Beyond STEMM-CCS

A synthesis of what has been accomplished through the project, and the implications for offshore CCS and marine CO_2 monitoring

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National Oceanography Centre

**plus everyone who contributed to the STEMM-CCS Research Highlights deliverable*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 654462

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Context

The need for STEMM-CCS

- Estimated that offshore sites represent ~66% of the potential CO_2 storage capacity in Western Europe (IEAGHG, 2009)
- Robust strategies for leakage detection and management are needed to comply with international marine legislation
- Series of precursor projects (e.g. ECO_2, QICS, ETI MMV) advanced our knowledge and ability on how to detect CO_2 at the seafloor
- Many of those techniques were yet to be tested under realistic leakage conditions, and enhanced models were needed to predict the pathways and potential impacts of CO_2 migration through the reservoir overburden

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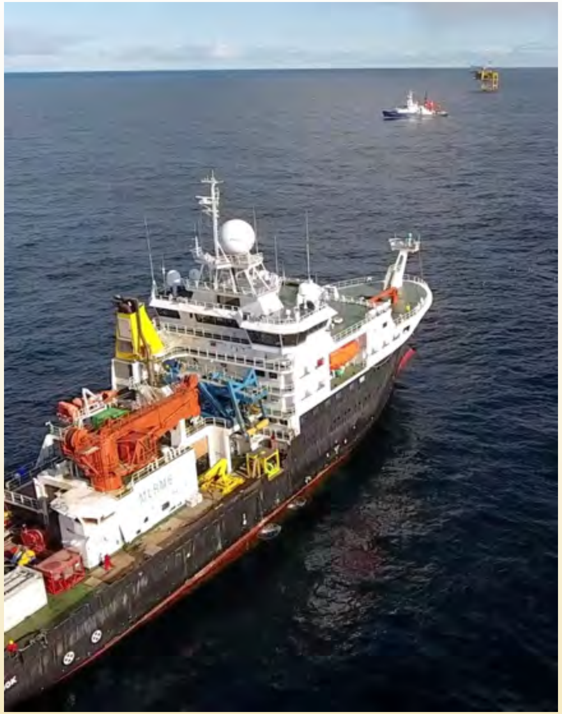
Approach

The activities of STEMM-CCS

- The first controlled sub-seafloor release of CO_2 to be carried out under real life conditions
- Establish accurate environmental baseline techniques
- Better understanding of fluid flow pathways in the sub-seafloor and their implications for reservoir integrity
- Methodologies for detecting, tracing and quantifying CO_2 leakage in the marine environment
- Test new technologies to enable cost-effective monitoring of marine CCS operations



