

3D multi-resolution mapping of Valles Marineris for improved understanding of RSL formation mechanisms

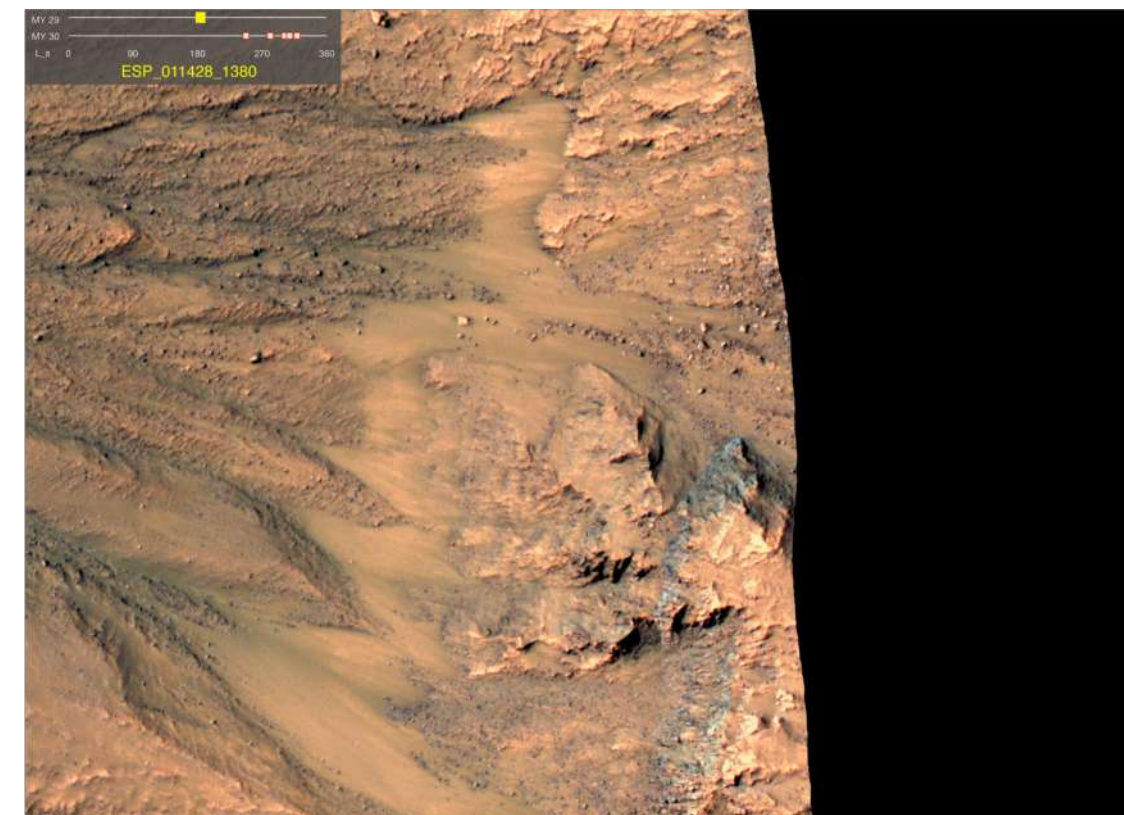
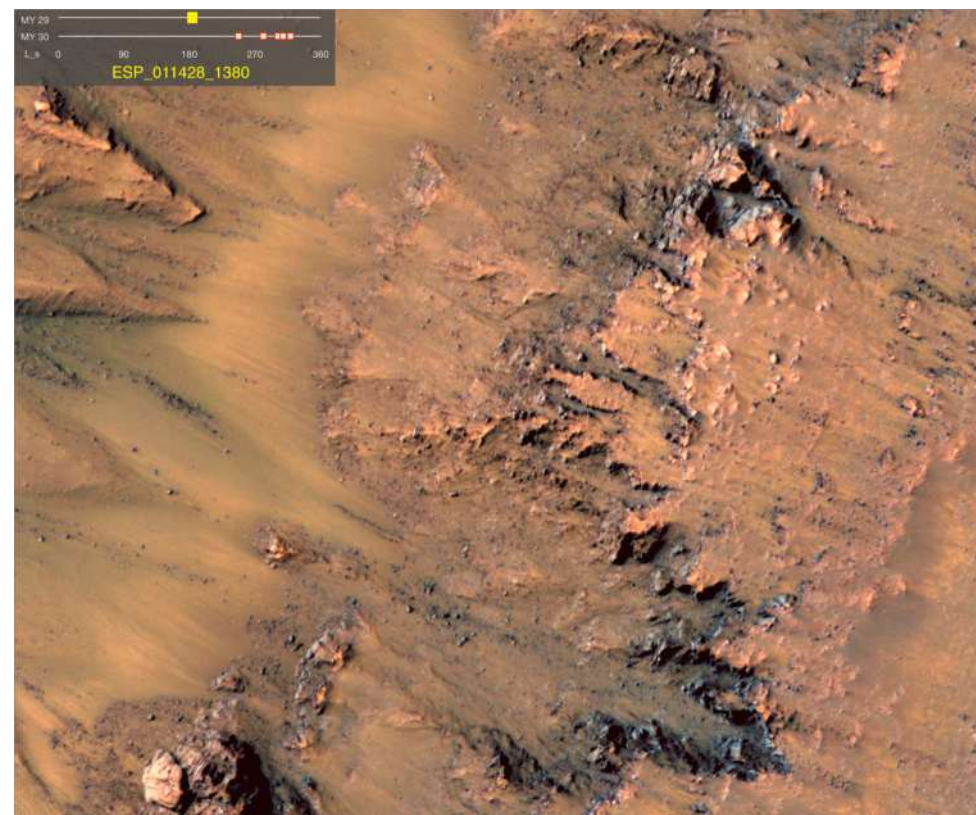
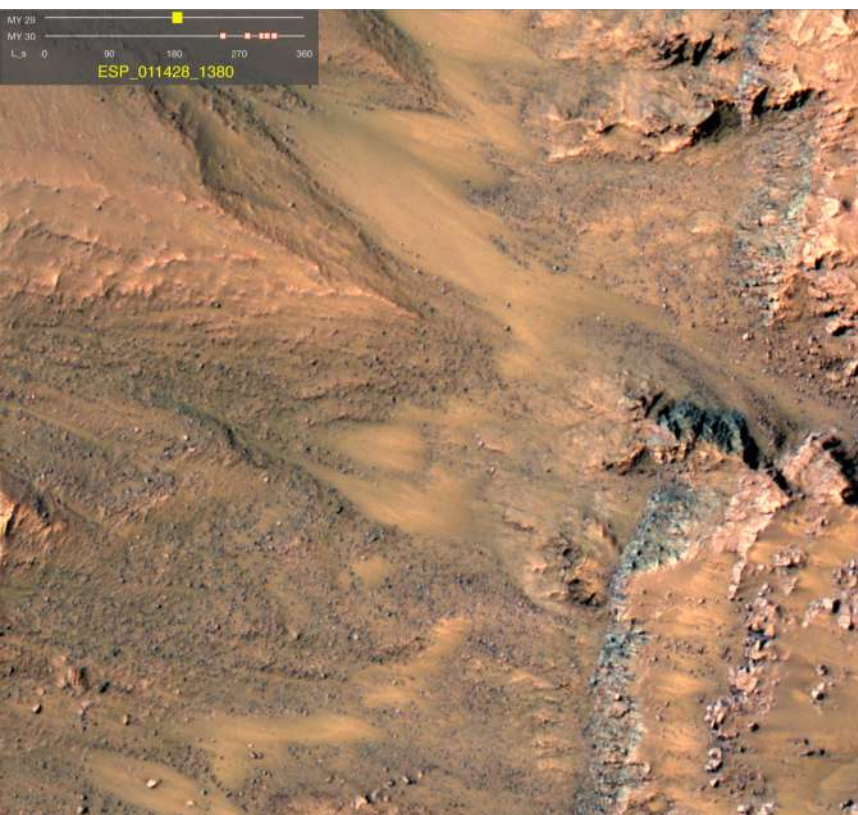
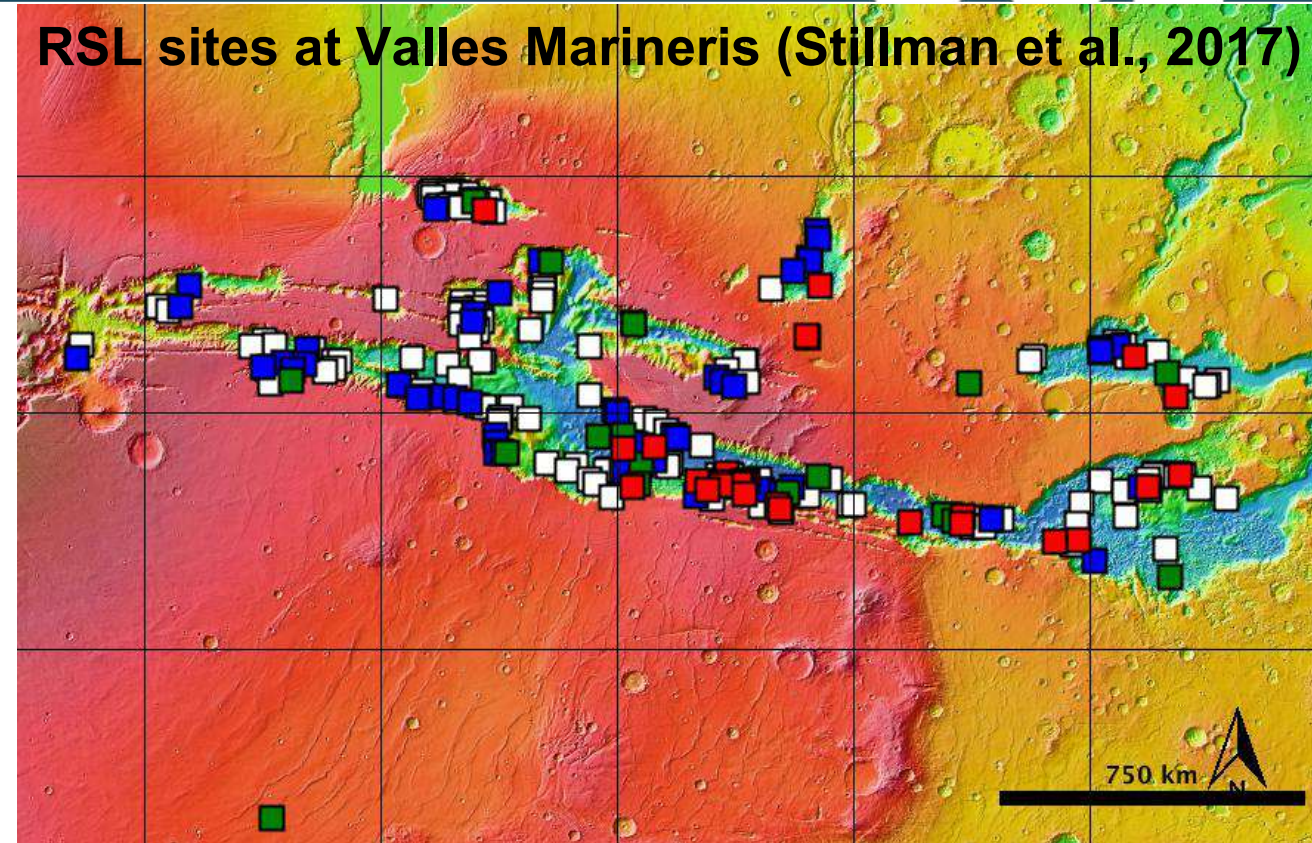
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EGU 2020

- We aim to study RSL features across the whole of Valles Marineris (VM), where the highest concentration of RSLs are found, using automated feature tracking; 3D reconstruction and multi-image super-resolution restoration (SRR).

