



## Proba-1: Current Status and Calibration Assessment

Dr Samantha Lavender

## Project for OnBoard Autonomy-1 (Proba-1):

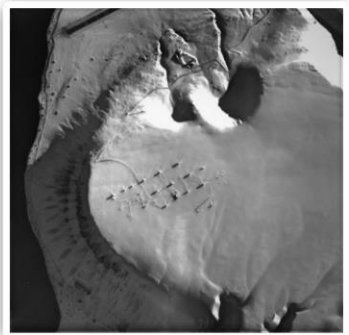
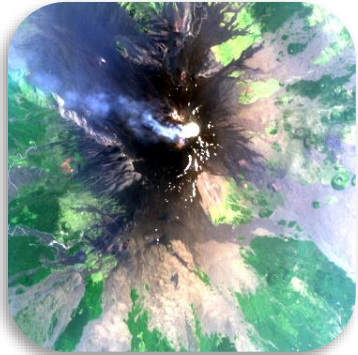
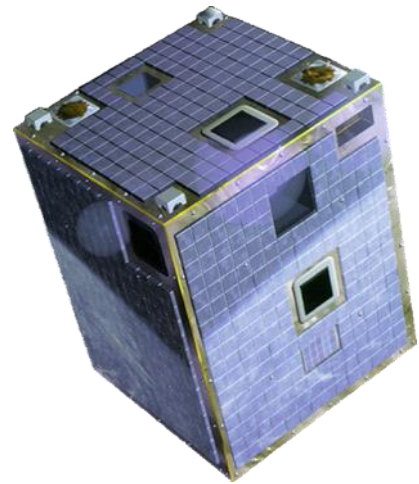
- Originally designed as a two-year mission, launched October 2001
- Spacecraft mass 94 kg, size of bus: 600 mm x 600 mm x 800 mm
- Can record up to five differently angled views of the same target
- With orbital drift, has provided both ascending and descending mode data since 2014 and the Local Time of Descending Node (LTDN) is currently 02:59

## Compact High Resolution Imaging Spectrometer (CHRIS):

- Up to 62 channels over the 400-1050 nm spectral range, operating in five different modes with a nadir ground sampling distance of 17 m at an altitude of 556 km

## High Resolution Camera (HRC):

- Field of view of 0.358 degrees, with a pixel resolution of <8 m for the current orbit.
- Grey scale images, 1026 x 1026 pixels, in BMP format.



## PROBA-1 SETS NEW RECORD



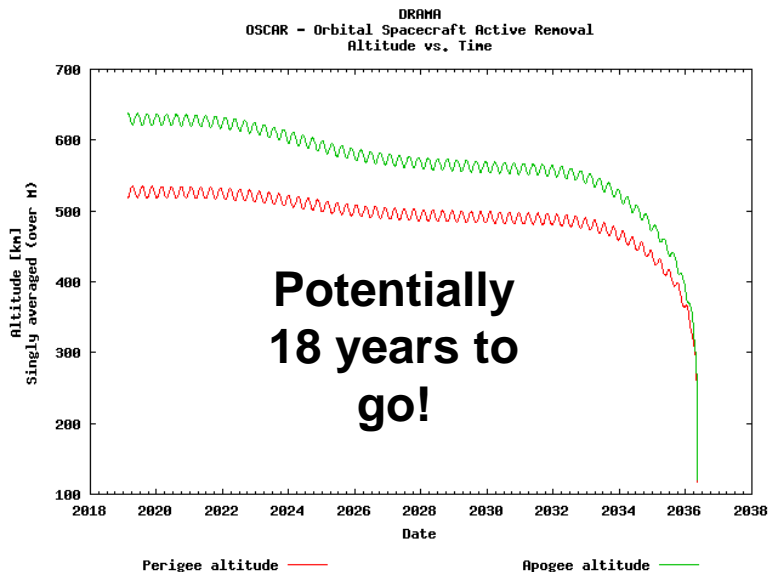
Over Serbia

8 March 2018 Originally designed as a two-year mission and launched on 22 October 2001, Proba-1 is still going strong, providing very valuable hyperspectral data.

The Project for On-Board Autonomy, or Proba-1, is ESA's technology demonstration mission operated with the support of ESA's Earthnet Programme. On 9 March, with 5982 days in orbit, Proba-1 will surpass ERS-2, making it ESA's longest operated Earth observation mission of all time.

