Working Group on Calibration and Validation (WGCV): 41

UKSA AGENCY report: NPL

Nigel Fox

NPL WGCV 41

Earth observation at NPL

NPL National Physical Laboratory | Centre for Carbon Measurement

Satellite data quality

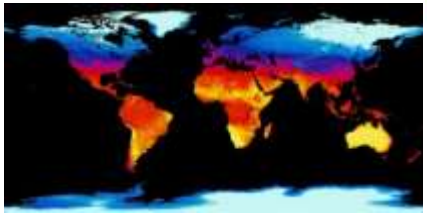
Pre-flight
Individual sensor data sets

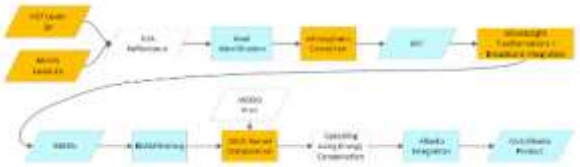
Instrument calibration and quality assurance: currently: S2, 3, 4 & EarthCare, MTG

In-flight
Individual and sensor to sensor

Establishing test-sites, field-work validation, land/ocean & Radcalnet, TRUTHS

Products & Exploitation
Multi-sensor/timescales and processing





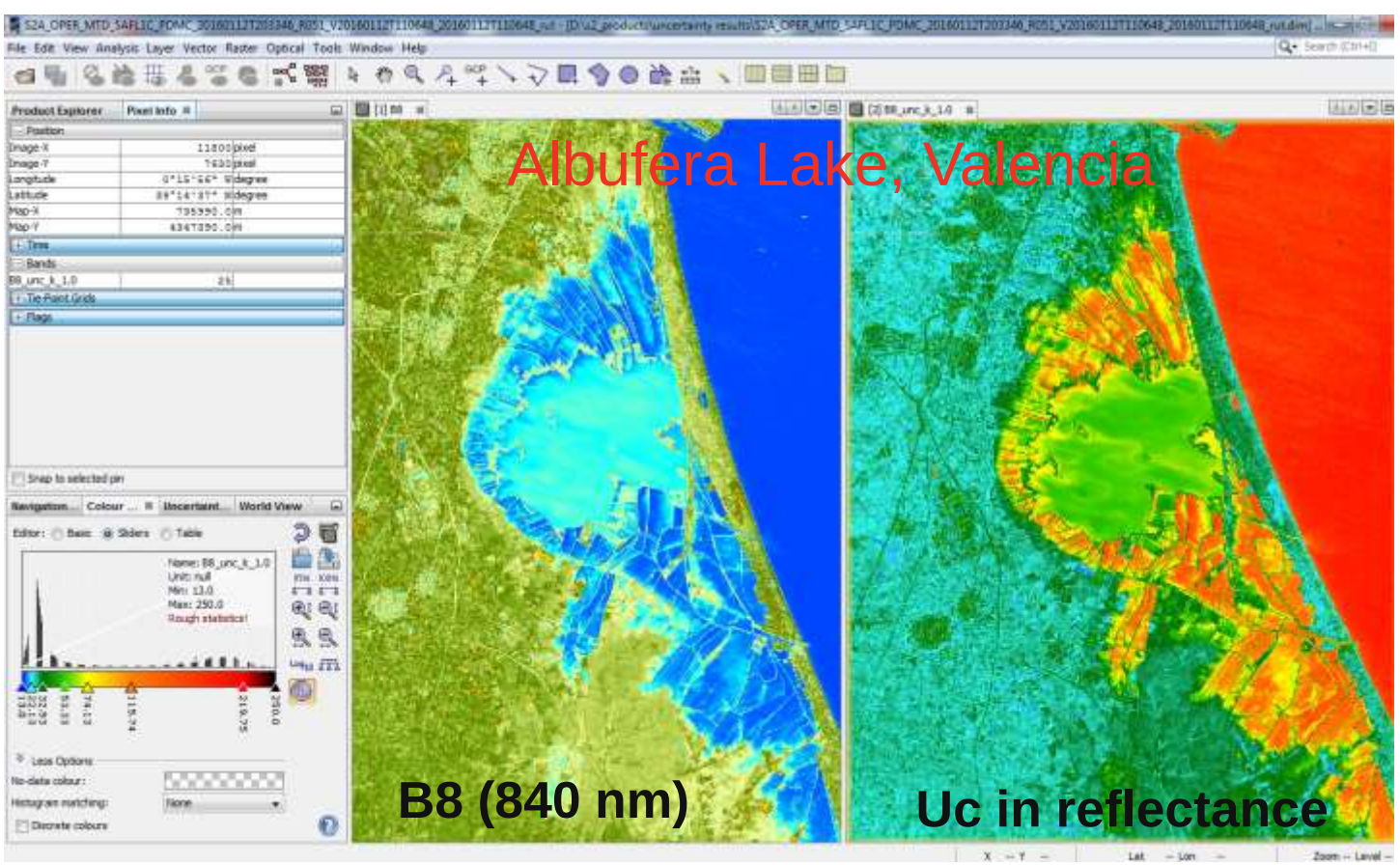
Improving climate services & models to support UK policy

