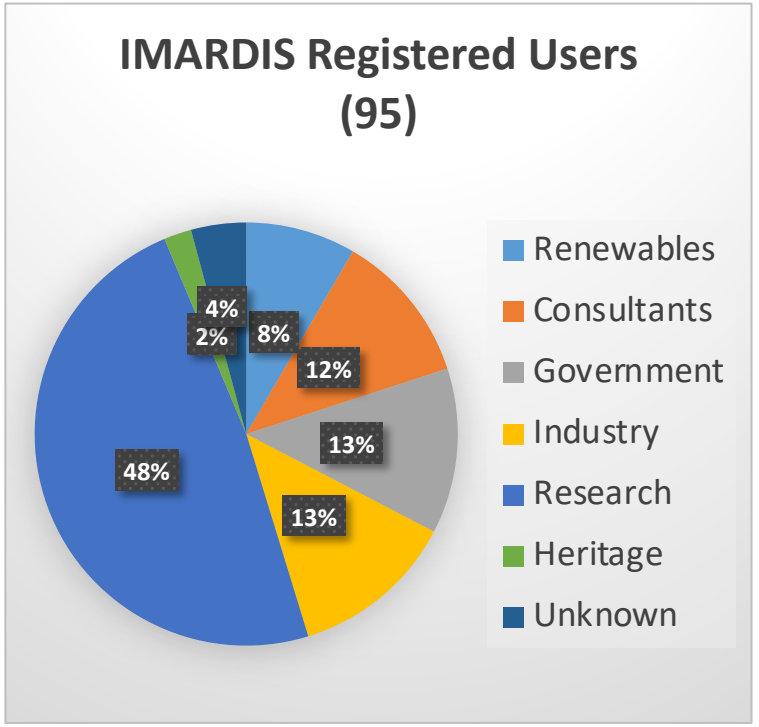
Stakeholder requirements

imardis.org/workshop2018/index.html



Users preferred: “a functionally powerful portal that was used by many rather than a simple portal and bespoke products used by the few”

