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Community Research

European Research Network of Excellence on the Geological Storage of CO_2

"CO2GeoNet"

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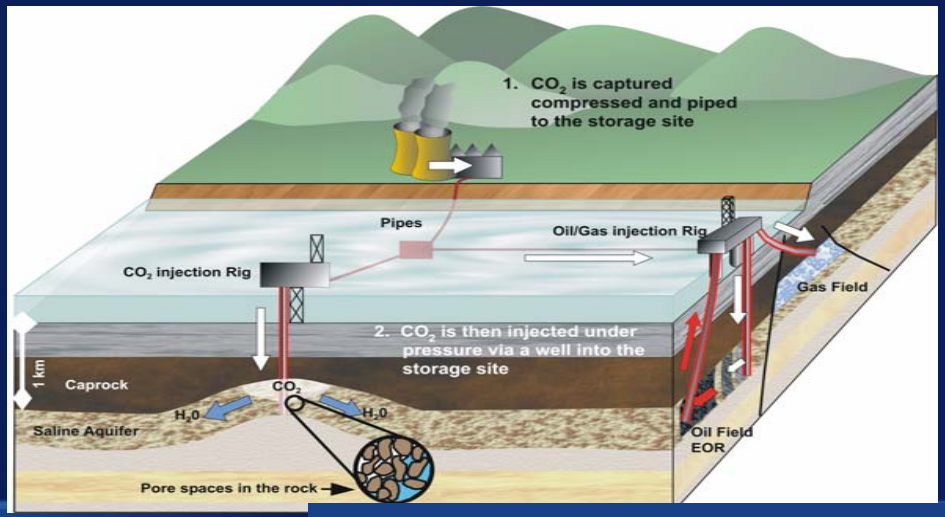
Main characteristics of CO_2 Storage

- Storage has to be long term (over 1000 years) and secure. It may be sub-sea bed or onshore
- Injection rates of at least 1Mt CO_2/annum over several decades
- Meet safety, environmental protection, carbon credit, public acceptance & regulatory needs- regulation still being formulated
- Avoid sterilising or impacting upon other resources
- Minimise risk and maximise performance by selecting suitable geological sites for storage
- Monitor and verify storage to ensure performance matches prediction
- Develop intervention & mitigation strategies for unexpected events



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CO_2GeoNet is a "Network of Excellence"
13 Research Partners

Started April 2004
€9m, 5 years

EC €6m

Collaboration with Japan (RITE) & Canada (PTRC)

Denmark
Geological Survey of Denmark and Greenland –GEUS

France
Bureau de Recherches Geologiques et Minieres- BRGM
Institute Francais du Petrole –IFP

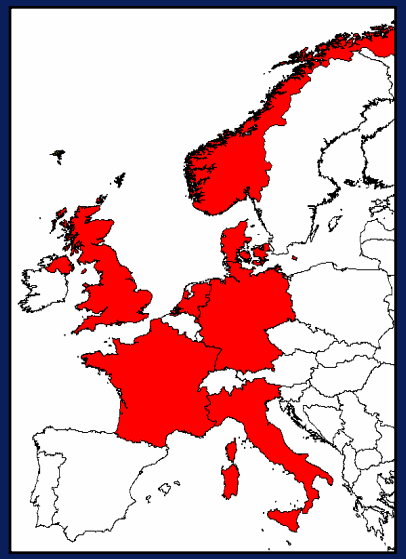
Germany
Federal Institute for Geosciences and Natural Resources –BGR

Italy
Istituto Nazionale di Oceanografia e di Geofisica Sperimentale-OGS
Università di Roma "La Sapienza" -URS

Netherlands
Netherlands Organisation for Applied Scientific Research –TNO

Norway
Norwegian Institute for Water Research –NIVA
Stiftelsen Rogalandsforskning-RF
SINTEF Petroleumsforskning AS –SPR

