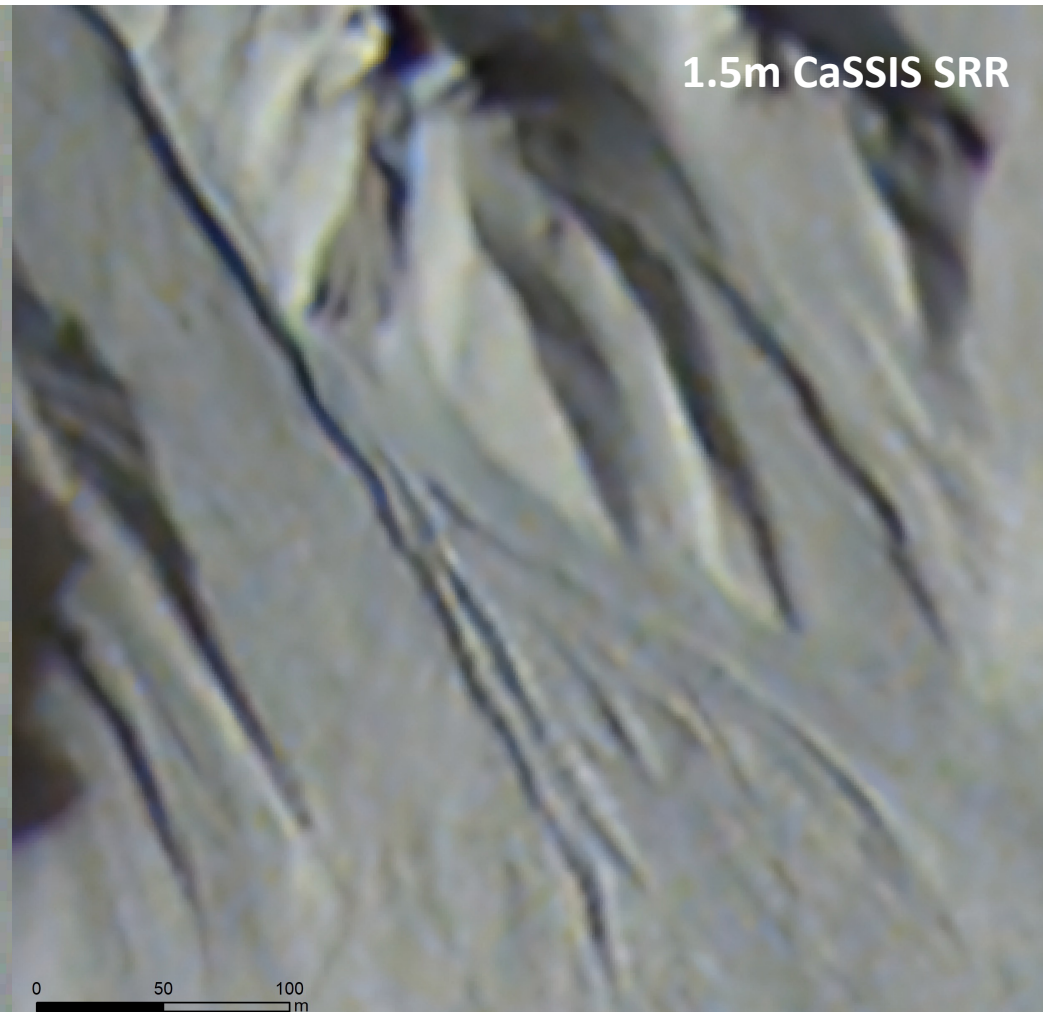
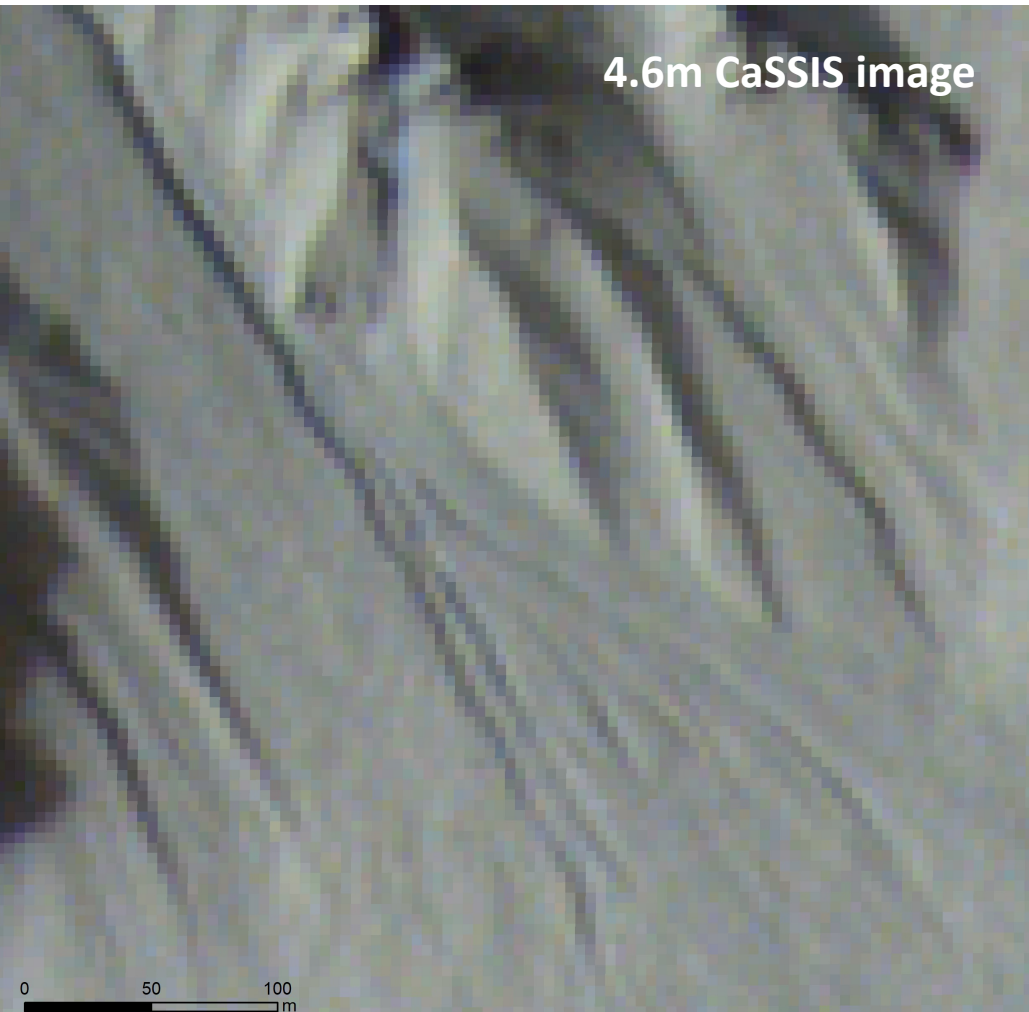