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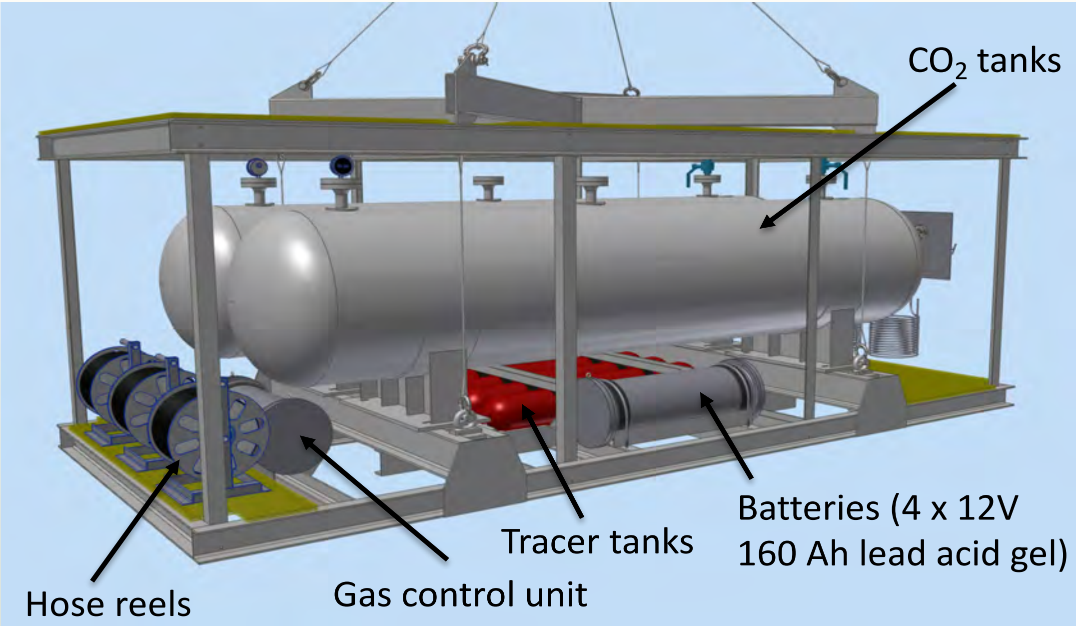
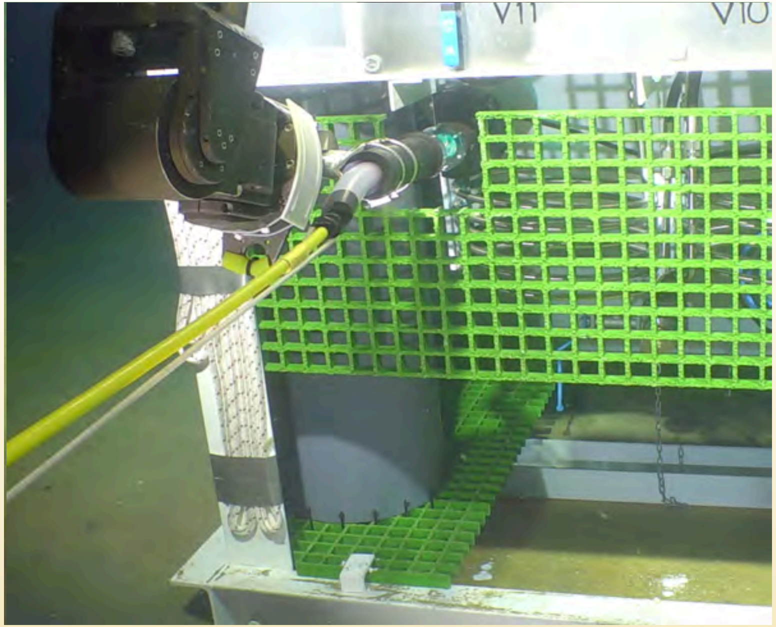
Outputs