On-going Co-funded projects

- Major Synergy from delivery with Co-funded projects but little short-term flexibility for additional science

National Measurement System

Enabling ‘user generated’ per pixel Uc images



NPL developed software tool (sentinel 2 tool box) to analyse L1 data allowing scene dependent Uc image to be created by, and at the user terminal after data download

Traceability Diagrams

visualising evidence/provenance

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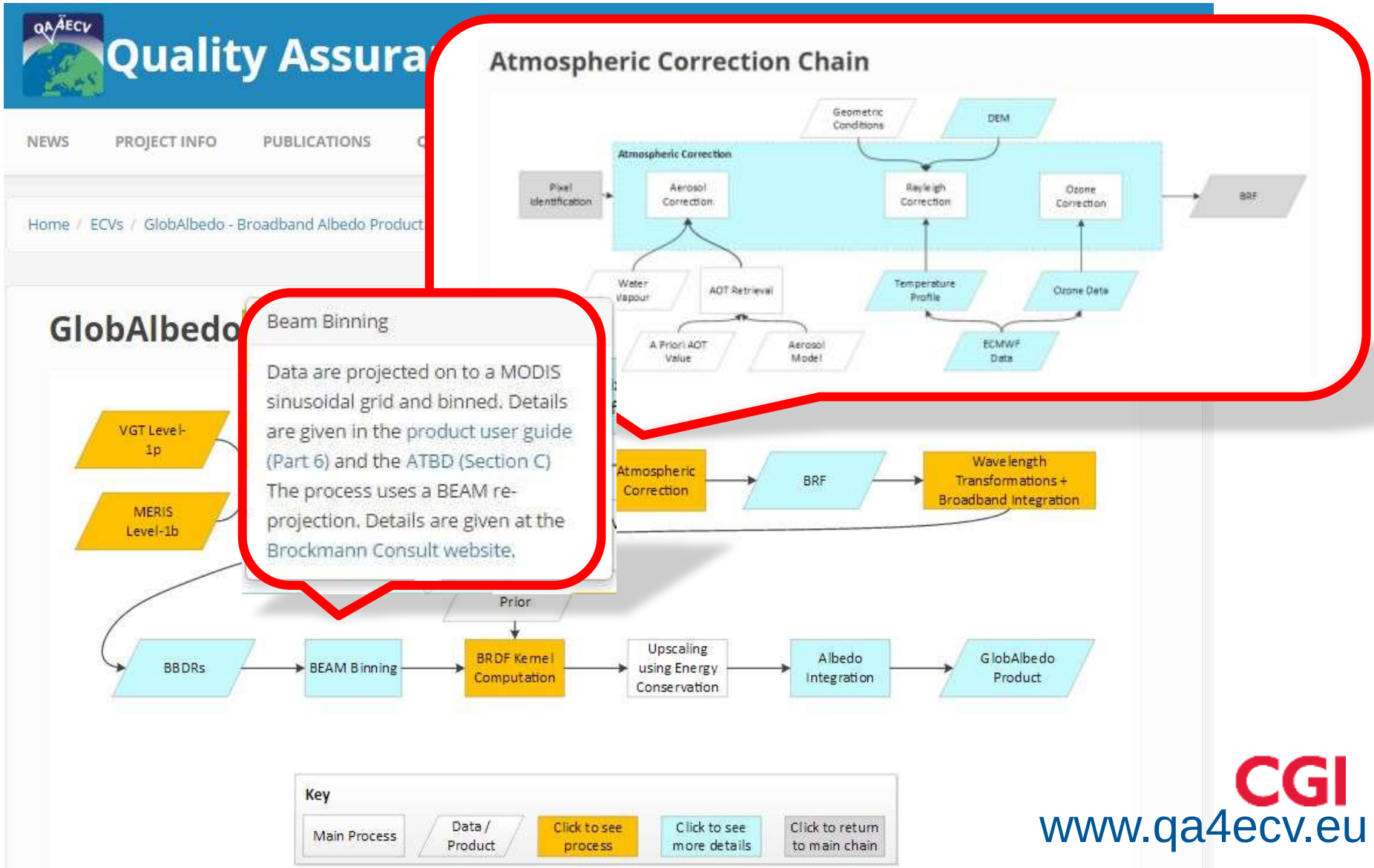
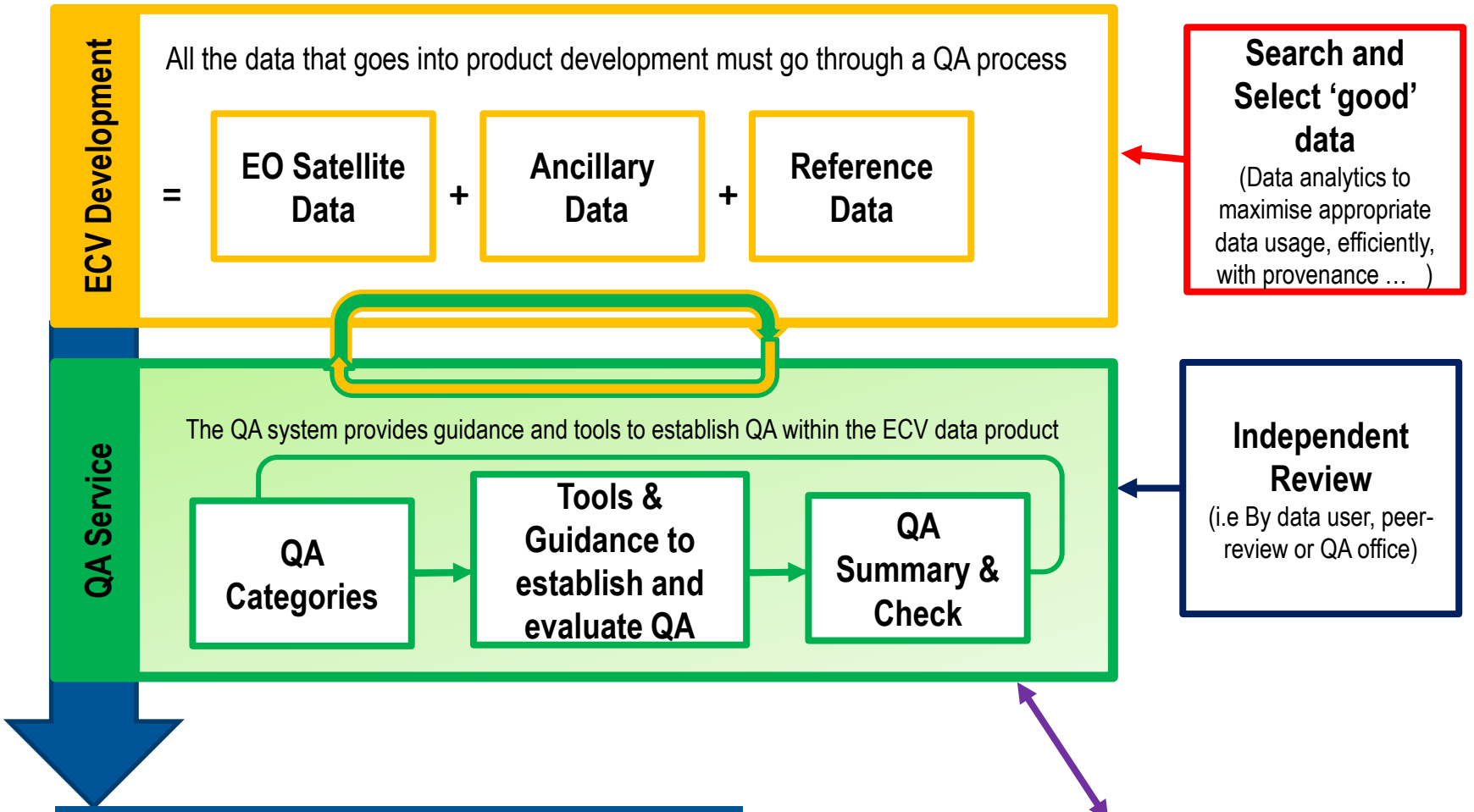


