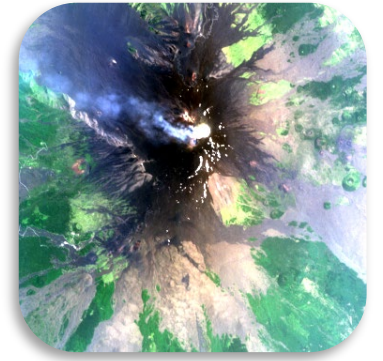


# IDEAS-QA4EO



## Reprocessing Campaign to Generate Analysis Ready Data

Dr Samantha Lavender, Mike Cutter and Roberto Biasutti

# Introduction

- Project for OnBoard Autonomy-1 (Proba-1): Originally designed as a two-year mission, launched October 2001
- Compact High Resolution Imaging Spectrometer (CHRIS): Up to 62 channels over the 400-1050 nm, operating in five different modes with a nadir ground sampling distance of 17 m

CHRIS Acquisition Modes

Mode	Application	No. Bands	Spatial Resolution [m]	Fraction of Swath
1	Hyperspectral	62	34	Full
2	Water	18	17	Full
3	Land	18	17	Full
3a	Land (San Rossore)	18	17	Full
4	Chlorophyll	18	17	Full
5	Land	37	17	Half

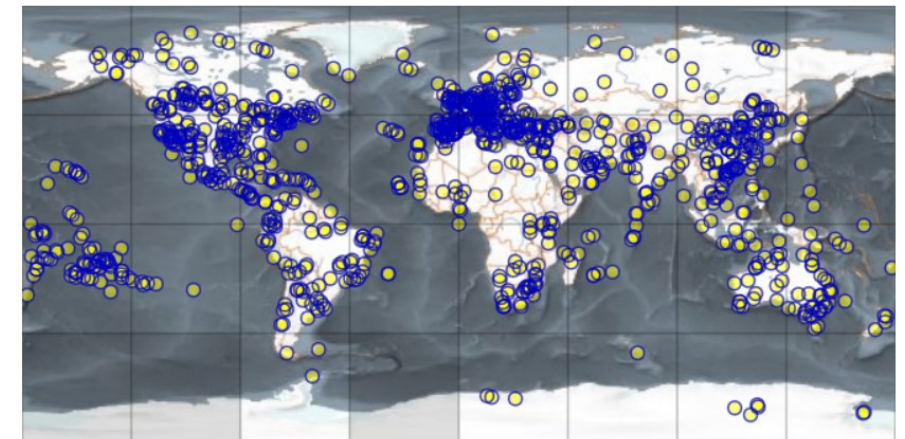
## ESA TPM Map Catalogue - Static Map

[back to collections](#) | [list of download URLs](#)

### Collection PROBA1-CHRIS

PROBA-1 CHRIS. [More details here.](#)

Select an active grid-cell to proceed to the next static map level.



Static map node (latitude from -90 to 90 dg, longitude from -180 to 180 dg).

Map: Data © OpenStreetMap contributors and others. Rendering © EOX.

Access to the archive:

