Simulation of the near-surface dust charging and transport on 67P Churyumov-Gerasimenko

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The Rosetta spacecraft reached comet 67P/Churyumov-Gerasimenko on August 2014 and was inserted into orbit, on November Philae separated from Rosetta and landed on the comet. After a first touchdown close to the expected landing site, Philae bounced and finally stopped in a more chaotic region after several touchdowns. In particular, the lander attitude and its position close to a cliff jeopardized its chances to survive. Eventually, the probe received enough power from the sun later in Rosetta's mission and brought new information on the comet surface. Among Philae missions, the Dust Impact Monitor collects dusts. ROSETTA's probe Philae landed on a dust covered soil. This dust may be ejected from the ground through many mechanisms (other than spacecraft landing) : micro-meteorite impacts, electrostatic charging and soil outgassing. In any cases, the dust grains charge electrostatically in the ambient plasma and this charge impacts the dust interaction with the spacecraft, which is itself differentially charged due to its partial exposure to the solar UV light. Using the DUST addition to the Spacecraft-Plasma Interaction Software (SPIS) routinely used to compute the charge state of the spacecraft surfaces, we simulate the electrostatic charging of Philae as well as its dust environment. SPIS-DUST allows one to compute the electrostatic charging of the dust grains on the ground and in the plasma, and to model their ejection and their recollection by the probe. The code dust charging and ejection model was validated against vacuum chamber experiments performed at ONERA for lunar dust stimulant. We simulated one cometary day of the Philae environment at different distances from the sun to observe the variation of the dust collection with Philae's local time.