

## Illumination maps of 67P: availability for the community

**A. Beth** (1), M. Galand (1), C. Carr (1), B. Geiger (2), V. Génot (3,4), N. Jourdane (3,4), M. Gangloff (3,4), S. Erard (5), B. Cecconi (5)

(1) Department of Physics, Imperial College London, London, UK (2) European Space Astronomy Center, European Space Agency, Villanueva de la Cañada, Spain (3) Université de Toulouse, UPS-OMP, IRAP, Toulouse, France (4) CNRS, IRAP, 9 Av. Colonel Roche, BP 44346, F-31028 Toulouse Cedex 4, France (5) LESIA, Observatoire de Paris, Meudon, France (arnaud.beth@gmail.com)

### Abstract

The initial analysis of the comet 67P-CG and its coma by the ESA/Rosetta probe has shown a strong correlation between the illumination on the comet and the outgassing activity. Thus, it has proved essential to determine the illumination of 67P for a given epoch in order to help interpreting the variability of the outgassing rate with local time and season.

In this sense, the ESA/Navigation Camera (NAVCAM) images offered the opportunity to reconstruct accurately the 3D shape model of comet 67P. Based on the last publicly available version generated by ESA of the shape model CSHP\_DV\_130\_01\_00200.obj (52098 nodes, 104192 faces) (<http://npsadev.esac.esa.int/3D/67/Shapes/>), we have developed an efficient and fast algorithm to assess the illumination. For a given direction of the Sun, the algorithm which we have developed calculates the cosine between the normal of each face and the Sun direction in less than 1 s.

We have produced 37800 illumination maps, and files containing the information for users to retrieve - and to rebuild from the 3D model - the illumination of the comet. The number of maps and files corresponds to  $1^\circ$  step for both the subsolar longitude, varying from  $0^\circ$  to  $359^\circ$ , and the subsolar latitude, varying from  $-52^\circ$  to  $52^\circ$ , in the comet frame. These maps and files are available through the Virtual European Solar and Planetary Access (VESPA) (<http://vespa.obspm.fr/>) with the support of CDP (<http://www.cdpp.eu>). The distribution system includes search functions on all parameters.

### Examples

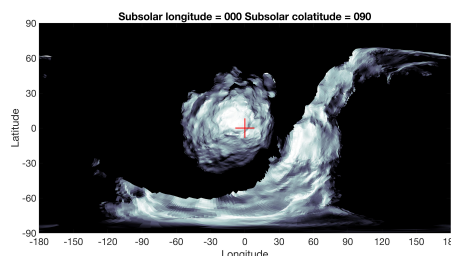


Figure 1: Illumination map in 2D of the surface of 67P for a given subsolar point location (here  $0^\circ$  in longitude and  $0^\circ$  in latitude). This illumination occurred during equinox. The red cross corresponds to the subsolar point. These pictures are available through the VESPA portal.

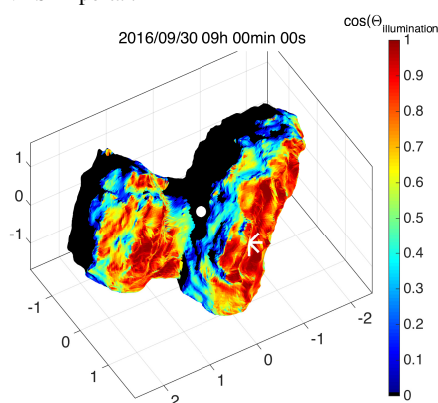


Figure 2: Reconstitution of the illumination of 67P in 3D for the last day of Rosetta at 9:00 UT from the files available through the VESPA portal. The white dot represents where the spacecraft is pointing on the surface and the white cross is the subsolar point.

## References

- [1] Erard, S. et al. (2014) Planetary Science Virtual Observatory architecture. A&C 7-8, 71-80  
[doi.org/10.1016/j.ascom.2014.07.005](https://doi.org/10.1016/j.ascom.2014.07.005)
- [2] Erard, S. et al. (submitted to PSS) VESPA: a community-driven Virtual Observatory in Planetary Science