UK SPACE AGENCY

Caribou Space

International Partnership Programme (IPP)

Tim Hayward, Caribou Space, tim@caribou.space

ESTEC, SpaceTech Symposium

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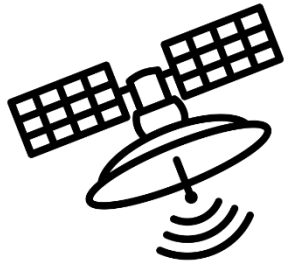
IPP: Space-enabled solutions that make a **positive and practical impact**

- £30 million pa programme using the UK space sector's **research and innovation strengths**
- **Cutting-edge innovation** – delivering practical products and services
- Delivering **sustainable** societal or economic benefits to **emerging and developing** economies
- Funded from the UK's Department for Business, Energy and Industrial Strategy's **Global Challenges Research Fund** (GCRF)
- Currently 33 projects, each delivered by a **UK led international consortium** with local in-country partners, who match fund

Using **data and technology** to solve specific challenges

ODA-compliant, providing a **measurable and sustainable** benefit



Show the **cost-effectiveness** and additional benefit of space-based solutions and applications over terrestrial systems

Develop valued and sustainable **partnership arrangements which lead to growth** opportunities

Contribute to the continued **strength of the UK's space sector**, building on it's unique strengths to deliver aid objectives

All projects were assessed on their applicability to the SDGs to ensure alignment of IPP. After 2 'Calls' IPP has so far **aligned with 12 of the 17 goals**

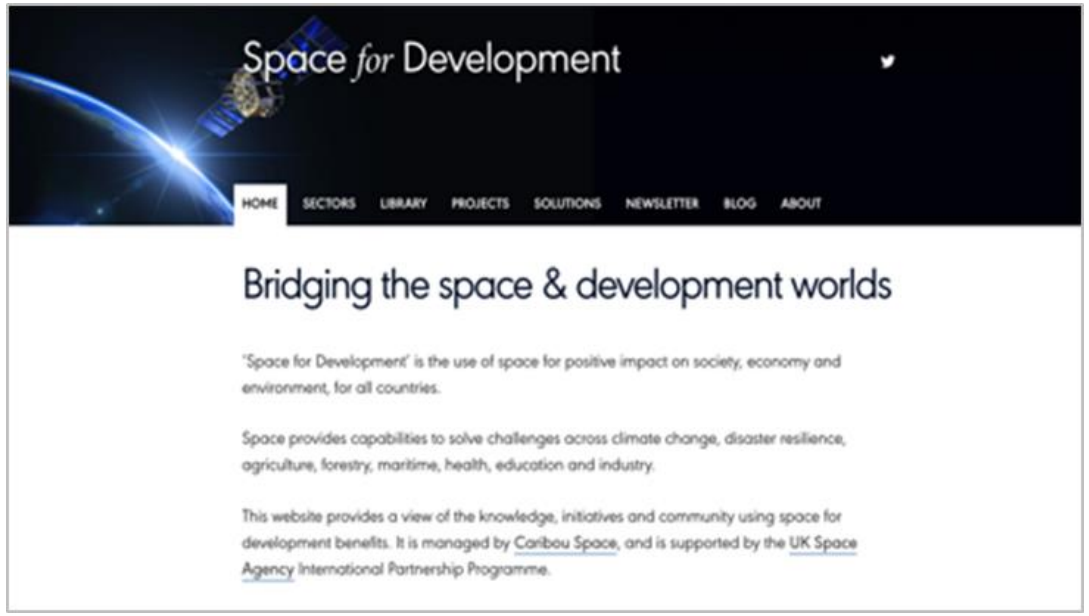
UK SPACE AGENCY

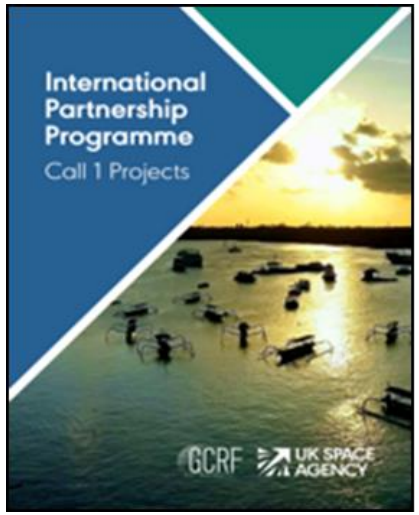
IPP will benefit over **seven million people in 29 developing countries** through the **112 international partnerships** it has formed, including government ministries, research institutes/academia, NGOs and private sector. IPP consortiums have **trained over 1,200 people** in developing countries on using space solutions to address development challenges

Eligible nations must be part of the OECD DAC List of ODA Recipients.

