



Earth Observation in action in UKSA

Beth Greenaway
Head of Earth Observation and
Climate
UK Space Agency

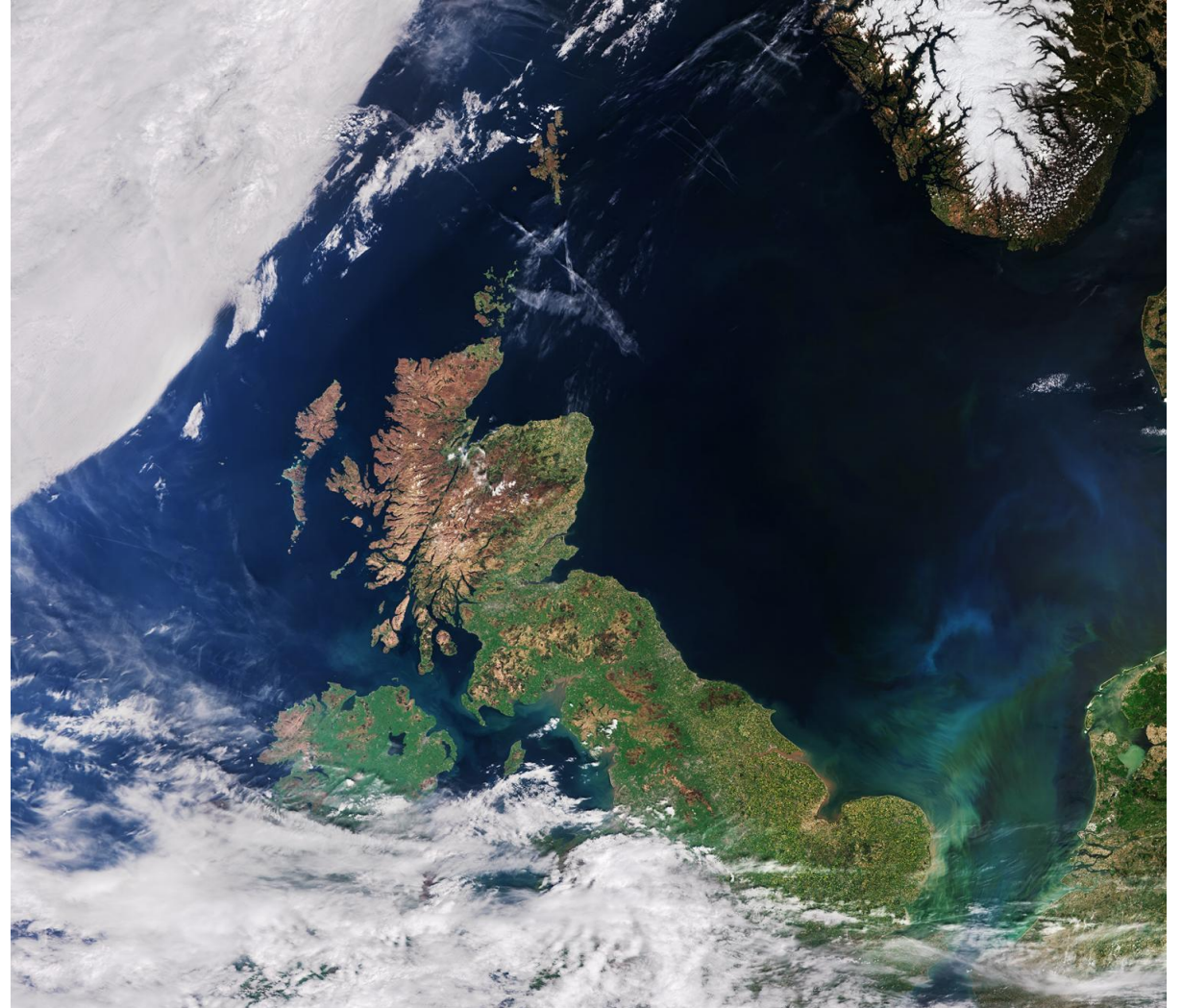
FRINGE Conference Leeds 11th September 2023





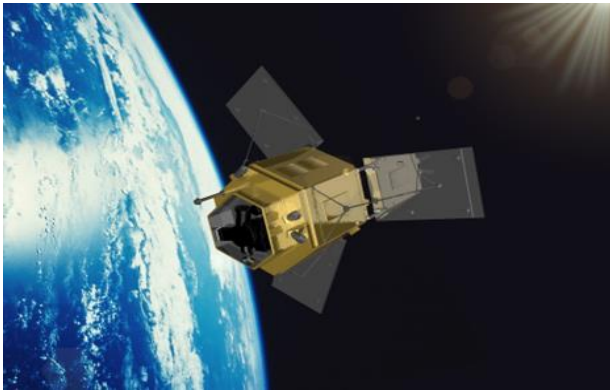
Joint Statement from UK Prime Minister and the EU on Thursday 7 Sept 2023

The UK to participate in the Copernicus component of the EU Space programme from 1 January 2024.