The products of STEMM-CCS

- Engineering solutions for a ground-breaking experiment





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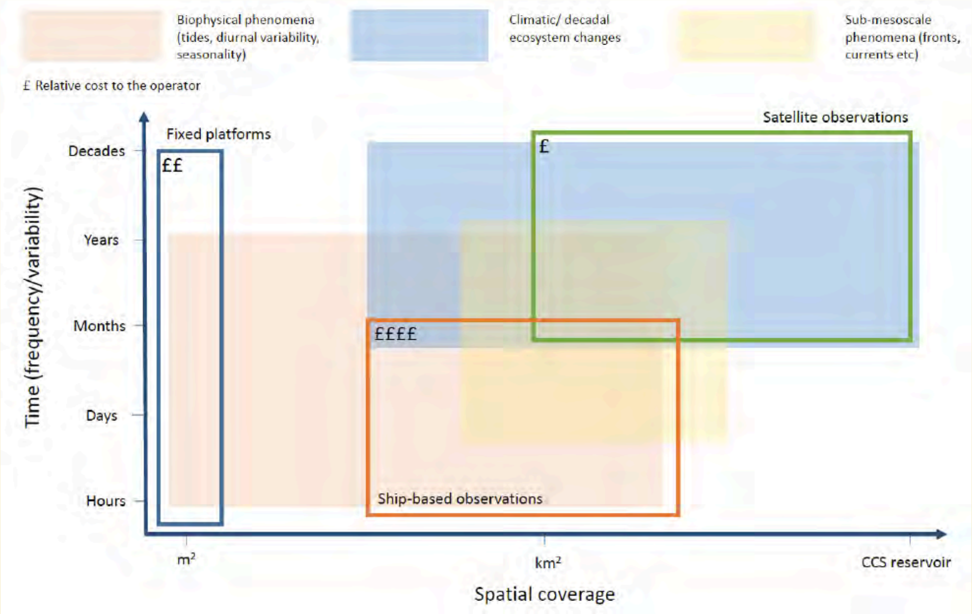
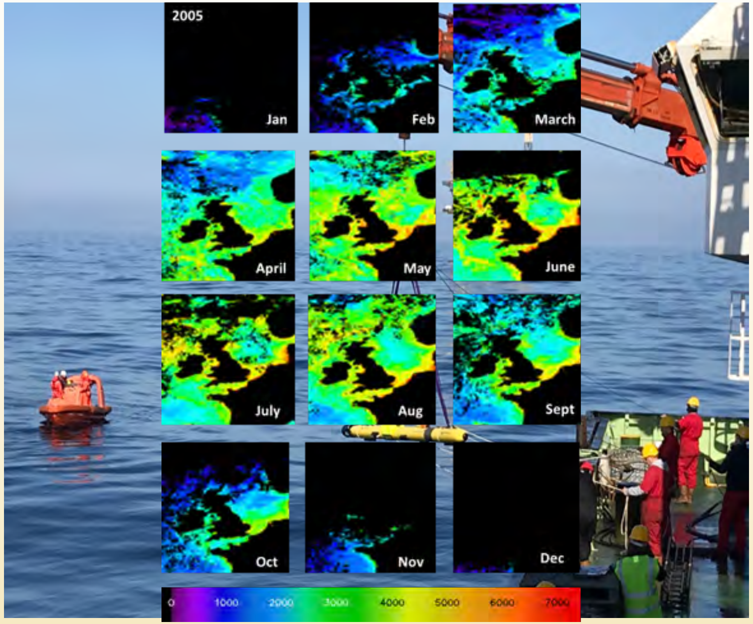
Outputs

The products of STEMM-CCS

- Framework for establishing an effective environmental baseline





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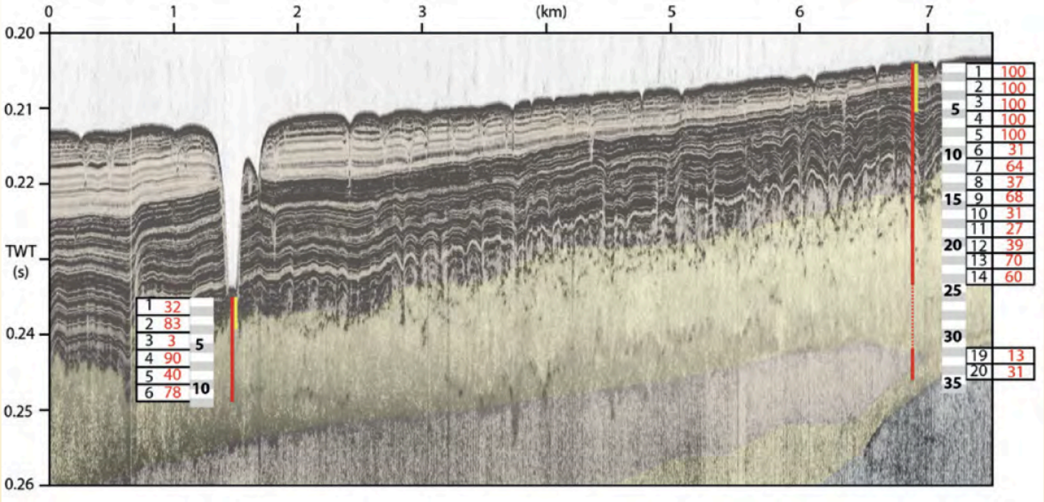
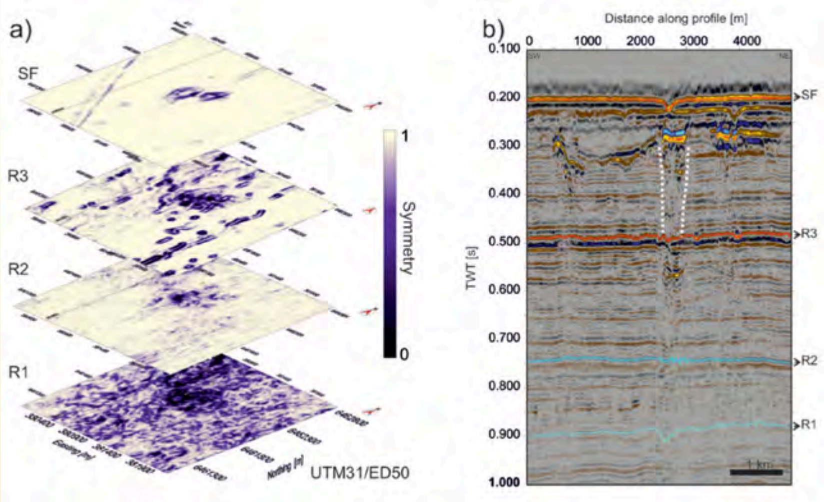
Outputs