Knowledge Sharing is a key part of IPP

- Caribou Space for Development website
  https://www.spacefordevelopment.org/
- Library (inc reports and downloadable Solutions Catalogue)
  https://www.spacefordevelopment.org/library/
- Individual solutions
  https://www.spacefordevelopment.org/catalogue/





Current IPP project sectors

Maritime
- Management of fisheries and aquaculture
- Identify and analyse unusual maritime behaviour to enable agencies to stop illegal fishing
- Find fishing boats at sea for safety, search & rescue

Health
- Communications (voice, messaging and internet) for rural health workers and clinics
- Assess risk of outbreak and spread of disease

Education
- Communications (voice, m… …nd internet) for rural schools

Water & Sanitation
- Improve infrastru… …r and sanitation
- Identify existing… …ped watering holes)

DAMSAT

Energy
- Accurately plan, … …and hydropower systems, based on i… …all, for countries, companies or communiti…

Mining and Industrial
- Minimise environmental damage from mining and industry
- Monitor the development of large infrastructure projects

Urban and Transport
- Monitor the development of large infrastructure projects

Communications and Connectivity
- Communications (voice, messaging and internet) for communities and businesses

Climate and Disaster Resilience
- Assess the risk of when, where and how severe a weather-based disaster, e.g. cyclones and floods, will be
- Assess the risk of when, where and how severe other disasters, e.g. fires, earth… …s, will be
- Monito… …ions when disaster strikes to impr… …ms and assets
- Ide… …e, including buildings, infra… …k
- Comm… …g and internet) when networks are damaged …

PRISE

Agriculture
- Forecast weather, including flood and drought, and monitor crops, to improve agricultural decisions for increased yields
- Assess risk of outbreak and spread of pests
- Forecasting agricultural productivity to improve agricultural supply chains

Forestry and Land Use
- Identify sites of potential illegal logging and provide enforcement agencies with information to interdict illegal loggers
- Measure social and economic value of forests and forest products
- Monitor carbon stocks within forests
- Observations of tropical peatland condition, as input to peatland management and restoration
- Map what land is used for at present, and what it could be converted to for greater economic or social benefit
- Monitor land and coastal environments for degradation
- Demonstrate opportunities for better use or management of land for economic, societal and environmental benefit

Project 1: **PRISE** - **P**est **R**isk **I**nformation **S**ervice

Contribute to reduction in hunger
Increase food security
Increase farmer income

- A **crop pest and disease risk forecasting product** designed for smallholders and commercial producers in Kenya, Zambia, Ghana, Malawi and Rwanda
- **Crowd sourcing observations** will be established to strengthen and validate the system
- Risk forecasts integrated into existing plant health systems **to trigger appropriate action** to deliver at scale alerts, advice and inputs to farmers
- **Builds in-country technical capacity** and interrelated business plans that **engage the private sector** (e.g. agro-dealers and insurance companies) for sustainability
- Ministries in all countries will be encouraged to **develop policies to strengthen crop protection,** by showing that an effective pest forecasting service that integrates innovative technologies can be scaled to national, regional and global levels