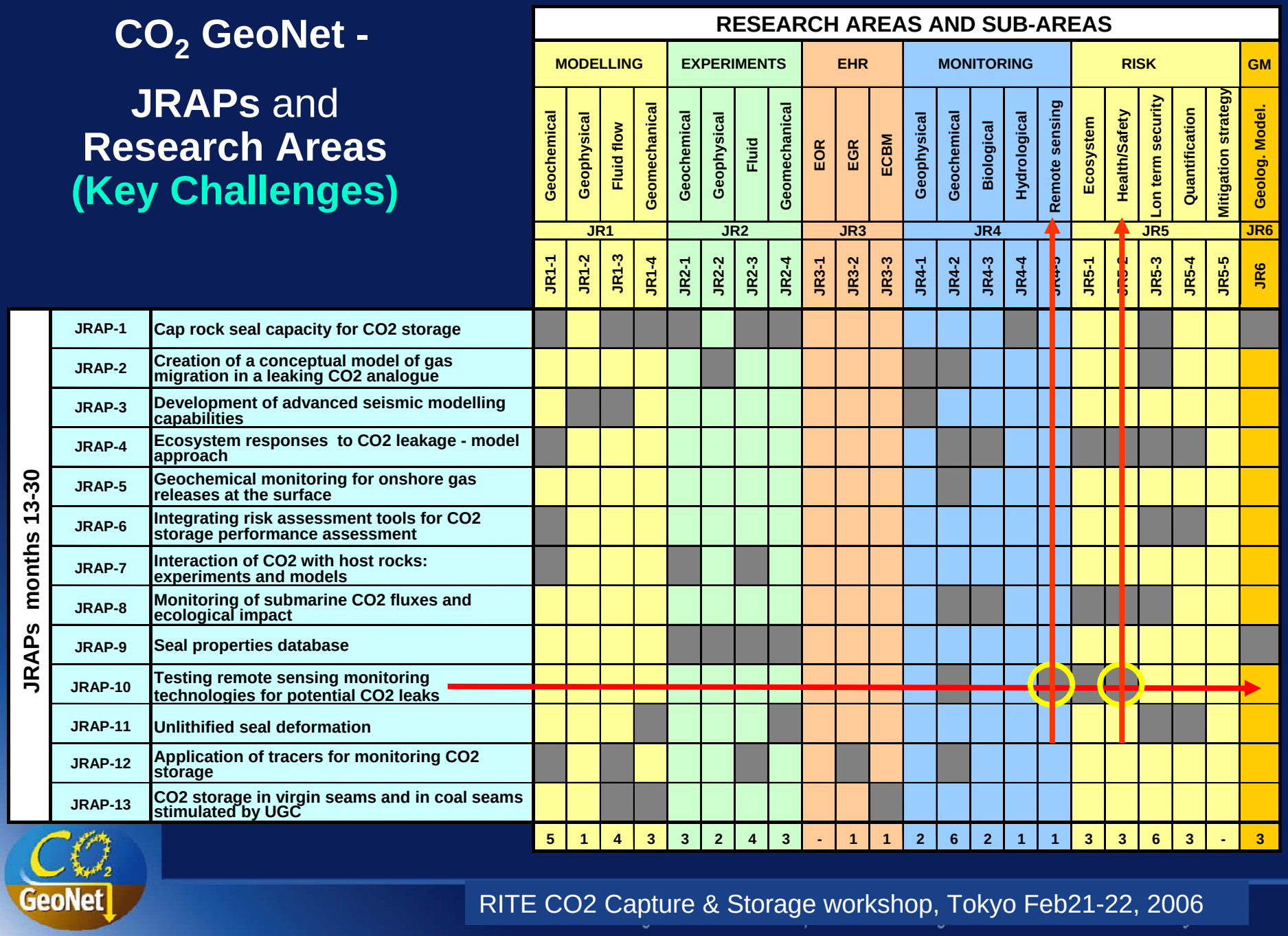
UK
Natural Environment Research Council-British Geological Survey-BGS)
Heriot-Watt University –HWU
Imperial College of Science, Technology and Medicine-IMPERIAL



GeoNet

CO_2 GeoNet -

JRAPs and Research Areas (Key Challenges)



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Conceptual model of gas migration in a leaking CO_2 natural analogue

JRAP-2

Objectives: To understand a leaking CO_2 system in terms of:

- ✓ migration mechanisms, pathways and times
- ✓ structural / depositional controls
- ✓ additional gas storage in overlying strata
- ✓ distribution / size of deep pathways, geochemical reactions and near-surface release points
- ✓ predicting the location, size and volume (i.e. risk) of a CO_2 leak at surface