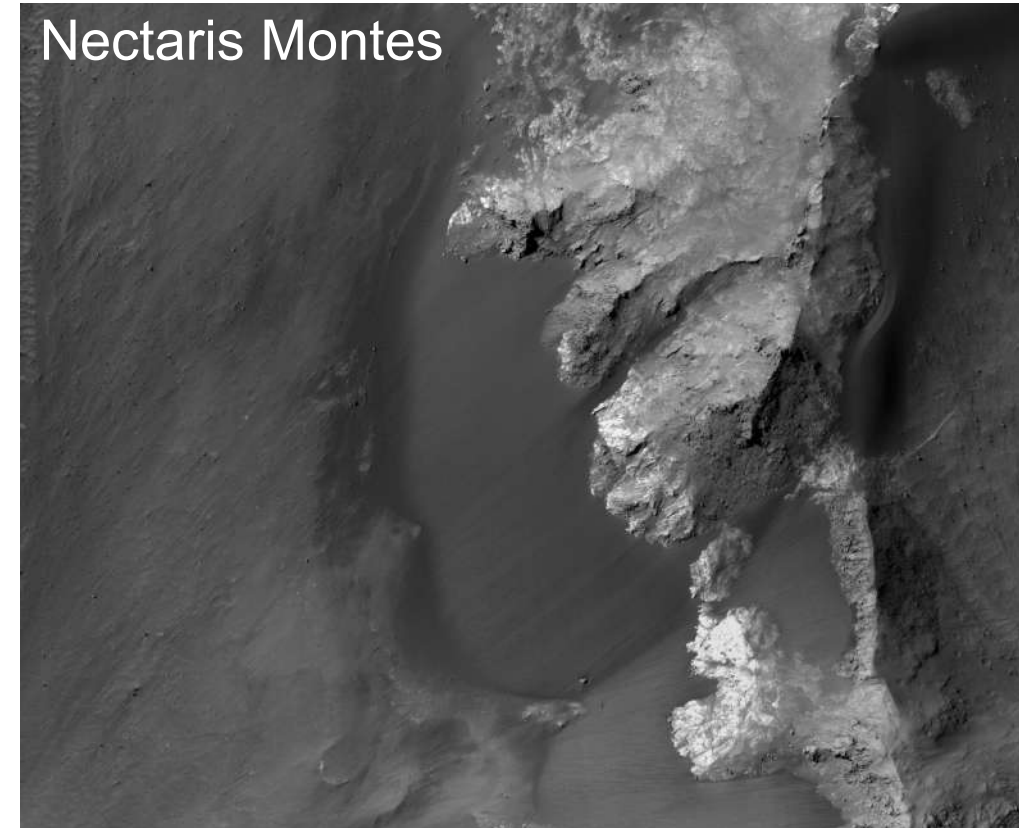


Objectives

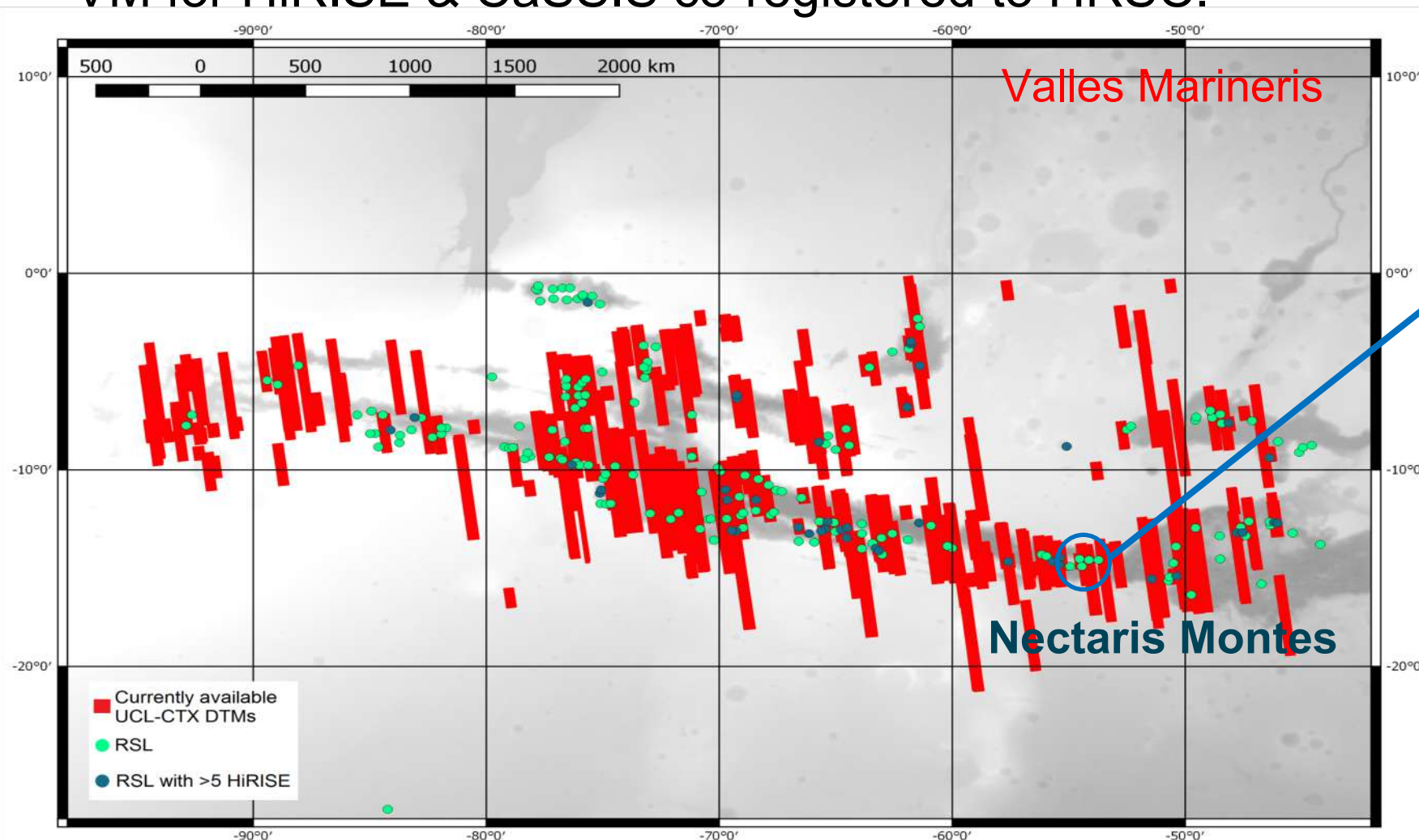
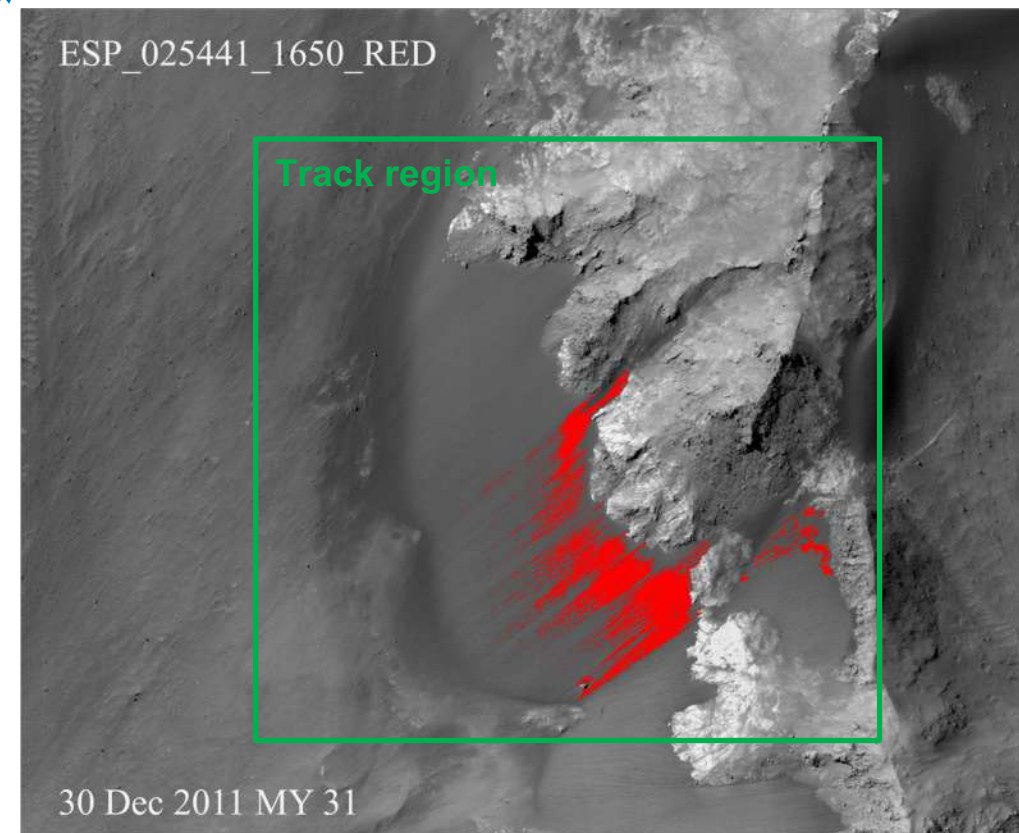


- An automated RSL tracking system has been developed.
- **The goal** is to create a regional map of tracked RSL occurrence for VM, with associated growth rates, timings (including inter-annual variability) and topographic information (including slopes and orientation).
- Currently, we are applying the UCL CASP-GO DTM processing system to the whole of VM for CTX and to all RSL sites within VM for HiRISE & CaSSIS co-registered to HRSC.