***Implementation partners**:*

CABI ASSIMILA

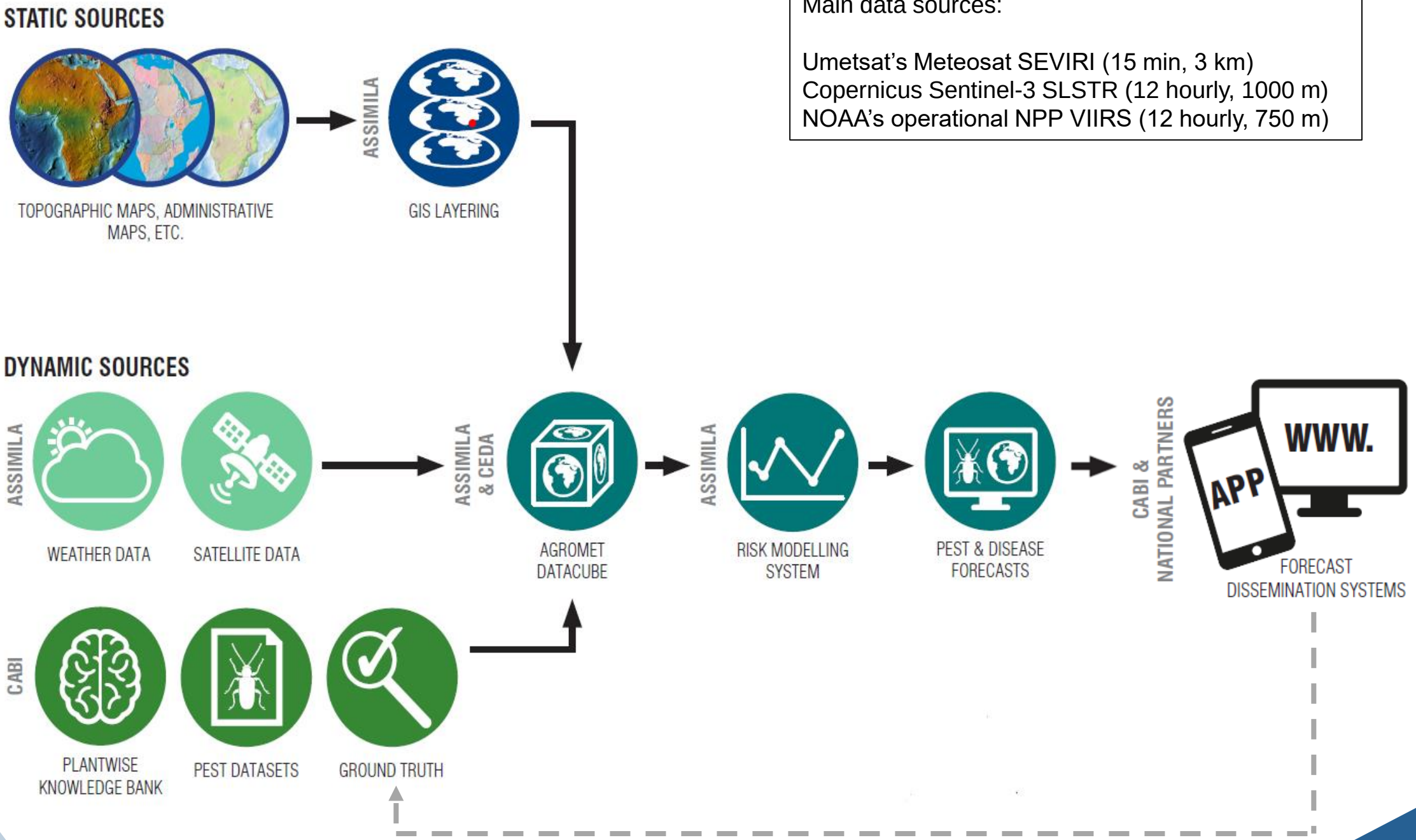
KING'S College LONDON

Centre for Environmental Data Analysis
SCIENCE AND TECHNOLOGY FACILITIES COUNCIL
NATURAL ENVIRONMENT RESEARCH COUNCIL

+ National partners

Main data sources:

Umetsat's Meteosat SEVIRI (15 min, 3 km)
Copernicus Sentinel-3 SLSTR (12 hourly, 1000 m)
NOAA's operational NPP VIIRS (12 hourly, 750 m)



- System architecture agreed and prepared.
- Relevant pests and growth models ascertained.
- Initial EO data products produced
- First user interface created.
- Coarse pest population estimates produced by the system provided

- Information from Plantwise ingested by the system
- Plantwise data incorporated into processing using some data assimilation methodology.

- Incorporation of new Earth Observation datasets.
- Inclusion of new pest population predictions
- Use of new map layers within the system to create new products for users.

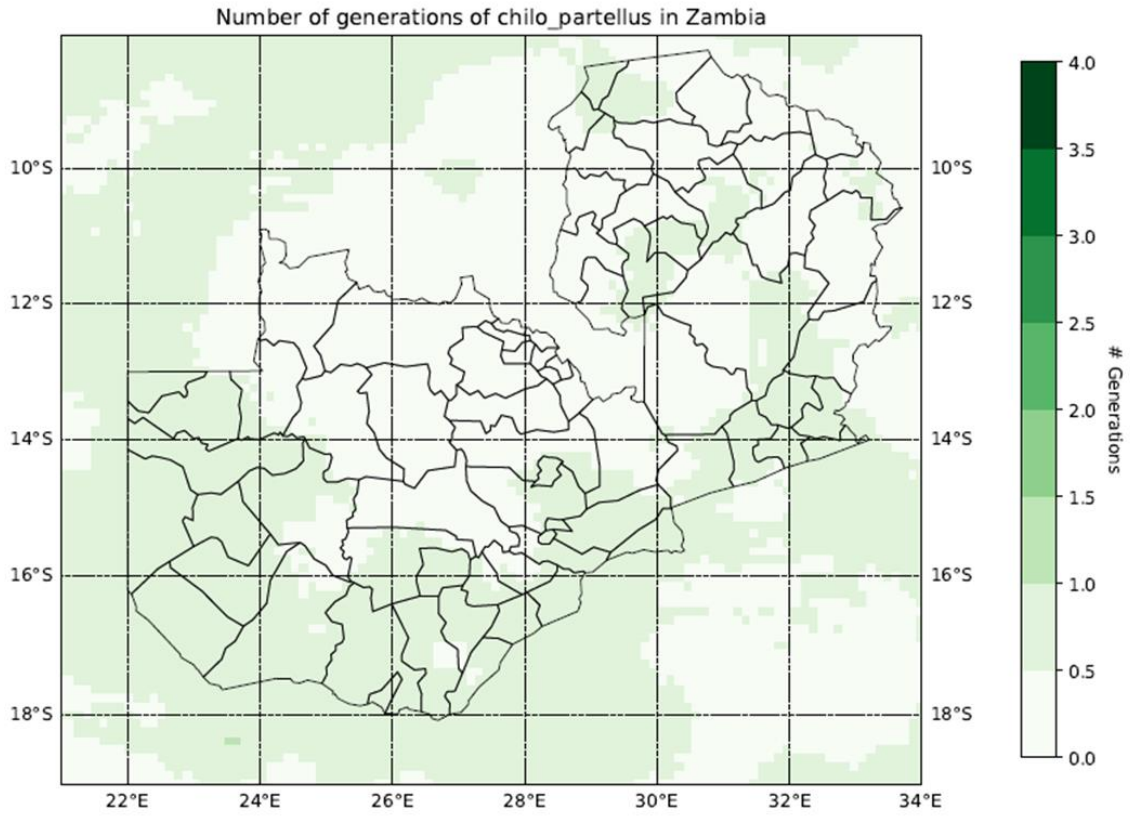
- Crowdsourced information (from app or similar) is ingested automatically into the system.
- New data assimilation-based algorithms established to make use of crowdsourced data.

