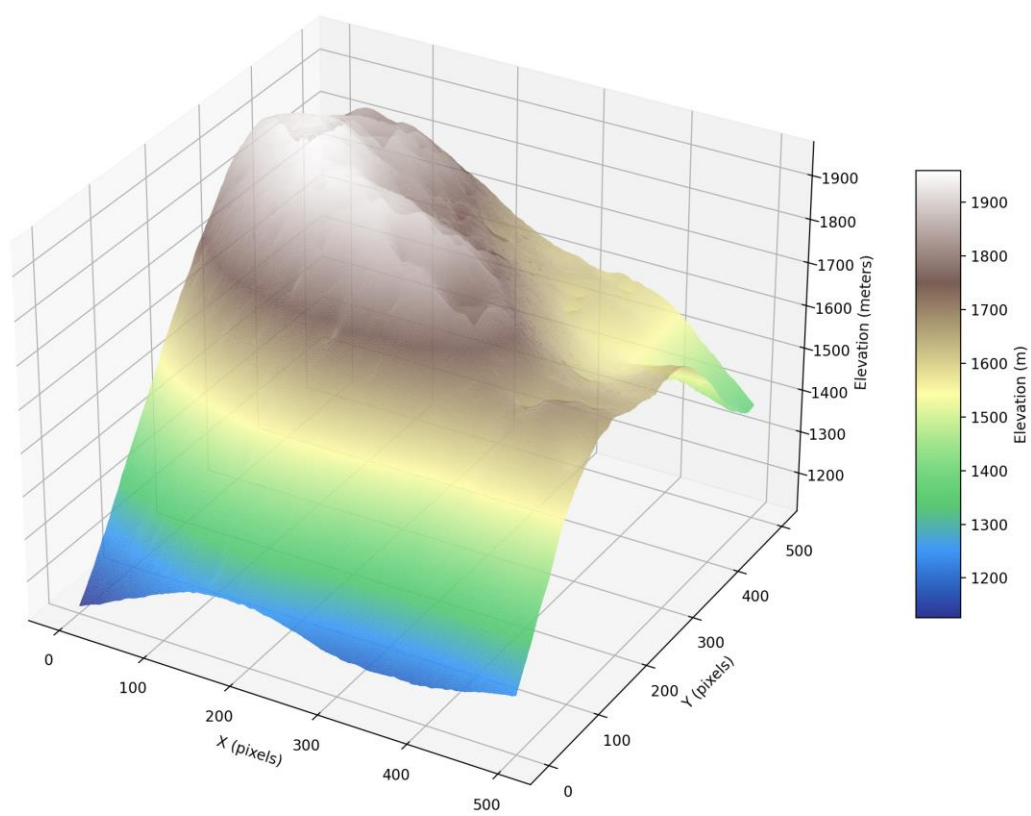
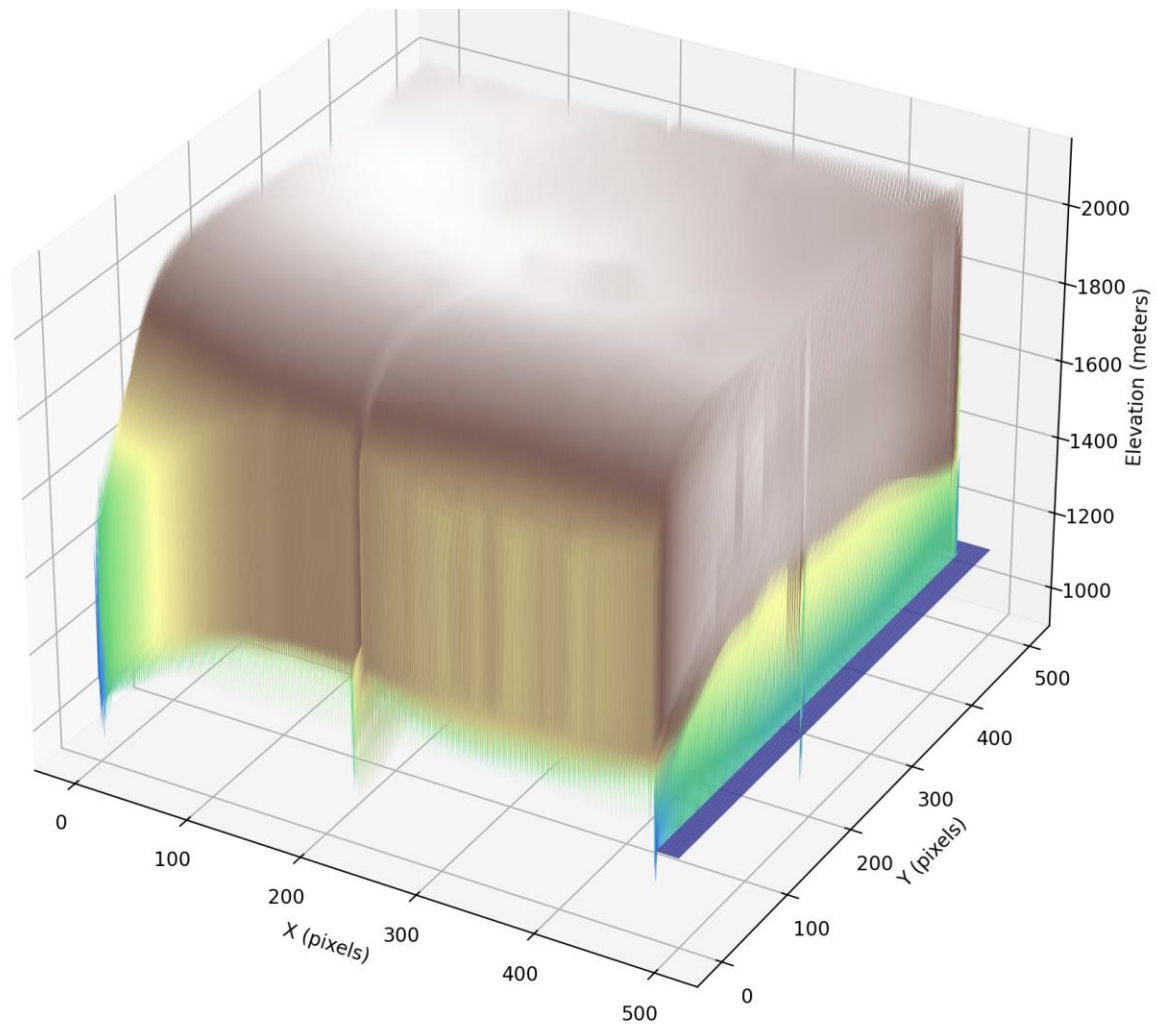