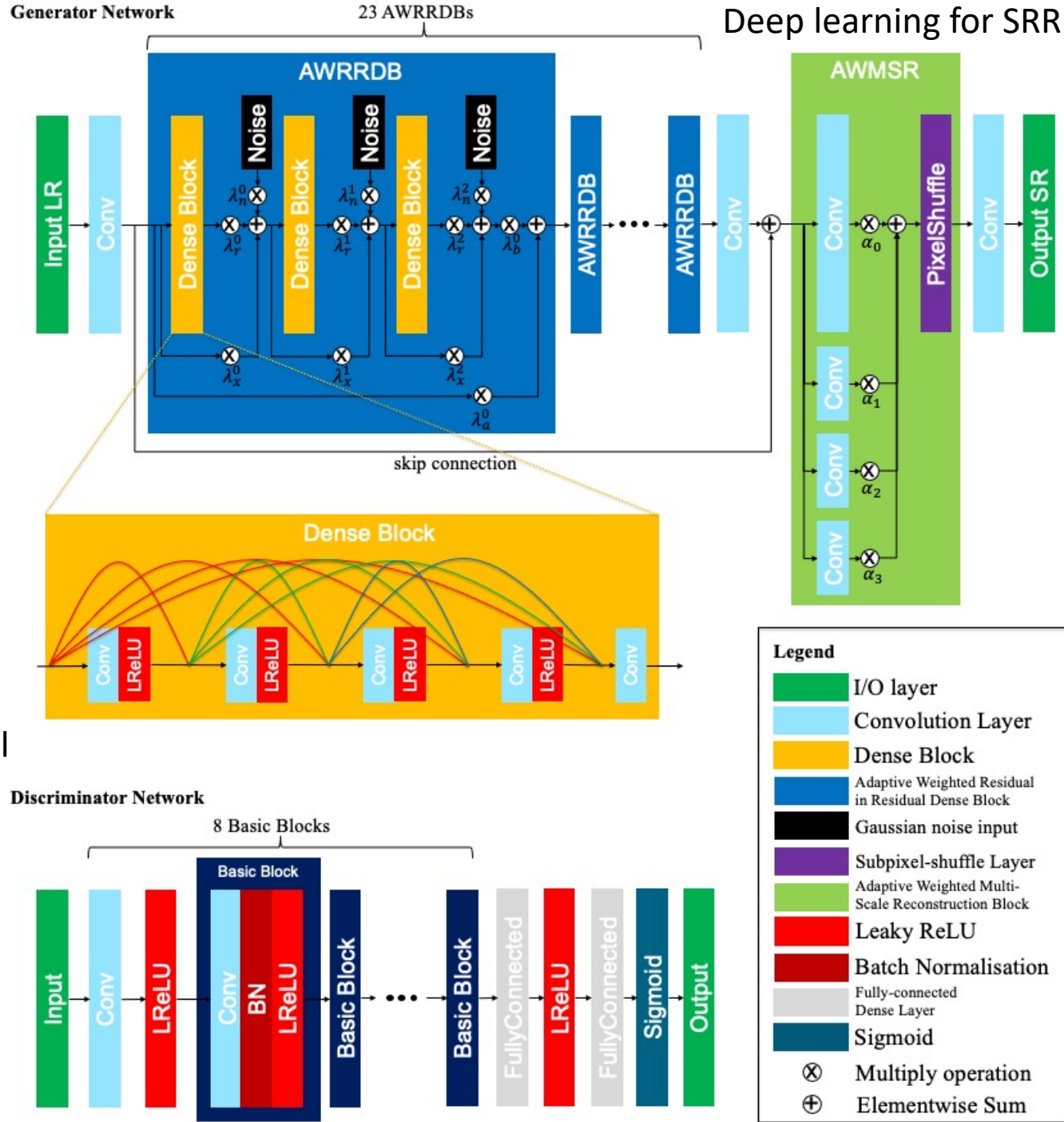
Single Image Super-Resolution Restoration of TGO CaSSIS Colour Images