- Final version tailored for smallholders and/or commercial users, provided as an API, SMS or an app for example.

Each year adds more:

- Pests/crops
- System features
- Users and dissemination channels

From satellites to stem borers: translating predicted risk to an actionable message



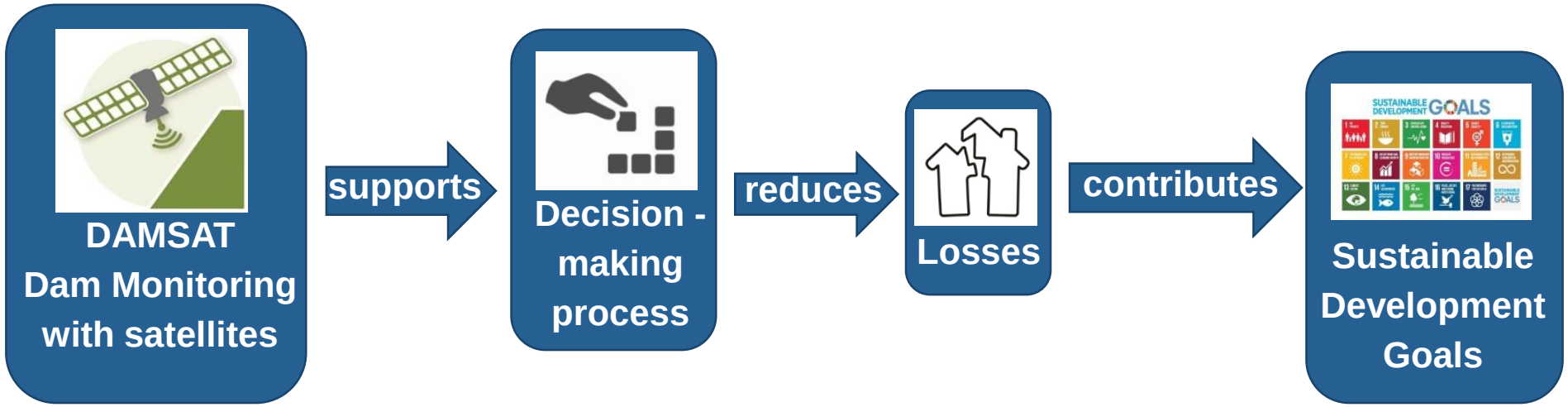
- PRISE models pest outbreaks by combining EO data with data on the biology of pests to predict when conditions match the necessary environment that allow pest populations to grow uncontrollably

- Pest outbreaks occur when a particular pest has the required time under particular weather conditions to develop and establish a population large enough to cause an impact

PRISE v1 (“Baseline”) alerts: pest forecast chatbot

- Target audience for first release: Plantwise Plant Doctors and other extension workers
- Delivery channel: Chatbot in Telegram messaging programme
- Weekly forecasts of pest development for each of the key pests prioritised by in-country partners
- There are currently over 600 users receiving PRISE pest alerts in Kenya, Zambia and Ghana. Malawi and Rwanda will follow

Project 2: **DAMSAT**, **DA**m **M**onitoring with **SAT**ellites



- Develop an operational **service to monitor** tailings deposits
- Support the **reduction of the environmental and social impacts** of tailings dams failures
- Influence the **adoption of Earth Observation monitoring tools**

What is a Tailings Dam?

