EPSC Abstracts
Vol. 12, EPSC2018-542, 2018
European Planetary Science Congress 2018

Meter scale changes on comet 67P. J.-B. Vincent[1], E. Kührt[1], and the OSIRIS team, [1]DLR Institute of Planetary Research, Berlin, Germany, jean-baptiste.vincent@dlr.de

Cometary surface evolution is assumed to be mostly driven by the sublimation of volatiles in the subsurface when the nucleus is in the inner Solar System. Rosetta at 67P has shown a more complex picture, with the nucleus changing through many different processes, epochs, time scales [1,2,3].

During its two years around comet 67P, Rosetta observed only a handful of large scale changes, with most modifications being very localized, sporadic events: cliff retreat, deflation of smooth terrains, transport of a decameter-size blocks [1].

These large scale changes are impressive, but do not account for all the material being lost due to activity. Distributing the orbital mass loss (0.1% comet mass [5]) evenly over the nucleus would lead to surface modifications of at least ~50 cm. However, due to the seasonal variations of insolation [6] and the resulting heterogeneous distribution of active sources, we expect most small scale changes to be below the OSIRIS NAC [7] typical resolution (60cm/px) in the least active areas, and reach several meters elsewhere.

Up to now, tracking these changes has been difficult, due the complexity of Rosetta observation, never quite having a real mapping orbit with consistent viewing geometry. To overcome this challenge, we have developed dedicated mapping tool and a new algorithm designed for automating the detection of surface changes [6], we are now able to extend our coverage of surface changes to the smallest scale (<1m) on the whole nucleus.

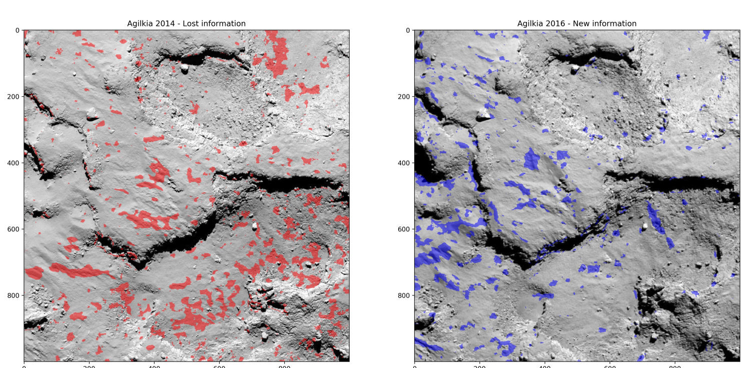
After processing OSIRIS-NAC images acquired before and after perihelion, we detected several thousands changes, ranging from the redistribution of dust in local ponds, to the possibly thermally induced breaking of blocks, or the opening of small pits (10 m diameter) in conjunction with fracture expansion and/or outbursts.

This presentation will review the different types of small scale changes thus detected, and their distribution on the nucleus. We will discuss how we use these changes to retrieve important physical parameters. For instance: the survival or destruction of boulders being transported across the surface sets a lower limit for the material strength; or the opening of small pits associated to outbursts can be related to the thermal inertial of the upper surface.

Among all changes, we will focus primarily on the reorganization of regolith in smooth terrains. It is the dominant type of surface changes and is particularly interesting as such terrains will be the preferred target of future sample return missions like NASA's CAESAR. We will present a numerical model of dust transport under shear (aeolian or saltation), aiming at assessing whether those changes are primarily due to dust deposition or to sublimation of volatile material below the dust cover.

References: [1] El Maarry et al, *Science* (2017); [2] Vincent et al, *MNRAS* (2017); [3] Birch et al, *MNRAS* (2017); [4] Vincent et al, *LPSC* (2018); [5] Pätzold et al, *Nature* (2016); [6] Keller et al, *A&A* (2015)

Acknowledgements: This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 686709.



Automatic change detection on nucleus-referenced images of Agilkia region (comet 67P)