ESA's Director of Earth Observation Programmes, Josef Aschbacher, states, "Belgium has entrusted Proba-1 to ESA for its operation, for which I am very grateful. The spacecraft has impressed us all, not only for its excellent EO

data provided by the CHRIS instrument but also for its longevity. My compliments to Belgium for developing such a robust satellite, but also to my ESA teams for its safe operation over the past 17 years."



esa Third Party Missions Online Dissemination European Space Agency

Help | Third Party Missions

### 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 © EOXX.

Access to the archive: <https://tpm-ds.eo.esa.int/oads/access/collection>

Can also request new sites.

# Initial Radiometric Assessment



- Approach:
  - Comparison to in-situ spectra measured during the ESA SPARC, SEN2FLEX and SEN3EXP campaigns with CHRIS/Proba imagery acquired between 2003 and 2019 at the Barrax site in Spain.
  - Used CHRIS Proba dataset shown in the table below: nadir view primarily used by also a limited investigation of angular influence.
  - CHRIS data were pre-processed to reduce noise, correct atmospheric effects and correct geometric position.

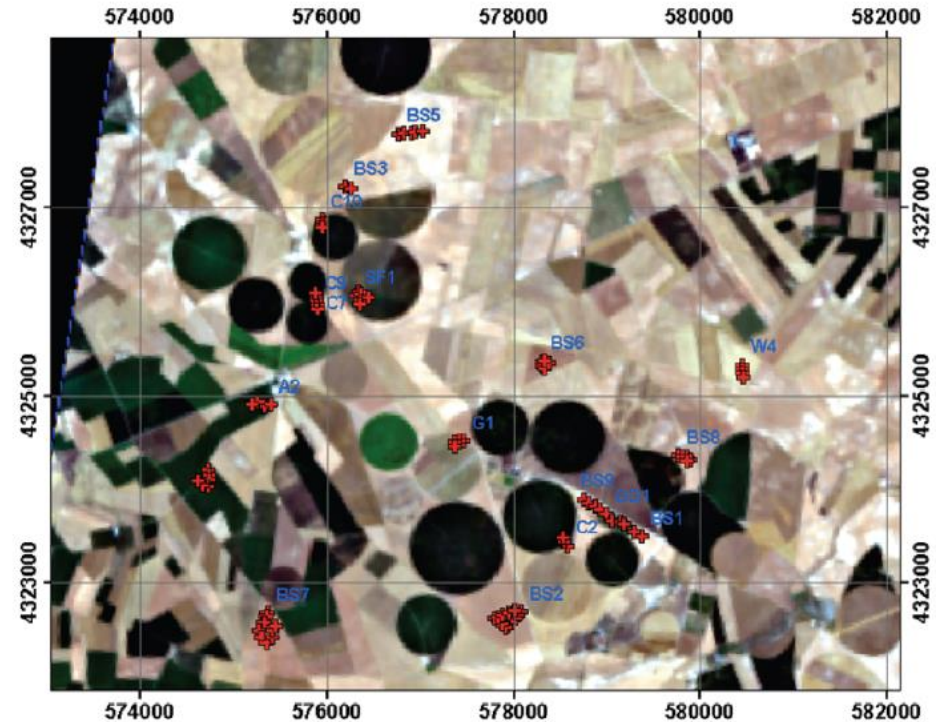
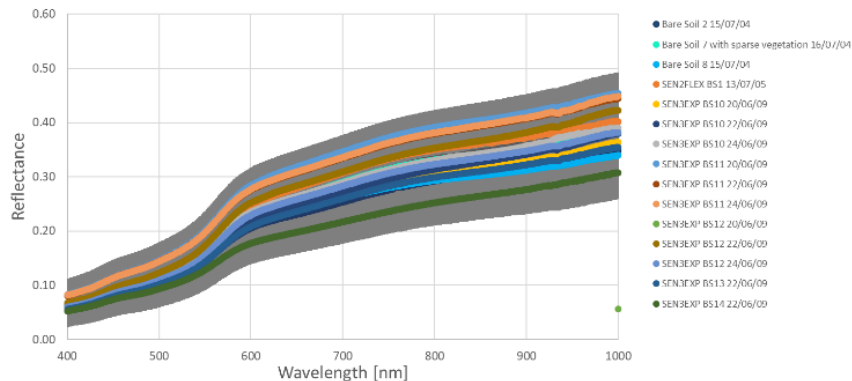
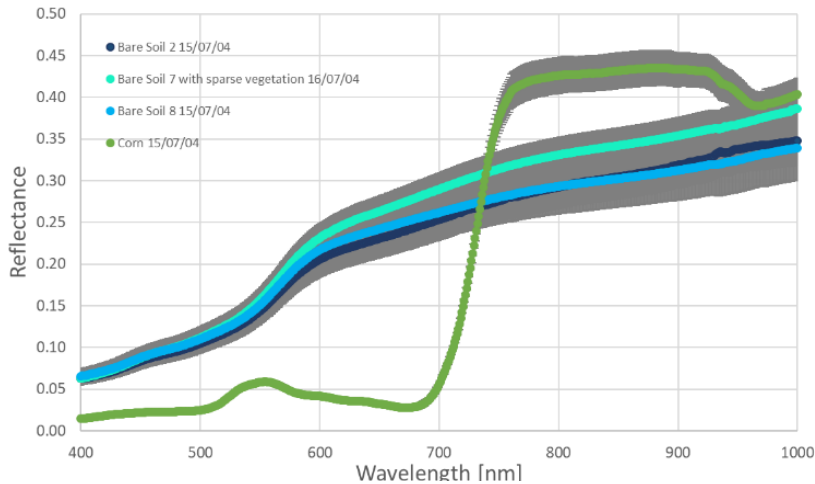
Date	Time	Observation Zenith Angle (Image Tag)	Solar Zenith Angle
12/05/2003	11:20	7.76 (3526)	23.00
14/07/2003	11:32	39.42 (35A4)*	20.00
23/03/2004	11:16	10.71 (3F20) & 36.87(3F22)	40.00
16/07/2004	11:25	8.80 (436C)	21.00
07/07/2009	10:10	5.67 (B7A2) & 32.67 (B7A4)	31.00
02/06/2011	08:48	17.77 (DB24) & 40.55 (DB26)	45.00
23/03/2014	17:26	Unknown** (032E)	79.83
04/08/2018	14:29	9.89 (4C85)	36.65
22/03/2019	14:21	2.40 (5775) & 32.21 (5777)	48.04



