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Coregistration of Mars South Polar CTX Images to HRSC Base Images

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1. Introduction

Large number of changes have been observed on the south polar region of Mars, as well as in the north polar region and globally, signing that even though pretty static, Mars surface is dynamic. Especially in the south polar region, changes such as seasonal and interannual changes have been observed, with the growth and recession of ice caps and features such as so-called "spiders" and "swiss-cheese terrains". There is a need of quantitative research on these changes, which is difficult to be done manually because of the increase of the number and size of image data available and the currently non-uniform reference between Mars image datasets.

2. HRSC Base Images

We have produced 33 single-strip HRSC DTMs over the south pole [1] to fill the gaps between MOLA DTMs with higher resolution images such as CTX, MOC-NA, and HiRISE. The HRSC DTMs with resolution of 50 m/pixel with mean average difference of 1.08 m to MOLA South Polar MEGDR and 2.20 (up to 0.04 m) to MOLA PEDR, and until half after correction. The full resolution DTMs are produced using a NASA-VICAR-based pipeline developed by DLR (German Aerospace Centre), with Kim and Muller [2] modified method in image matching based on (Gruen-Otto-Chau) algorithm [3]. The setup has also been modified for the polar region. Orthorectified (ORI) images have been produced to be used in further research, including change detection research and as base images for coregistration.
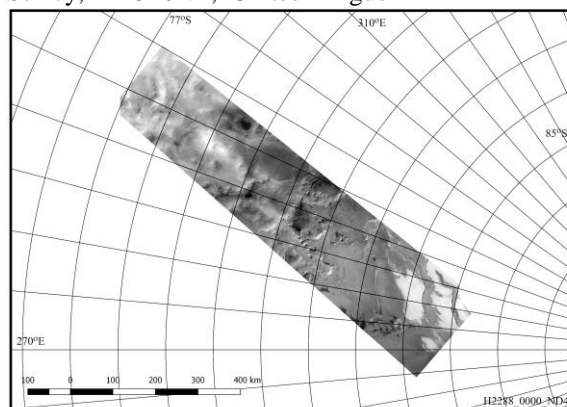

Figure 1: HRSC ORI H2288 0000 (25-10-2005, MY27, Ls 312.46) produced

3. Coregistration of CTX Images

As previously over the south pole the images are coregistered to MOLA baseline, coregistered dataset of Mars south polar high-resolution images are currently unavailable. As the information obtained for SPICE kernels as NASA-supplied areoreference information is unsatisfactory to produce coregistered dataset, autocoregistration and orthorectification (ACRO) programme has previously been developed to fulfill this objective.

The previously developed ACRO programme mentioned has been successfully coregistered highresolution images from CTX, MOC-NA, THEMIS VIS, and Viking to MC11 Quadrangle and to Mars global dataset by utilizing DLR-produced HRSC ORI images. For this research the programme is modified to receive the HRSC base images input and to produce the result in polar stereographic projection.

4. Result

The example of the coregistration result can be seen in Figure 2. We could see that CTX images with 2 MY difference could be orthorectified to HRSC orthorectified images. Further results and their statistics in regards of the south pole and comparison to global Mars coregistration will be presented during the congress.
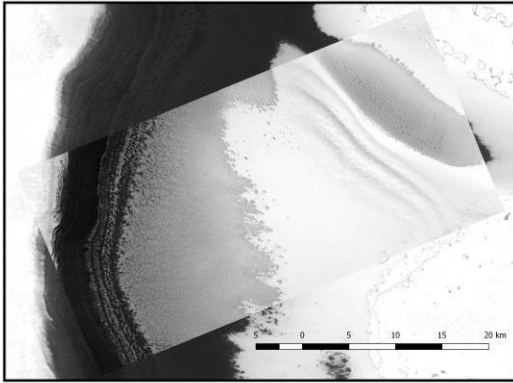

Figure 2: Example of result, back: level-4 HRSC ORI H2288 0000 (25-10-2005, MY27, Ls 312.46), front: B11 013813 0955 XN 84S078W (07-07-2009, MY29, Ls 299.19)

5. Summary and Conclusions

In this paper we have been able to present the work regarding coregistration on Mars South Polar images. We have successfully applied the pipeline previously used to MC11 and to Mars global images to Mars South Polar images. Currently ongoing work is being done to coregistered more than 5000 CTX images in polar stereographic projection to HRSC orthorectified base images. Coregistration of other South Polar high-resolution images will follow.

Acknowledgements

References

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