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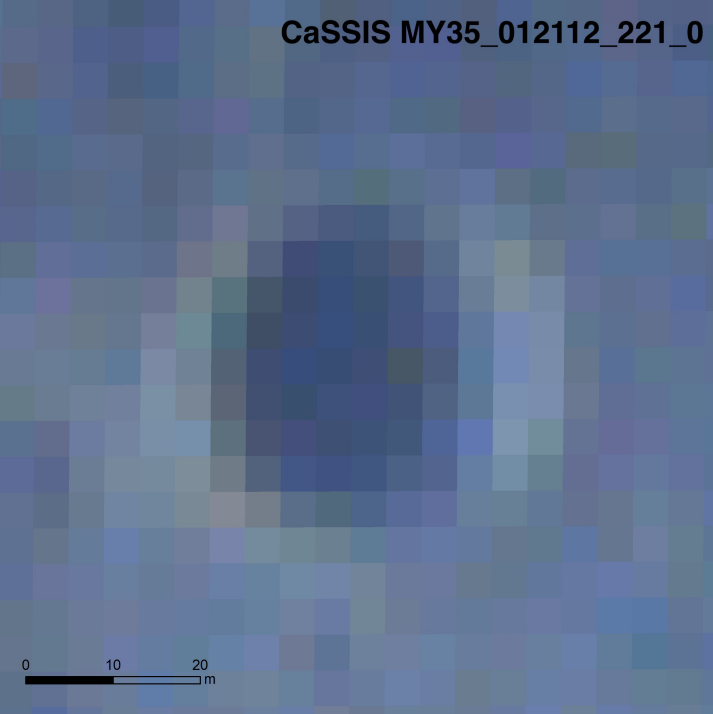