UK in ESA

- UK was the fourth largest contributor to ESA EO at CMin19 and CMIN22 in November investing in over £400m across 7 EO programmes
- ESA EO Programmes are a large contributor to the UK's growth in EO opportunities and activities across the entire value chain.



Far-infrared Outgoing Radiation Understanding & Monitoring (FORUM) Mission



Example of a digital twin interface using data provided from missions

Civil Earth Observation (EO) Priorities (DSIT 2023)

Purpose: National Space Strategy ambition to “**stay at the forefront of EO technology and know-how**” is substantiated in 14 ambitious priorities which build on our excellent science and industrial capability and maximise the benefits of international partnerships.

Scope: All forms of civil EO, including remotely sensed data from space, airborne and ground-based systems. They will consider activities across the breadth of the EO value chain.



GROWTH

- Enhance national capability and create exports
- Stimulate EO data applications and technologies

LEADERSHIP

- Create a long-term national strategy between government, industry and academia
- Improve public sector use of EO data for decision-making and policy development
- Create innovative civil and defence dual-use EO programmes

TECHNOLOGY

- Capitalise on the UK's strength in small satellites
- Create a comprehensive end-to-end technology ecosystem

DATA

- Create cutting edge integrated EO data architecture
- Develop world-leading, next generation calibration and validation systems

CLIMATE, WEATHER and ENVIRONMENT

- Support the next generation of weather services and satellites for longer range, higher resolution models
- Provide global leadership against climate change

INTERNATIONAL

- Strengthen the UK's position as a member of ESA, EUMETSAT and GEO
- Reset the UK relationship with the EU Copernicus programme
- Cultivate and harness bilateral relationships with international partners



*Scan to view the
EO Priorities in full*



Department for
Science, Innovation
& Technology

Earth Observation is a UKSA priority

The UK Space Agency plays a major role in delivering the government's National Space Strategy and support a thriving space sector in the UK, which generates an annual income of £17 billion and employs 47,000 people across the country.

- **Catalyse investment** to support projects that drive investment and generate contracts
- **Deliver missions and capabilities** that meet public needs and advance our understanding
- **Champion the power of space** to inspire people, offer greener, smarter solutions, and support a sustainable future

Earth Observation Priority: studying our planet to drive discovery and tackle climate change.

UKSA Earth Observation Priorities



- *“To deliver a portfolio of Earth Observation focused activities, that ensures long-term value for money and access to the data, we need a series of related programmes” - UKSA Corporate Plan 2023*
 - The creation of Earth Observation space assets and missions
 - Maximise EO data exploitation
 - Sustaining and enhancing Earth Observation technological capability
 - National and International Earth Observation and Climate Policy Leadership

EO Mission Capability Review – and CEOI

The latest EOMCR received **35** responses from at least **18** different industrial and academic organisations:

- Airbus
- University of Edinburgh
- RAL Space
- Open University
- Open Cosmos
- TAS-UK
- NOC
- Global Satellite Vu
- SSTL
- Craft Prospect
- Supersharp (CU spinout)
- Deimos as Prime, with Northumbria Univ + OSS
- Resilience
- Spire Global
- University of Reading
- Clyde Space
- MDA
- Teledyne e2V

Range early ideas to full missions across all domain areas

Atmosphere - meteorology	9
Atmosphere - chemistry	5
Upper atmosphere & magnetosphere	3
Aerosols	1
Ocean & Coastal	8
Inland water	4
Land use	16
Cryosphere	6
Climate	11
Water cycle	5
Maritime ops & surveillance	8
Air Quality	2
Forestry & Biomass	6
Soil moisture/inundation	2
Urban	7
Dual Use	8

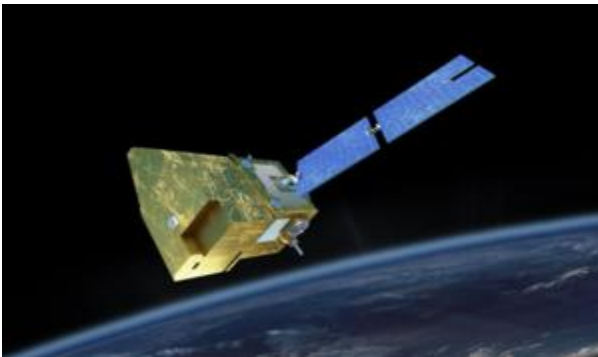
And covering many technology areas,

SAR	5
SAR interferometry	3
Other radar	3
Passive microwave & RF inc. AIS etc	8
THz radiometry	1
Optical high res imaging	5
Hyperspectral	4
Multispectral Imager	5
Spectroscopy (imaging)	4
Magnetometers	1
Langmuir probes	1
IR spectroscopy	5
MWIR and TIR imaging	6
SWIR Multispectral	1
Gradiometer/Cold atom	1
LIDAR	1
Polarimetry	3