Activities:

- ✓ **field studies** mainly focused on an Italian site **(Ciampino or Latera)**
- ✓ **reservoir to surface using geophysics, structural geology and geochemistry**

Methods:

- ✓ **high resolution Seismics** by Vibroseis
- ✓ **ground penetrating radar** (GPR)
- ✓ soil gas measurements
- ✓ mineralogy analysis
- ✓ geological and structural surveys

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Ecosystem responses to CO_2 leakage - model approach -

JRAP-4

- ***Objectives:*** **To provide a holistic integrated site investigation tool enabling stakeholders (eg. regulators) to assess the long-term potential risks of CO_2 storage on subsurface, terrestrial and marine ecosystems**

- ***Methods:***

- Systems Model

✓ based on **natural** and **experimental CO_2 leaking systems** both **on** and **offshore**
✓ applied to natural sites leaking CO_2 to identify knowledge gaps and to understand the behavior of the system as a whole to assess the importance of different risks

- Feasibility study to set up European Test Facilities

✓ review / feasibility study
✓ **scoping studies** (off and on shore ecosystems) evaluating significance through cost benefit analysis

- Development of a Decision support tool

✓ GIS Decision Support System (web products) to aid assessment of information on environmentally sensitive areas in site selection process
✓ **screening tool** to be used in first stages

- Dissemination

✓ to end users (industry, regulators and policy makers)

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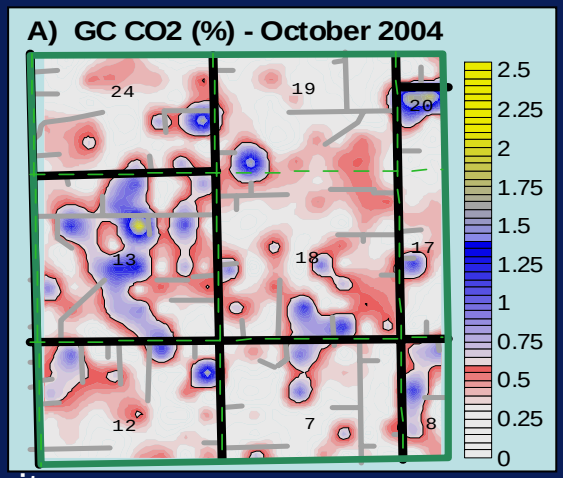
Geochemical monitoring for onshore gas releases at surface

JRAP-5

- ***Objectives:*** **Integrated assessment of a range of gas monitoring approaches on well-described sites**

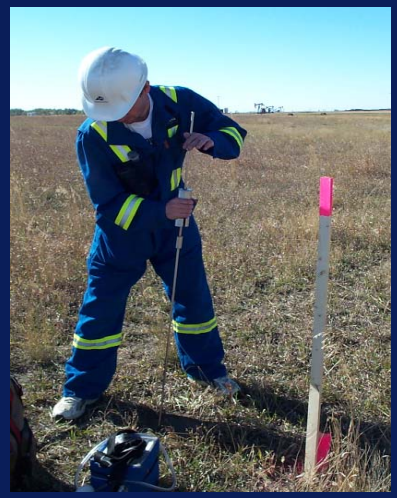


- ***Relevance:***

✓ it is important to prove that stored CO_2 does not reach the surface in order to:
  - demonstrate containment
  - underpin carbon credits
  - re-assure the public, etc.

- ***Methods:***

✓ monitoring gases in the soil and / or the air above it, as done in **Nascent, Weyburn, In Salah, Castor**



- ***Possible areas of improvement:***

✓ define how small a release of gas could be detected given the often large natural fluctuations in soil gases
✓ study natural tracer gases
✓ speed up surveying techniques
✓ refine low cost automatic monitors

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Monitoring of submarine CO_2 fluxes & ecological impact