Stakeholder uptake



IMARDIS - Integrated Marine Data and Information System

Metadata Manager

Metadata Catalogue

Cloud Data Storage Services

Raw file store

Model output store

AV store

Parameter store

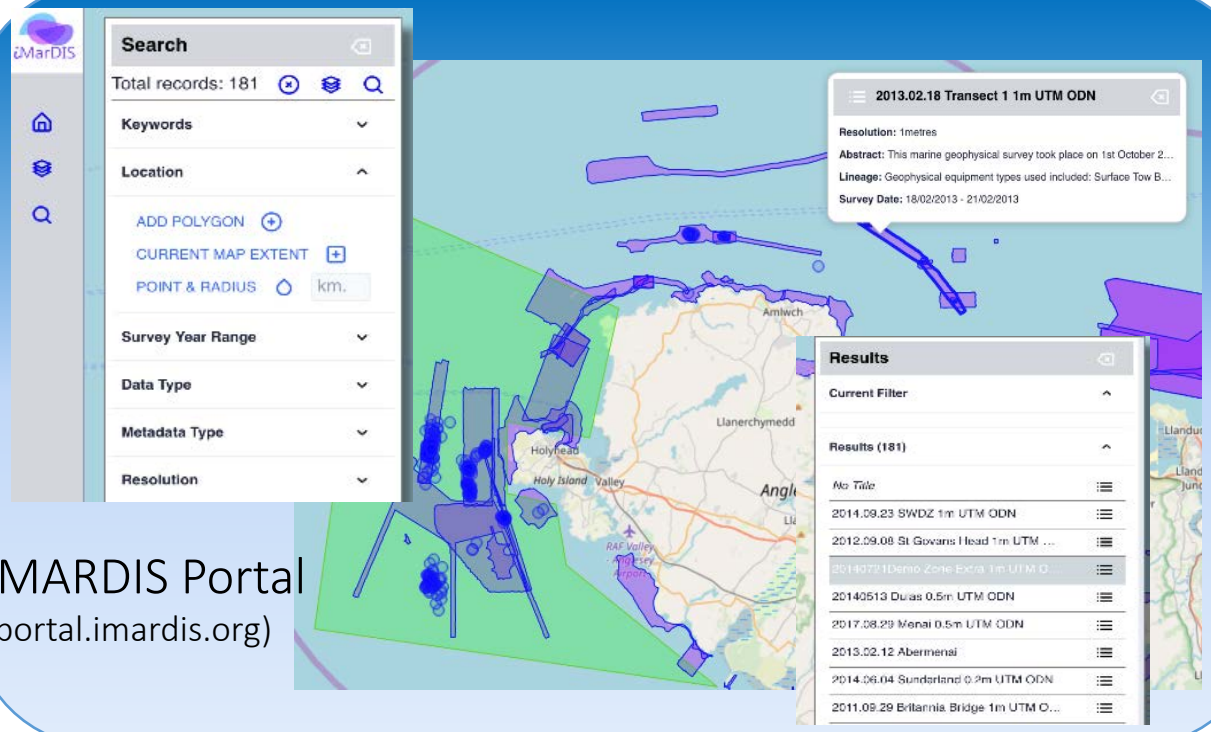
Point cloud store

SEACAMS Observatory

IMARDIS data streams

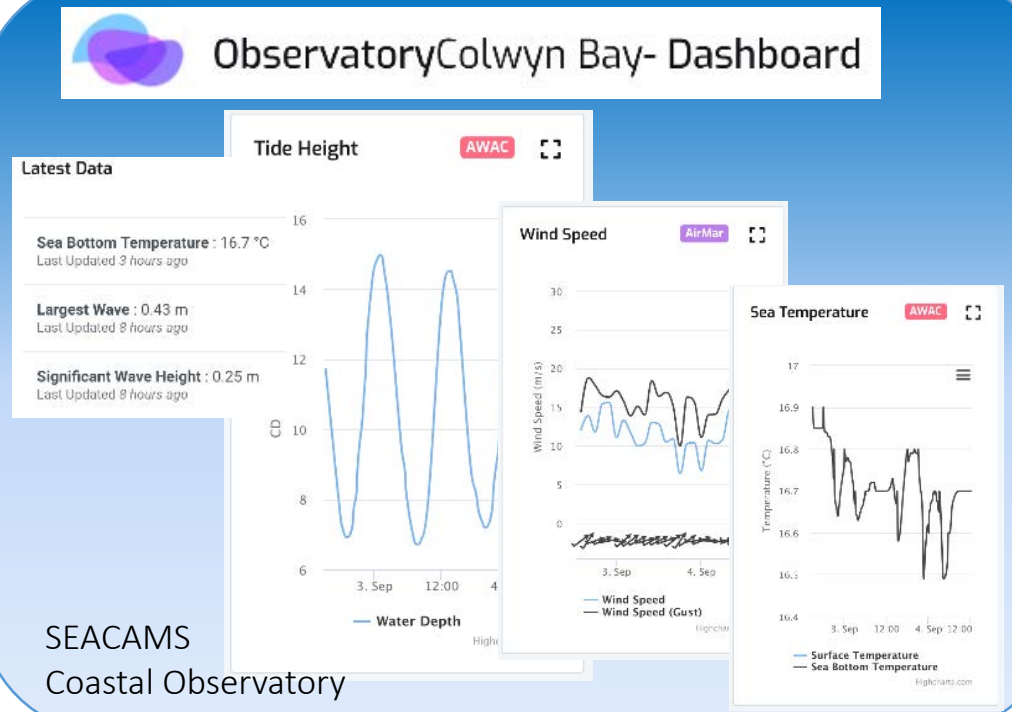
iMarDIS API (Applications Programming Interface)

Data Discovery and Download Service



IMARDIS Portal
(portal.imardis.org)

Data streaming & web publishing



SEACAMS
Coastal Observatory

IMARDIS Portal

SEACAMS

iMarDIS

Search

Total records: 181

- Keywords
- Location
  - ADD POLYGON
  - CURRENT MAP EXTENT
  - POINT & RADIUS km.
- Survey Year Range
- Data Type
- Metadata Type
- Resolution

2013.02.18 Transect 1 1m UTM ODN

Resolution: 1metres

Abstract: This marine geophysical survey took place on 1st October 2…

Lineage: Geophysical equipment types used included: Surface Tow B…

Survey Date: 18/02/2013 - 21/02/2013

Portal.imardis.org

Results

Current Filter

Results (181)

