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3D Modeling of South Polar Layered Deposits on Mars with SHARAD radar data

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The SHAllow RADar (SHARAD) is a subsurface sounding instrument aboard the NASA's Mars Reconnaissance Orbiter (MRO) spacecraft. The routine science observations started in November 2006 has already provided a huge amount of data promising an unprecedented insight into the Martian subsurface. The main SHARAD scientific objectives are to map the underground distribution of water over the planet as well as to seek buried geological structures in order to understand the formation of the superficial Martian landscape.

SHARAD is working at a 20 MHz central frequency with a 10 MHz bandwidth. The operating parameters allow a 10 m vertical free space resolution and a penetration depth in the range of 0.1 to 1 km. Horizontally, the cross-track and along-track foot print range are respectively 3-7 km and 0.3-1 km.

Assuming a low impurities water ice the depth range of the radar should be 1 km with about 7 m of theoretical vertical resolution. This makes possible to sound the internal polar caps structures like never before.

We report some observations made in Planum Australe over a 36.000 km^2 area. 24 orbits crossing it have been selected. Each shows clear radar echoes with linear shape reaching the radar later than the surface echo. After comparison with simulations able to highlight any potential clutter signals, they have been interpreted as being polar layers. From this set of data a 3D modeling of the subsurface layering was undertaken.

We show the results and discuss the method employed. A comparison between the layers behaviour determined in this study, the MOLA topography and the basal mapping made by MARSIS recently, allows initiating geomorphologic discussions.