JRAP-8

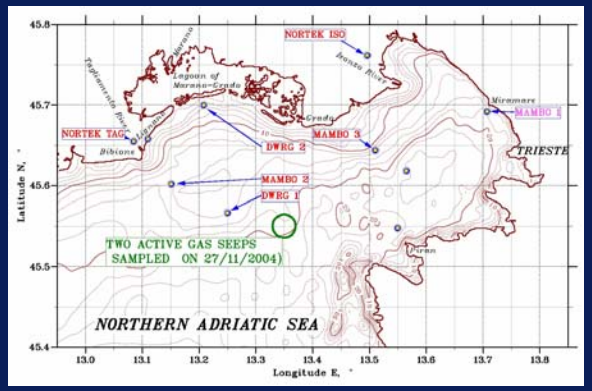
- ***Objectives:*** **Feasibility study for automatic sampling & detection of offshore gas release, coupled to analysis of water chemistry, and CO_2 exposure tests on marine organisms**

- ***Relevance:***

✓ improve experience in offshore monitoring

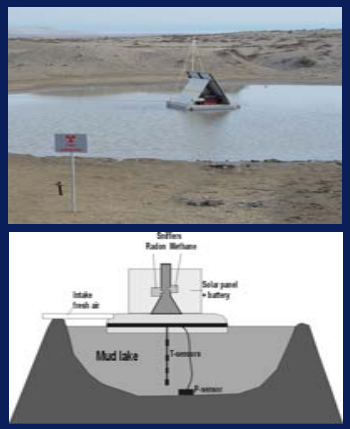
✓ first operational testing of basic monitoring installations, coupled to ecological investigations

✓ to assess knowledge and define technical gaps in order to facilitate further developments of continuous geochemical monitoring devices to be used in open sea environments and lakes