3D High-Resolution Elevation



Original image



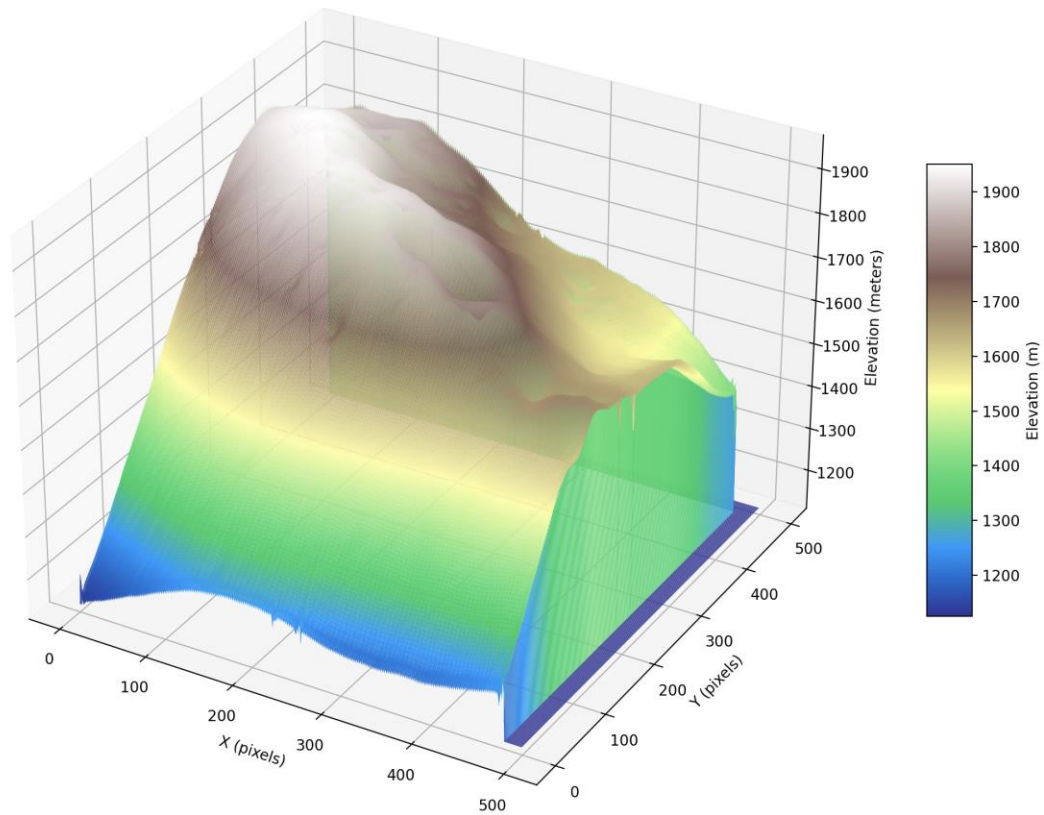
Without normalization

**Past issue:** De normalization for elevation points, patch boundary overlapping

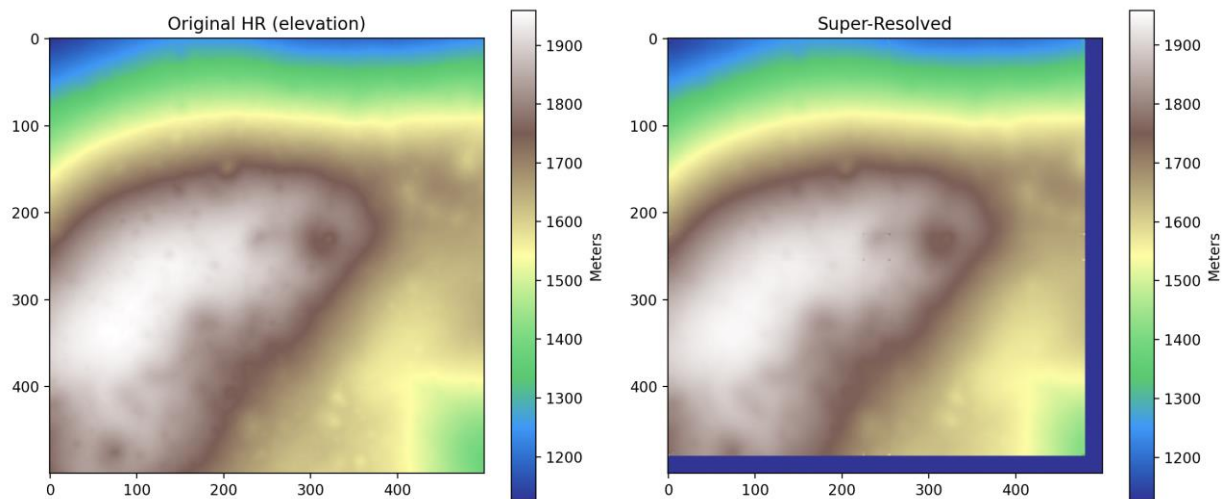
Working on better NAN pre processing handling, as well as normalization and de normalization

