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Observations of the layering structure in the Martian Polar Layered Deposits with the MARSIS instrument

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One of the many goals of Martian exploration is to uncover the history of Mars through analysis of the polar layered deposits (PLD). Martian polar ice caps contain most of the exposed water ice on the surface on Mars and yet their history and physical processes involved in their formation are unclear. This work will concentrate on analysis of the internal structure of the North (NPLD) and South Polar Layered Deposits (SPLD) using Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS) experiment data.

Recent MARSIS observations have provided full coverage of the subsurface interfaces and layering structures in both NPLD and SPLD. We now have full dataset to start comparison and understanding of the subsurface of the Martian Layered Deposits. Data from the MARSIS instrument can come in two basic types: standard and raw. Standard data is processed on the spacecraft to reduce data rate. Raw data contains individual echoes as received by the MARSIS instrument and provides much better spatial resolution along the track. Raw data mode, also known as, "individual echoes" mode, requires a much higher data volume and therefore is not used frequently. MARSIS allows simultaneous collection of standard data and individual echoes. This work will present results of raw data analysis.

In the SPLD we will concentrate on two smaller regions : a region between 86S-80S and 170E-220E (very smooth area of SPLD) and a region located near topographic maximum of SPLD. We will present analysis of multiple MARSIS passes in these regions to look for significant signature of internal layers and their extent. Our preliminary interpretation of these data suggests that detection of individual layers in SPLD is complicated due to the nature of radar wave propagation inside a layered structure.

However, we were able to identify a consistent interface which can be correlated with layers exposed on the surface. In the NPLD we will approach with a similar technique and search for correlation between observed layers and outcrops, visible in the optical images.

We know from optical and other remote sensing measurements that North and South layered deposits are quite different in appearance. We will present some preliminary comparisons of their subsurface structure. The SHARAD instrument is now operational and also taking data. We will propose possible ways for comparing MARSIS and SHARAD data for understanding of the subsurface structure of PLD.