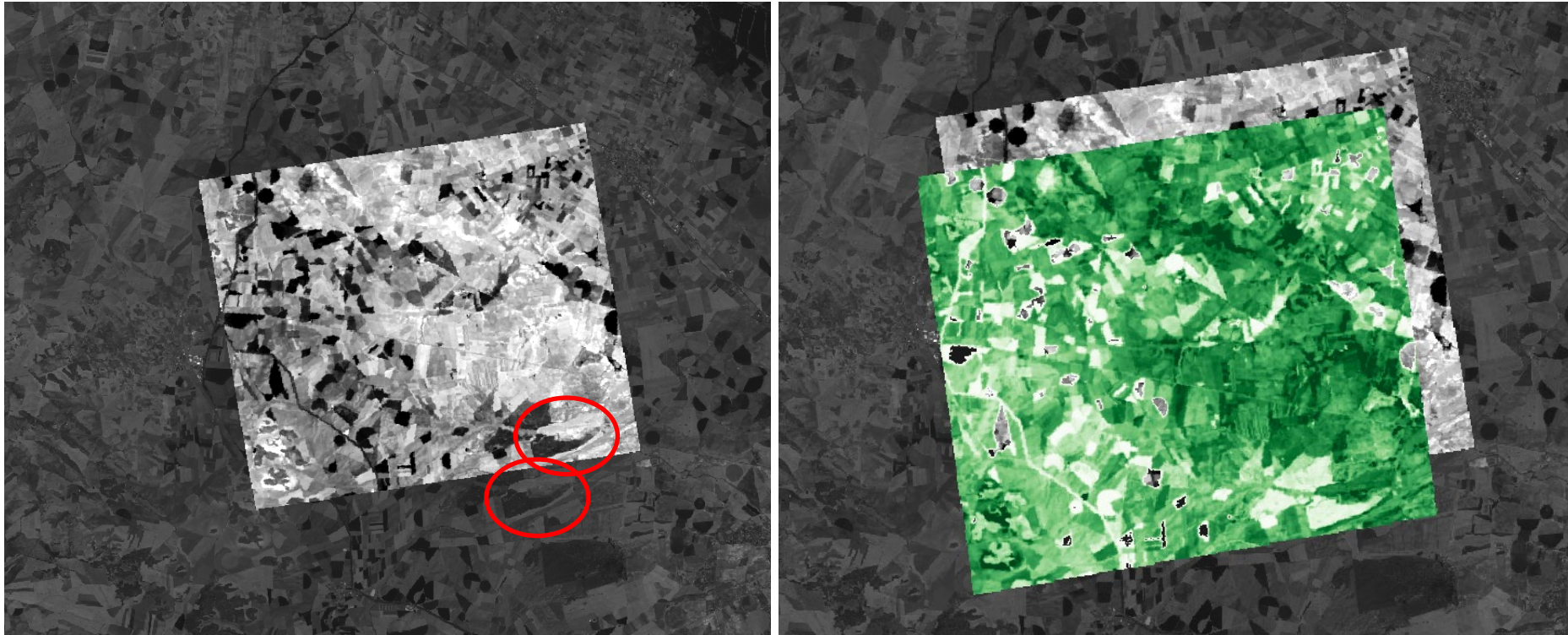
<https://tpm-ds.eo.esa.int/oads/access/collection>

Two relevant Product Family Specifications, with the Threshold (Minimum) Requirements, including:

- **Surface Reflectance** (of the land):
  - Sub-pixel accuracy is achieved in relative geolocation, i.e. consistent data set through time. Defined as less than or equal to 0.5-pixel radial root mean square error (rRMSE) or equivalent in Circular Error Probability (CEP) relative to a defined reference image.
  - Atmospheric correction includes corrections for aerosols and molecular (Rayleigh) scattering plus water vapour.
  - Pixels assessed as being cloud and cloud shadow
  
- **Aquatic Reflectance** (in addition to the above):
  - Atmospheric correction, ozone and other trace gaseous absorption, also needs to be corrected for, plus sky glint and whitecaps.
  - Detailed metadata on what each pixel is, e.g. sun glint, scum, turbid water, optically deep/shallow, land/water, sea/lake/river ice

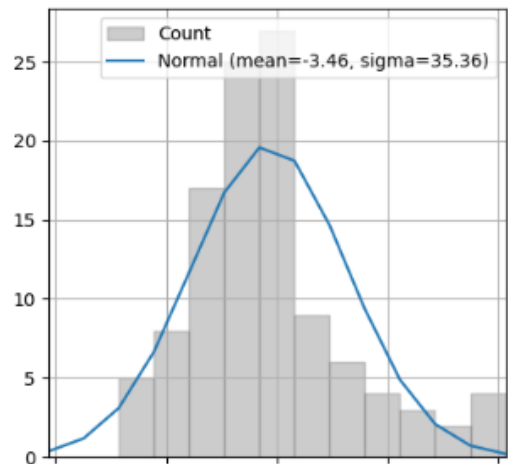


# Geometric analysis using KARIOS



- After processing with the SNAP CHRIS Toolbox, no GCPs, a large offset.
- KARIOS struggled to assess as the difference was too large.
- Used 8 manually selected GCPs (between Sentinel-2 and CHRIS) and warped using ENVI
- KARIOS could now assess the internal geometry

# Geometric analysis using KARIOS



Total Number of Key Point : 110  
Confidence value : 0.40  
Percentage of Confident Pixels : 0.01%  
Pixel size : 10.0 m EPSG: 32630