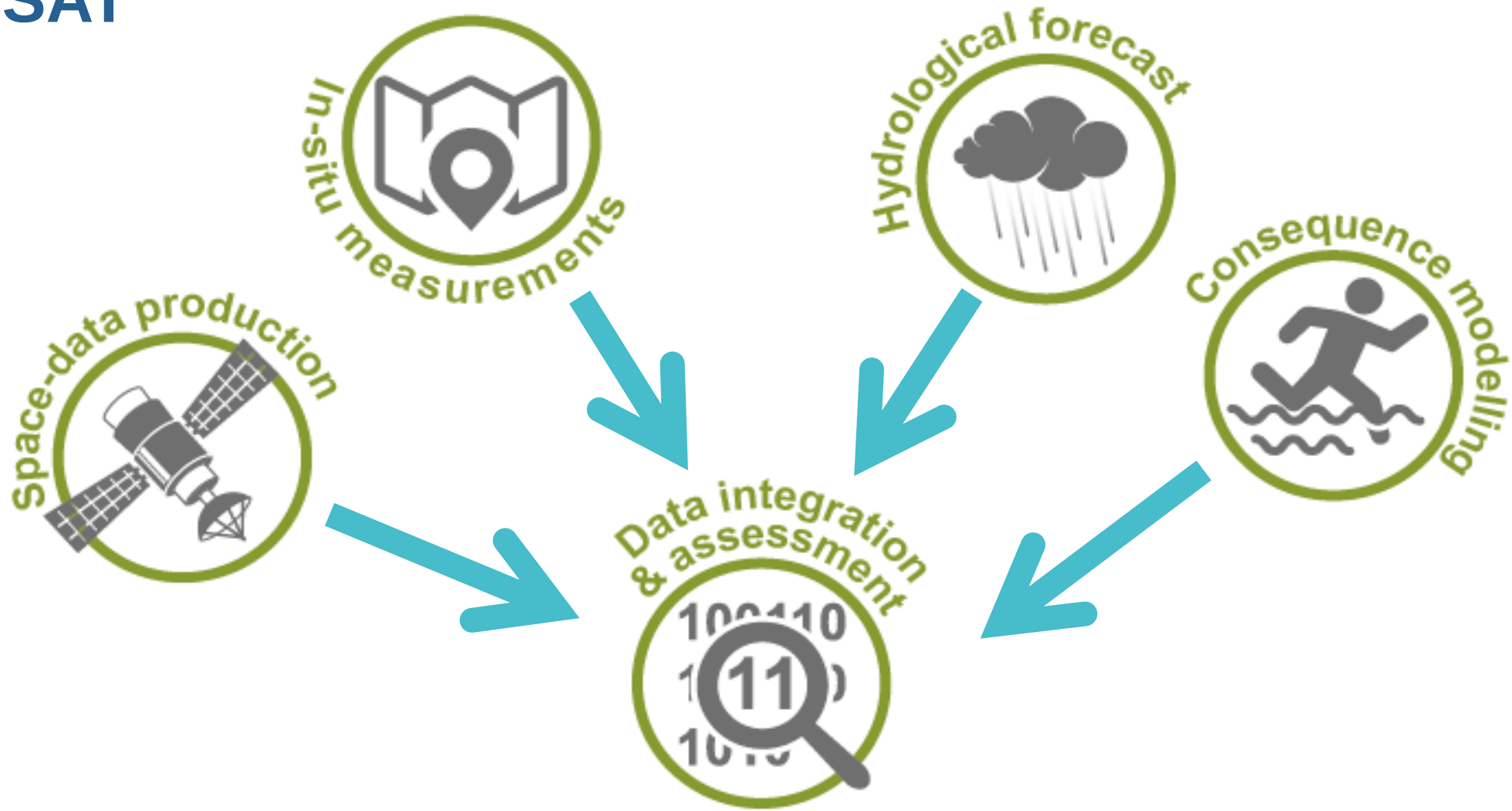
The problem

Brumadinho tailings dam in Brazil. Failed in January this year

Closed tailing deposits

Abandoned tailing deposits

DAMSAT

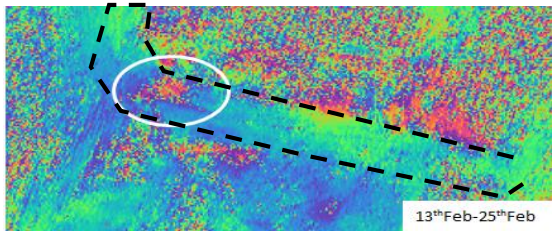

In-situ measurements
Hydrological forecast
Consequence modelling
Space-data production
Data integration & assessment

Satellite information

MOVEMENT DETECTION

INSAR: SyntheticApretureRadar Interferometry

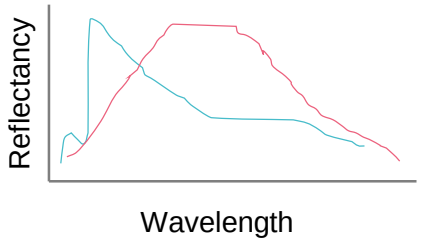
- Many points over a large area
- Precision of mm-cm
- Cosmo-SkyMed, Sentinel-1



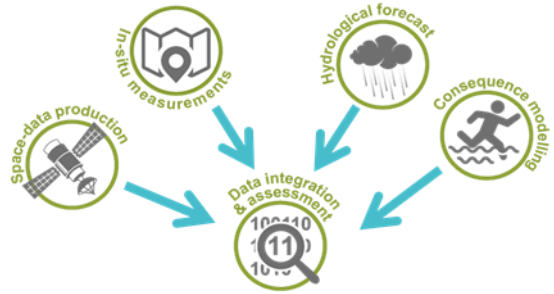
POLLUTION DETECTION

Optical imagery

- Iron Oxide
- Vegetation health (NDVI)