Nectaris Montes

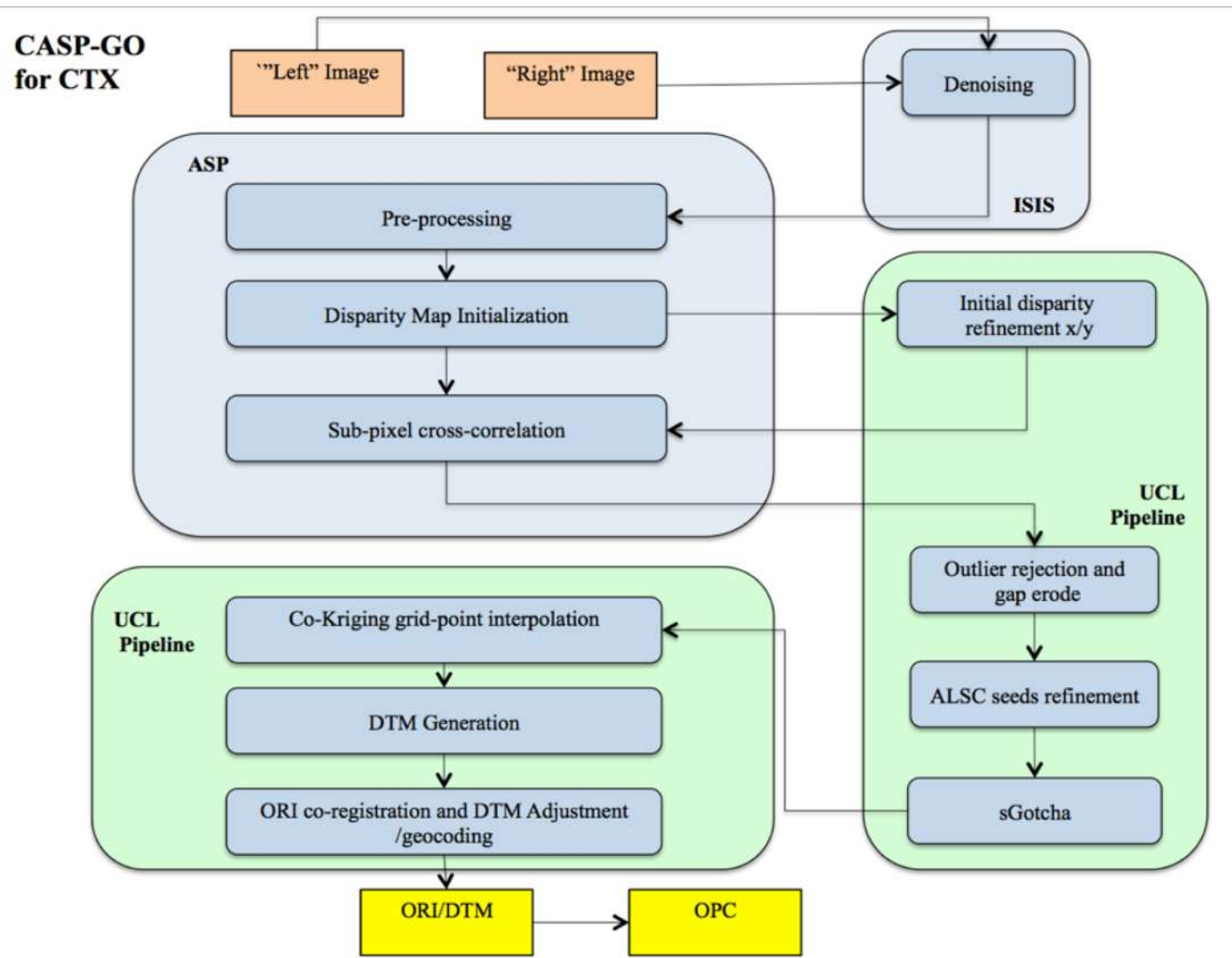


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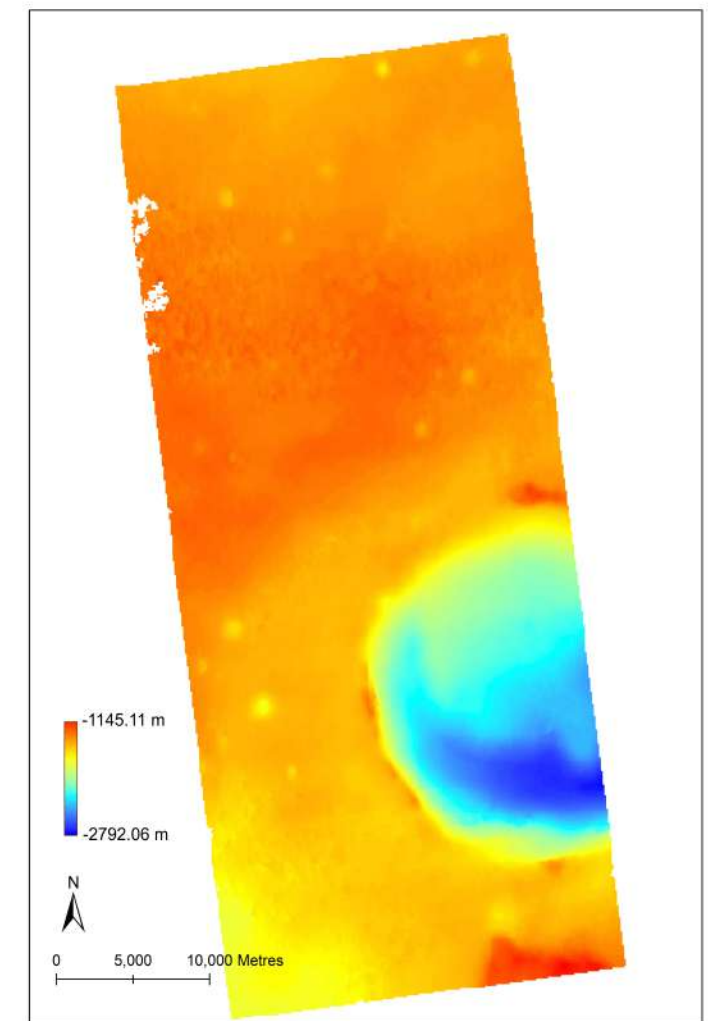
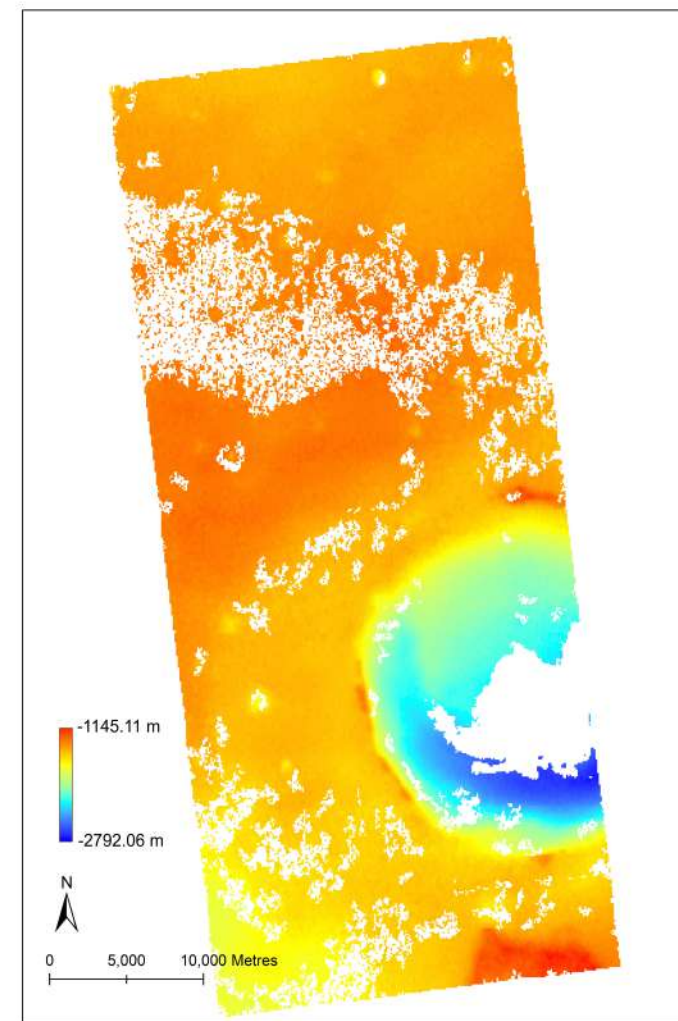
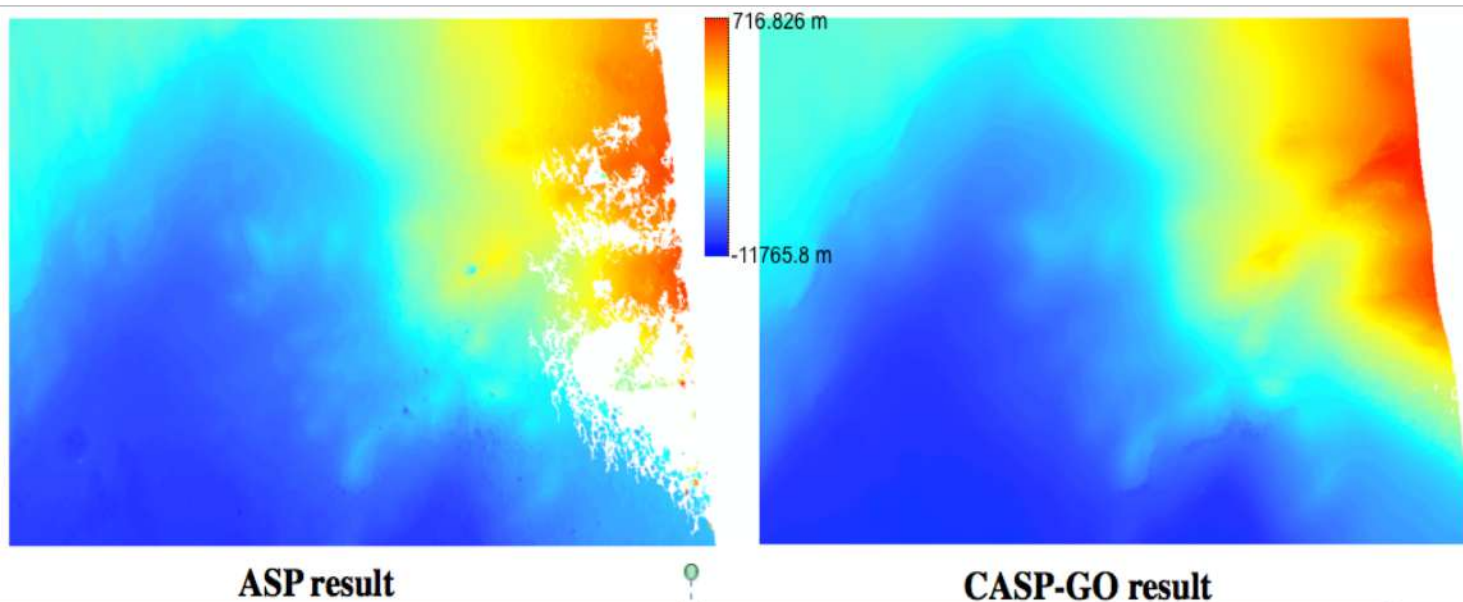


239 candidate/confirmed RSL sites in VM with CTX DTMs and repeat HiRISE images (≥ 5)