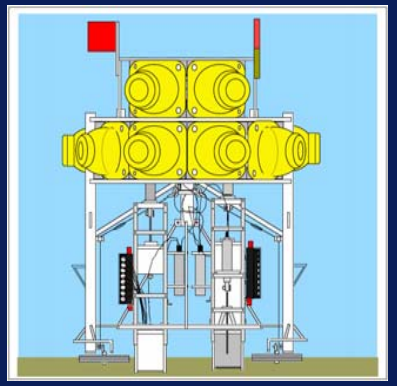


Monitoring network in the Gulf of Trieste by three OGS buoys

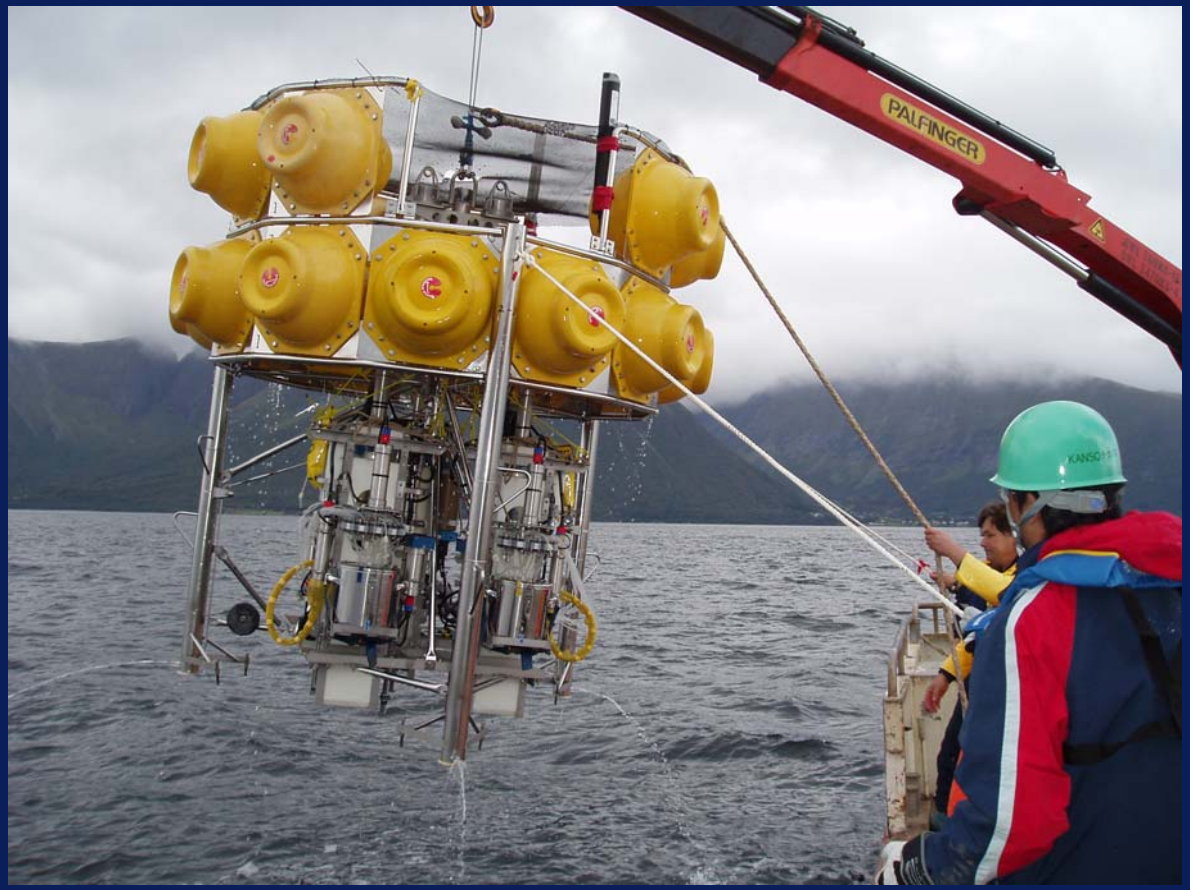
Meteo-oceanographic buoy OGS-MAMBO



Monitoring station on a lake above Dashgyl mud volcano, Azerbaijan



Benthic Chamber system



Benthic lander" used by RITE/NIVA in a Norwegian fjord in order to study effects of CO_2 on a benthic sediment community at 400m depth (September 2005).

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Testing remote sensing technologies for potential CO_2 leaks

JRAP-10

- ***Objectives:*** **To demonstrate airborne and satellite remote sensing techniques as reliable methods for monitoring the performance of storage sites**

- ***Activities:***

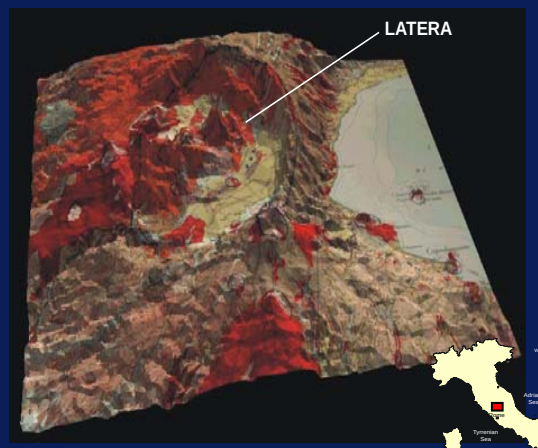
✓ **natural CO_2 seeps detection through:**
  - changes in vegetation
  - temperature anomalies

✓ **control of the spatial distribution of CO_2 seeps:**
  - such as fracture and fault distribution at **Latera**

✓ **ground truth of the NERC (BGS) airborne remote sensing results with geochemical surveys to improve total emission estimates using:**
  - gas flux measurements
  - an innovative laser-based atmospheric CO_2 measurement technique

✓ **use the OGS' helicopter borne hyper-spectral camera to analyse and correlate vegetation stress to identify anomalous CO_2 concentrations**

✓ **remote sensing data over a larger area to improve the current GIS-based demonstrations of hazard identification**



