Introduction
Layers of ice and dust cover the north polar region of Mars and are widely considered to contain a record of recent climate. The layers are exposed primarily within walls of the extensive spiral troughs (Howard, 2000). Until recently, these exposures were the only means for accessing the stratigraphy, leading to ambiguous interpretations of north polar layered deposits (NPLD) development. 

The Shallow Radar (SHARAD) instrument on Mars Reconnaissance Orbiter has observed the NPLD subsurface and proven valuable for determining the evolution of the NPLD, including the detection of migrating spiral troughs (Smith and Holt, 2010). Here we present the first comprehensive survey of troughs using SHARAD and a regional map based on trough characteristics. We also include a topographic map of the NPLD around the time of trough formation.

Study Area: Martian North Pole

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Regional Summary

Region 1: Thorough initiated ~1000 m beneath current surface and have migrated up to 100 km, some trough migration path variability.

Region 2: Troughs are younger than in Region 1, but have compound cross sections or central promontories. Some promontories have been buried during migration.

Region 3: Topographic undulations and migration detected. Central promontories like Region 2. Troughs are younger than in Region 1.

Region 4: Difficult to observe in radar. Troughs are ~same age as in region 1 with smaller wavelength and steeper regional slope.

Region 5: Very young troughs. Regional scale erosion predating trough formation, which was long after Region 1.

Region 6: Southward migrating troughs, ~same age as Region 1. Buried by ~150 m of recent ice.

Region 7a: Poor radar observations. Troughs possibly same age as those in Region 5. Steep slopes and scarps.

Region 7b: Immagure troughs and undulations

References:
Smith et al., The Spiral Troughs of Mars as Cyclical Processes. JGR-Planets, (2010).

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