- Improving the spatial resolution of CaSSIS images will allow greater amounts of scientific information to be extracted about the nature of the Martian surface and how it formed or changes over time.
- We developed a single-image super-resolution restoration (SRR) network for TGO CaSSIS images, called MARSGAN (Multi-scale Adaptive weighted Residual Super-resolution Generative Adversarial Network) ¹.

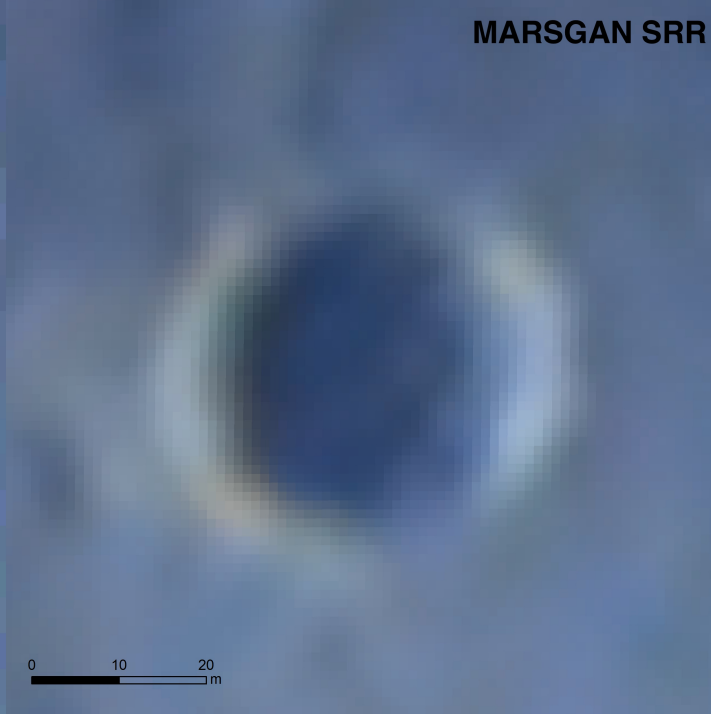


¹ Tao, Y.; Conway, S.J.; Muller, J.-P.; Putri, A.R.D.; Thomas, N.; Cremonese, G. Single Image Super-Resolution Restoration of TGO CaSSIS Colour Images: Demonstration with Perseverance Rover Landing Site and Mars Science Targets. *Remote Sens.* **2021**, *13*, 1777.