# Site Characterisation



- Reference spectra were collected for a number of Land cover types but Bare Soil was focused on as the most time-invariant type.

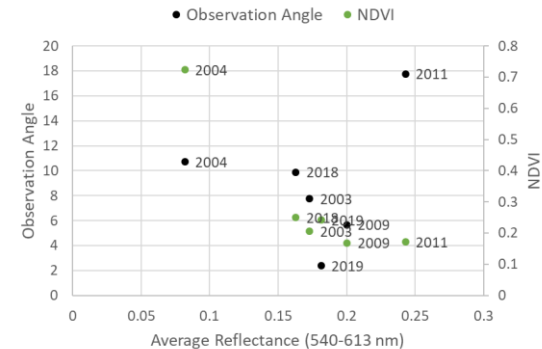
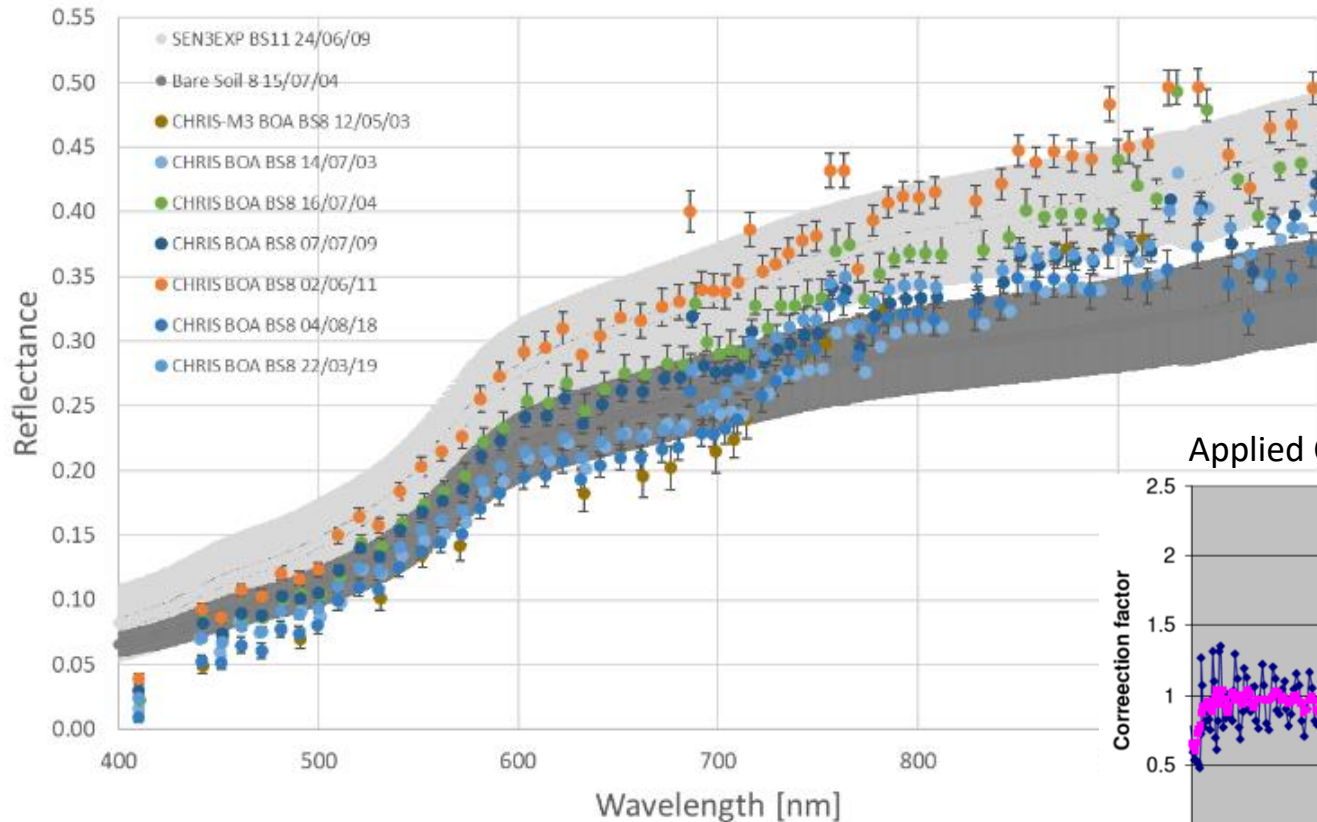


Barrax site, with + indicating the position of the spectra collected

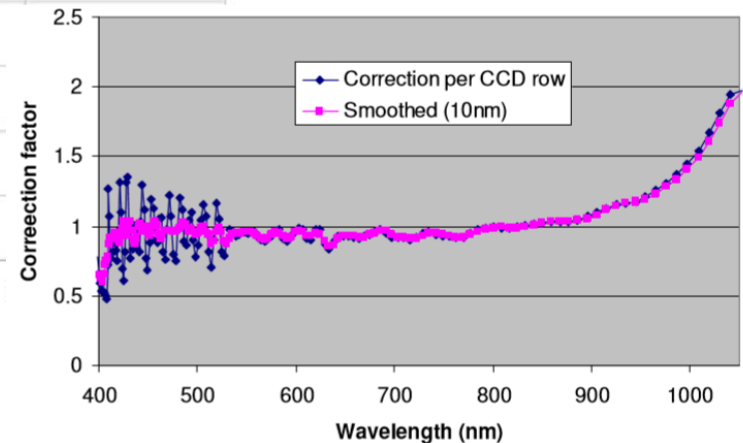
# Time-Series Comparison



- Time-series comparison for the Bare Soil (BS8) site with two in-situ spectra plotted for comparison (SEN3EXP BS11 and SPARC BS8).
- Underestimation of Blue Bands, overestimation in NIR bands



Applied Calibration Coefficients (from SIRA)



# Conclusions



- CHRIS-Proba provides a useful dataset, both historically and going forward in parallel with the launch of new hyperspectral missions.
- Over time, there has been a change in the instrument dark current (work by SSTL) that could influence the calibration, but it is small.
- Aspects of this assessment agree with previous activities but need to understand further.
- Future analysis will focus on:
  - using the atmospheric data collected during the ESA campaigns, to improve the uncertainty quantification and see if potential errors and uncertainties can be reduced.
  - expanding the analysis to other sites, CEOS sites have been activity acquired since mid-2018.
  - joint acquisitions with other instruments, e.g. PRISMA.
  - Improving the mission data, through quality indicators and uncertainty quantification, within the recently started ESA QA4EO service.