EO Missions in partnership

MicroCarb

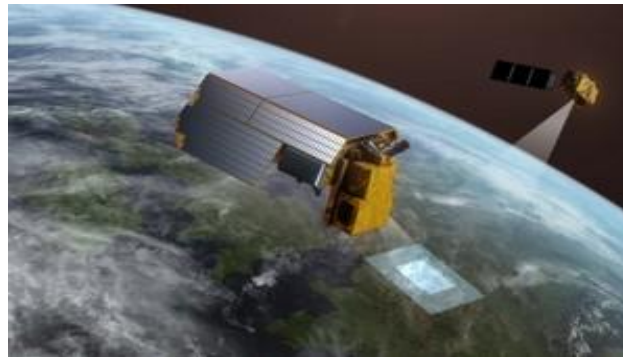
- **Joint mission with CNES - France**
- Designed to map sources and sinks of carbon dioxide (CO₂)—the most important greenhouse gas—on a global scale.
- Uniquely has a special city-scanning observing mode to map CO₂ emissions



Final testing and assembly in HARWELL

TRUTHS

- Traceable Radiometry Underpinning Terrestrial- and Helio- Studies
- **UK led ESA mission with 5 other countries**
- Designed to provide optical climate data ten times more accurately than is currently possible and upgrade the performance and integration of the global Earth Observation system as a whole.



Passed Science and Technology review and now in Phase B2

SWOT

- Surface Ocean Topography Mission
- **Jointly developed by NASA and CNES, the French space agency, in partnership with the Canadian Space Agency and UK Space Agency.**
- Will make the first global survey of Earth's surface water, observe the fine details of the ocean's surface topography, and measure how water bodies change over time.



