EPSC Abstracts
Vol. 12, EPSC2018-382-1, 2018
European Planetary Science Congress 2018

Global and Local Color Mapping of 67P/Churyumov-Gerasimenko using Rosetta-OSIRIS images

N. Masoumzadeh (1), H. Sierks (1), C. Güttler (1), C. Tubiana (1), J. Deller (1), and the OSIRIS team
(1) Max-Planck-Institut für Sonnensystemforschung, Justus-von-Liebig-Weg 3, 37077 Göttingen, Germany (masoumzadeh@mps.mpg.de).

Abstract

During the 2 year of Rosetta mission in August 2014 to September 2016, from arrival to the comet to end of mission, OSIRIS [1], the scientific imaging system onboard Rosetta acquired high resolution images of the comet surface in different filters in the visible wavelength range. OSIRIS contains two cameras: the Wide Angle Camera (WAC) and the Narrow Angle Camera (NAC). Surface images have been acquired at varying resolution in the different phases of the mission. For this work we have selected NAC images acquired when the spacecraft was at distance lower than 30 km from the comet's surface, thus providing resolution higher than 0.52 m/pix.

Based on OSIRIS NAC images, the global shape model of 67P has been constructed using either the stereo-photogrammetric analysis technique (SPG) [2, 3] or the stereo-photoclinometric method (SPC) [4]. From the shape model a coordinate system can be extracted and the surface can in theory be mapped into any map projection. However, for very irregular shapes such as the bi-lobed shape of 67P, the map projection can be problematic. Other approaches to map comet 67P, such as 3-D visualizations, are also under developed [5].

We use the OSIRIS NAC images acquired in the F24 filter (480.7 nm), F22 filter (649.2 nm) and F41 filter (882.1) in order to generate the color images. The color images (RGB images) are created assigning the filters F41, F22, and F24 to the color channels red (R), green (G), blue (B), respectively. Further, the images are co-registered, photometrically corrected using the Lommel-Seelinger (LS) disk function and then projected into a two dimensional coordinate map. We use the simple cylindrical projection, which is the most common used global map in literature and easy to understand.

The map projected images can be stitched together (mosaicked) to create local or global maps. All procedures are performed using the Integrated Software for Imagers and Spectrometers (USGS ISIS3) software [6].

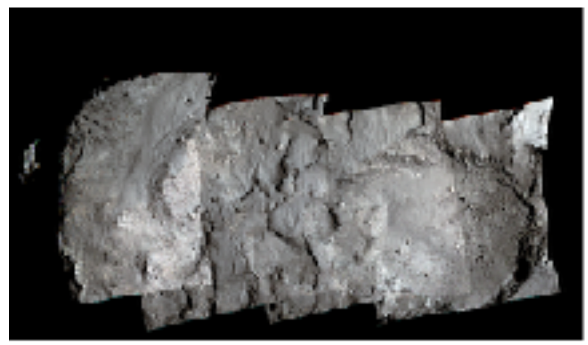

Figure 1: Local color map of the surface of 67P in simple cylindrical projection with 2.18 meters/pixel resolution.

Figure 1 shows an example of a local color map from the region covering the Hatmehit depression, and the Ma'at and Nut regions. As can be seen in the color map, the map-projected images show brightness mismatches even though they are already corrected using the LS photometric function. This suggests that the LS function does not adjust the brightness in a way that the resulting images appear as if they were obtained under uniform observation and illumination conditions. We aim to implement more photometric functions such as Minnaert's model and Akimov function to address the brightness mismatches.

Acknowledgements

OSIRIS was built by a consortium of the Max-Planck-Institut für Sonnensystemforschung, Göttingen, Germany, CISAS University of Padova, Italy, the Laboratoire d'Astrophysique de Marseille, France, the Instituto de Astrofísica de Andalucía, CSIC, Granada, Spain, the Research and Scientific Support Department of the European Space Agency, Noordwijk, The Netherlands, the Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain, the Universidad Politechnica de Madrid, Spain, the Department of Physics and Astronomy of Uppsala University, Sweden, and the Institut für Datentechnik und Kommunikationsnetze der Technischen Universität Braunschweig, Germany. The support of the national funding agencies of Germany (DLR), France (CNES), Italy (ASI), Spain (MEC), Sweden (SNSB), and the ESA Technical Directorate is gratefully acknowledged. We thank the Rosetta Science Ground Segment at ESAC, the Rosetta Mission Operations Centre at ESOC and the Rosetta Project at ESTEC for their outstanding work enabling the science return of the Rosetta Mission. We also gratefully acknowledge the developers of SPICE and NAIF/PDS resources.

References

[1] Keller, H.U. et al, OSIRIS – The Scientific Camera System Onboard Rosetta, Space Science Reviews, vol. 128, pp. 433-506, 2007.

[2] Preusker et al, Shape model, reference system definition, and cartographic mapping standards for comet 67P/Churyumov-Gerasimenko -Stereo-photogrammetric analysis of Rosetta, A&A 583, A33, 2015.

[3] Preusker et al, The global meter-level shape model of comet 67P/Churyumov-Gerasimenko, A&A, 607 L1, 2017.

[4] Jorda et al, The global shape, density and rotation of comet 67P/Churyumov-Gerasimenko from preperihelion Rosetta/OSIRIS observations, Icarus 277, pp. 257-278, 2016.

[5] Vincent, J.-B. et al, An atlas of comet 67P/Churyumov-Gerasimenko, EPSC2017-368, 2017.

[6] Anderson, J. A., Sides, S. C., Soltesz, D. L., Sucharski, T. L., & Becker, K. J. 2004, in Lun. Planet. Sci. Conf., eds. S. Mackwell, & E. Stansbery, Lunar and Planetary Inst. Technical Report, 35, 2039