The products of STEMM-CCS

- Characterisation of pipe structures and numerical simulation of gas seepage





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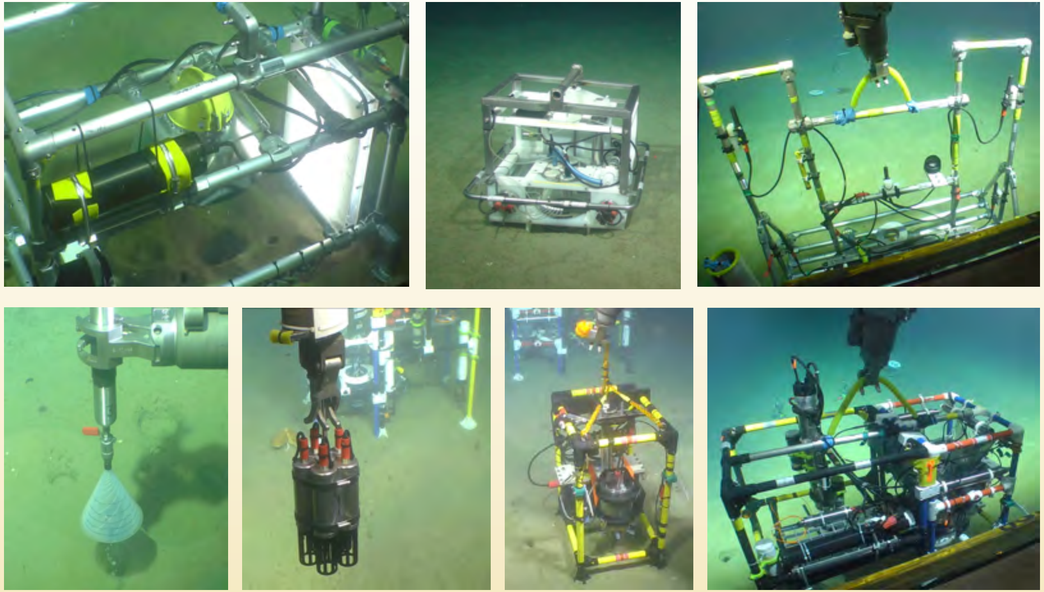
Outputs

The products of STEMM-CCS

- Techniques for detecting and quantifying CO_2 leakage across the seabed



Method	CO_2 bubbles	CO_2 dissolved
Acoustical		
• *Active*	✓	
• *Passive*	✓	
Optical	✓	
Chemical		
• *Tracers*	✓	✓
• *Eddy Covariance*		✓
• *Benthic Chambers*		✓