CGI

www.qa4ecv.eu

FRAMEWORK FOR QA of INPUT observations to EU C3S Data Store



Traceability and Validation of Bio-physical products (Joanne Nightingale ex LPV chair)

National Physical Laboratory

Metrology for Earth Observation and Climate

Field Gonio-meter for spectral reflectance (BRF) of individual leafs

(JRC, INRIM, NPL)

GRASS ~ 2 m diameter

To ~ 20 cm diameter

NPL Management Ltd - Commercial

Virtual Truth

Metrology for Earth Observation and Climate

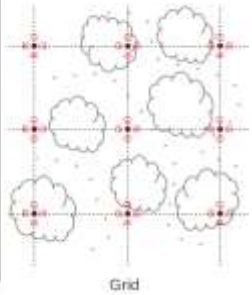
NPL National Physical Laboratory

Centre for Carbon Measurement

- Establishing ECV traceability through modelling, reference measurements and test-site characterisations

Instrument characterisation in lab and field conditions

Testing and evaluation of sampling schemes (Temporal, Spatial)



3D Radiative Transfer model
- Simulate a virtual validation site (algorithm quantification)
- Simulate real-world test site

Comparison of in situ with satellite data with full traceability and known uncertainties

Validation Needs…

- Rigorous calibration of sensors in the laboratory (PAR, LAI)
- Spectral, angular and environmental information

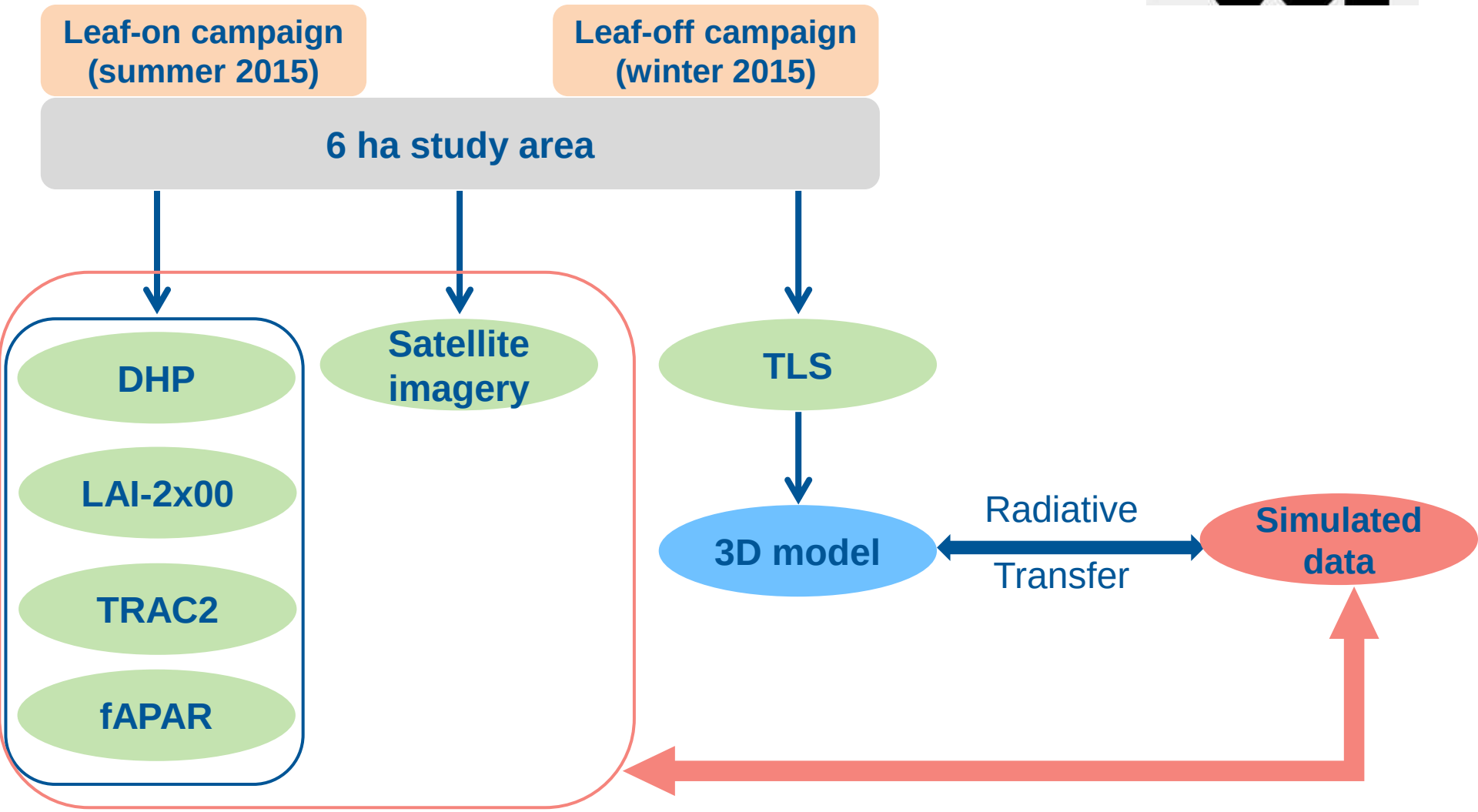
Evaluating TLS & creating virtual test sites