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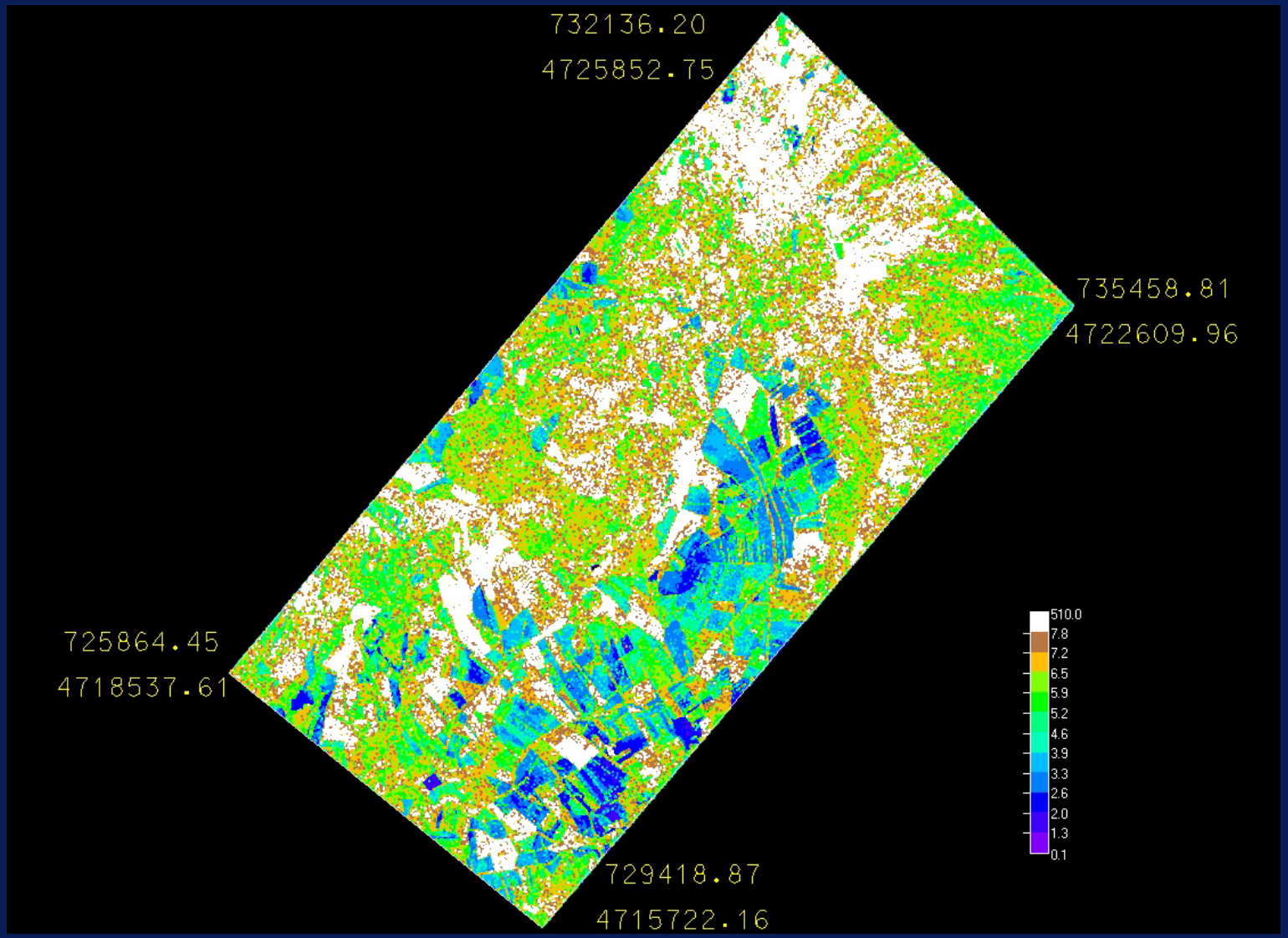