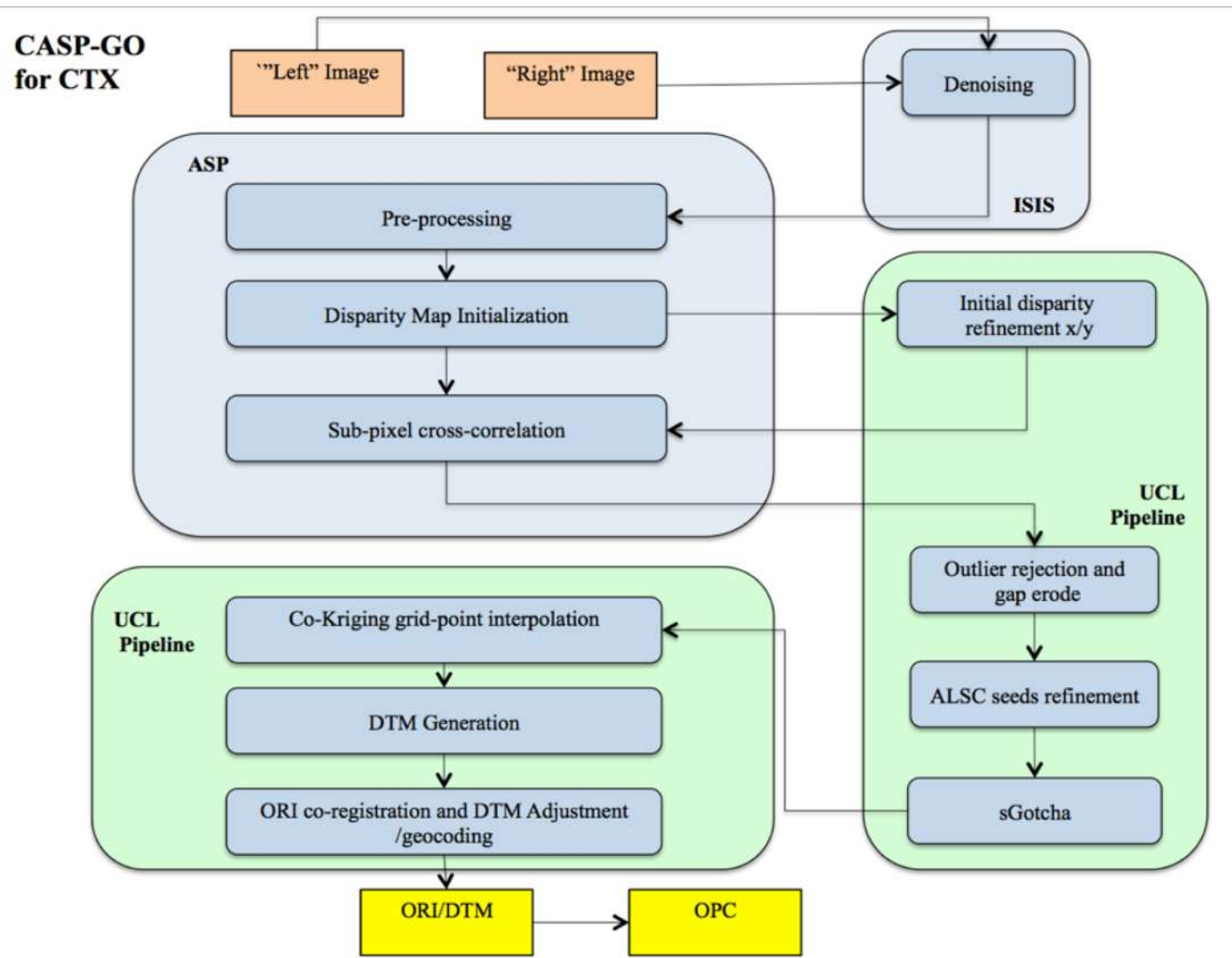
The CASP-GO automated DTM system



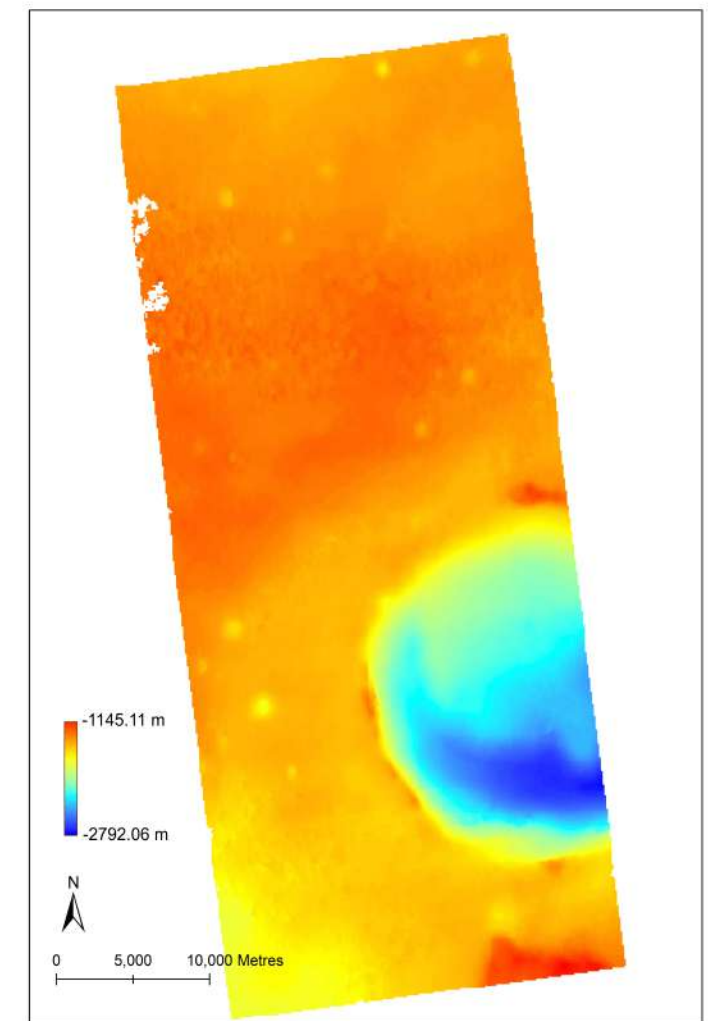
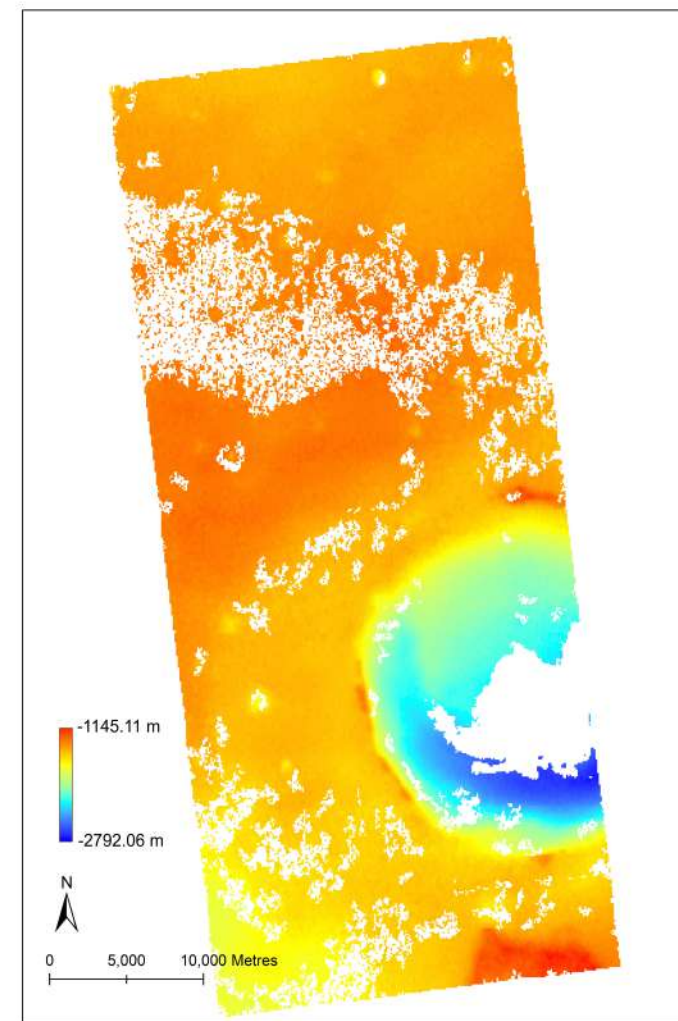
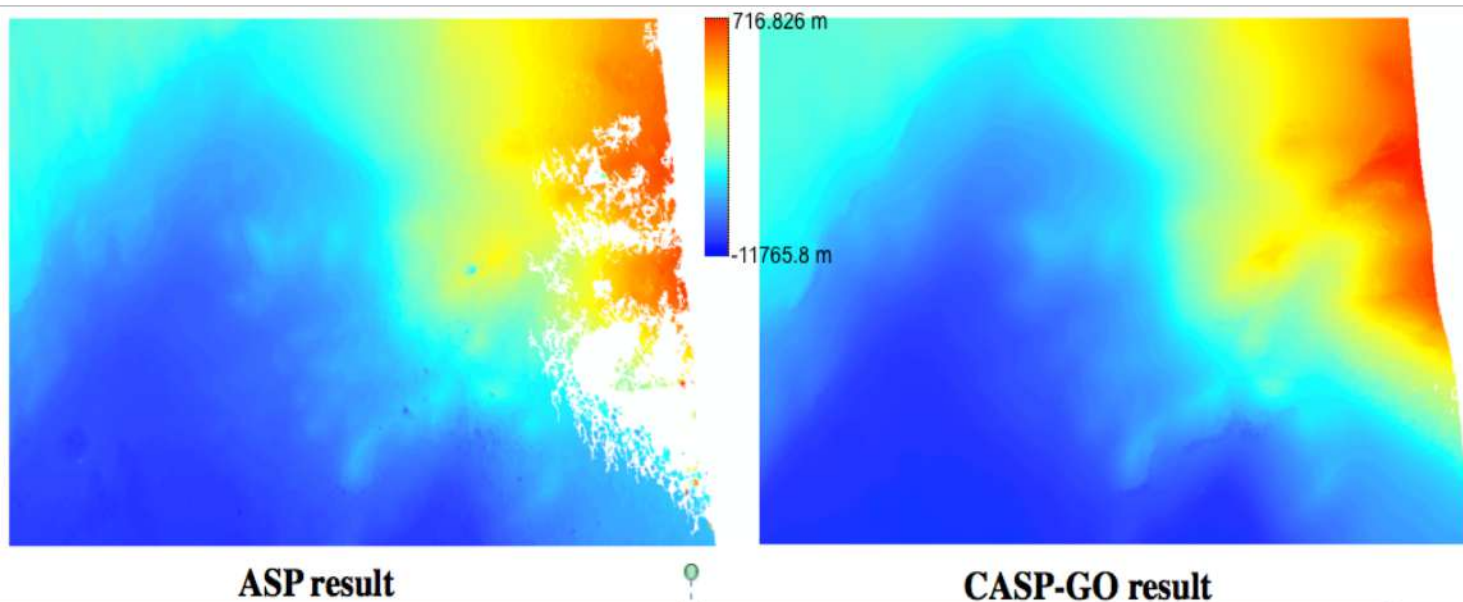
- A fully automated multi-resolution DTM processing chain was developed, called **CASP-GO** (Co-registered ASP with Gotcha and Optimisations) within iMars.
- CASP-GO (*Tao et al., PSS, 2018*) is based on the open source NASA Ames Stereo Pipeline, tie-point based multi-resolution image co-registration (*Tao & Muller, Icarus, 2016*), and ALSC/region growing sub-pixel refinement method (*Shin & Muller, PR, 2012*).



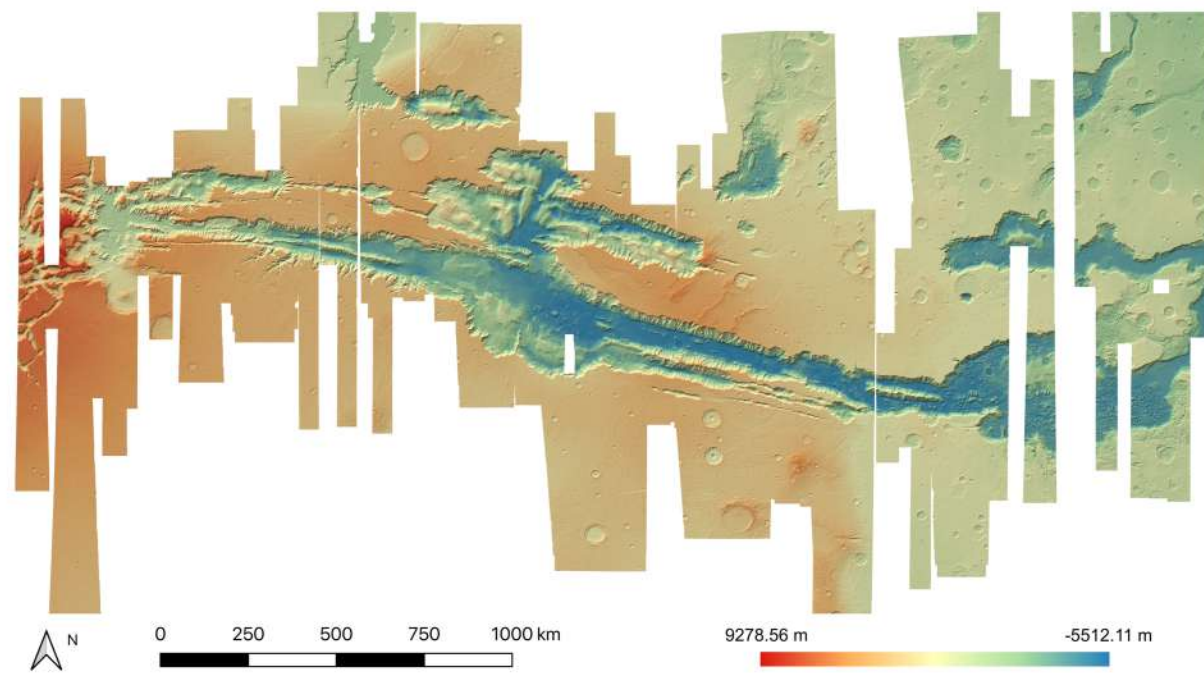
The CASP-GO automated DTM system



- It has the following key features:
 - (a) Co-registered geo-spatial coordinates;
 - (b) Improved DTM completeness;
 - (c) Reduced DTM artefacts;
 - (d) Improved DTM accuracy;
 - (e) Uncertainty value for interpolated areas;
 - (f) CTX, HiRISE, HRSC and CaSSIS (under dev.)