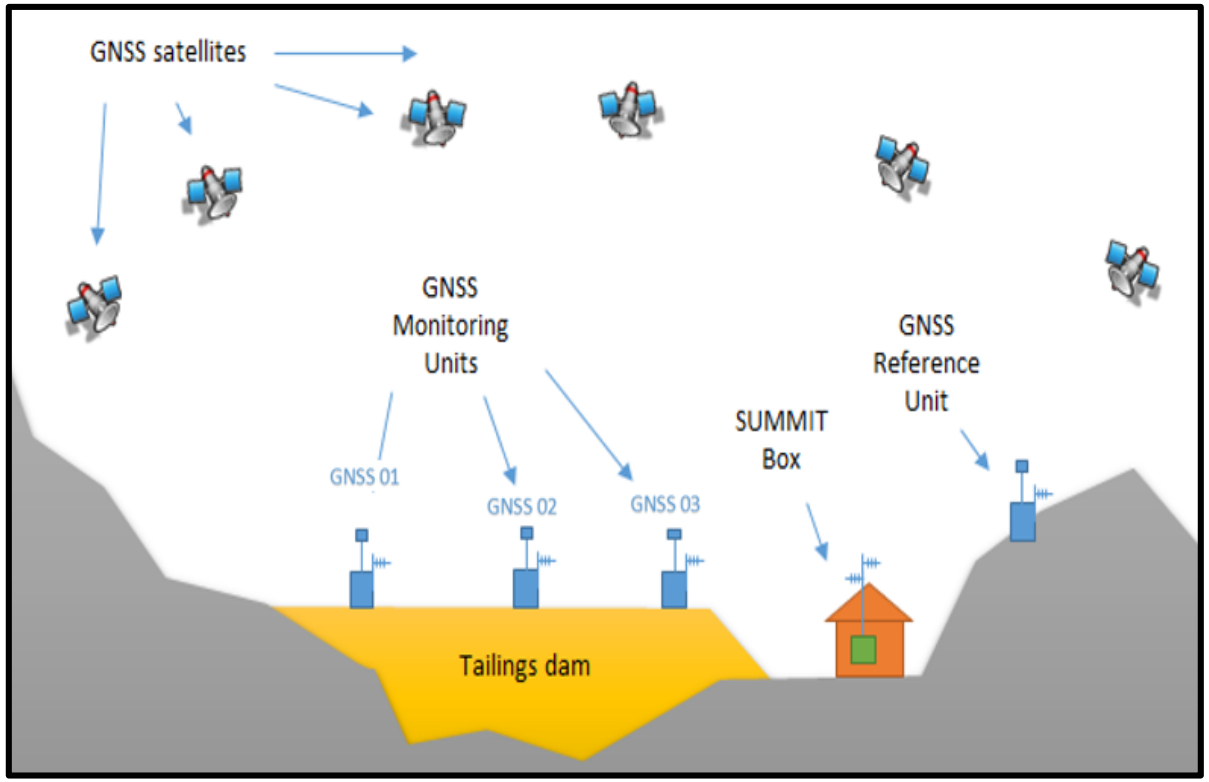
In-situ information



MOVEMENT DETECTION

GNSS - Global Navigation Satellite System

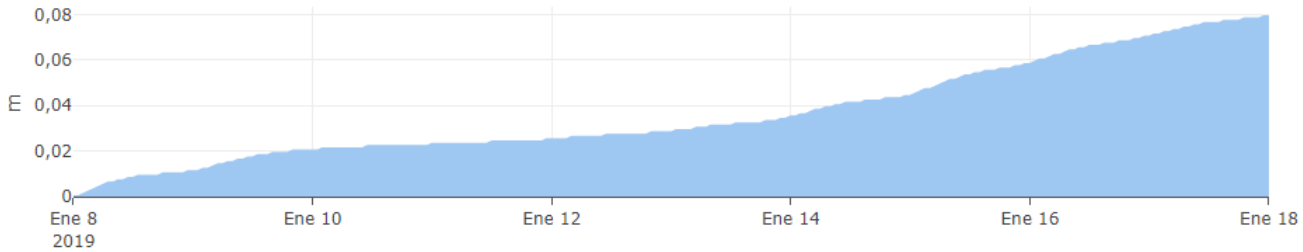
- Real time measurements
- Precision of mm



