

Satellite Applications

Case Study

Collaborative Synthetic Aperture Radar Solutions for Australia



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CATAPULT

SAR data presents a huge opportunity for environmental mapping applications due to the measurements it can make and because its unaffected by cloud cover or lack of sunlight.

Australia's geographical location allows it to act as a gateway to the Asia-Pacific region where potential SAR applications and markets are numerous.

Developing Environmental Mapping Applications

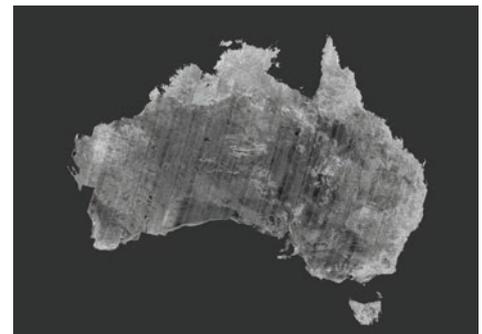
The increasing availability of satellite-derived Synthetic Aperture Radar (SAR) data is opening new measurement and service opportunities across different natural resources and agricultural markets. SAR Earth Observation (EO) data, whilst different to traditional optical EO data, is highly advantageous in being unaffected by cloud cover or lack of sunlight, therefore ensuring users can obtain critical data when required. However, making the most effective use of SAR data for specific applications is still a challenge, requiring deep understanding of the technology alongside the undertaking of complex processing, analysis and interpretation practices different from traditional optical EO imaging.

Through funding from the UK Space Agency's IPSP Programme, the Satellite Applications Catapult has been working alongside three leading Australian science and innovation groups – Commonwealth Scientific and Industrial Research Organisation (CSIRO), Geoscience Australia (GA) and the Cooperative Research Centre for Spatial Information (CRCSI) – to overcome the outlined challenges associated with SAR and to develop a sustainable, collaborative R&D programme initially based around the use of SAR data.

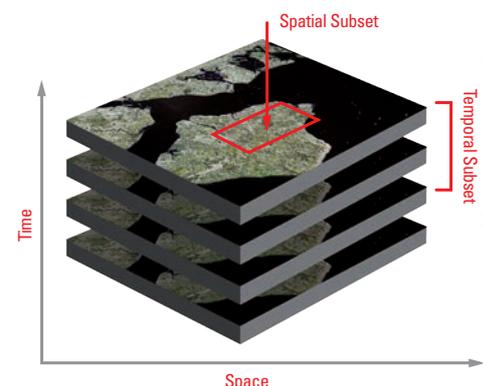
Extending SAR capability into Asia-Pacific region

The project aimed to lay the foundations for future opportunities in the wider Asia-Pacific region, supported by Australia's geographical location acting as a gateway, as well as its excellent record for global outreach and partnerships. Together, the project partners will promote and showcase the opportunities afforded by SAR data, both used singularly and in combination with optical EO data to governments and businesses, particularly in the natural resources, environmental and agricultural sectors, in order to stimulate those markets.

In parallel to the establishment of the programme, the partners have developed a high performance, multidimensional database – a 'data cube' – for SAR data, based on work previously completed in Australia for an optical data cube. With accessibility of data a blocker to the exploitation of EO data, infrastructure such as this will open up data exploitation to a new range of users across various market sectors. To showcase this technology and the advantages of working in collaboration, three demonstration projects were completed in the areas – forestry, water and agriculture. These involved additional UK commercial companies – CGG Services, NPA Mapping, Environment Systems Ltd and Carbomap Ltd, as well as leading academic expertise from Aberystwyth University.



Sentinel-1 Terrain Corrected GAMMA0 VH Mosaic @ 40 m, 451 GRDH-DV (VV+VH) processed acquired from January to May 2015



A data cube comprises a multi-dimensional array of values which can be analysed to highlight change over time at a given location.

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Solution & Benefits

The technical solution developed has been aptly termed the 'SARCube'. It applies the concept of a 'data cube' to a large collection and ongoing stream of SAR data from Sentinel-1. The

A 'data cube' stores and manages data as a multi-dimensional array, enabling any geographical point to be visualised as a time series of information.

Benefits of managing and displaying data through a data cube are that it can be explored to see changes over time in any aspect, such as deforestation, surface water loss or agricultural productivity.

concept was developed in collaboration with the Australian research community to build upon their experience gained creating an optical data cube that stores Landsat data acquired over the past 30 years. It enables applications such as GA's Water Observations from Space (WOFs) product that depicts the frequency of occurrence of surface water across the whole of Australia.