--- Elevation Dataset Statistics --- Original HR shape: (500, 500) HR (after Gaussian + normalization) min: 0.0000, max: 1.0000 HR real-world min: 1125.83 m, max: 1958.88 m LR shape: (250, 250) LR real-world min: 1126.88 m, max: 1958.77 m

3D High-Resolution Elevation

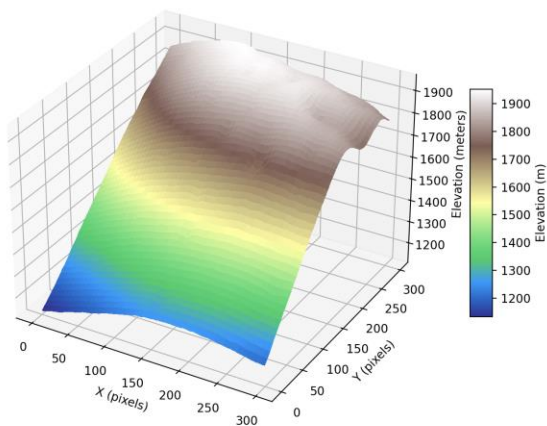


Normalization (10 epochs) , really good yayyyyy



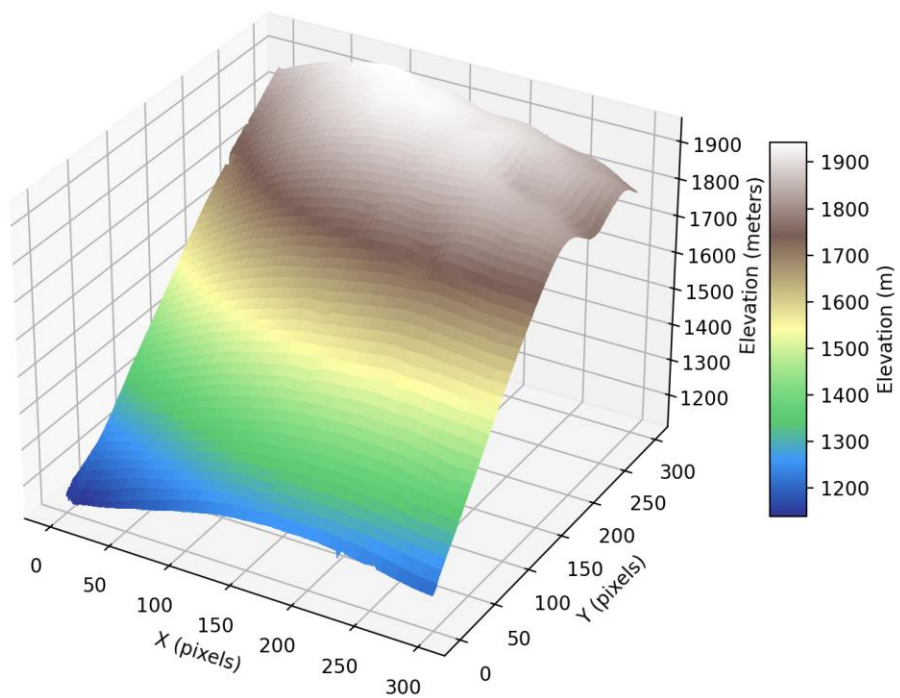
padding issue !!

Changed from pixelShuffleDirect to PixelShuffle, testing on 30 epochs rn, most likely early boundary padding interfering with NAN handling



Original

3D Super-Resolved Elevation



Window Padding Fix (7 minutes 17 seconds; 10 epochs)