CaSSIS MY35_012112_221_0



MARSGAN SRR

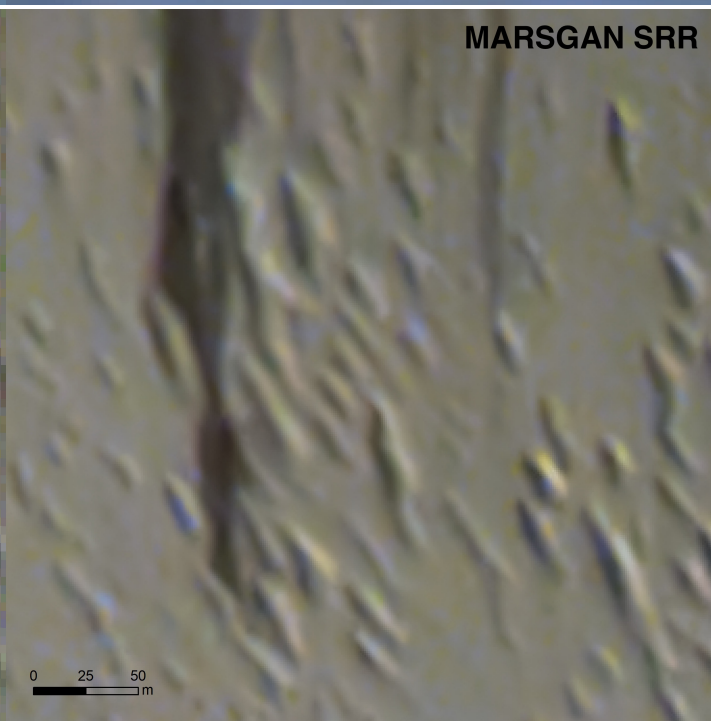


- MARSGAN was demonstrated with qualitative and quantitative assessments of CaSSIS SRR results over the Mars2020 Perseverance rover's landing site and 8 different science sites.
- Quantitative assessment of CaSSIS SRR results have an effective resolution enhancement factor of about 3 times.
- The pre-trained MARSGAN model can also be applied to HiRISE, CTX, and CRISM multi-spectral images.