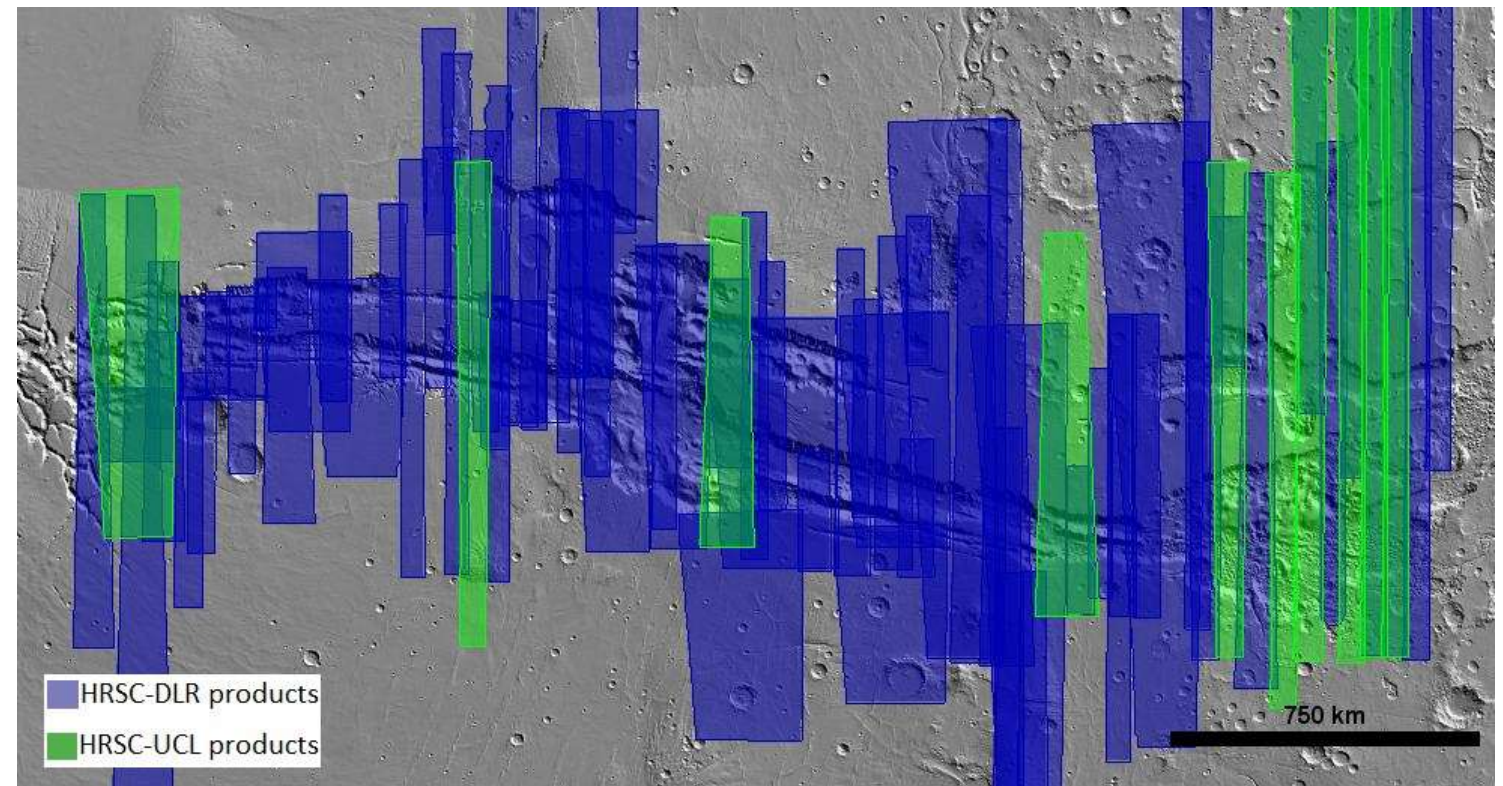
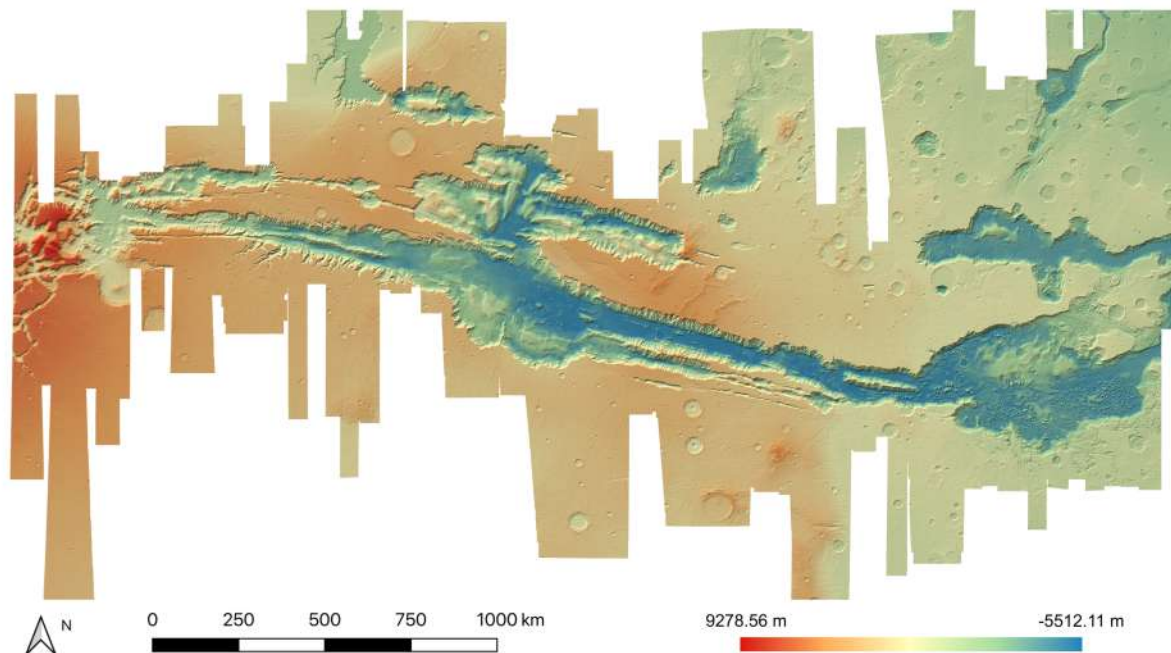


DLR HRSC DTM products

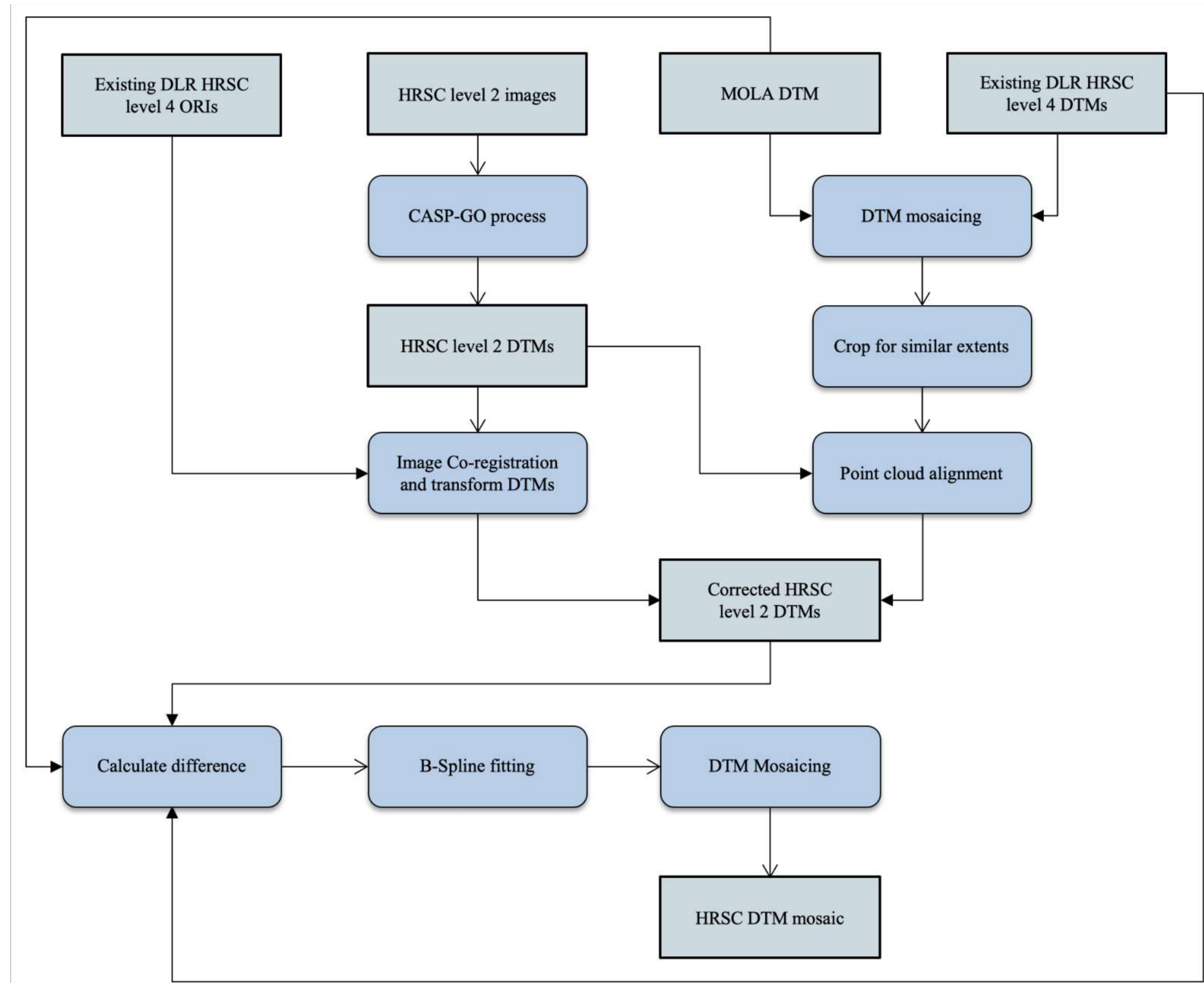


- HRSC level 2 images are processed to 50m DTMs using CASP-GO, co-registered with the existing ESA DLR HRSC level 4 DTMs, and mosaiced at 50m grid spacing.
- Individual HRSC DTMs are corrected using B-Spline fitting against MOLA DTM
- HRSC mosaic consists of 71@50-150m DLR HRSC DTMs and 11@50m CASP-GO processed DTMs.

DLR +UCL HRSC DTM products

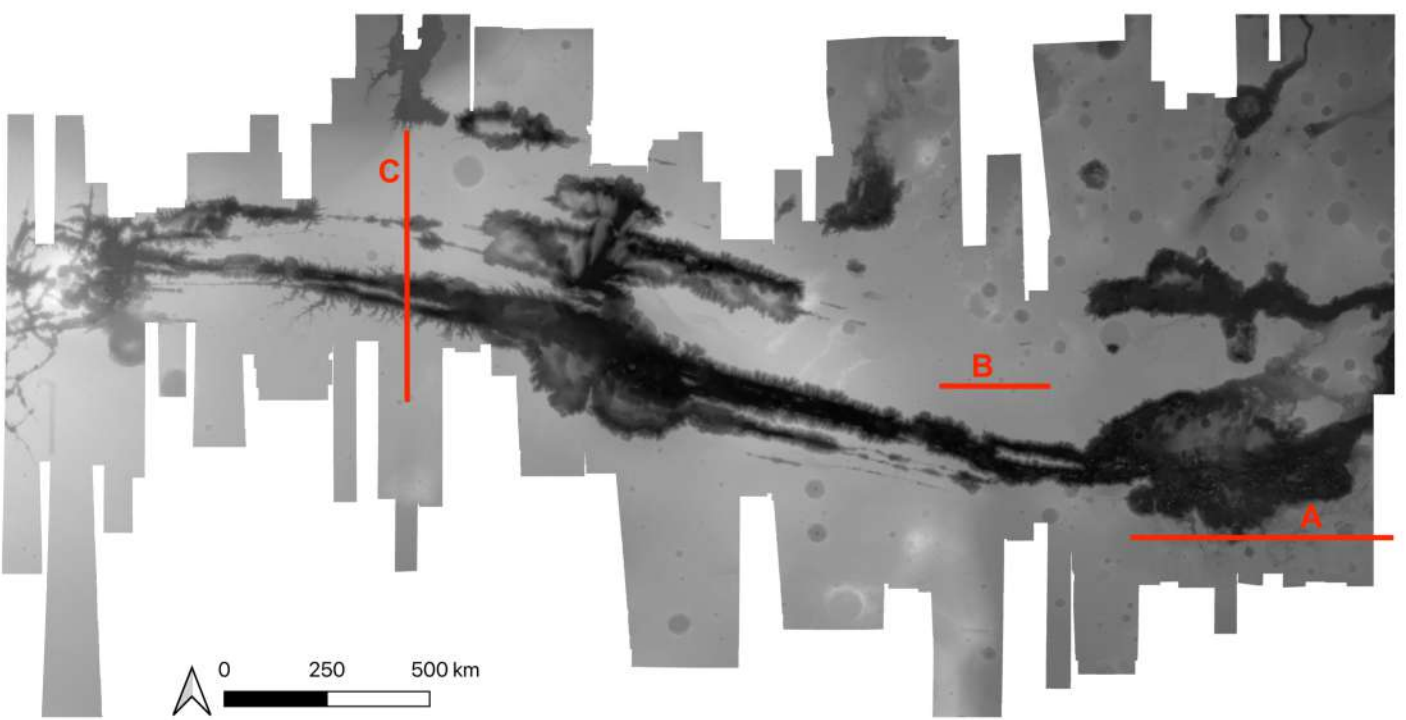


- CASP-GO was used to create 11 DTMs from HRSC level 2 images.
- Joint image co-registration and DTM point cloud alignment is used to co-register the 11 UCL HRSC DTMs with the existing DLR HRSC DTMs and MOLA.
- B-Spline fitting of all HRSC DTMs with MOLA DTM is used to eliminate surface “jitter” and warping errors.