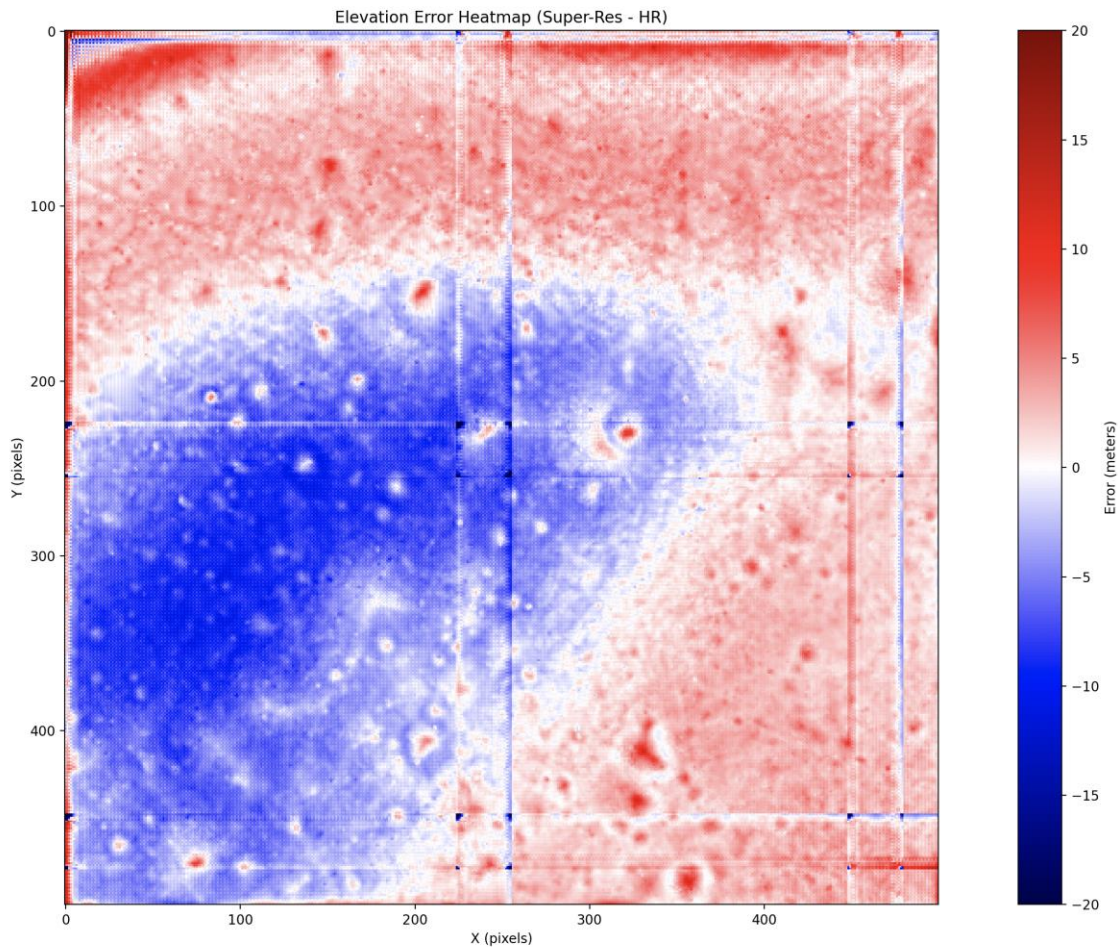
Smoother interference padding

Still rough on certain edges



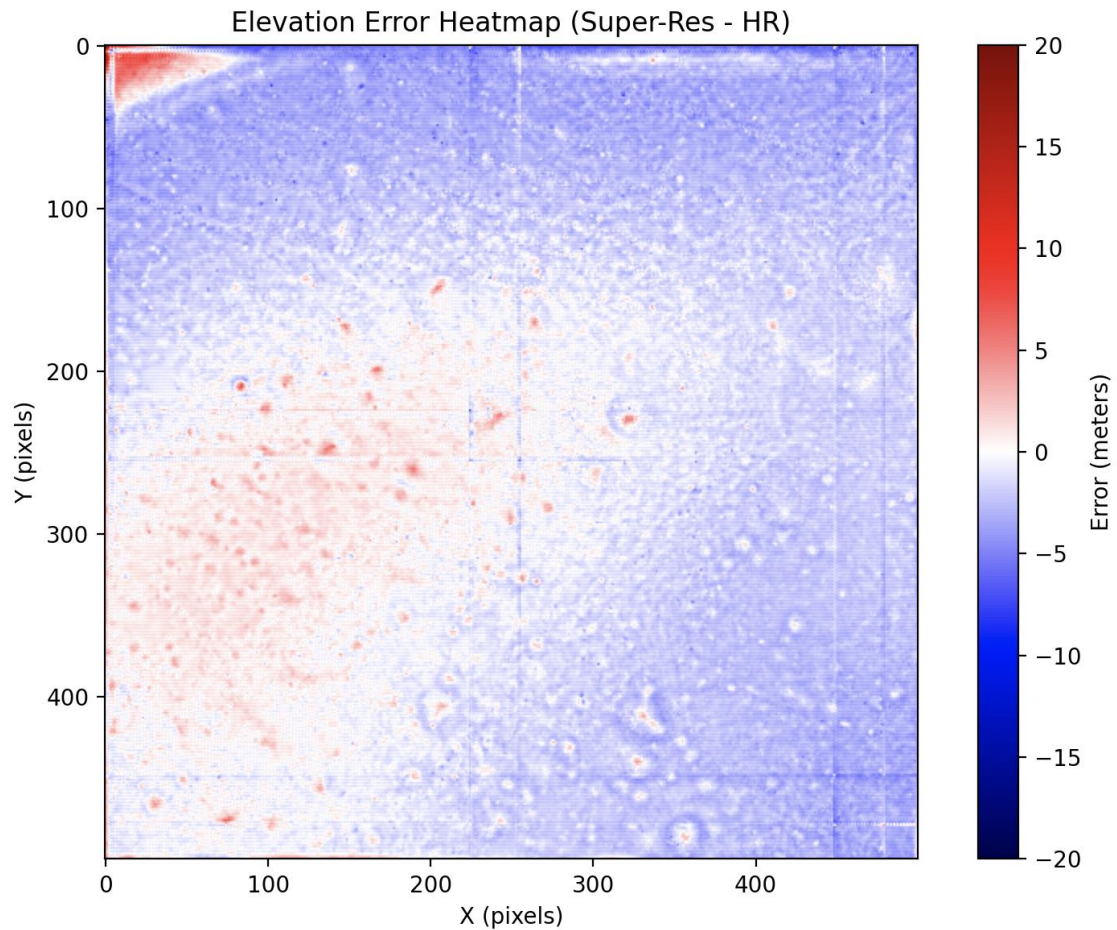
--- Elevation Statistics --- Original HR: min=1124.64, max=1959.37, mean=1660.22, std=190.12  
Super-Res: min=1125.83, max=1949.99, mean=1659.76, std=186.83