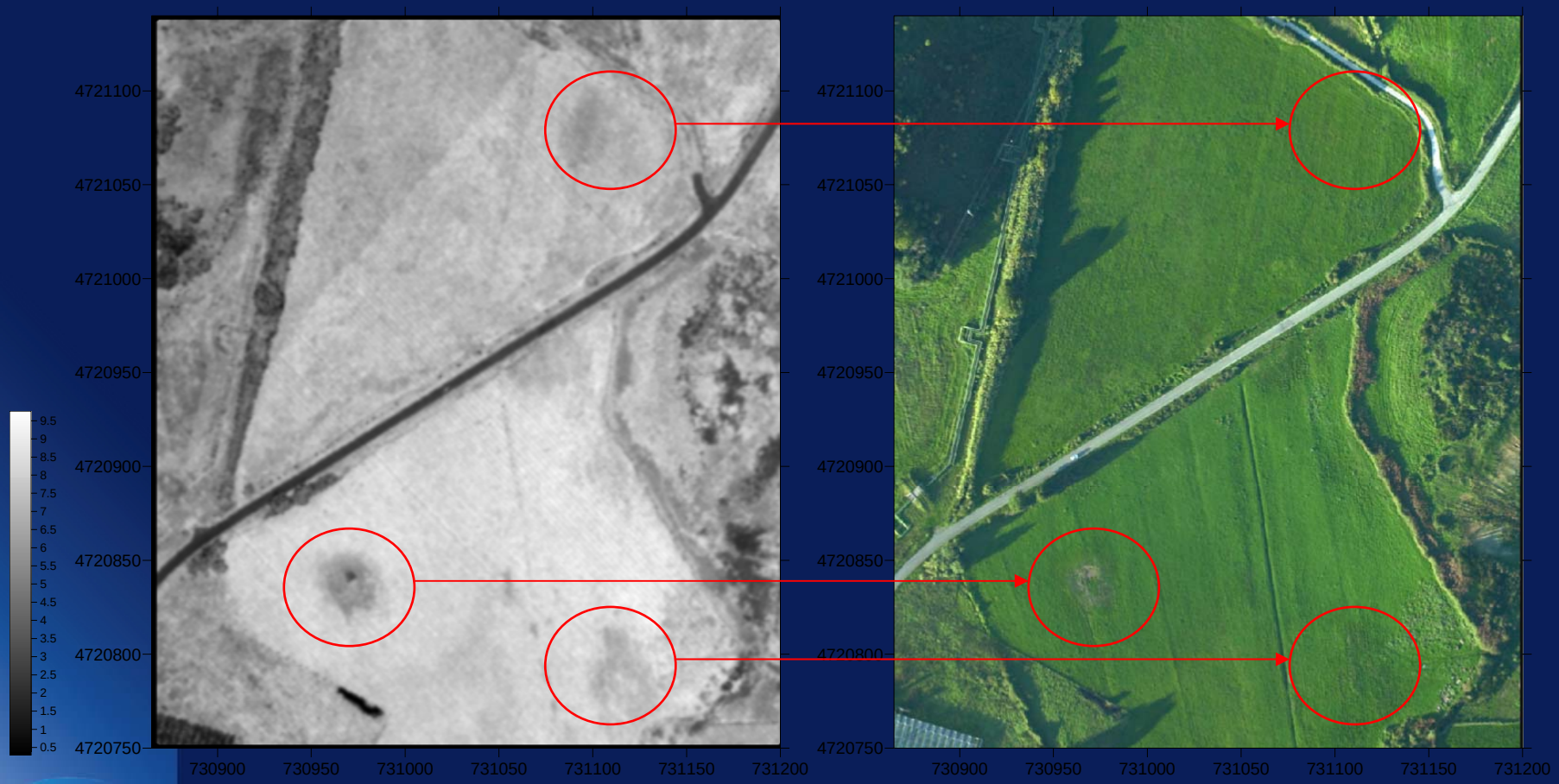
Latera survey – orthophotos, elevation image, intensity image

