SMD Space Science & Astrobiology

- Sublimation as a landform-shaping process on Pluto
- POC: Jeff Moore (SST)
- Short story:

On May 1st 2017, Icarus journal published a special issue focusing on science results of the New Horizons flyby of the Pluto system in July 2015. Several Ames-based researchers have published first-author studies within this issue. One such study is the investigation of sublimation as a landform-shaping process on Pluto, authored by Jeff Moore. Fields of pits, both large and small, have been observed within Tombaugh Regio (the bright heart-shaped feature in the center of the encounter hemisphere, note that all feature names are informal), and along the arcuate scarp of Piri Rupes. These pits are hypothesized to form and evolve via sublimation, and heuristic modeling performed by this study closely mimics the form, spacing, and arrangement of a variety of Tombaugh Regio’s pits. The modeling suggests that Pluto’s sublimation-modified landforms require a significant role for (diffusive) mass wasting. In the models, the temporal evolution of pitted surfaces is such that initially lots of time passes with little activity, followed by very rapid development of relief and rapid sublimation. Small pits on Sputnik Planitia, the expanse of plains that forms the western half of Tombaugh Regio, are consistent with their formation in nitrogen-dominated materials (nitrogen ice being the most volatile of the major ices on Pluto’s surface). The accompanying figure, adapted from the paper, shows six successive stages of modeled pit development through a combination of sublimation and diffusive mass wasting, accompanied beneath by a New Horizons image of pits in Sputnik Planitia (shown to the same scale as the simulated landscapes). As nitrogen ice readily flows, some other “stiffer” volatile ice may play a role in supporting the relief of sublimation-degraded landforms that exhibit several hundred meters of relief, such as Piri Rupes. A strong candidate is methane, which is spectroscopically observed to be associated with these features, but the current state of rheological knowledge for methane ice at Pluto conditions is insufficient for a firm assessment.