PSNR: 45.86 dB SSIM: 0.9981



Overlapping blending is still an issue, however at a larger scale so thats good

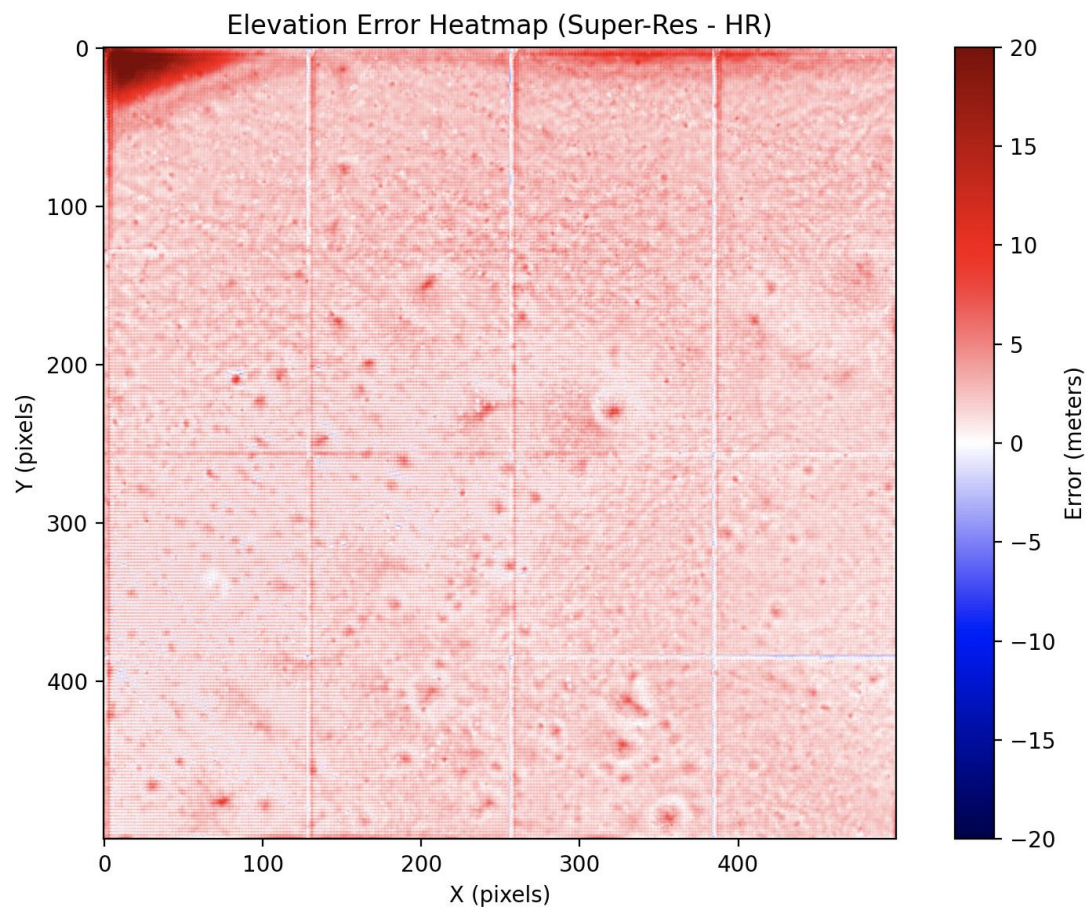
Deviation in elevation isnt too crazy



40 epochs so epic , still large patching - occurs in interference ( prediction of patches across low res image)

Would cause problems in multiple upscaling  
need to update interference with window operation