- *No Title*
- 2014.09.23 SWDZ 1m UTM ODN
- 2012.09.08 St Govans Head 1m UTM …
- 20140721Demo Zone Extra 1m UTM O…
- 20140513 Dulas 0.5m UTM ODN
- 2017.08.29 Menai 0.5m UTM ODN
- 2013.02.12 Abermenai
- 2014.06.04 Sunderland 0.2m UTM ODN
- 2011.09.29 Britannia Bridge 1m UTM O…

Amlwch
Llanerchymedd
Holyhead
Holy Island
Valley
Anglesey
Llangefni
RAF Valley - Anglesey Airport
Caernarfon

PRIFYSGOL BANGOR UNIVERSITY

Location of seabed bathymetry surveys

SEEC- Smart Efficient Energy Centre

SEEC Smart Efficient Energy Centre

Data → **Information** → **Actionable knowledge**

OBSERVATIONS

- Distributed 'smart' sensor network
- Platform centric network
- Open data sources (social media)

Cyberinfrastructure

- Big Data
- Diagnostic models
- Prognostic models
- Artificial intelligence
- Machine learning
- Visualisation
- Multi variate statistics

THEMES	APPLICATION
Ocean Energy	Long/short term forecasts
	Resource assessment
Built Environment	Embedded control systems
	Product testing
Nuclear Energy	Design optimisation
	Remote condition monitoring

BENEFITS

- Reduced risk
- Reduced uncertainty
- Increased resource effiiency
- Improved safety
- Reduced time to insight

