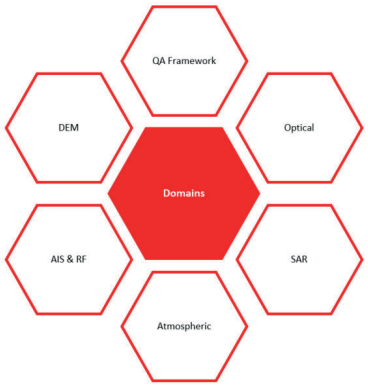
DATA QUALITY ASSURANCE SERVICES

INTRODUCTION

Telespazio UK (TPZ UK) is a leader in Earth Observation (EO) data quality assessment and assurance, delivering quality assurance & quality control (QA/QC) services to institutional and commercial customers. EO data is vital to address critical societal challenges, whilst also presenting numerous economic opportunities. We see data quality as a key priority to ensure the trustworthiness of EO data, to ensure its increased uptake within all sectors and to enable it to provide decision-critical information.

EARTHNET DATA ASSESSMENT PROJECT (EDAP)

The ESA Earthnet Programme provides the framework for integrating non-ESA missions, i.e. TPMs into the overall ESA Earth Observation strategy. Complementary to ESA-owned EO missions, the programme allows European and international users access to a large portfolio of TPMs and is particularly important for promoting the use of EO data internationally.



TPZ UK leads a team of domain-specific scientific and technical experts to perform independent preliminary quality assessments of the data and documentation procured for the identified missions (i.e. potential / candidate TPM), in a fair and consistent way following the QA framework and best practice guidelines, and establish fitness for purpose.

The generated technical notes provide important quality information that can be used to support decisions on whether assessed missions are suitable for integration into the programme as ESA Third Party Missions (TPMs).

telespazio.co.uk

Telespazio UK Ltd 350 Capability Green,
Luton Bedfordshire, LU1 3LU, UK

Tel: +44 (0)1582 399 000
Info: info_uk@telespazio.com

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INSTRUMENT DATA EVALUATION AND ANALYSIS SERVICE (IDEAS) QUALITY ASSURANCE FRAMEWORK FOR EARTH OBSERVATION (QA4EO)

IDEAS-QA4EO

IDEAS-QA4EO is an operational EO data quality service for the European Space Agency (ESA) that covers ESA and selected Third Party Missions (TPMs). The service covers expert scientific and reprocessing support, software, Instrument Processing Facilities (IPF), and tool maintenance and evolution. TPZ UK is the prime contractor with responsibility for the overall service management, operations, reporting and evolution. We provide specialist support for data quality assurance relating to specific missions (and instruments) including Landsat, SMOS, CryoSat, ERS (ATSR, SAR), Envisat (AATSR, MERIS, ASAR), JAXA's ALOS mission and others.

The service includes four main tasks:

Quality Control Operations & Tools Maintenance & Evolution

Mission-focused operational task for:

- monitoring mission & instrument performance
- checking data production & quality
- assisting reprocessing campaigns
- providing information & support to users

Contributes to the algorithms, processors & QC tools activities, supporting the production of required documentation (e.g. Product Specification Documents and Product Handbooks).

Task 1

R&D Cal/Val and Metrology

- Supporting R&D (in Algorithms & Product evolution, and Cal/Val) and Metrology
- Works in close collaboration with SPPA for promoting & supporting R&D and Metrology activities in EO domains (Land, Water, Cryosphere & Atmosphere) Cal/Val and algorithm evolution
- Supports the longer-term strategic aims of SPPA – international collaboration in Cal/Val measurements, campaigns & working groups, and organisation of workshops.

Task 2

Web Service & Communication

- Support for ESA SPPA web portal
- Makes information available to EO users via a consistent and harmonised structure on the SPPA web portal.

Task 3

Expert Support to Mission Management

Expert support of on-site personnel for different mission managements – missions & activities included are:

- SMOS
- CryoSat & GOCE
- Proba-V & Optical Sensors
- Atmospheric Missions & Cal/Val Systems
- Heritage Missions Activities.

Task 4

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EO SUPPLY CHAIN QUALITY ASSURANCE

Building on the importance of high-quality satellite data, TPZ UK as prime contractor along with the National Physical Laboratory (NPL) and Lloyd's Register's Business Assurance and Inspection Services (LRQA), is working closely with ESA and EARSC to explore how to better understand and improve the quality assurance of the whole end-to-end EO supply chain.

EOSure

This project will:

- ***Recommend*** improvements to metadata across the different product levels
- ***Rollout*** the EARSC Quality Management System (QMS) certification to EO companies
- ***Identify*** an approach for EO Product Certification and pilot the process with EO companies
- ***Define*** a Quality Assurance Facility (QAF) of EO products and services.

EOSure activities are split into three main areas:

EO Product Metadata: Ensuring quality outputs from satellite data providers

To make recommendations for metadata improvements throughout the EO supply chain & define a Quality Assurance Facility (QAF) through:

- An industry survey & requirements analysis
- Reviewing state-of-the-art EO product traceability techniques
- Proposing recommendations for metadata specifications
- Identifying & cataloguing validation sites and measurements
- Defining a library of validation site information
- Reviewing innovations in checking EO data quality
- Defining a QAF for EO products.

1

Quality Management Systems: Review the Quality management processes of an EO information service / product provider

To run a pilot that will certify EO companies to the EARSC QMS certification scheme, by:

- Producing a business case analysis for the QMS certification scheme
- Rolling out a certification scheme to EO value adding companies, supporting Lloyd's Register.

2

Product Certification: Investigating a product certification scheme for EO information products

To develop an EO Product Certification scheme in line with end-user requirements and run a pilot activity rolling out the scheme, by:

- Producing a business case analysis for EO Product Certification
- Defining an EO Product Certification scheme
- Piloting the scheme to certify candidate products.

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EASE QC

Ease QC is a TPZ UK developed toolset that incorporates Artificial Intelligence (AI) techniques to support quality control assessments of EO data. Advanced AI models are used to assess high volumes of data to identify anomalies previously only detectable by human QC operators.

AI developments have focused on:

- Deep learning-based models to detect visual anomalies in the data
- Underlying infrastructure and tools to support the development and deployment of those models.

AI MODELS

- Detect visual anomalies in an archive of 600,000+ Landsat data products
- Multiple model types assessed and developed focusing on specific anomaly types and broader multi-anomaly detection:
  - Supervised models successfully developed to detect specific anomaly ("Scan Start") within Landsat 1-5 data products
  - Experimental multi-anomaly detection models, chaining together multiple ML models – under development to detect multiple anomaly types
- Planned activities include further development of the multi-anomaly model and extension of the model to other sensors (Sentinel-1, Sentinel-2).

TOOLS

- Developed to jointly support the QC assessment process and data preparation phase of the AI model development:
  - Assembly of labelled training and validation datasets is often the most effort-intensive stage of AI model development
- QCOLT software developed by TPZ UK combines:
  - Facility for QC engineers to assess, interrogate and label data
  - Facility for AI model developers to filter data by anomaly and create training datasets
- Other QCOLT features include:
  - Backend database for metadata and results
  - Customised GUI
    - visual inspection of the data
    - inspection of metadata
    - anomaly assignment.

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