Launched 16th Dec 2022 and calibration over Bristol Channel

NovaSAR

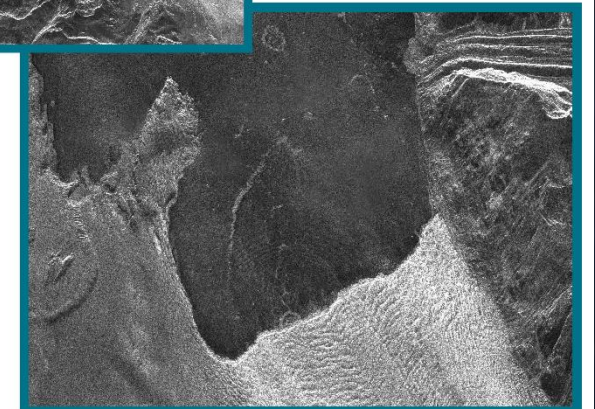
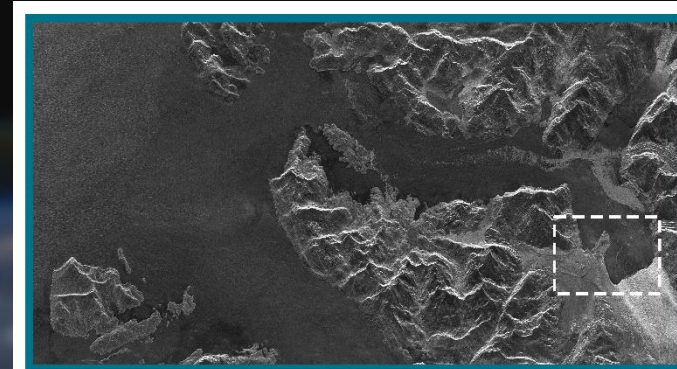
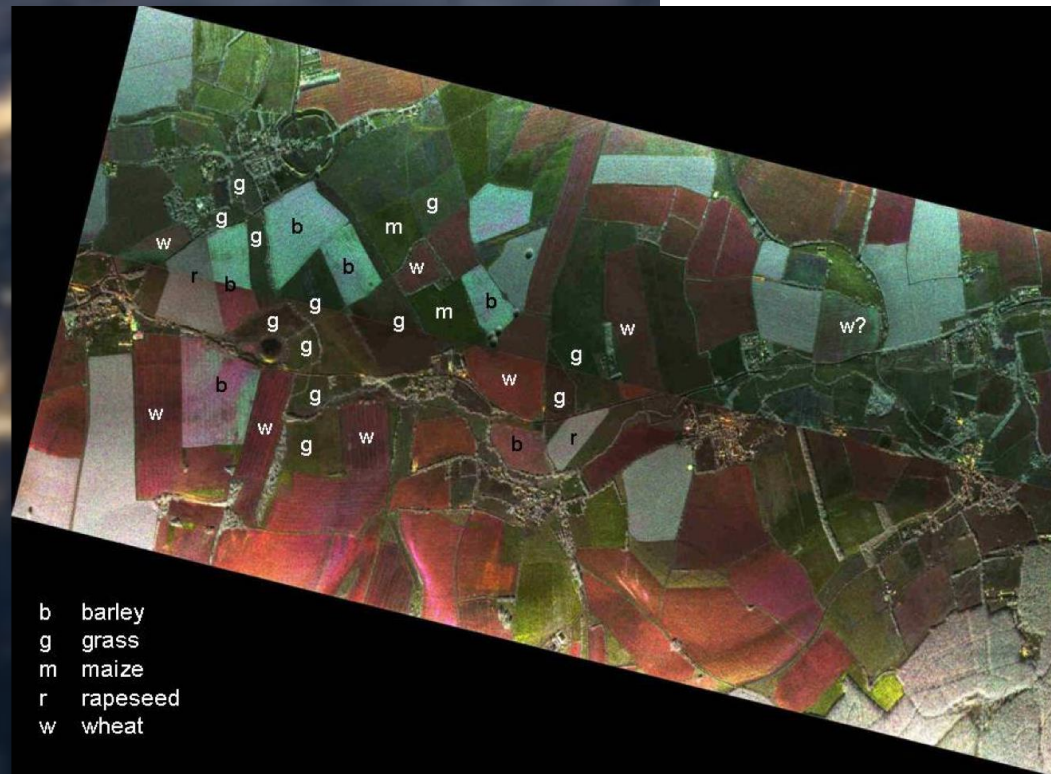
- UKSA co investment in the S Band technology in 2012
- Low cost SAR with simultaneous AIS for enhanced Marine mode.
- Commercially owned, built and operated mission (SSTL)
- Launched in Sept 2018 operational to approx. 2027



NovaSAR

- Environmental applications
- Land use –
- agricultural applications

Multi-polarised image from Airborne trials of the NovaSAR-1 imager with crop classifications (Green VV, Red HH, Blue HV). Credit: SSTL



Ice fall Columbia Glacier Alaska 19 February 2021 in Maritime mode at a resolution of 6m. Credit: SSTL

Monitoring Trees from Space – REDD++



- **Reducing Emissions from Deforestation & forest Degradation**

Malaysian Prime Minister Mahathir bin Mohamad (1992) Advocated that

- « **If it is in the interests of the rich that we do not cut down our trees, then they must compensate us for the loss of income** »
- Verification and monitoring – via satellite EO
 - triggers payments to the community to reforest
 - Helps understand and manage the trees, growth rates and successes.

Validation of deforestation: Smallholder Coffee Farming Practices.

Key Activities:

- Assess deforestation near smallholder farms identified by Global Forest Watch.
- Conduct ground verification of deforestation.
- Recalibrate proprietary machine learning algorithm using ground sourced data.
- Integrate additional Sentinel Parameters for enhanced identification.

Prepared for UKSA Climate Services
By. Dr Charlotte Bunce & Dr. Will Smith

Our mission

To enable agricultural supply chains to be more **ethical, sustainable** and **auditable** using the most **innovative space** and **blockchain technologies**