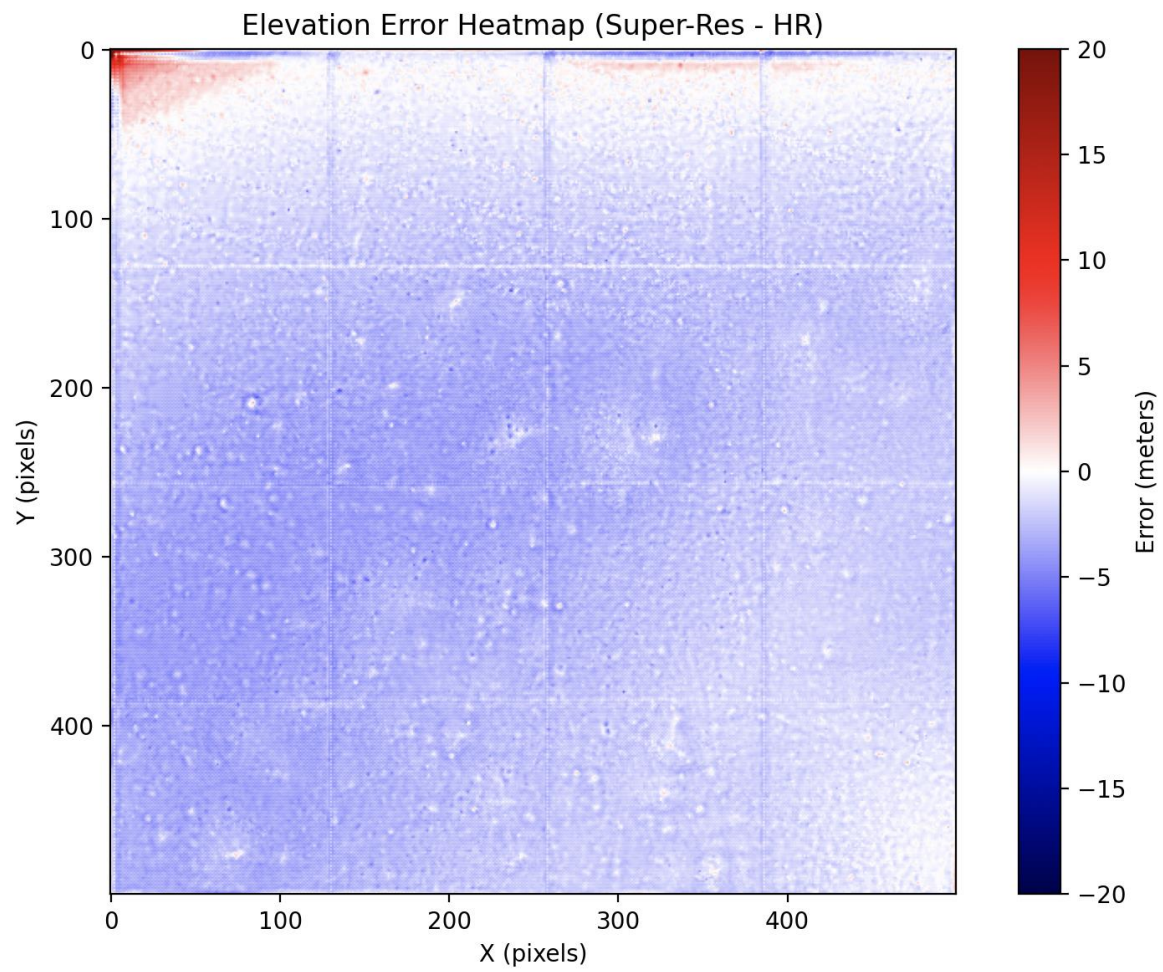
Window interference ( as a cosine ) has been implemented, failed pretty bad at 10 epochs, trying with 40 now



