Effects of surface roughness on the VIRTIS/Rosetta thermal measurements

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Thermal emission from planetary surfaces depends on many physical processes/parameters such as the Bond albedo, the heat capacity, the thermal inertia, the sublimation of ices at the surfaces, but also on the small-scale surface roughness. Distinguishing the effect of both thermal inertia and surface roughness on the infrared measurements is not trivial. In particular, surface roughness, that cannot be resolved within the pixels of instruments frame, can produce both shadows at small scales and mutual heating, which affect the thermal flux and the temperature estimations. The effect of roughness also varies with local incidence and emission angles, and local time, being significantly stronger closed to terminator when the local hills cast their shadows at far distances.

In this poster, we present a thermo-physical model based on thermal conduction of heat over several diurnal and seasonal skin depths and show how surface roughness affects the retrieved temperature, especially, in the near-infrared domain [1–5 microns], where the VIRTIS/Rosetta instrument will observe comet CG 67/P starting in July 2014. We first compute the surface temperature of CG 67P using a simple thermo-physical model that takes into account the global shape of the nucleus. Then, we investigate (1) how the surface roughness can modify the apparent surface temperature and the thermal inertia, and (2) what are the best geometries of observation to distinguish between topographic effects and physical thermal processes.