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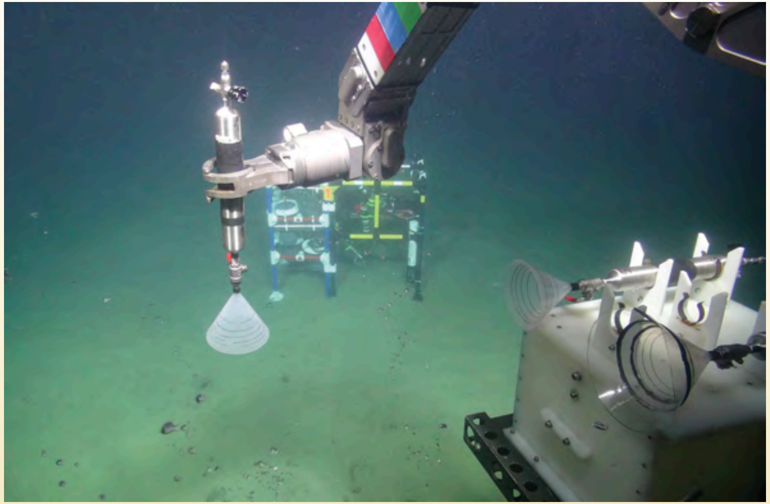
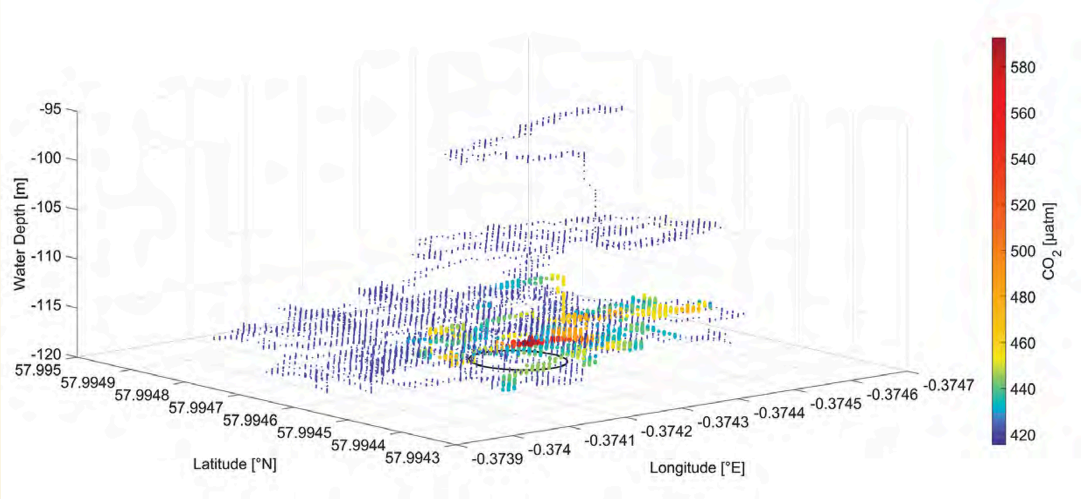
Outputs

The products of STEMM-CCS

- Quantification of the efficacy of a variety of natural and artificial CO_2 tracers for CO_2 detection, quantification and source attribution in the marine environment