CaSSIS MY35_007017_173_0



MARSGAN SRR



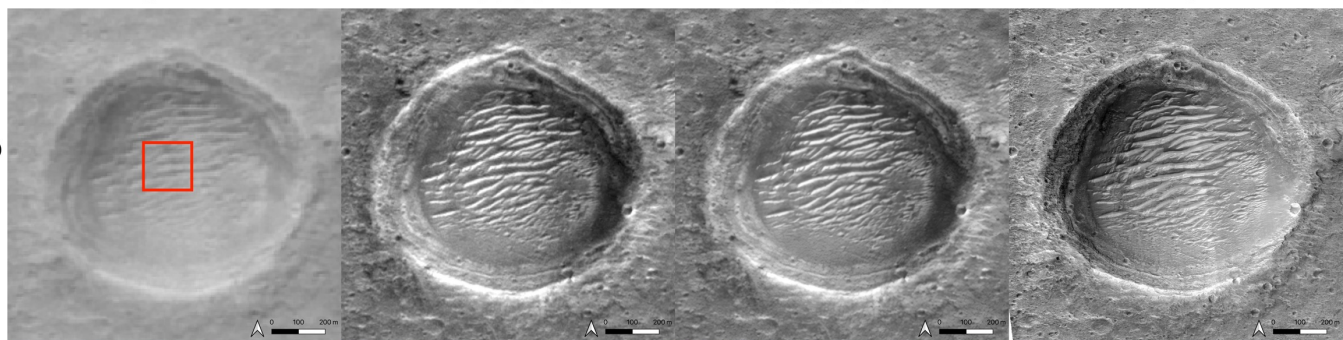
CTX

CaSSIS

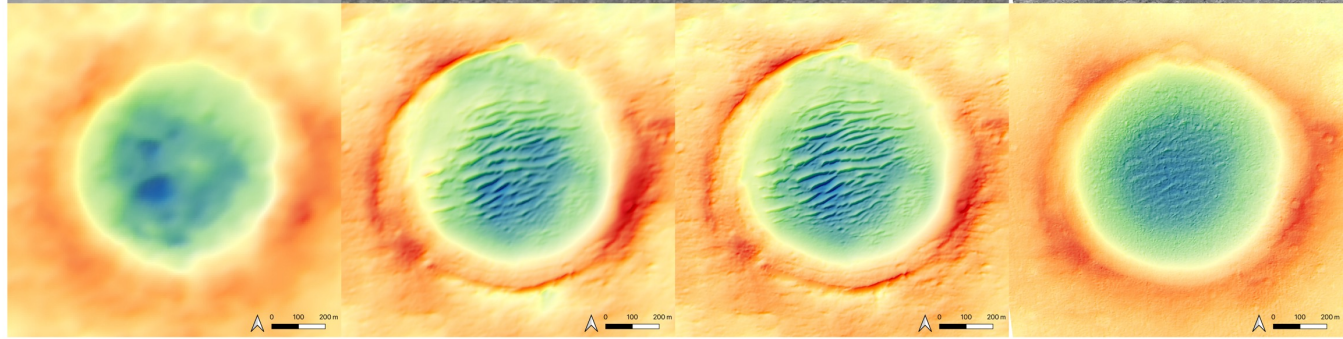
CaSSIS SRR

HiRISE

Image



DTM

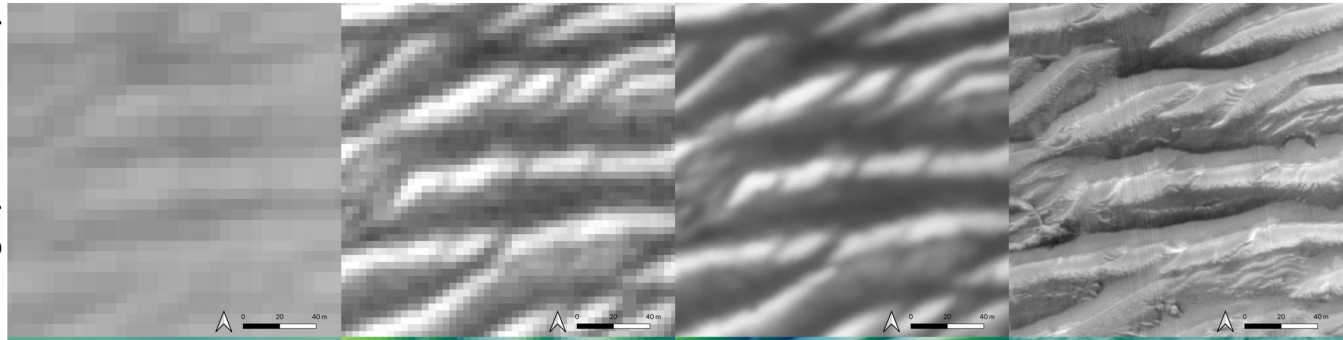


-3168m

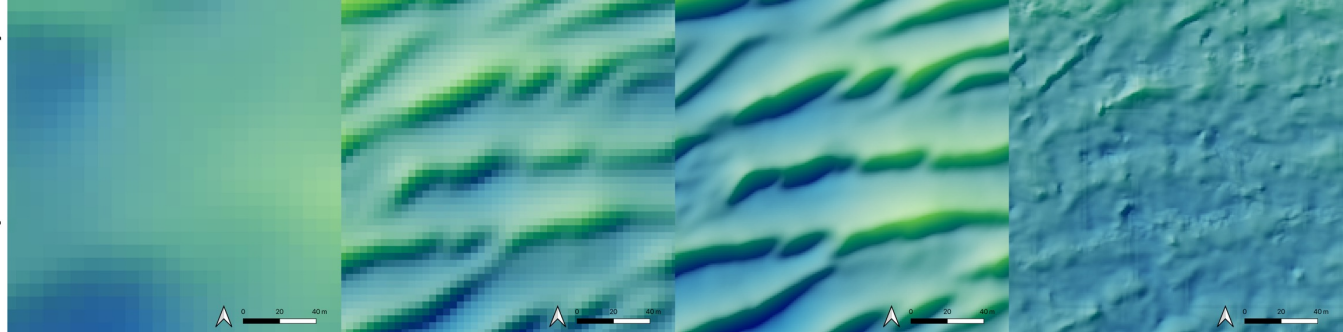


-3098m

Image (zoom-in view)



DTM (zoom-in view)



- MARSGAN SRR can be coupled with photogrammetry and/or photoclinometry to produce sub-pixel resolution digital terrain models ².

- Results were demonstrated using 4.6m/pixel CaSSIS panchromatic images and an overlapping 6m/pixel CTX stereo pair to produce 1m/pixel CaSSIS SRR DTM for four small areas over Oxia Planum ².

- Visual and quantitative assessments have shown that the resultant CaSSIS SRR photoclinometry DTM achieved comparable and sometimes more detailed 3D information than HiRISE when compared to HiRISE PDS DTMs ².

² Tao, Y.; Douté, S.; Muller, J.-P.; Conway, S.J.; Thomas, N.; Cremonese, G. Ultra-High-Resolution 1 m/pixel CaSSIS DTM Using Super-Resolution Restoration and Shape-from-Shading: Demonstration over Oxia Planum on Mars. *Remote Sens.* 2021, 13, 2185.