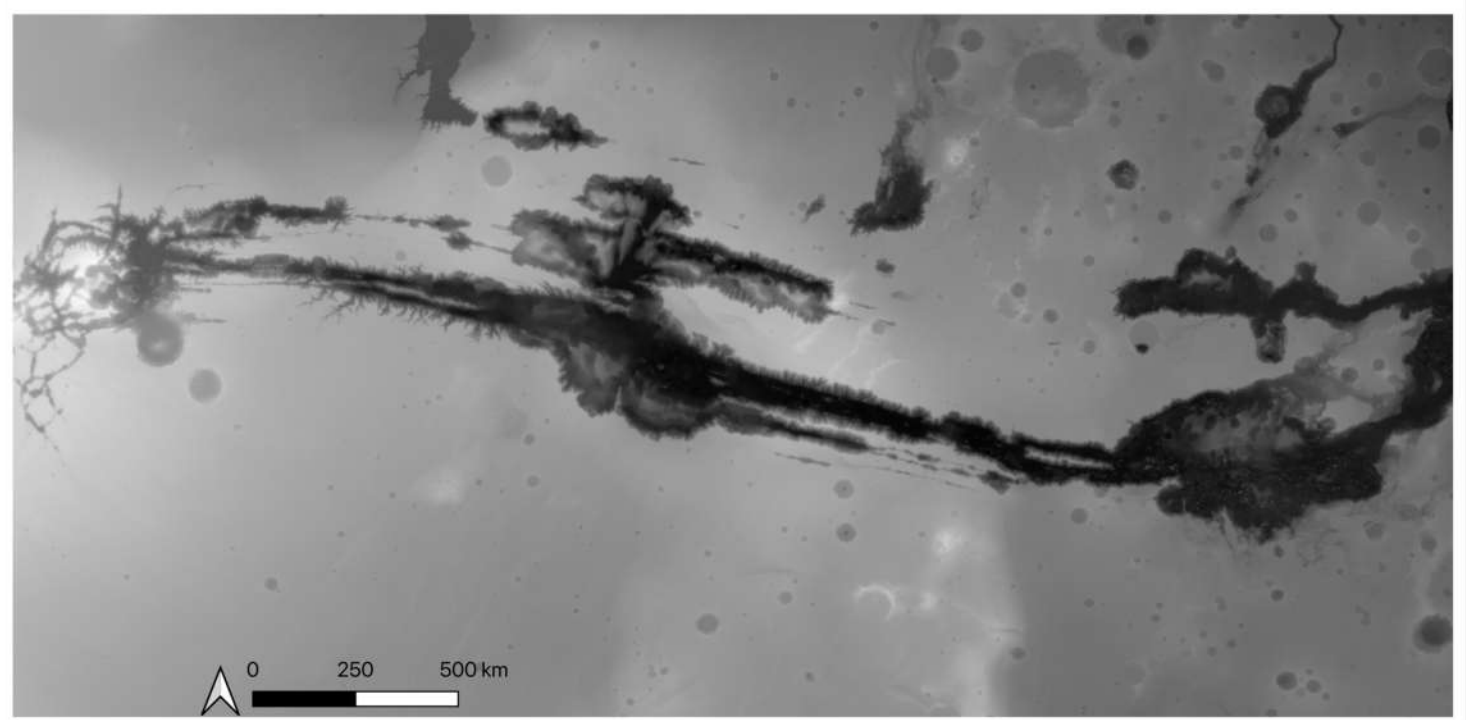


HRSC DTM Mosaic – Validation against MOLA – Profile A

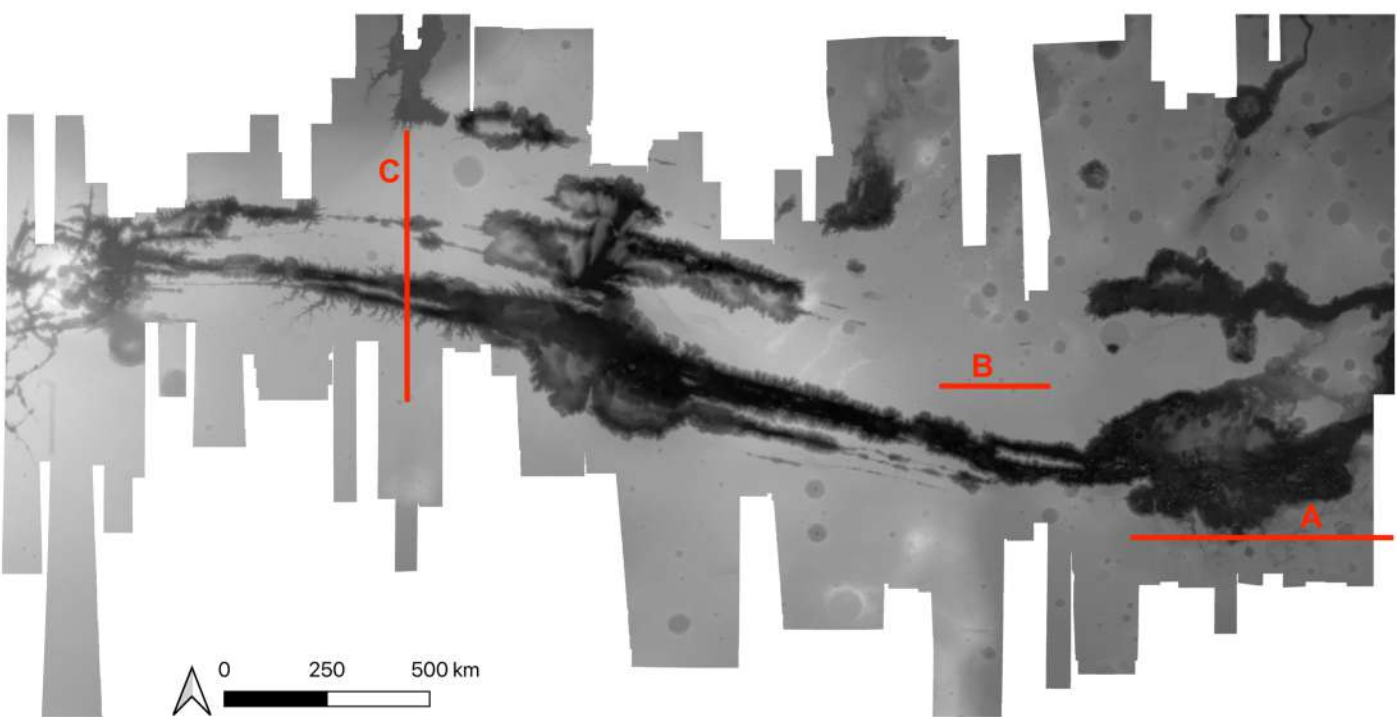
HRSC DTM mosaic



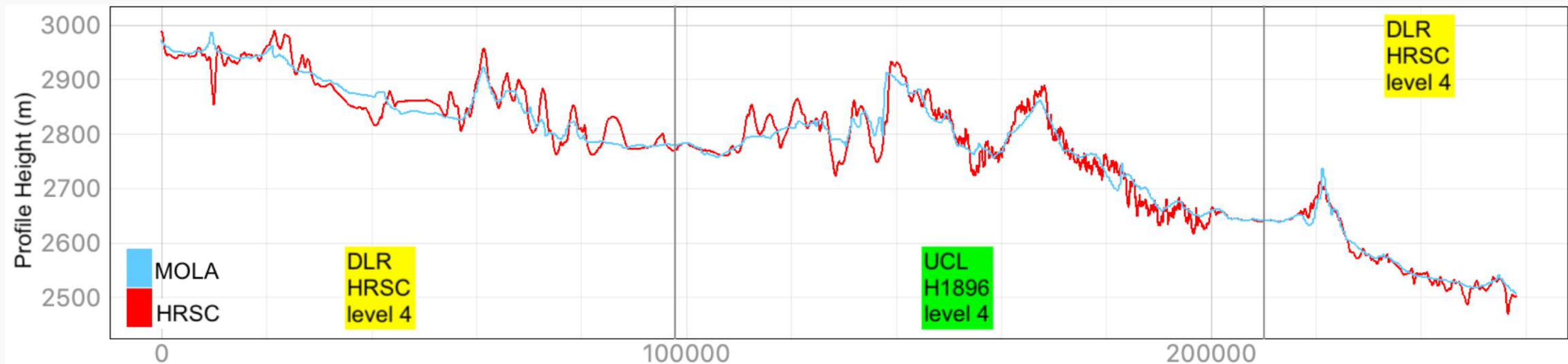
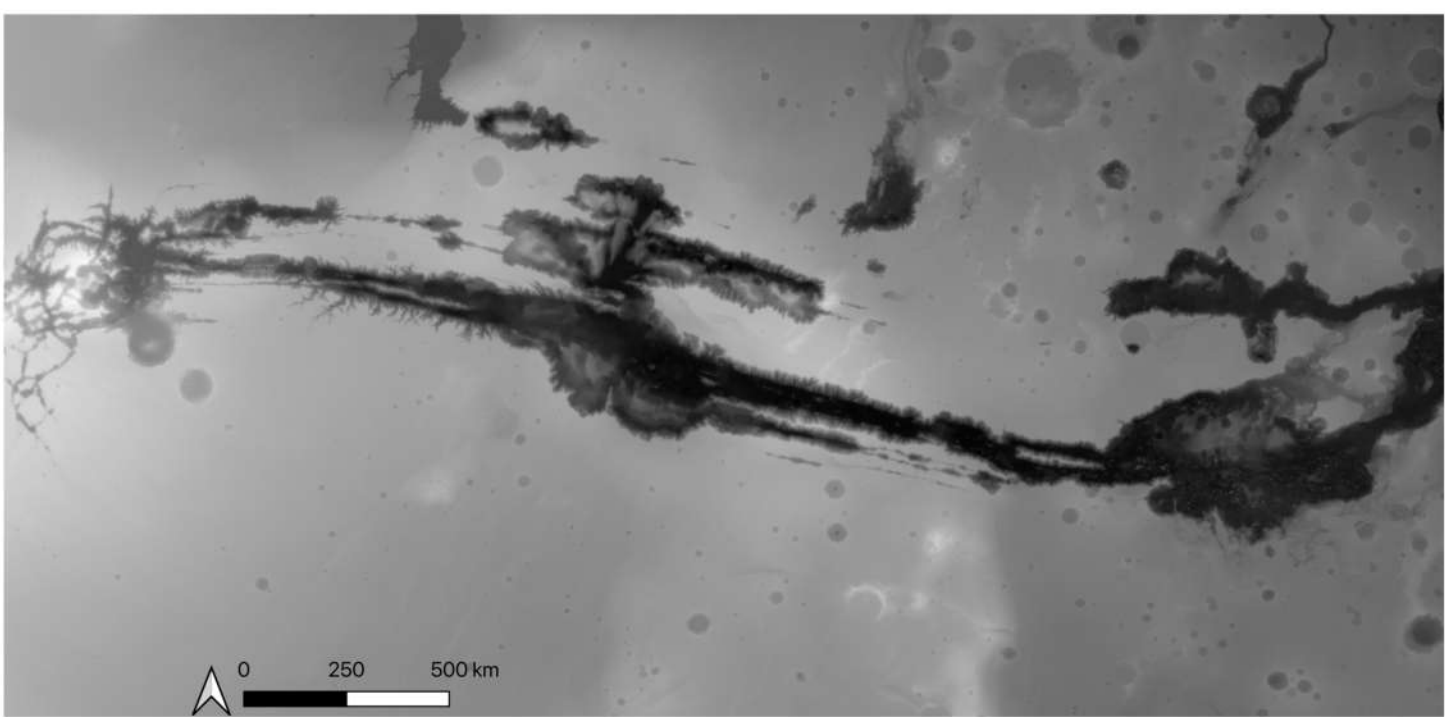
MOLA DTM