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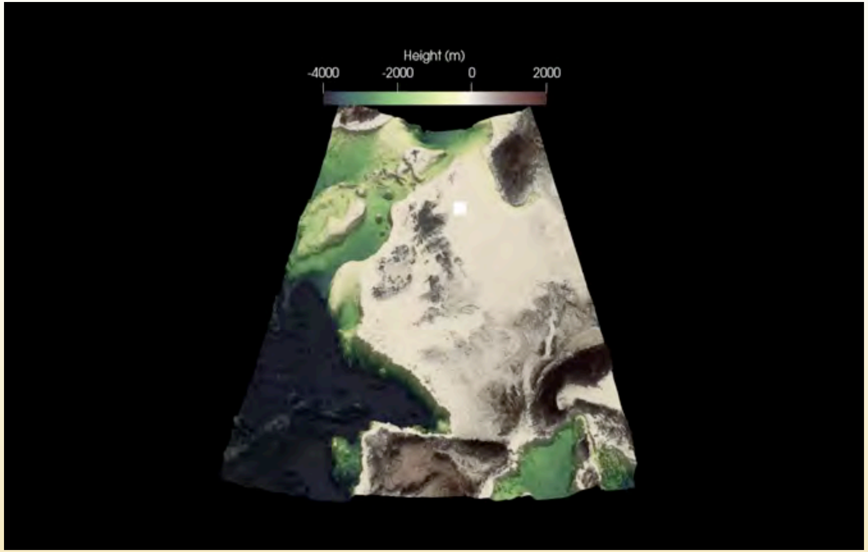
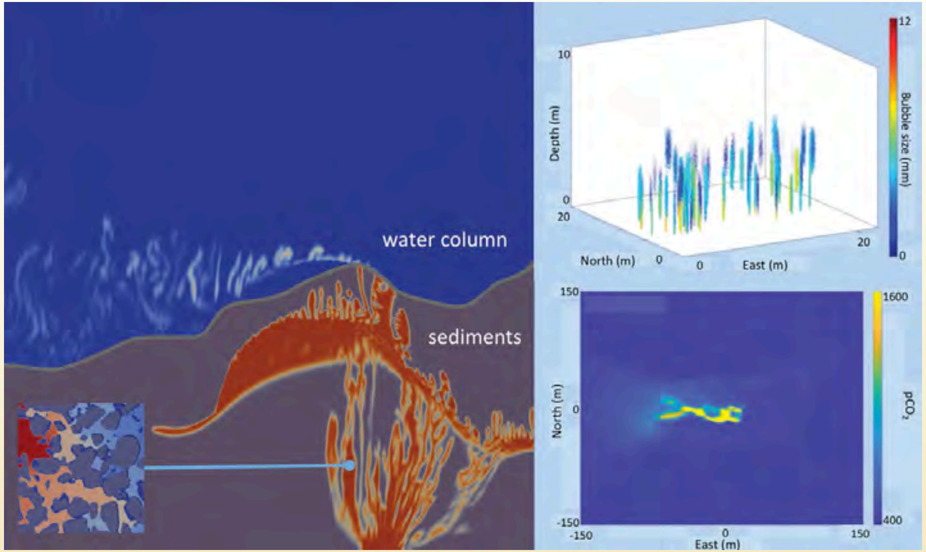
Outputs

The products of STEMM-CCS

- Comprehensive model system for monitoring and predicting the impact of fugitive CO_2 emissions for a range of leakage scenarios





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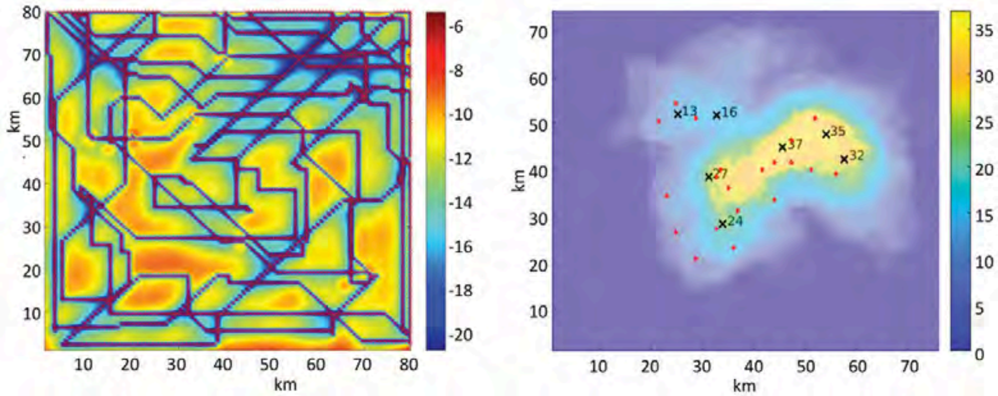
Outcomes