---

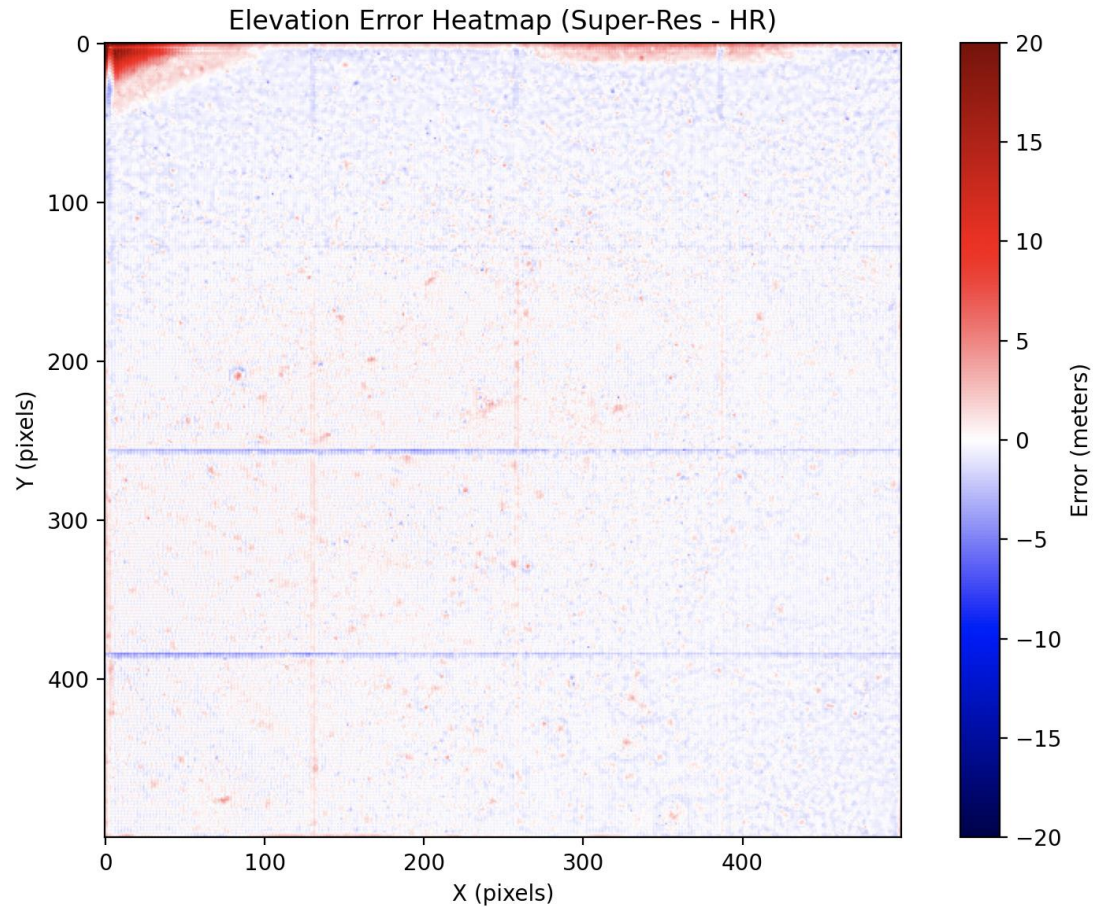
40 epoch window sliding inference





80 epochs, patching is quite minor



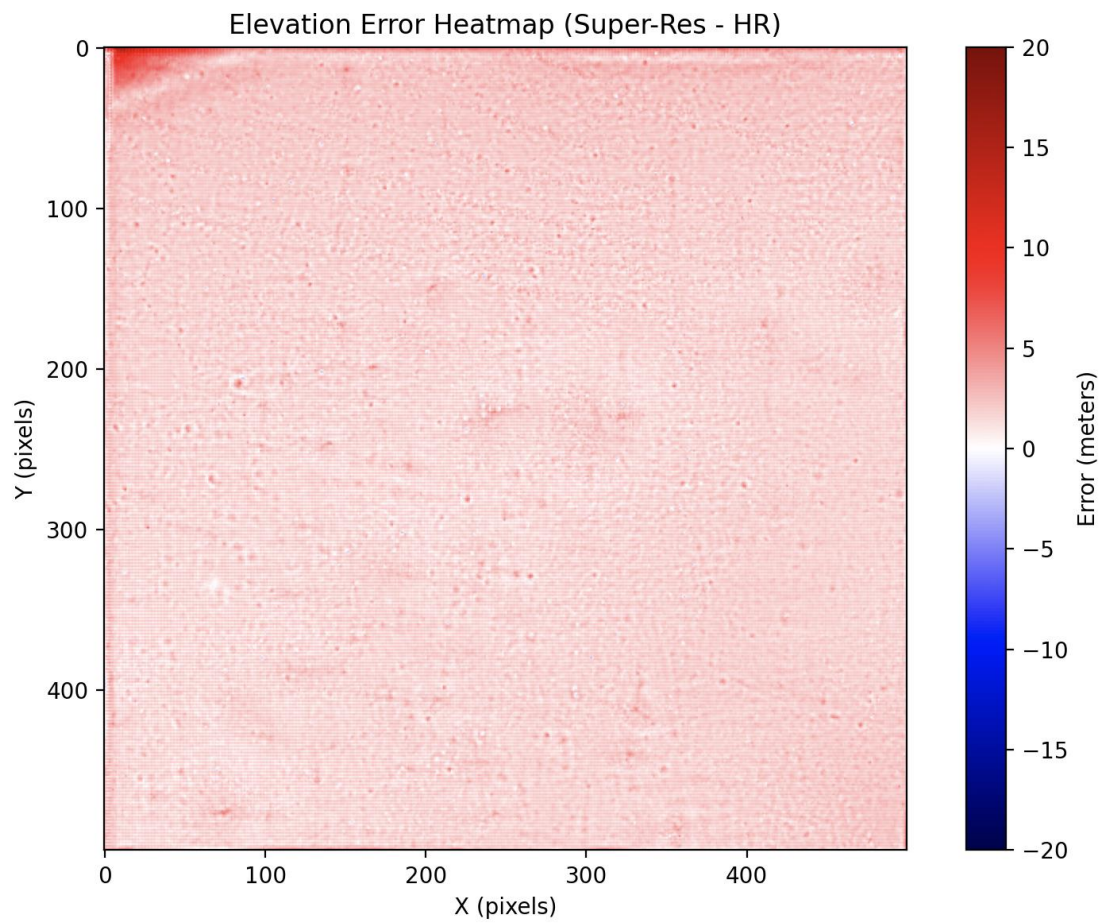


80 epochs (increased batch sizing and overlay blending). [fire AF]

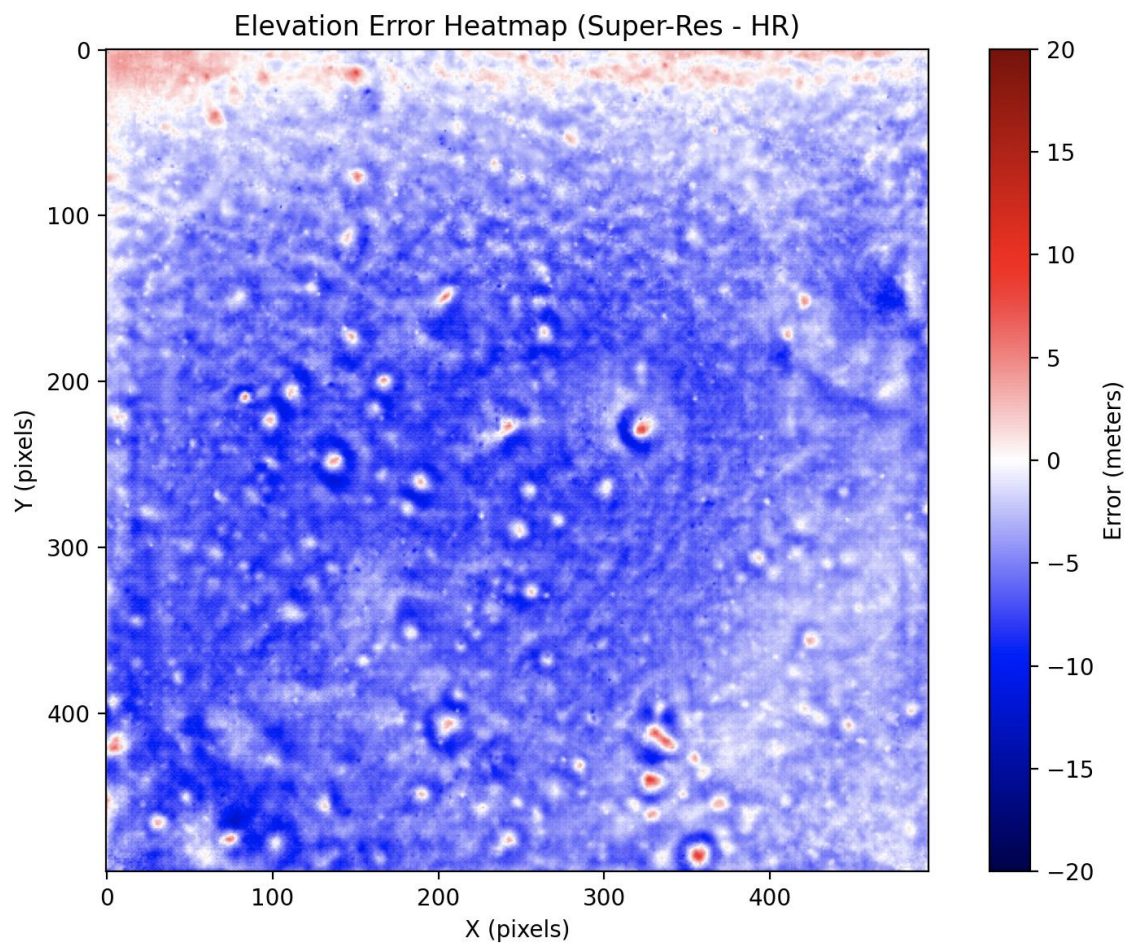
SwinIR uses patch attention windows so that's the main cause of this gridding issue