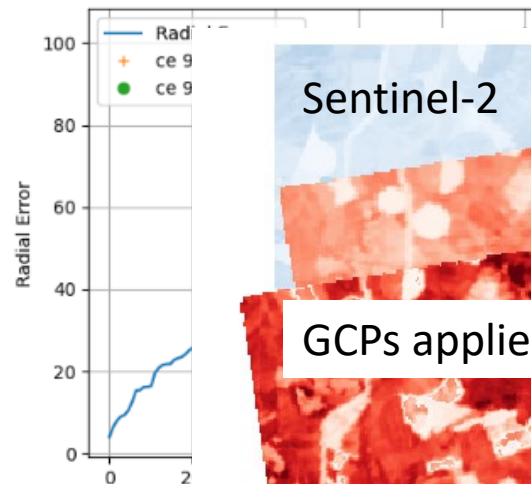
Easting displacement (meter):

Min : -68.42 m  
Max : 103.22 m  
Mean : -3.46 m  
Sigma : 35.36 m  
RMSE : 35.52 m

Northing displacement (meter):

Min : -29.38 m  
Max : 82.21 m  
Mean : 26.55 m  
Sigma : 25.17 m  
RMSE : 36.58 m

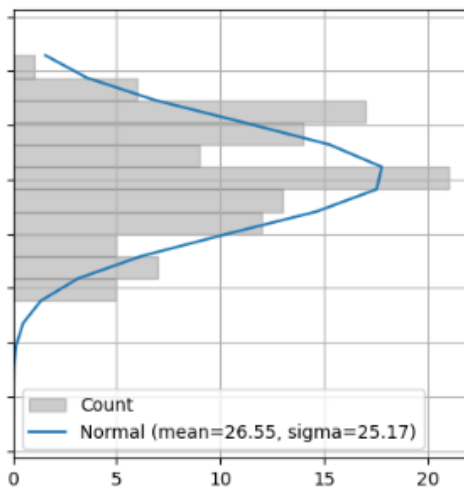
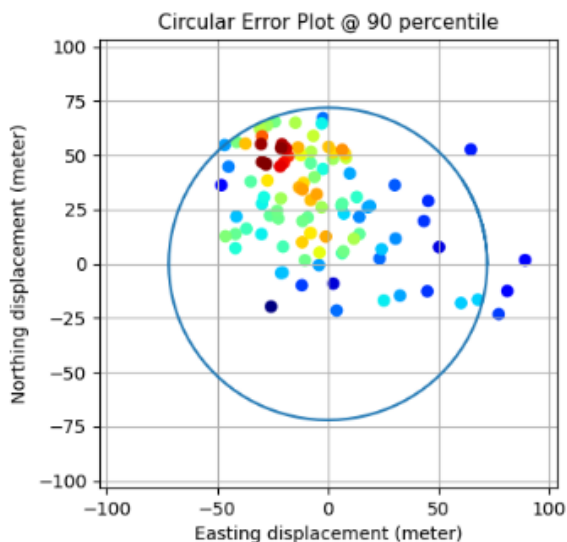
Global RMSE : 50.99 m  
CE @90 the percentile : 71.96 m  
CE @95 the percentile : 82.18 m



Sentinel-2

Warped

GCPs applied



# Cloud and cloud shadow masking

We've been bringing together a list of approaches to test:

- **SNAP CHRIS Toolbox** – The implemented approach envisaged the correction of specific acquisitions with manual interaction required
- **Fmask** – Has been developed for multiple platforms, including the Landsat series and Sentinel-2. Can it be transferred to CHRIS? The code is being developed to call the existing Python repository.
- **Machine Learning models** – The University of Valencia is working on sensor-agnostic models where cloud detection models are trained using well-established sensors, and then the model is transferred to other sensors, such as CHRIS, that have limited/complex data. They developed the approach for PROBA-V.



# Atmospheric Correction

We've been bringing together a list of AC code/repositories, which we've started to test:

- **SNAP CHRIS Toolbox** - As already used, open-source code is available so can be adjusted. Currently supports limited modes.
- **SMAC** – Coefficients are to be calculated by CNES, so initial over-land testing can occur. The first step is modelling the spectral response curves as the central wavelength and FWHM are available, so we need to find a suitable Gaussian curve.
- **ACOLITE** - Aquatic-focused code, which has been implemented to support CHRIS. So, it can be used as a comparator to the other approaches and as a possible alternative for aquatic test sites. are to be calculated by CNES, so initial overland

- Work has started on defining what could be included within the ARD-focused reprocessing
- This presentation has outlined the initial thoughts/discussions and the prototyping/testing that is occurring
- The aim is to seek feedback from the CHRIS community in order to make the dataset more user-friendly and useful for the community going forward