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Mapping the radar reflectivity of the Martian surface with the SHAllow RADar (SHARAD)

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Introduction

In the search for buried water ice on Mars, radar sounding instruments have unique abilities. Their capacity to resolve glacial structures down to kilometers depth has already provided a huge amount of information related to Martian glaciers [e.g. 1, 2]. Sounding radars are also relevant tools to determine the composition of the surface, since the radar-waves reflectivity is sensitive to the dielectric properties of the sounding materials. It also has the originality to be representative of the first decameter of the surface (depending on the bandwidth), whereas other observations method do not exceed few millimeters. A reflectivity map from the Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS) has been recently presented [3]. Here we present a method to extract the surface reflectivity from the SHAllow RADar (SHARAD/ASI) data, and the related results. The SHARAD along-track resolution gives the advantage to study areas at regional scales. SHARAD is a subsurface sounding instrument aboard the NASA's Mars Reconnaissance Orbiter (MRO) spacecraft [3]. The routine science observations started in November 2006 is still ongoing. SHARAD is working at a 20 MHz central frequency with a 10 MHz bandwidth. The along-track foot print range is between 0.3 and 1 km, while the typical footprint radius (Fresnel zone) is ~3 km. The operating parameters allow a 10 m vertical free space resolution.

Results and discussions

A first global map of the SHARAD reflectivity of the surface has been established with a spatial resolution of 3 kilometers. The reflectivity is depending on the surface composition, and on the surface geometry (roughness and slopes). In the case of SHARAD, no surface elevation model with sufficient resolution exists to presume of the surface roughness contribution at the radar wavelengths. However, the correlation of the reflectivity with upper-scale roughness is clear (Fig. 1). We will discuss possibilities to derive the contribution of the roughness to the reflectivity in order to extract the surface reflectivity depending only on the surface dielectric constant.

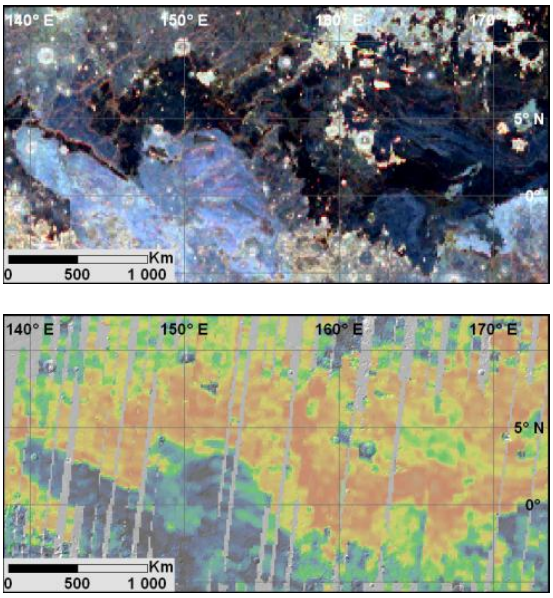

Figure 1: (Top) Surface roughness of Elysium Panitia, from *Kreslavsky and Head* [4]. (Bottom) SHARAD surface reflectivity of the same region (red=strong, black=weak reflectivity).

References

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