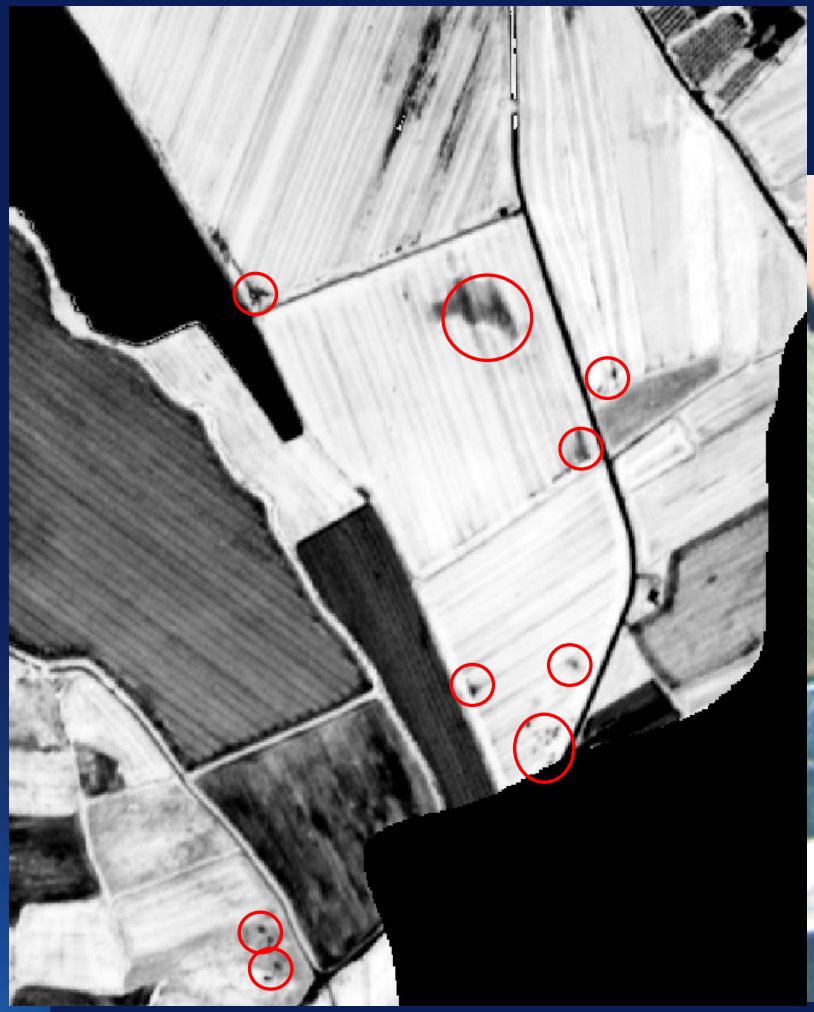


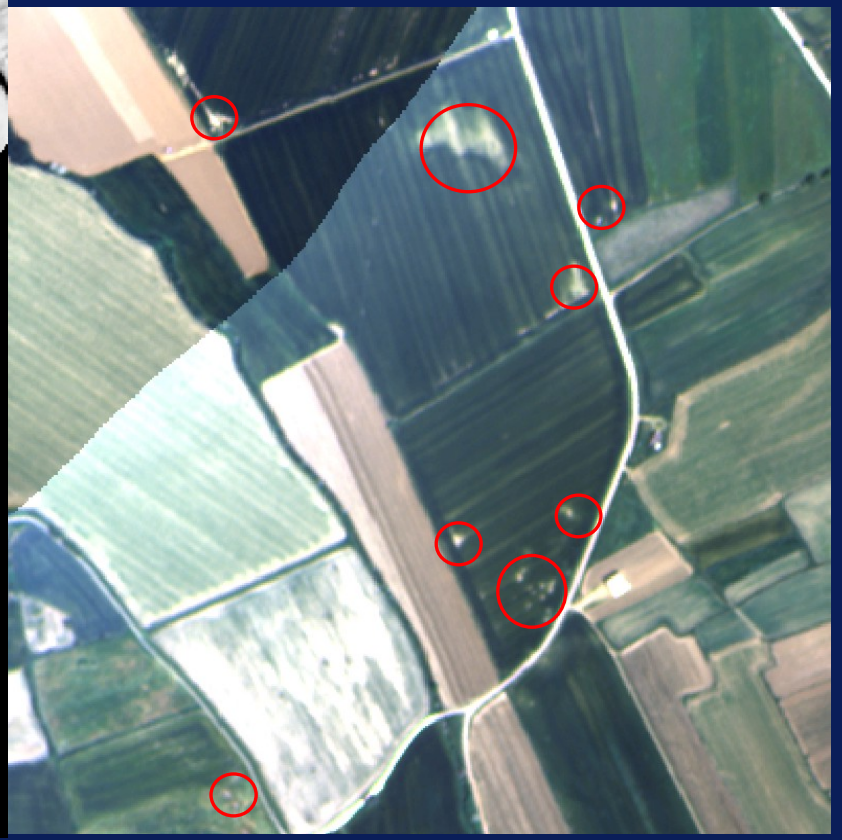
Latera survey – comparison between laser uncalibrated amplitude and orthoimages



Latera survey – RGB, NDVI hyperspectral and classified image

Latera survey – 3 NDVI and true color CASI





OUR CHALLENGE

Without regulatory, industrial and public confidence about CO_2 storage there will be no possibility of decarbonising emissions from fossil fuels

THANK YOU!