tradeinspace



Case Study – Misclassification Example

 Deforestation



19th Jul 2019



16th Jan 2020



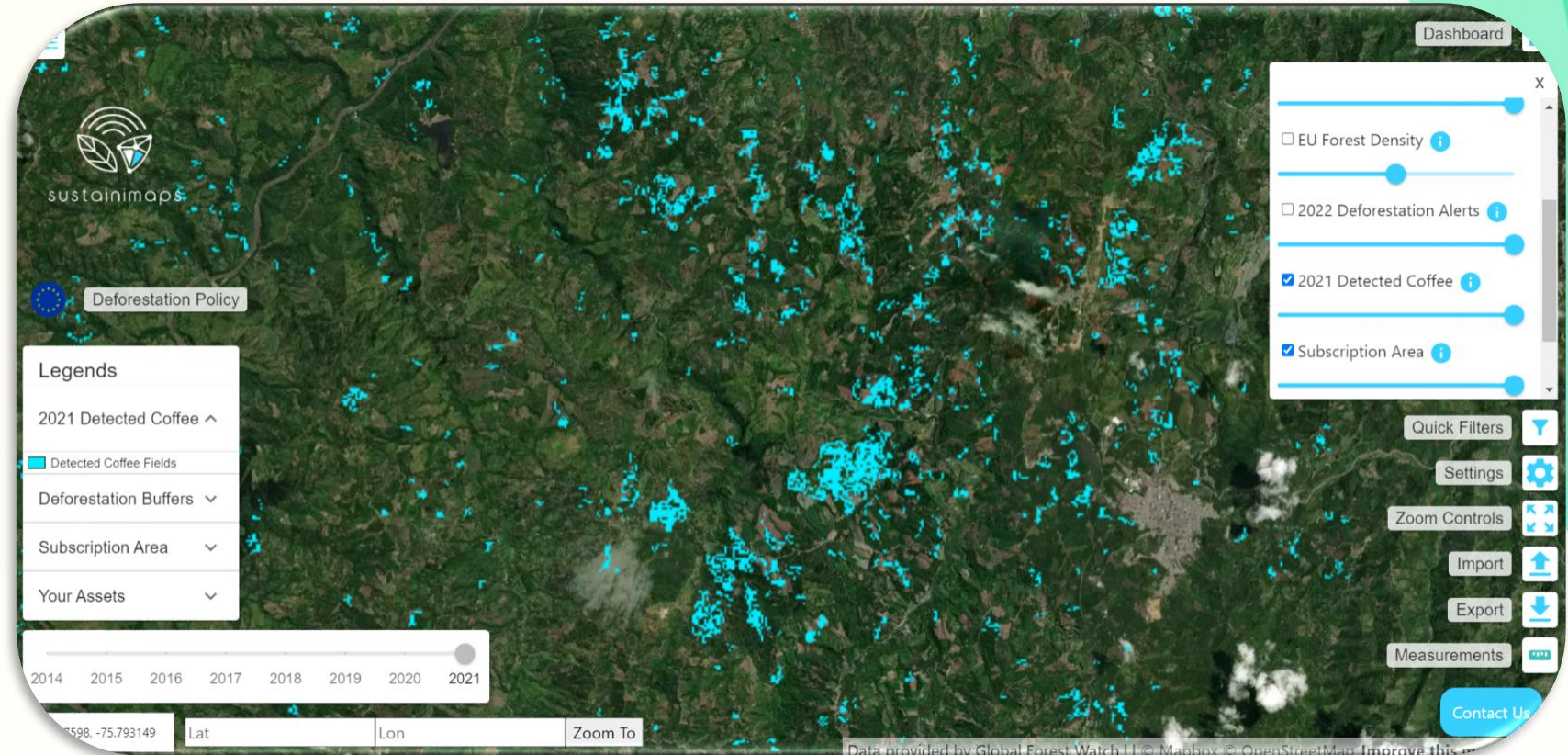
4th Oct 2021

- **Smallholder farming is approx. 50% of the growers in the scheme**
- To prolong the productive lifespan of coffee, the trees are skeletonized once every 3–6 years.
- This image reflects these farming practices as misclassified deforestation.
- Deforestation is not acceptable so farmers are not paid the high premiums.

