
OSIRIS

Optical, Spectroscopic, and Infrared Remote Imaging System

OSIRIS Georeferenced Data Products

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1 General aspects

1.1 Scope

This document describes the OSIRIS georeferenced Level 4¹ (CODMAC L5) data products and their creation.

1.2 Introduction

OSIRIS Level 4 (CODMAC L5) data products are .IMG files with nine layers. The first layer repeats the Level 3 (CODMAC L4) calibrated image data, while the other layers contain pixel-precise information on distance, emission angle, incidence angle, phase angle, (shape model) facet index, and $x/y/z$ coordinates. Section 2 describes the products on a user level while Sect. 3 provides the technical details of the product generation.

1.3 Reference Documents

no.	document name	document number, Iss./Rev.
RD1	Software Interface Specification for OSIRIS Science Products	RO-RIS-MPAE-ID-023, 1/a
RD2	OSIRIS calibration pipeline OsiCalliope	RO-RIS-MPAE-MA-007, 1/d
RD3	Rosetta-OSIRIS To Planetary Science Archive Interface Control Document	RO-RIS-MPAE-ID-015, 4/d

1.4 Acronyms and Abbreviations

CODMAC	Committee on Data Management and Computation
LAM	Laboratoire d'Astrophysique de Marseille
MPS	Max Planck Institute for Solar System Research
NAC	(OSIRIS) Narrow Angle Camera
OSIRIS	Optical, Spectroscopic, and Infrared Remote Imaging System
PSA	Planetary Data System
PSI	Planetary Science Institute
SPC	Stereo-Photo-Clinometry (shape reconstruction method)
SPG	Stereo-Photo-Grammetry (shape reconstruction method)
WAC	(OSIRIS) Wide Angle Camera

¹ Note that OSIRIS levels and CODMAC levels are shifted by one [RD3]. OSIRIS levels are used internally and converted to CODMAC levels for public data delivery to PSA.



2 Product Description

The OSIRIS Level 4 (CODMAC L5) data products are derived data products that include pixel-precise georeferencing information. The data are organized in nine layers with their PDS OBJECT names and content are listed in Table 1. Note that the incidence-, emission-, and phase angle are provided in radians and not degrees.

Table 1: Image layers of OSIRIS Level 4 (CODMAC L5) data product.

PDS OBJECT Name	Unit	Description
IMAGE	$\text{W m}^{-2} \text{sr}^{-1} \text{nm}^{-1}$	Copy of the Level 3 (CODMAC L4) radiometric calibrated and geometric distortion corrected image layer.
DISTANCE_IMAGE	km	The distance per pixel from the camera to the target surface.
EMISSION_IMAGE	rad	The emission angle per pixel.
INCIDENCE_IMAGE	rad	The incidence angle per pixel.
PHASE_IMAGE	rad	The phase angle per pixel.
FACET_IMAGE	integer	The facet ID per pixel, related to the shape model used for the product generation.
X_IMAGE	km	The x coordinate per pixel in the target body fixed frame.
Y_IMAGE	km	The y coordinate per pixel in the target body fixed frame.
Z_IMAGE	km	The z coordinate per pixel in the target body fixed frame.

Visual examples of the nine layers of an OSIRIS Level 4 (CODMAC L5) product are presented in Figure 1 (image) and Figure 2 (georeferencing layers).

The georeferencing data are generated through raytracing, based on a 3D digital terrain model. The accuracy of the data are thus limited by (a) the precision of the relative spacecraft-comet orientation, which was determined in the SPC shape reconstruction process and (b) the resolution of the utilized shape model.

The HISTORY section of the .IMG attached headers contain the necessary information to reproduce the data, in particular the name of the shape model with the PDS tag GEO_SHAPE_MODEL. The specified filename is likely not the same as the publicly delivered shape model filename but contains the model name (e.g., SHAP5, SHAP7, ...) and number of facets such that it can be related. The PDS OBJECT names of the layers are defined in the OSIRIS SIS [RD2].

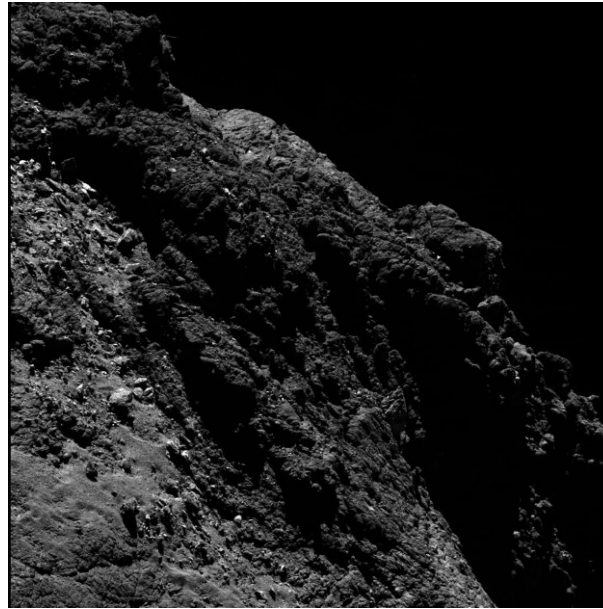


Figure 1: Image layer of the sample product NAC_2016-06-01T08.50.37.949Z_ID40_1397549600_F22 (displayed in Rosetta standard orientation, see [RD2]).