Hydrological forecast

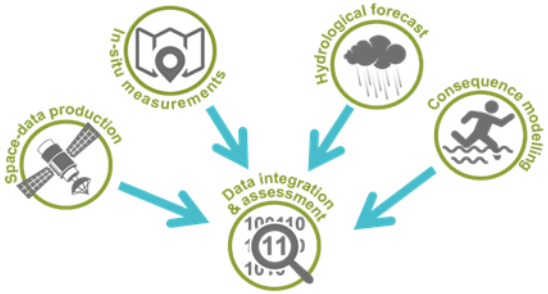
Rainfall forecast

Hydrological models

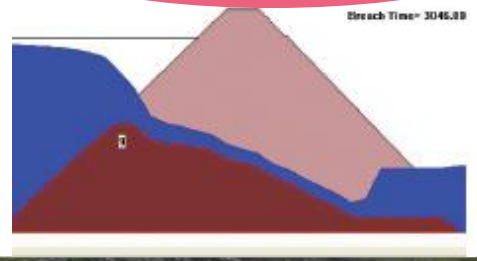


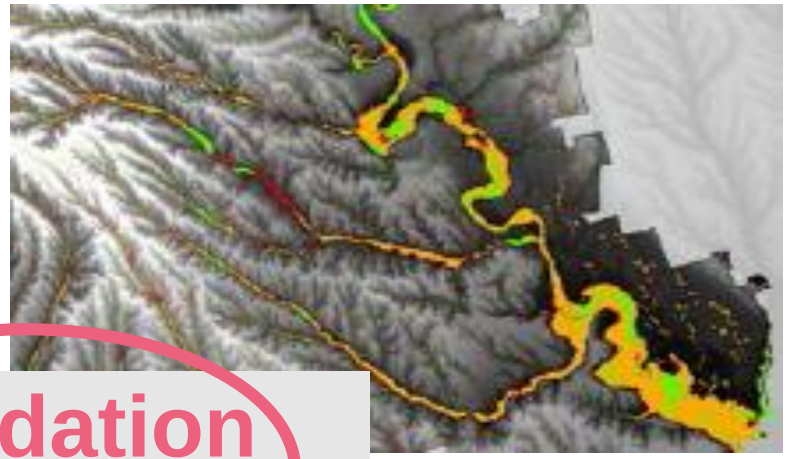
Increase of water levels

Consequences modelling

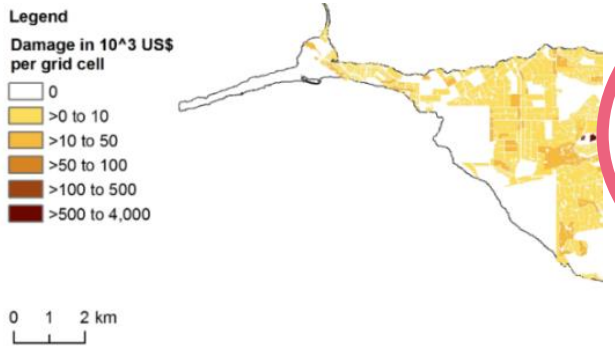


Dam breach





Inundation models



Loss of life & economic damages

In summary

- IPP **develops and implements space-enabled solutions** that make a positive and practical impact
- **Uses cutting-edge innovation** – delivering practical products and services
- Delivering **sustainable** societal or economic benefits to **emerging and developing** economies
- Currently 33 projects in 29 countries, each delivered by a **UK led international consortium** with local in-country partners, who match fund
- **Making a practical contribution to the management and monitoring of the environment from space**

Background

General Solutions

- Earth and Sea Observation System (EASOS) (Satellite Applications Catapult)
- Ecometrica Platform (Ecometrica)
- Satellite Data Services: Near Real Time Imagery (Environment Systems)
- Radiant Earth Foundation Platform
- Service4EO (Deimos Space UK)

Climate and Disaster Resilience

Assess the risk of when, where and how severe a weather-based disaster, e.g. cyclones and floods, will be

- CommonSensing (UNITAR)
- Coastal Risk Information Service (C-RISe) (National Oceanography Centre)

Assess the risk of when, where and how severe other disasters, e.g. fires, earthquakes and volcanoes, will be

- FireSat (Clyde Space)
- Forest and Wild Fire Monitoring (eOsphere)

Monitoring of disaster-impacted regions when disaster strikes to improve coordination of response teams and assets

- EASOS Data Discovery Hub (Geocento)
- Rapid Flood Mapping Service (RFMS) (Telespazio VEGA UK)
- Humanitarian Rapid Mapping Service (UNOSAT)

Identify and value assets for insurance, including buildings, infrastructure and agriculture/livestock

- SIBELIUs (eOsphere)

Communications (voice, messaging and internet) when networks are damaged or absent

- SatComms for Climate and Disaster Resilience (Avanti)
- SatComms for Natural Disasters (Inmarsat)

Agriculture

Forecast weather, including flood and drought, and monitor crops, to improve agricultural decisions for increased yields

- Crop Observation, Management & Production Analysis Services System (COMPASS) (Rezatec)
- Drought and Flood Mitigation System (DFMS) (RHEA)
- Earth Observation for Flood and Drought Resilience (Airbus Defence and Space)
- Ecological Production Management Information System (EcoProMIS) (Agricompas)
- Grape Production Climate Resilience (Rothamsted Research)

Assess risk of outbreak and spread of pests

- Advanced Coffee Crop Optimisation for Rural Development (ACCORD) (Earth-i)
- Pest Risk Information Service (PRISE) (CABI)
- Pest Prediction (CABI)
- WeatherSafe Platform (WeatherSafe)

Forecasting agricultural productivity to improve agricultural supply chains

- Agriculture Simulations (Sensonomic)
- Agri-track (Environment Systems)
- Land Resource Evaluation Service for Agricultural Activity and Production (Booker Tate)
- Land Cover® plus Crops (Remote Sensing Applications Consultants)

Forestry and Land Use

Identify sites of potential illegal logging and provide enforcement agencies with information to interdict illegal loggers

- Forest Change Mapping (Telespazio VEGA UK)
- Forest Disturbance Early Warning System (FDEWS) (Remote Sensing Applications Consultants)

Measure social and economic value of forests and forest products

- Forests 2020 & ForestWatch Optical Change Detection (University of Leicester)