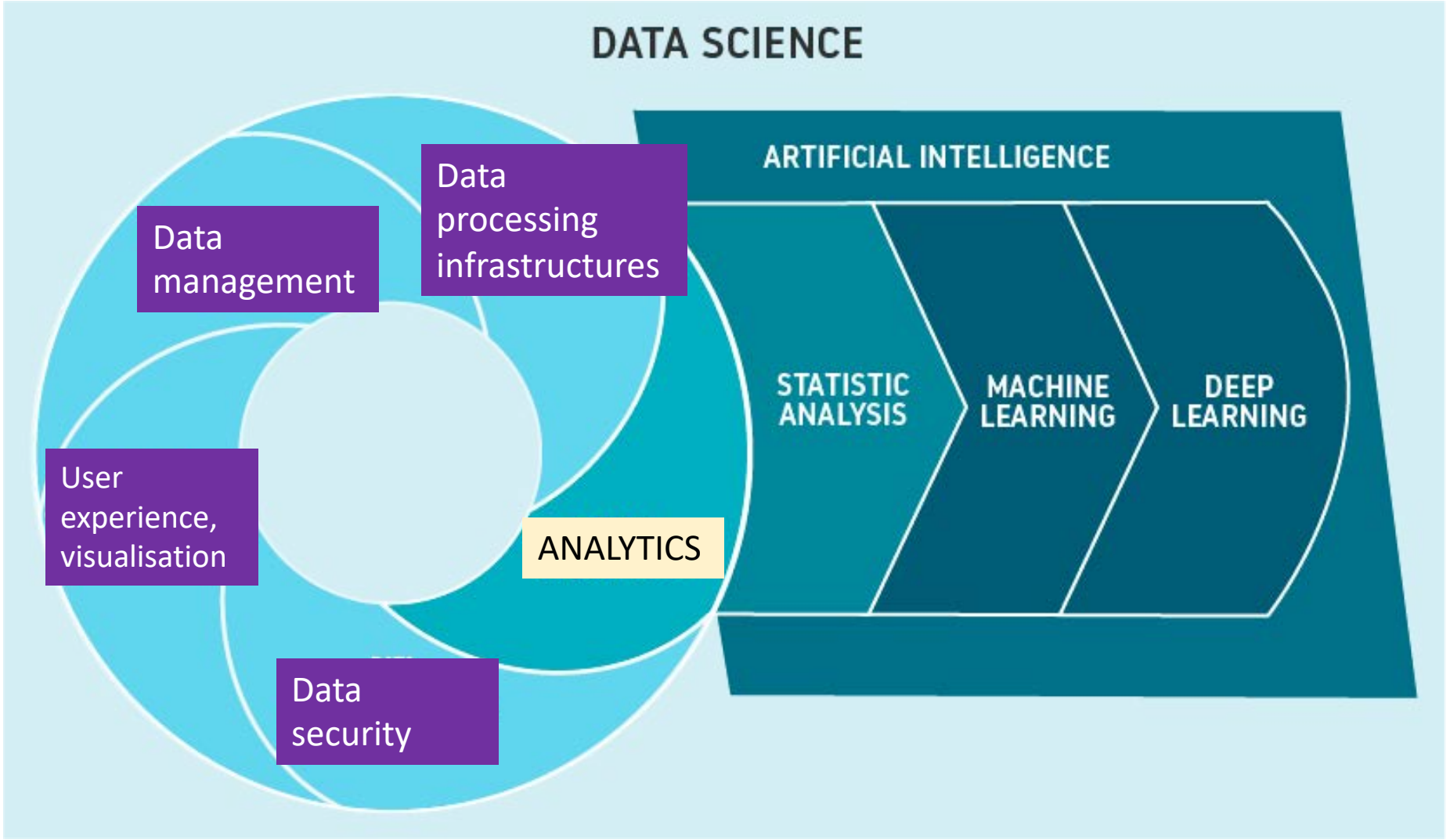
Network optimisation

http://seec.bangor.ac.uk/

What is the SEEC Cyberinfrastructure?

- Built on IMARDIS data infrastructure
- Facility for integrated monitoring, analysis, modelling and visualisation at very high spatial and temporal scales
- Scalable cloud based capacity to ingest, store and make data (delayed mode and real-time) available for re-use
- To reduce engineering uncertainties and increase resource efficiencies in low carbon energy generation and utilisation

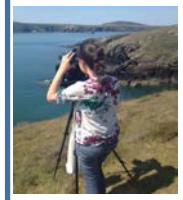
SEEC
Smart Efficient Energy Centre



Examples of new user requirements

Data

Citizen Science-Voluntary Observer

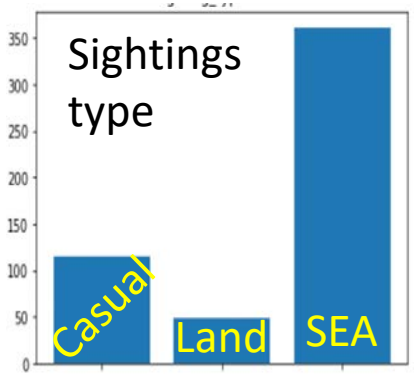


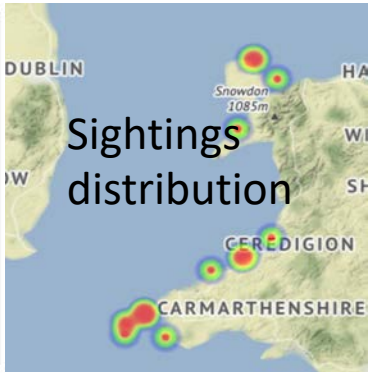
Sea Watcher (App)

- Submit Sighting
- Start Survey
- Video Guide
- Species Pack

Data science applications

Data pipeline, Visualisation, Social social media analysis (photos, tweets)





Actionable knowledge

- Marine mammal abundance & distribution
- Population health
- Conservation
- Upskill observers
- Promote awareness

Data intensive science observations

Cetacean detection with acoustic arrays

>1 TB per day

Data pipeline, Visualisation, Machine learning (separate signal from noise)

- **Trends in cetacean seasonal, diurnal and tidal behavioural patterns**
- **Cetacean diving behaviour informing collision risk**
- **Cetacean foraging & predator-prey interactions at tidal turbine sites**

- Moderate underwater turbine operation
- Demonstrate compliance with regulations
- Risk assessment
- Site characterisation

Summary and next steps

- IMARDIS is “earning the right to be sustained”
- New products and services required by users (research, industry and government)
- New data science capacity key to meeting future needs
- SEACAMS provides invaluable lessons in how to deliver Blue Growth in Ocean Renewable Energy sector
- SEEC Goal to increase grant application – we are “Open for Business”