HRSC DTM mosaic

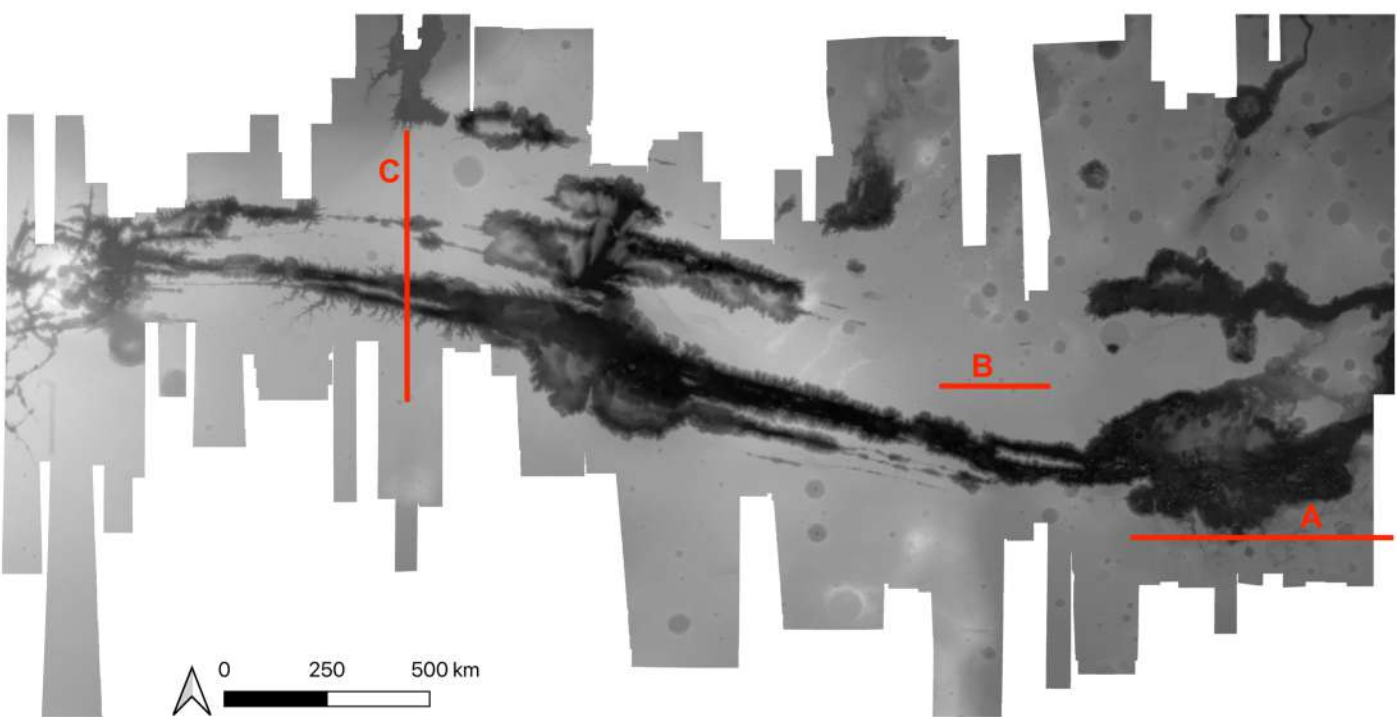


MOLA DTM

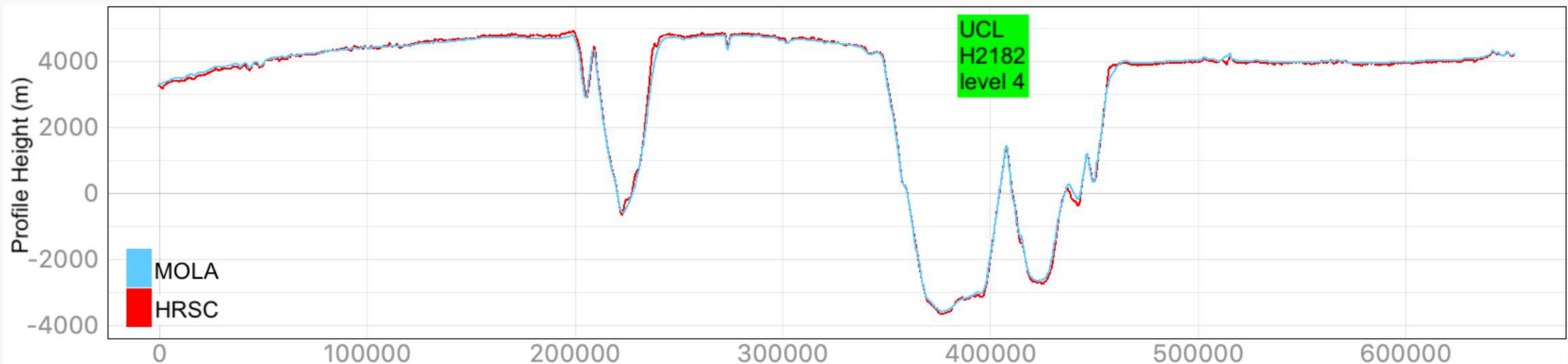
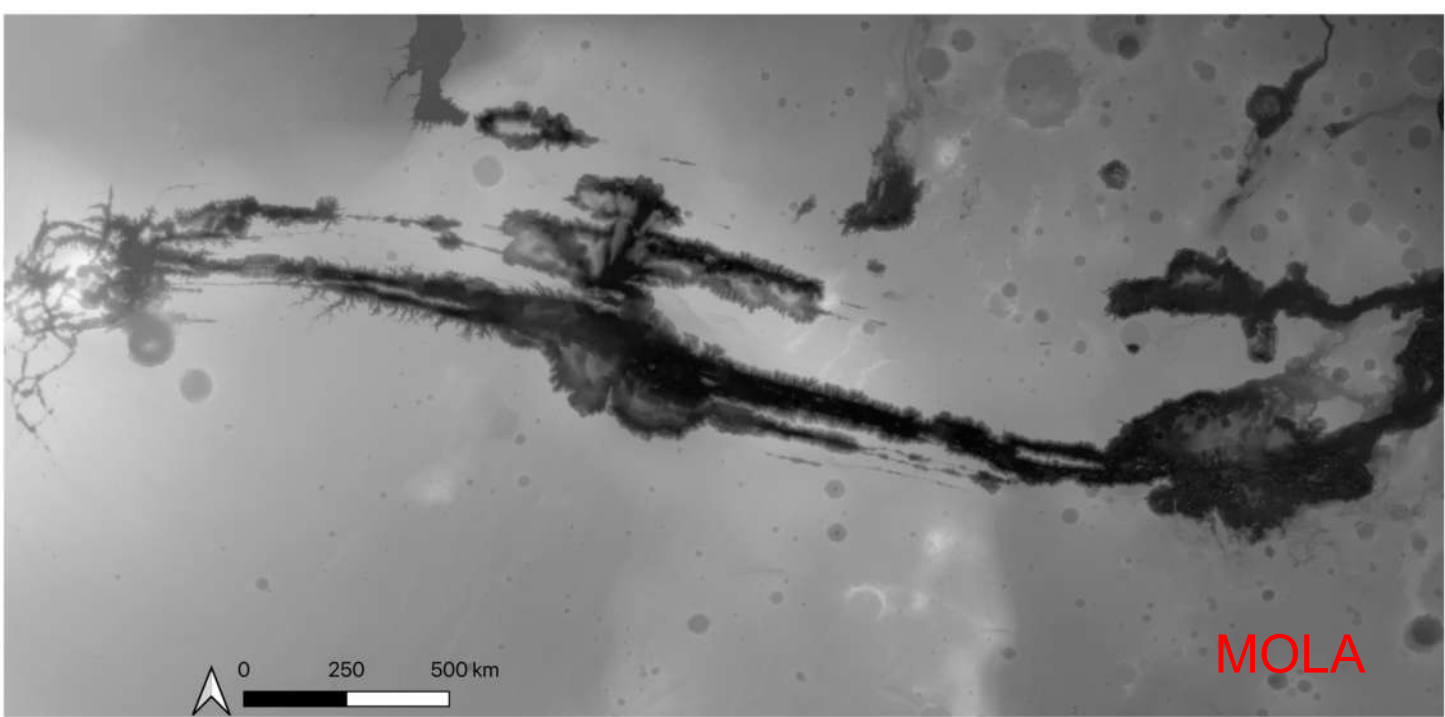