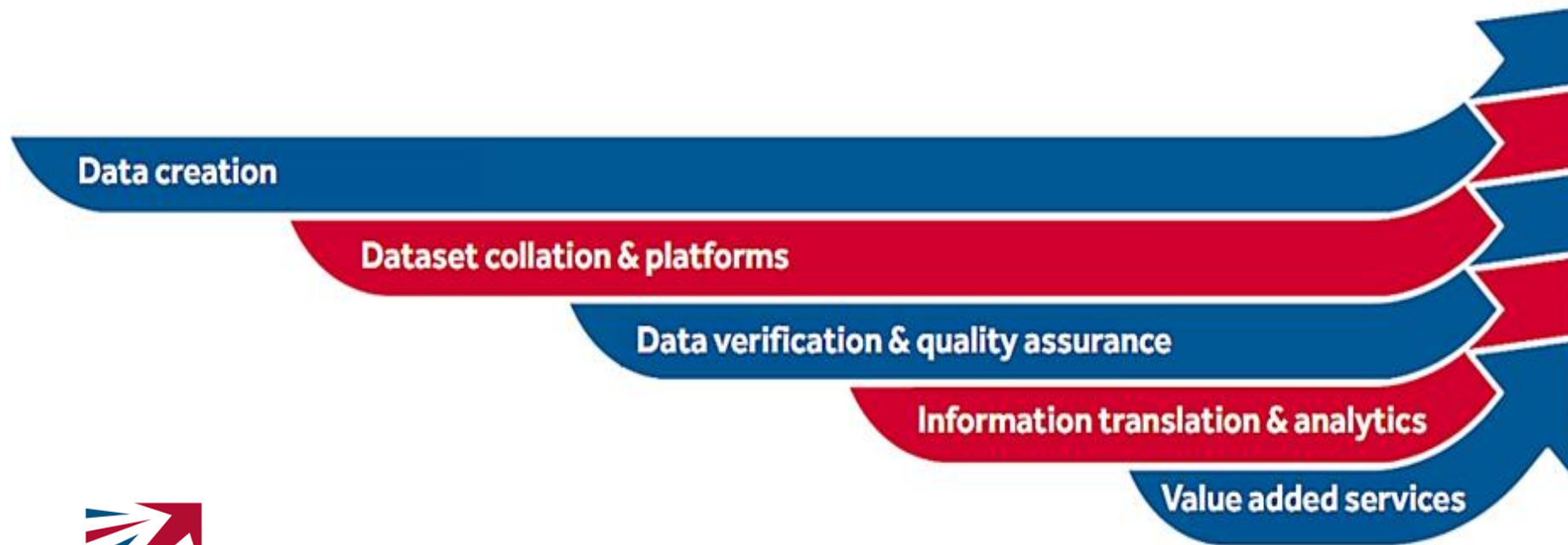


Integration of new service into Sustainimaps

- Service is integrated into Sustainimaps.
- Ground verification is underway with partners.
- This service needs a robust alert or reporting mechanism.



UNITING UK SPACE-ENABLED CLIMATE EXPERTISE AND SERVICES



Convene the Satellite EO climate community

Showcase UK space climate service capabilities and successes

Facilitate the exploitation of climate data from space

Host and support climate development innovation activities



National Centre for Earth Observation
NATURAL ENVIRONMENT RESEARCH COUNCIL

SPACE 4 CLIMATE MEMBERSHIP

- 60 + Members span government, industry and academia, working in partnership
- Support the UK's world-leading climate science and services community
- Enable a seamless supply chain of climate data from space





CASE
STUDY

RESILIENCE

SPACE
CLIMATE

RAPID FLOOD HAZARD MAPPING

Using satellite data for emergency response to extreme flood events



- A tool developed for flood management practitioners to get the best operational performance out of satellite radar data.
- Images are downloaded within 25 minutes of acquisition and revisits every 12 hours provide exceptional high currency updates of flood extents.
- Superior accuracy of flood edges, including in challenging urban areas.
- Uses slope and vegetation to provide optional depth and water velocity metrics.



AMBIENTAL
RISK ANALYTICS

TELESPAZIO
a LEONARDO and THALES company

www.Space4Climate.com

@Space4Climate

Space4Climate

FIND OUT
MORE





CASE
STUDY

RESILIENCE

ADAPTATION

SPACE
CLIMATE

SPACE4NATURE

Mapping habitats with satellites and Artificial Intelligence



- The Space4Nature Project uses Earth Observation technologies and Artificial Intelligence to map and assess the type, quality, and quantity of habitats in Surrey. This information is used to work on with landowners and organisations to create, restore and connect fragmented habitats and support healthier, more abundant biodiversity.
- The project will engage with local communities, landowners, schools, and community groups in activities to recover nature on their land.