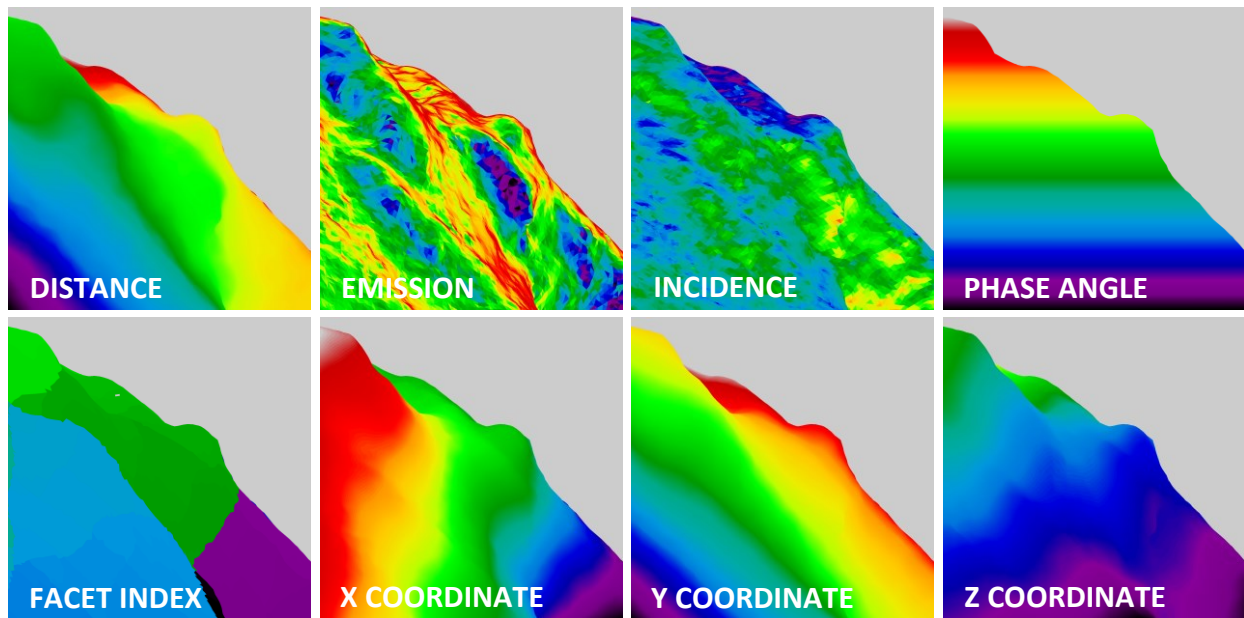


Figure 2: Eight geometry layers for the sample product NAC_2016-06-01T08.50.37.949Z_ID40_1397549600_F22.



3 Product Generation

The data are generated using the `sumxgeo.exe` from June 2016, provided by Laurent Jorda (LAM). The software is based on the following input:

- Set of SUM files, provided by Bob Gaskell (PSI) during shape model reconstruction:
 - One .SUM file per image in a non-OSIRIS naming scheme.
 - The file `make_sumfiles.in`, providing the list of .SUM files and the translation to their internal OSIRIS filename [RD1].
 - The file `PICTLIST.TXT`, providing a list of bad .SUM files, which are to be ignored.
- Shape model in SPC coordinate system. It is possible to use the SHAP7 SPG model, if it is converted to the SPC coordinate frame.

The software is run on a Linux system, through the Python script `sumxgeo.py`. The script is parsing the required input files above to run and monitor `sumxgeo.exe` per image file. The output is one .log file per image with metadata and runtime data and – in the case of success² – eight .fts files with the 32-bit georeferenced data. These are copied into the `.geo\` subfolder per observation activity on the OSIRIS internal data server.

The filenames are:

- Logfile: `.[level_1_image_filename].log`
- Distance: `[level_1_image_filename]-d.fts`
- Emission angle: `[level_1_image_filename]-e.fts`
- Incidence angle: `[level_1_image_filename]-i.fts`
- Phase angle: `[level_1_image_filename]-p.fts`
- Facet index: `[level_1_image_filename]-t.fts`
- X coordinate: `[level_1_image_filename]-x.fts`
- Y coordinate: `[level_1_image_filename]-y.fts`
- Z coordinate: `[level_1_image_filename]-z.fts`

The .fts and .log files in the `.geo\` folder are used by the OSIRIS calibration pipeline `OsiCalliope` [RD2] to create PDS compliant .IMG files with 9 layers as described above in Sect. 2. Since .fts and .log files are intermediate products and all information is covered in the resulting .IMG files, these are not delivered to PSA.

² At the time of writing this document, 185 out of 38601 images produce errors in the `sumxgeo.exe` run. The status is followed on the OSIRIS CVS server, under `.\Archiving\Completeness\geoStatus.txt`.