Monitor carbon stocks within forests

- Carbon Data Model Framework (CARDAMOM) (University of Edinburgh)

Observations of tropical peatland condition, as input to peatland management and restoration

- Peatland Monitoring (CGI)
- Surface Motion Monitoring (ISBAS) (GVL)

Map what land is used for at present, and what it could be converted to for greater economic or social benefit

- Land Cover Mapping (Remote Sensing Applications Consultants)
- Inventaire Modélisation et Alerte de la Gestion l'Environnement (IMAGES) (Vivid Economics)

Monitor land and coastal environments for degradation

- Pixalytics Portal (Pixalytics)

Demonstrate opportunities for better use or management of land for economic, societal and environmental benefit

- SENCE (Environment Systems)

Maritime

Management of fisheries and aquaculture

- Marine Environment Monitoring (eOsphere)

Identify and analyse unusual maritime behaviour to enable agencies to stop illegal fishing

- Innovative SatComms for Inclusive and Sustainable Fishing (Inmarsat)

Find fishing boats at sea for safety, search & rescue

- C-RISe Near Real Time Marine Information Service (Satellite Oceanographic Consultants Limited)

Health

Communications (voice, messaging and internet) for rural health workers and clinics

- SatComms for Rural Health Services (Inmarsat)

Assess risk of outbreak and spread of disease

- Dengue MOsquito Simulation from Satellites (D-MOSS) (HR Wallingford)

Education

Communications (voice, messaging and internet) for rural schools

- iKnowledge (Avanti)

Water & Sanitation

Improve infrastructure for provision of clean water and sanitation

- Watershed Management (Rezatec)

Identify existing water sources (previously unmapped watering holes)

- Water Availability (Pixalytics)

Energy

Accurately plan, design and monitor solar, wind and hydropower systems, based on insolation, wind and rainfall, for countries, companies or communities

- Renewable Energy Space Analytics Tool (RE-SAT) (Institute for Environmental Analytics)

Mining and Industrial

Minimise environmental damage from mining and industry

- Dam Monitoring from SATellites (DAMSAT) (HR Wallingford)

Monitor the development of large infrastructure projects

- Satellite-Structural Health Monitoring (S-SHM) & Satellite Ultra-Precise Motion Monitoring Integrated Technology (SUMMIT) (Telespazio VEGA UK)

Urban and Transport

Monitor the development of large infrastructure projects

- Satellite Image Analysis for Maintenance of Property Databases (Airbus Defence and Space)

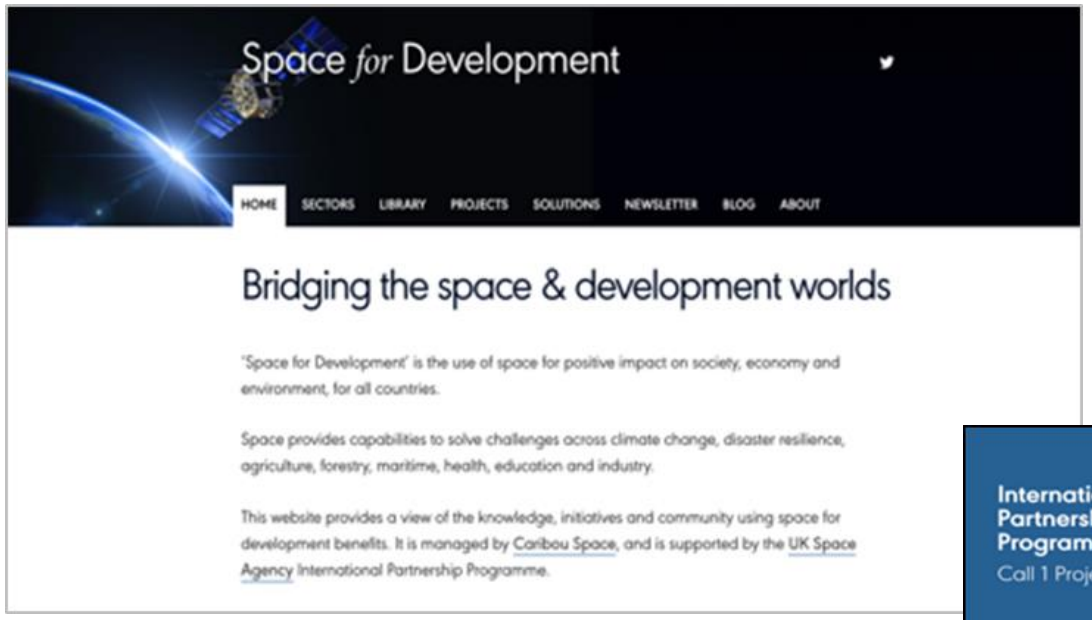
Communications and Connectivity

Communications (voice, messaging and internet) for communities and businesses

- Every Community Online (ECO) (Avanti)
- SCYTALE Suite (GRC)

Thank you

Tim Hayward
Caribou Space
tim@caribou.space



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- Individual solutions https://www.spacefordevelopment.org/catalogue/
- Caribou Digital https://www.cariboudigital.net/