www.Space4Climate.com

@Space4Climate

Space4Climate

FIND OUT
MORE





RESILIENCE

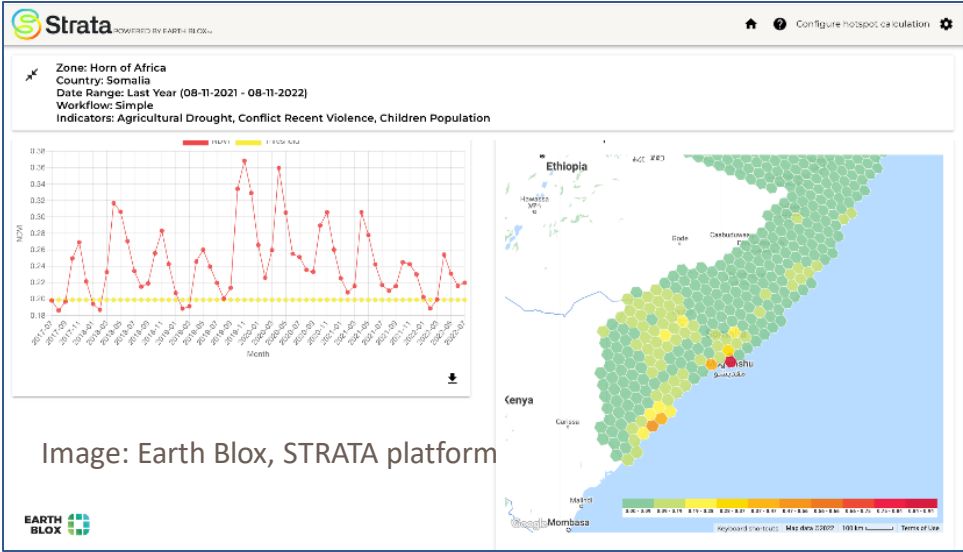
MITIGATION

ADAPTATION



STRATA

Earth Stress Monitor for the United Nations Environment Programme



- Strata is a web-based, easy-to-use data platform to support practitioners and policymakers to identify and track environmental and climate stresses potentially driving threats to peace and security.
- Strata integrates environment and climate stressors whose outputs can be analysed, encompassing precipitation, flooding, fires, tree loss, and land productivity, among others.

Image: Earth Blox, STRATA platform



www.Space4Climate.com

[@Space4Climate](https://twitter.com/Space4Climate)

[Space4Climate](https://www.linkedin.com/company/space4climate)

FIND OUT MORE





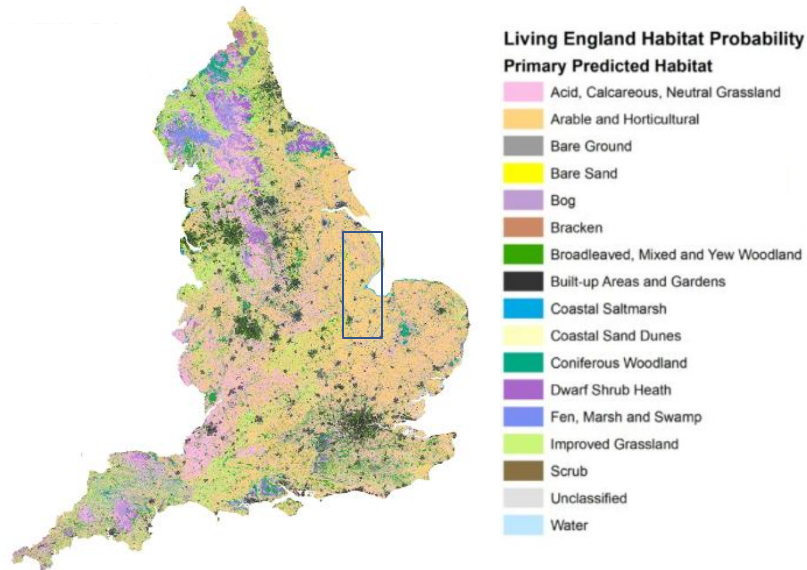
CASE
STUDY

RESILIENCE

SPACE
CLIMATE

LIVING ENGLAND HABITAT MAP

National Scale Habitat Probability Mapping



- Natural England have produced a nationwide UK map of habitats using UK Biodiversity Action Plan (UKBAP) Classification.
- The dataset is regularly updated with field data, providing evidence in a previous knowledge gap.
- The data is being used to provide evidence for the UK government's 25-year environment plan.


Department
for Environment
Food & Rural Affairs


NCEA | Natural Capital
and Ecosystem
Assessment


**NATURAL
ENGLAND**

www.Space4Climate.com

 [@Space4Climate](https://twitter.com/Space4Climate)

 [Space4Climate](https://www.linkedin.com/company/space4climate)

