Martian South Polar Research with Mars Express' HRSC Data

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Introduction: High Resolution Stereo Camera (HRSC) is one of the instruments on board of Mars Express. Working since 2003, currently HRSC has imaged 100% of the Martian Surface with the highest resolution of 12.5m/pixel (97% at better than 100m/pixel). With its nine CCDs with two specifically planned for stereo imaging, 3-Dimensional information of Mars could be obtained globally.

South Polar HRSC DTM Production: Digital Terrain Models (DTM) for South Polar region covering latitude of 80º-90º S has previously been produced using thirty-three single-strip HRSC images [1]. The DTMs are produced using a NASA-VICAR-based pipeline developed by DLR (German Aerospace Centre), which Kim and Muller [2] modified method to use image matching based on the (Gruen-Otto-Chau) algorithm [3]. This DTM product could fill the DTM gaps over the South Pole in Mars Orbiter Laser Altimeter (MOLA) DTM with higher resolution HRSC images, with a mean average difference of 1.08 m to the MOLA South Polar MEGDR and 2.20m (down to 0.04 m) to MOLA PEDR [1].

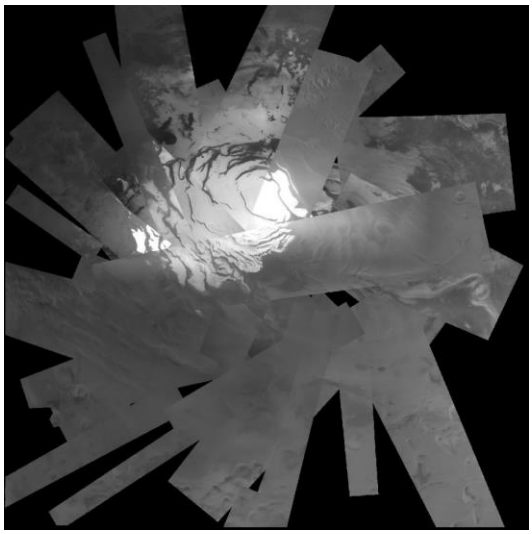

Figure 1: Mosaic of HRSC Orthorectified Images [1]

South Polar HRSC Orthorectified Images as Base Images for Coregistering Higher Resolution Images: With the produced DTMs, orthorectified products covering south polar region could be produced. Orthorectified products could then used as base images to coregister different high-resolution polar images (from HRSC itself, CTX, THEMIS-VIS, and MOC-NA.) in one reference system. Using different high-resolution images from different instruments, temporal and spatial information for south polar research is widened, especially considering the changing surface, seasonal and otherwise. High-resolution images have been successfully coregistered to HRSC base images using previously developed Auto Coregistration and Orthorectification (ACRO) software, with difference in solar longitude (seasonally changing the surface) as high as 113.778 LS, with registration improvement averaging $\geq$ 22%. More accurate measurement for surface change research (and other research in general) can be done utilising different image strips, not only for research in seasonal changes and change observable in HRSC (down to 12.5m/pixel) resolution, but also for research for changes observable in higher-resolution images.

References:

[1] Putri, et. Al. Icarus, under review, 2017.
[2] Kim and Muller. PSS, 57(14-15):2095 2112, 2009.
[3] Shin and Muller. Pattern Recognition, 45(10):3795 3809, 2012.
[4] Sidiropoulos and Muller. IEEE Transactions on Geoscience and Remote Sensing. 2017

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