UCL
NPL
National Physical Laboratory

1. Data collection within the MetEOC2 project: sampling large areas with TLS ➔ new opportunities

2. Building a 3D virtual reference site from TLS data ➔ a “virtual laboratory” as QA framework for other sensors & end-to-end traceability

Methods


Leaf-on campaign (summer 2015)
Leaf-off campaign (winter 2015)
6 ha study area
DHP
LAI-2x00
TRAC2
fAPAR
Satellite imagery
TLS
3D model
Radiative Transfer
Simulated data

TRUTHS Fiducial reference data sets from space (in-orbit climate and calibration satellite)

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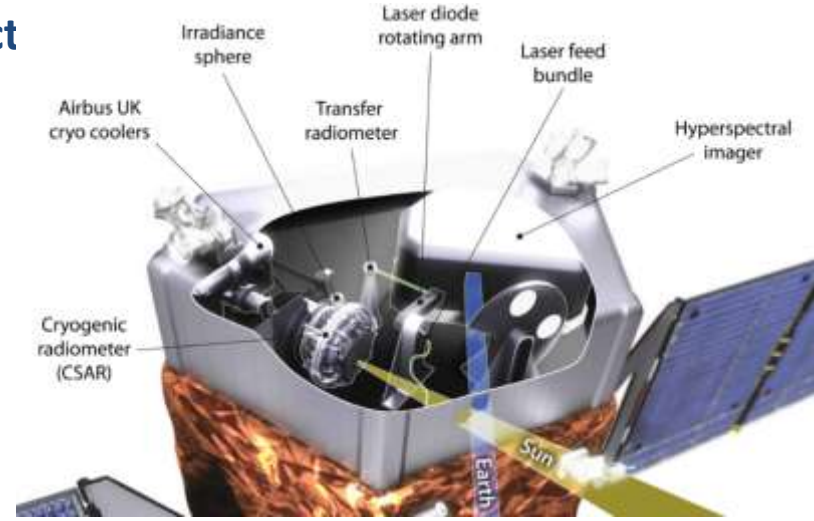
- A satellite proposal (currently to ESA EE9) developed with a wide UK partnership led by NPL to provide 10 times more accurate climate data (a Snapshot of climate state from which to monitor change) and upgrade the performance of the world's EO satellites
  - A space climate and calibration observatory, NMI in space
    - Requested by international bodies (WMO, GCOS etc)
  - A plug-in to Copernicus to upgrade its capability to climate quality
- Benefits include:
  - Informing policy on the best adaptation strategies
  - Facilitating growth in climate services extract long term risk e.g. insurance
  - Secondary products agriculture, resources …
- Based on heritage components: disruptive innovation resides in on-board calibration system and its implementation



Imperial College London | UK Space Agency | EMRP European Metrology Research Programme Programme of EURAMET | University of Reading | SURREY Satellite Technology Ltd | RAL Space | Met Office | Metrology for Earth Observation and Climate | UCL | CEOI-ST | TELESPAZIO VEGA UNITED KINGDOM | AIRBUS DEFENCE & SPACE