Search of shallow subsurface reflectors around RSLs in Martian Chryse and Acidalia planitiae by the MRO/SHARAD public data

*Aina Oura[1], Yasumasa Kasaba[1], Atsushi Kumamoto[1], Rina Noguchi[2], Tomohiro Usui[2], Ken Ishiyama[2], Chihiro Uemura[3]

1. Tohoku University, 2. Institute of Space and Astronautical Science, 3. SOKENDAI

One of recent discoveries on Mars is the recurring slope lineae (RSL), which are certain features on the surface invoking current icy processes. RSLs are distributed on Mars and these narrow features incrementally lengthen down steep slopes, fade in colder seasons, and recur annually. Candidate and confirmed RSL sites are distributed in four regions, (1) southern mid-latitudes (SML), (2) Valles Marineris (VM), (3) equatorial highlands, and (4) northern Chryse Planitia and southwestern Acidalia Planitia (CAP). The RSLs in (2) VM and (4) CAP are more densely located than other two areas.
This study tries to identify the subsurface structures of the northern mid-latitude RSL in (4) Chryse and Acidalia Planitiae by the public data of Mars shallow radar sounder (SHARAD) onboad the Mars Reconnaissance Orbiter opened on the PDS Geosciences Node. That is because CAP RSLs are densely distributed compared to other regions. CAP RSLs are found on the steep slopes of craters. Their source zones are at or below the elevation of the surrounding plains. We used the Java Mission-planning and Analysis for Remote Sensing (JMARS, https://jmars.asu.edu/) in order to investigate the geological information of the RSL sites and the MRO locations at the SHARAD observed data. We then picked up the location correspond to the RSL sites and generated radargrams from SHARAD data. The observation frequency of SHARAD is 15-25 MHz with the bandwidth of 10 MHz, and the subsurface close to the surface can potentially be resolved with the depth resolution of 15 m in vacuum. Using MOLA data, we generated the virtual radargrams with the surface clutter emulated by the Kirchhoff approximation. Then, we compared both observed radargrams with emulated ones to identify whether there are subsurface reflectors or not.
We surveyed about 12 orbits close to the confirmed RSLs. We could find the hypothetical detection of the subsurface reflector in ‘orbit.00688101’ (Jan 14 2008, N10.0-44.7˚, E313.6-318.3˚) and ‘orbit.00673602’ (Jan 03 2008, N10.1-44.7˚, E312.7-317.4˚). In this abstract, we concentrated the characteristics of the former candidate. In this sample, the closest RSL located at N34.1˚, E317.0˚ and nadir line from the orbit was 13.8 km. Another RSL close to this orbit located N34.8˚, E318.6˚ and nadir line from the orbit was 85.2 km. Apparent elevation of closest RSL was about -3,763 ±10 m. The deepest elevation of the crater was about -4,744 ±10 m and the highest elevation of it was about -3,640 ±10 m. The radargram of this orbit showed that the elevation of surface echo was in the range from -3720 to -3780 m and that of subsurface echo ranged from -3750 to -3800 m. This means that the closest RSL height was almost the same as the depth of subsurface reflector. The subsurface echo located 25 m below the surface, and it had a little bit weak echo strength compared to surface one. If this subsurface echo shows the underground reflection, the subsurface layer will be 180 km wide along the orbit. Although this depth is marginal for the depth resolution of SHARAD, we could not identify such an echo in the emulated radargram.
In the presentation, we will summarize the results of this region including other orbits.

Keywords: Mars, RSL, SHARAD