In a 'data cube' the data is stored and managed as a multi-dimensional array, enabling any geographical point to be visualised as a time series of information. The benefits of managing and displaying data in this way are that the data can be explored to see changes over time in any aspect, such as deforestation, surface water loss, or variations in agricultural productivity across fields. Over time, these layers can be compared and analysed to provide information and products to support decision making.



The project team

Outcomes & Future

Through successes of the programme, all partners are keen to continue working together to capitalise on emerging business opportunities and technical infrastructure developments to allow the programme to operate in the short-term without attracting additional funding. In the longer term and through building upon these strengthening relationships, it is hoped that additional funding will become available to sustain dedicated resources. The successful demonstrator projects saw strong collaboration between the UK and Australian Governments, SMEs and academic partners. As a result, the commercial opportunities identified and technical work undertaken puts the consortium in a strong position to work together to exploit future market opportunities across the globe.

The SARcube solution developed through the project will be a powerful way for users to access and interrogate SAR data alongside an optical 'data cube' to ensure users can exploit EO data to its 'true' potential within applications and services. Through the securing of further funding in the near future to continue the development and to also integrate the system with the existing Sentinel Data Access Service, users will have an access point for EO data built on scalable infrastructure that will be a real enabler to routine and application-driven exploitation of EO data.



Collaborative cross-border partnerships can be highly complementary and lead to the acceleration of service development, market delivery and market access.

Electron Building
Fermi Avenue
Harwell Oxford
Didcot
Oxfordshire
OX11 0QR

For more information:

T: +44 (0) 1235 567999
W: sa.catapult.org.uk
E: info@sa.catapult.org.uk
@SatAppsCatapult

Demonstration Projects

Agriculture

Australian partners, the CRCSI and Geospatial Intelligence, alongside the Catapult and Environment Systems Ltd from the UK, undertook a collaborative project to assess the technical and commercial feasibility of leveraging EO-derived services through a geospatial data infrastructure (i.e. Data Cube) for the Australian agricultural market.

The project focused on the sugarcane and wheat industries, working with key stakeholders in both supply chains to understand the barriers and opportunities for the development and exploitation of new science opportunities that have clear economic and agronomic benefits. Grain production, and in particular wheat, is the most important contributor to broad acre farming profit in Australia and therefore the ability to distinguish between crop species, and predict crop area and crop yields is hugely important for agri business. Sugar cane is also a significant export crop, where challenges around logistics are pertinent; the ability to accurately assess age, biomass and yield of sugar cane has implications for harvest and processing planning, as well as intelligence for commodity trading.

Forestry

This collaborative project explored the potential export of a robust, internationally comparable and sustainable National Forest Monitoring System (NFMS) service to public and private stakeholders within and outside Australia. Australian partners CRCSI and CSIRO and UK partners Catapult, Carbomap Ltd, and the University of Aberystwyth addressed how such a service would enable a country to address all three components of Measuring, Reporting and Verification to enable eligibility for the United Nations REDD+ program subsidies, and to also improve commercial provision of forest management services such as inventorying and commodity trading at a variety of scales.

Expertise of the respective collaborating UK and Australian organisations enabled the project to address two key areas: (i) demonstrating robust forestry-related product generation from an Analysis Ready Data (ARD) format, including within a SAR data cube environment; and (ii) development of a commercialisation strategy for provision of a forestry-related service orientated around ARD from a data cube environment.

Water

Geoscience Australia (GA), Catapult, CGG Services – NPA Mapping (UK) Ltd (CGG) undertook a collaborative project to identify the barriers and opportunities to the development of an operational water resource monitoring system that harnesses both SAR and optical data through a flexible and high performance data infrastructure.

In 2014 GA released a dataset derived from 28 years of Landsat data that depicts the frequency of occurrence of surface water across Australia (Water Observations from Space (WOFs)). The use of SAR data for surface water detection capabilities will aid the observation frequency and complement the current WOFs data product in Australia and when exploited in future 'data cubes' developed around the world.

InSAR techniques will also deliver additional value by providing proxy measures of available ground water resources. Coupling this information alongside surface water data is expected to enable the creation of a robust, internationally comparable and sustainable Water Resource Monitoring System service to public and private stakeholders within and outside Australia.