FIND OUT
MORE





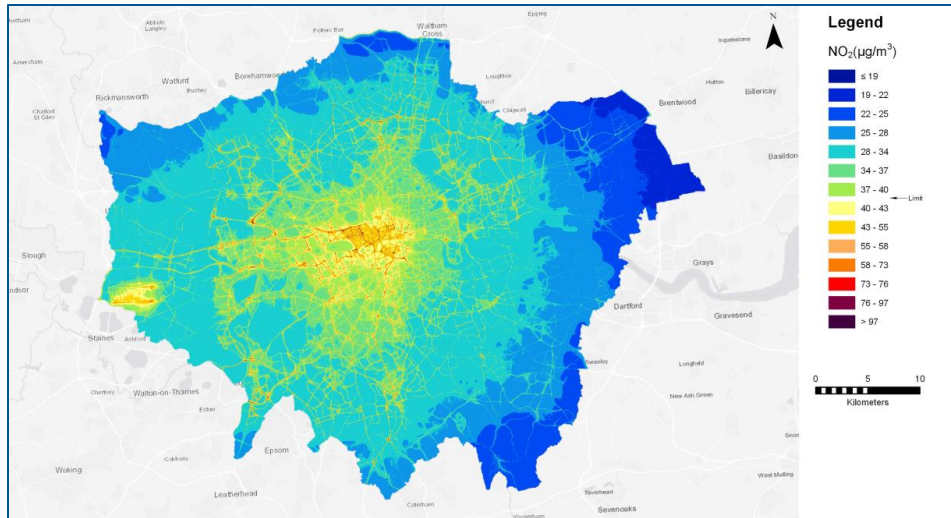
RESILIENCE

MITIGATION

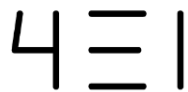


AIR QUALITY & TRAFFIC EMISSIONS

EO data for modelling air quality and traffic emissions



- On-demand air quality estimates are provided at a very high level of detail (20m resolution), using pollution models powered by a wide range of data sources, including the detection, counting and classification of vehicles based on satellite imagery.
- Other applications include: forecasting; ‘what-if’ scenario analysis; insurance/risk modelling; policy and strategy advice; air pollution concentrations and data visualisation.



Imperial College London



www.Space4Climate.com

[@Space4Climate](https://twitter.com/Space4Climate)

[in Space4Climate](https://www.linkedin.com/company/space4climate)

FIND OUT MORE





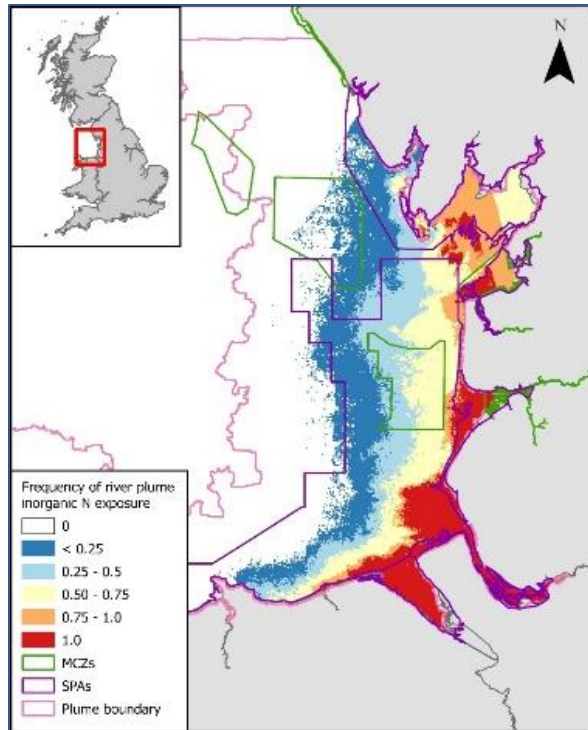
RESILIENCE

MITIGATION




MARINE POLLUTION RISK MAPPING

Using Earth Observation to map pollution from space




Department
for Environment
Food & Rural Affairs


Centre for Environment
Fisheries and Aquaculture
Science

- Combines in-situ data with satellite data.
- Provides data to map the risk to vulnerable habitats and supports a natural capital approach to environmental monitoring.
- This allows researchers to explore interactions between coastal water quality and habitat extent and conditions, helping to predict the effects of climate change and impacts of water pollution.





RESILIENCE

MITIGATION



CRISP

Climate Risk Indicators from Space

- Provide access to quality assured, world-leading climate data
- Enable analysis of our changing climate and extreme weather events
- Provide data synthesised by climate experts in a form useful to end users

- CRISP brings together quality-assured EO, reanalysis and climate projection datasets to generate a range of climate indices, including: high and low temperature extremes; heavy rainfall; drought; high wind speed and sea level.
- Users select a particular geographic point to discover historic trends and future projections of key climate indices, which can inform climate risk assessments and investment decisions based on extreme weather events and their likely frequency now and under different climate scenarios.



www.Space4Climate.com

@Space4Climate

Space4Climate

FIND OUT MORE





Space Pavilion– Space Sector Activities at COP 28

For the first time ever, COP28 will feature a dedicated Space Pavilion and the Agency has been invited to exhibit alongside a select group of other major global space agencies. The agency has been invited as a result of the outstanding work done at COP26 in emphasising the vital role Space plays in tackling climate change.



Green Zone – Space Sector Activities at COP 28



**Space Agencies leader's summit
- Pledge to accelerate climate action
through space tools and research**



Exhibition Area @ Space Pavilion



Conference Area @ Space Pavilion

THANK YOU!

- Satellite EO is a high priority for the UK and is essential we have a holistic view of the chain from technology innovation to the user needs.
- Enjoy your conference.