The implications of STEMM-CCS

- Methodologies and techniques for establishing environmental and ecological baselines applicable to CCS reservoirs have been tested under 'real life' conditions
- A suite of cost-effective tools are available for identifying, detecting and quantifying CO_2 leakage from a sub-seafloor CCS reservoir
- Models can be used to optomise offshore CCS monitoring strategies (both AUV and fixed lander deployments) that maximise detection chances and minimise cost



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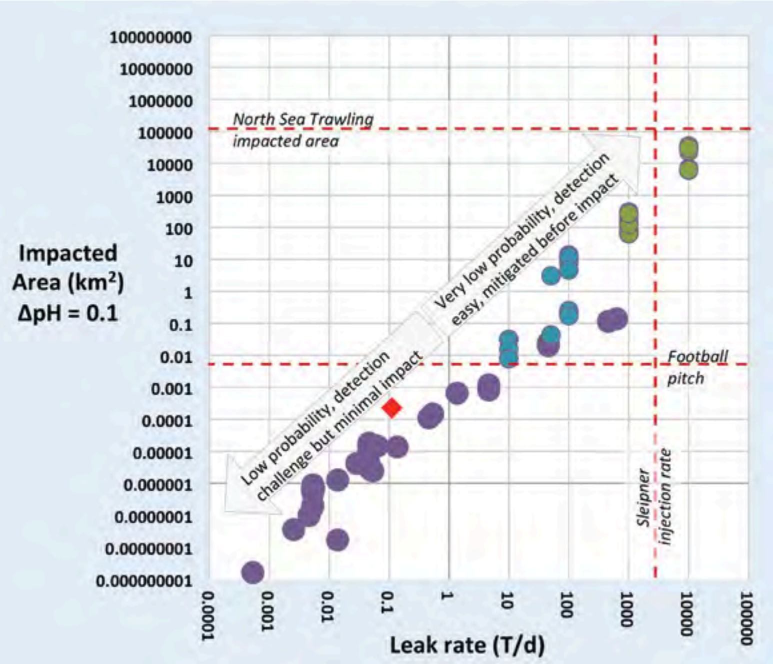
Outcomes

The implications of STEMM-CCS

- The local and regional impacts of different CO_2 leak scenarios have been modelled, including the potential role that fluid pathways in the shallow subsurface may play in reservoir integrity
- Resulting environmental impact assessment implies that CCS release from offshore complexes is expected to have a small impact footprint, orders of magnitude less than other marine activities such as trawling



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Outcomes

The implications of STEMM-CCS

- Best practice guidance for the selection and operation of offshore CCS sites shared with industrial and regulatory stakeholders
- Increased confidence in the physical security of CCS, and support for the European Union's progress towards a carbon neutral society

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Impact

The legacy of STEMM-CCS

- Realising the impact potential of STEMM-CCS requires continuing work…
- Models, technologies and engineering solutions developed through the project are being applied in other projects and future funding applications
- An online monitoring and decision support tool has been developed to assist operators in choosing optimal offshore CCS monitoring mechanisms, and ensure continued access to the knowledge and experience gained through the programme: *A. Lichtschlag (15:00)*

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Impact

The legacy of STEMM-CCS

- Translate industry awareness of the project to engagement and uptake of its outcomes: *M. Dean (15:15)*
- Inform regulatory bodies and policy makers of project findings, and its broader implications for offshore CCS: *D. Connelly (15:30)*
- Ensure accurate public understanding of the trials conducted through the project and how they can help realise the potential of offshore CCS: *V. Gunn (15:40)*

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Thank you for your attention

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