Geophysical Research Abstracts
Vol. 18, EGU2016-17371-1, 2016
EGU General Assembly 2016

Seasonal effects on the nucleus of comet 67P revealed by Rosetta/VIRTIS

Federico Tosi (1), Fabrizio Capaccioni (1), Gianrico Filacchione (1), Stéphane Erard (2), Batiste Rouseeau (2), Jean-Philippe Combe (3), Maria Teresa Capria (1), Cédric Leyrat (2), Andrea Longobardo (1), Dominique Bockelée-Morvan (2), David Kappel (4), Gabriele Arnold (4), Sergio Fonti (5), Francesca Mancarella (5), Ekkehard Kuehrt (4), and Stefano Mottola (4)

(1) INAF-IAPS, Rome, Italy (federico.tosi@iaps.inaf.it), (2) LESIA, Observatoire de Paris/CNRS/UPMC/Université Paris-Diderot, Meudon, France, (3) Bear Fight Institute, Winthrop, WA, USA, (4) Institute of Planetary Research, German Aerospace Center (DLR), Berlin, Germany, (5) Dipartimento di Matematica e Fisica “Ennio De Giorgi”, Università del Salento, Italy

We describe thermal effects on the nucleus of comet 67P. Due to the overall low thermal inertia of the nucleus surface, the surface temperature is essentially dominated by the instantaneous value of the solar incidence angle and the heliocentric distance. However, for each location, the smallest achievable value of insolation angle depends on the season and topography. Given the substantial obliquity of comet 67P, seasons are such that the northern hemisphere is mainly illuminated at aphelion while the southern hemisphere receives most insolation soon after perihelion. In addition, the heliocentric distance strongly affects the surface temperature, all other parameters being equal. This is a larger effect in comets than in asteroids, due to the wide range of heliocentric distance values spanned by comets.

When Rosetta started its global mapping observation campaign, in early August 2014, hyperspectral images acquired by the VIRTIS imaging spectrometer onboard the Rosetta Orbiter covered only the northern regions of the cometary surface, and the equatorial belt became gradually unveiled, while the southern region has been revealed from 2015 onwards. In parallel, the comet's heliocentric distance has been decreasing from $\sim$3.6 AU down to 1.24 AU, the distance at which the perihelion passage occurred on 13 August 2015. By relating surface temperatures as measured by VIRTIS to three variables: solar incidence angle, true local solar time and heliocentric distance, we aim to separate the relative contributions due to season and to the heliocentric distance.

To do this, we use both VIRTIS-M data (namely data from the mapping spectrometer covering the 1-5 μm range, available up to April 2015, i.e. before the failure of the IR cryocooler) and VIRTIS-H data (namely data from the high-resolution point spectrometer covering the 2-5 μm range), and we focus in particular on three regions: one in the northern hemisphere, one in the equatorial region and one in the southern hemisphere. These three regions are chosen so as to be relatively smooth at the spatial resolution that is achieved from a distance of about 100 km (25 m/px for VIRTIS-M, 50$\times$150 m/px for VIRTIS-H), in order to limit the effects of large-scale surface roughness.

Acknowledgements: The authors would like to thank the following institutions and agencies, which supported this work: Italian Space Agency (ASI - Italy), Centre National d'Etudes Spatiales (CNES- France), Deutsches Zentrum für Luft- und Raumfahrt (DLR-Germany), National Aeronautic and Space Administration (NASA-USA) Rosetta Program, Science and Technology Facilities Council (UK). VIRTIS has been built by a consortium, which includes Italy, France and Germany, under the scientific responsibility of the Istituto di Astrofisica e Planetologia Spaziali of INAF, Italy, which guides also the scientific operations. The VIRTIS instrument development has been funded and managed by ASI, with contributions from Observatoire de Meudon financed by CNES, and from DLR. The computational resources used in this research have been supplied by INAF-IAPS through the DataWell project.