Evolution of circular depressions at the surface of 67P/Churyumov-Gerasimenko

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The surface of comet 67P/Churyumov-Gerasimenko is covered with extreme features: the Rosetta/OSIRIS high-resolution images reveal remarkably diverse surface morphologies and textures. In this work, we are particularly interested by circular depressions, whose origin is not understood yet. We use a high-resolution shape model of 67P's nucleus to compute how much energy is received at the surface, by including shadowing and self-heating effects (both on a global and local scale), with a high-temporal resolution. We select 30 morphological features across the nucleus, to sample the diversity of illumination conditions (big and small lobes, northern and southern hemispheres, from the equator to the poles). This input is used as a boundary condition for a 1D thermo-physical evolution model, which is rum to simulate the behavior of the surface during 10 orbital revolutions, i.e. the time 67P has spent on this current orbit. With this detailed quantitative work, we show that none of the surface features could have been formed under the current illumination conditions. Overall, we show that cometary activity tends to erase surface features, as they become wider and shallower with time. This suggests that the least processed morphological features may be representative of what depressions would look like when they formed. Their formation would have happened in a previous evolutionary stage of this comet's life.