Profile B

HRSC DTM mosaic

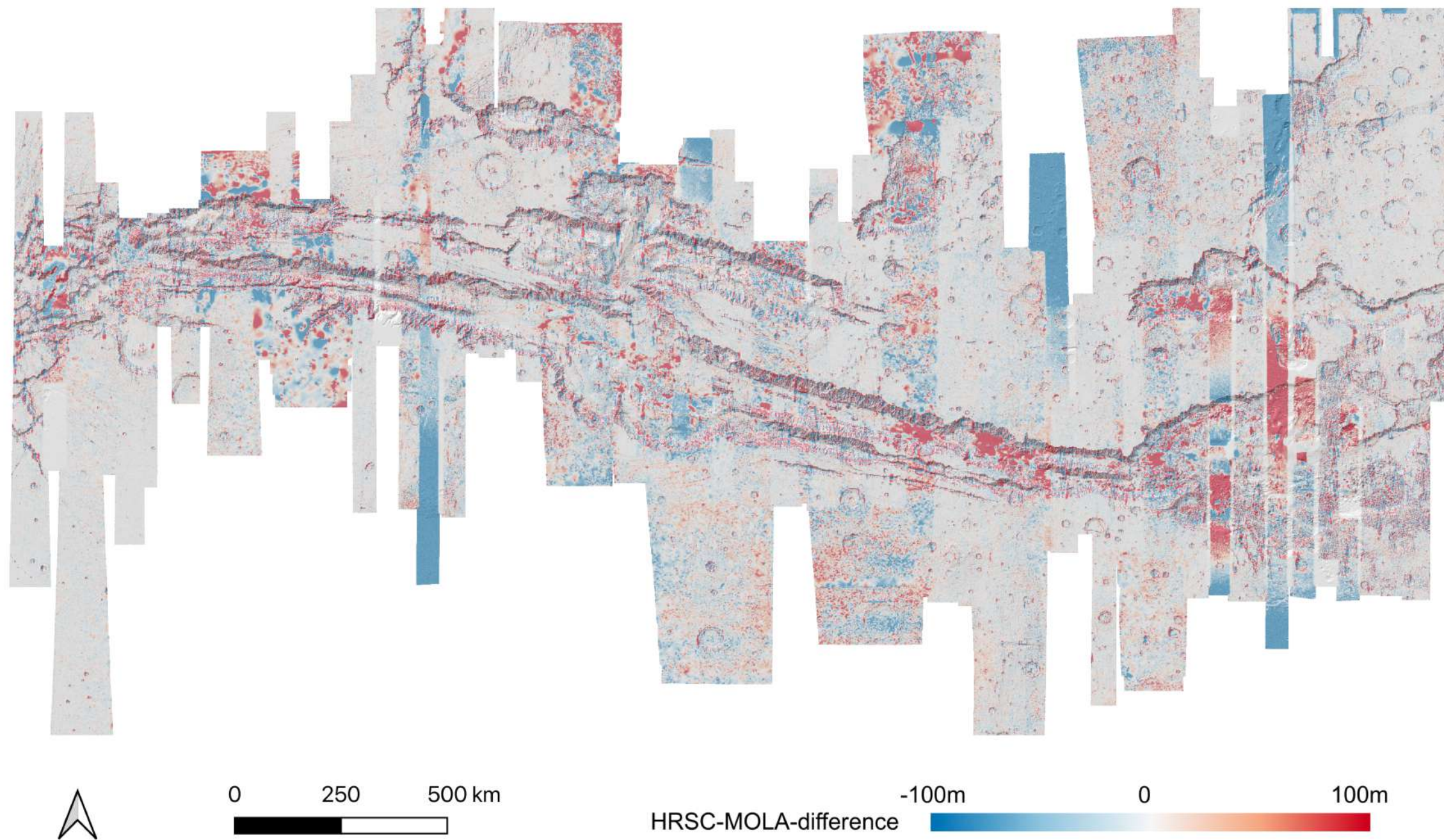


MOLA DTM

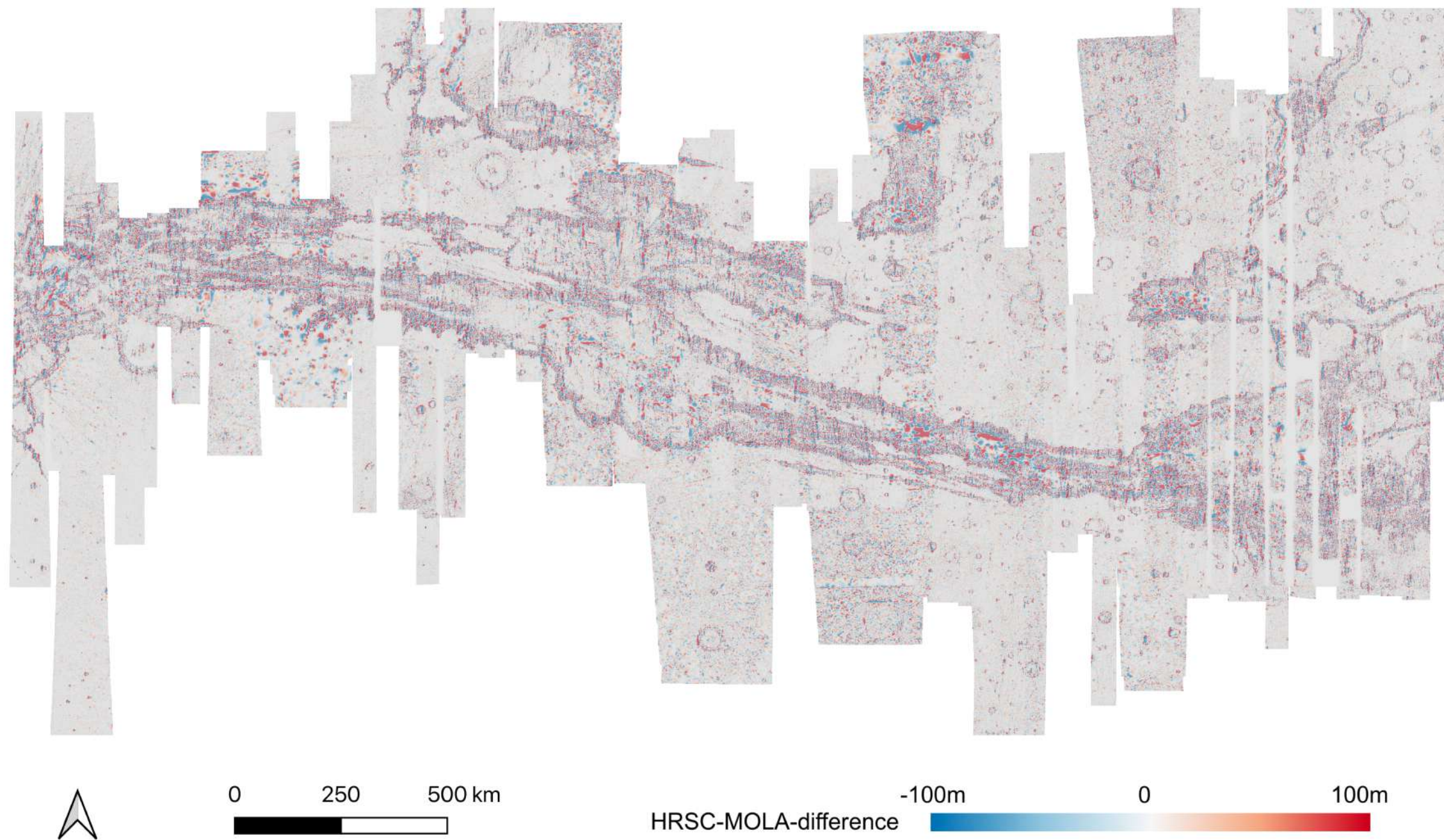


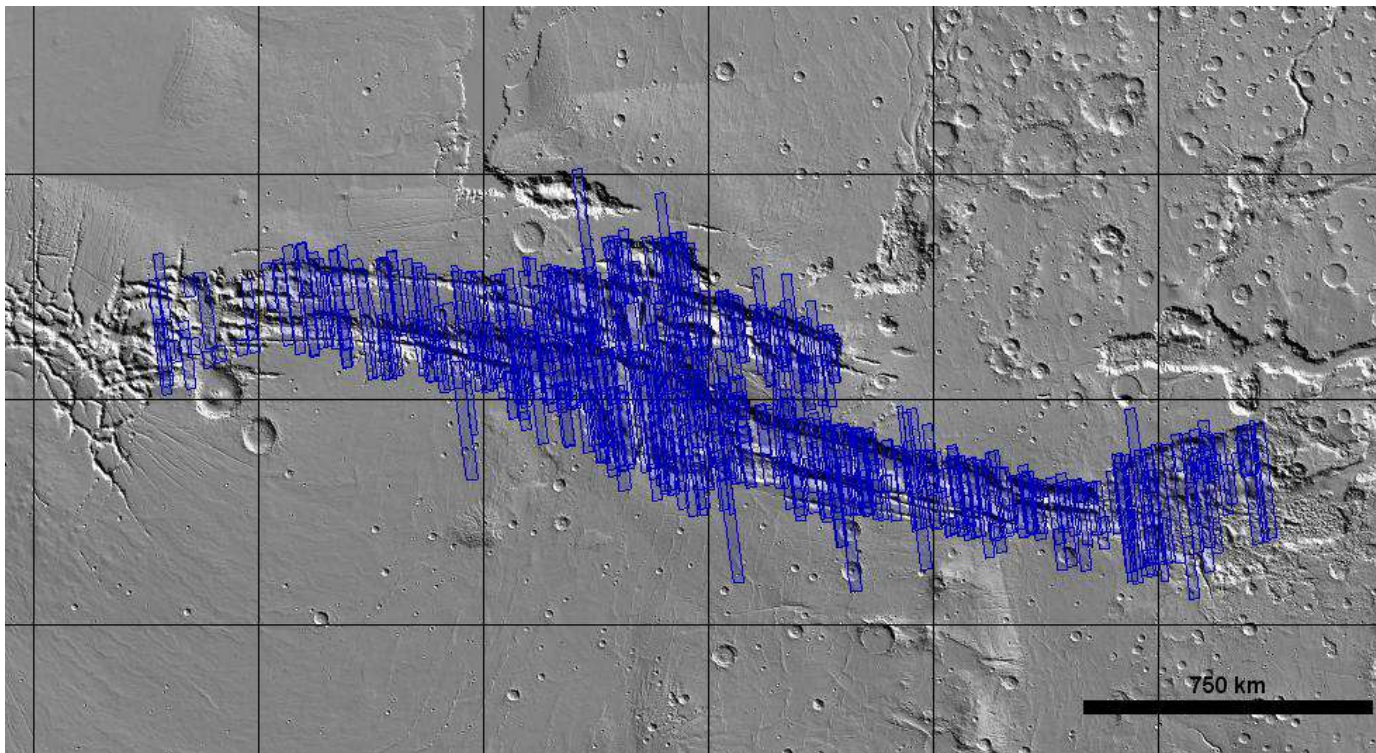
Profile C

Difference map: HRSC co-registered single stripe DTMs - MOLA

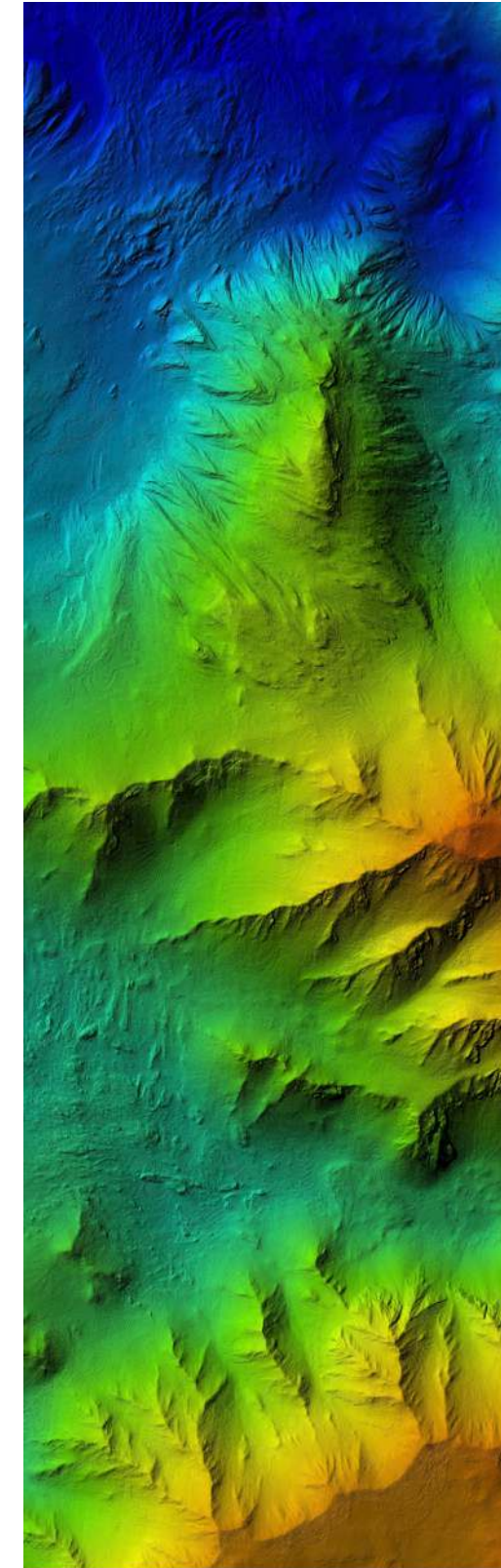
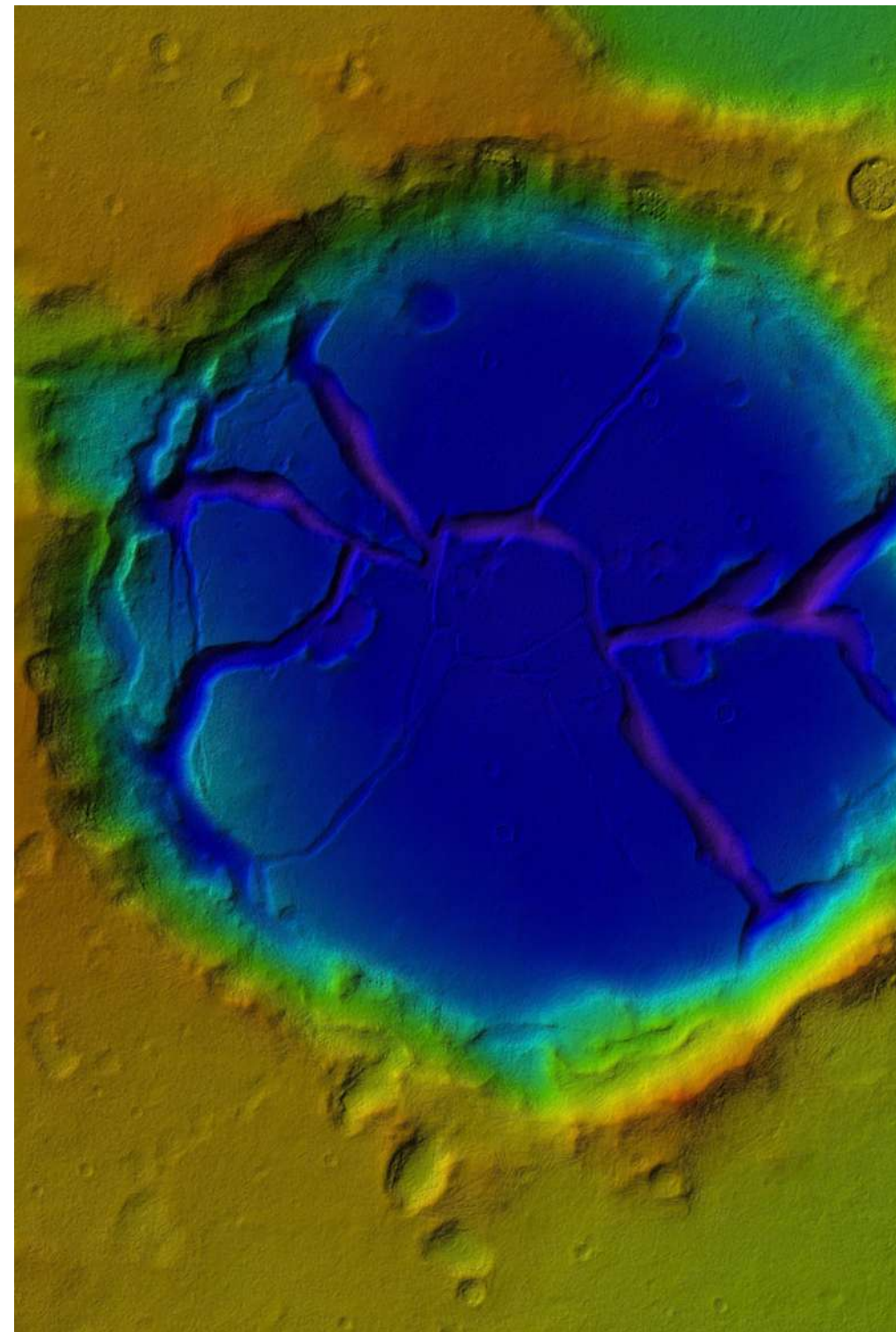


Difference map: final corrected DTM mosaic – MOLA after B-Spline





- 1763 CTX stereo pairs were identified covering and processed for the whole of VM.
- Post-processing including joint image co-registration and point cloud alignment, B-spline fitting with HRSC DTM mosaic, and possible artefact removal using SFS methods (Douté et al.) will be achieved in the summer 2020.



- For HRSC, we are building a HRSC ORI mosaic (in collaboration with FUB).
- We are also working on 3 selected study sites for Coprates Montes, Nectaris Montes, and Capri Chaos for cascaded HiRISE-CaSSIS-CTX-HRSC datasets as well as Shape-from-shading densified HiRISE DTM and Super-resolution resolved HiRISE images.
- Previously processed global CTX DTMs from iMars will be available through the ESAC GSF site soon at (https://www.cosmos.esa.int/web/psa/UCL-MSSL_iMars_CTX_v1.0).
- Plan to publish the VM HRSC datasets very soon.
- All products will be viewable through the iMars webGIS and downloadable from there linked to the ESA Guest Storage Facility.

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