Current interference uses that batch like to compile and put everything together

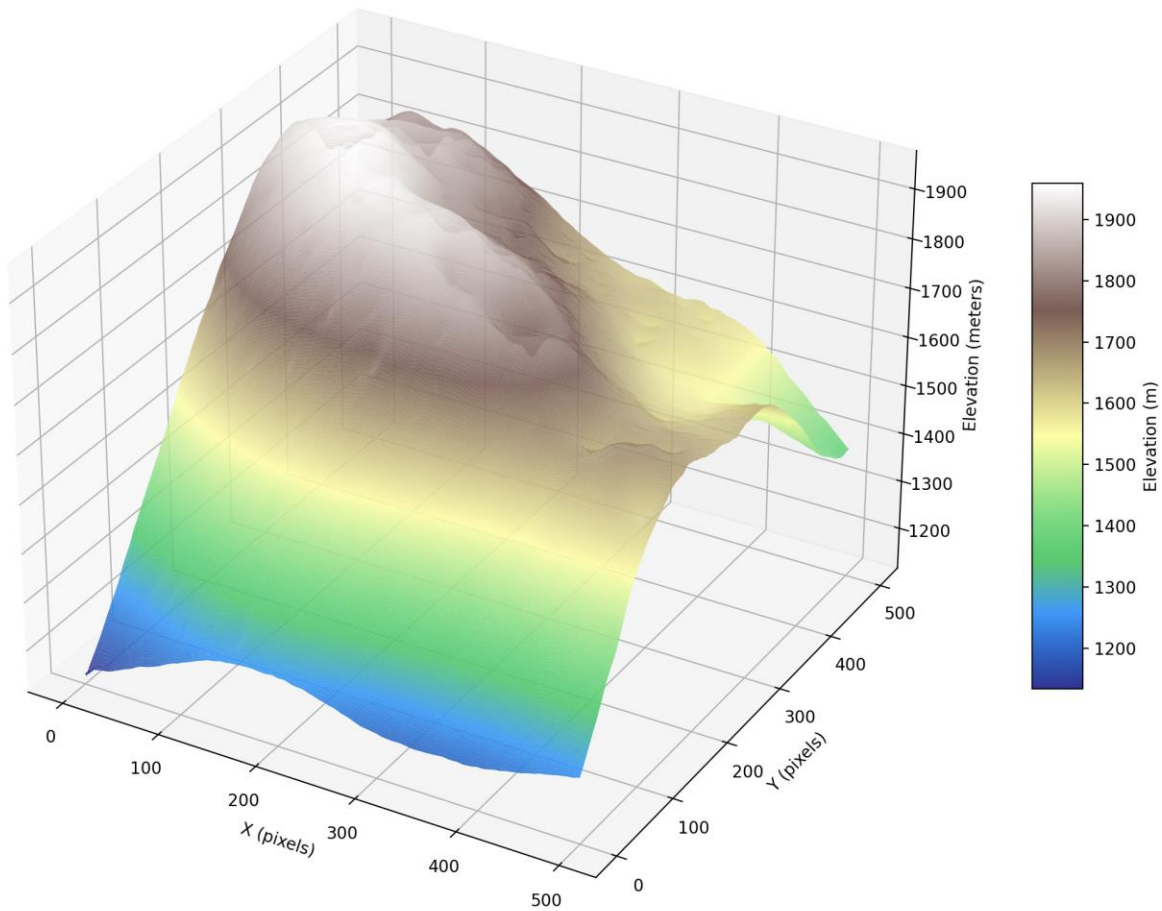
Convolution interference ??, could have more of a blending approach to completing the jigsaw puzzle



100 epochs, convolution interference, one hour 12 minutes  
beatiful



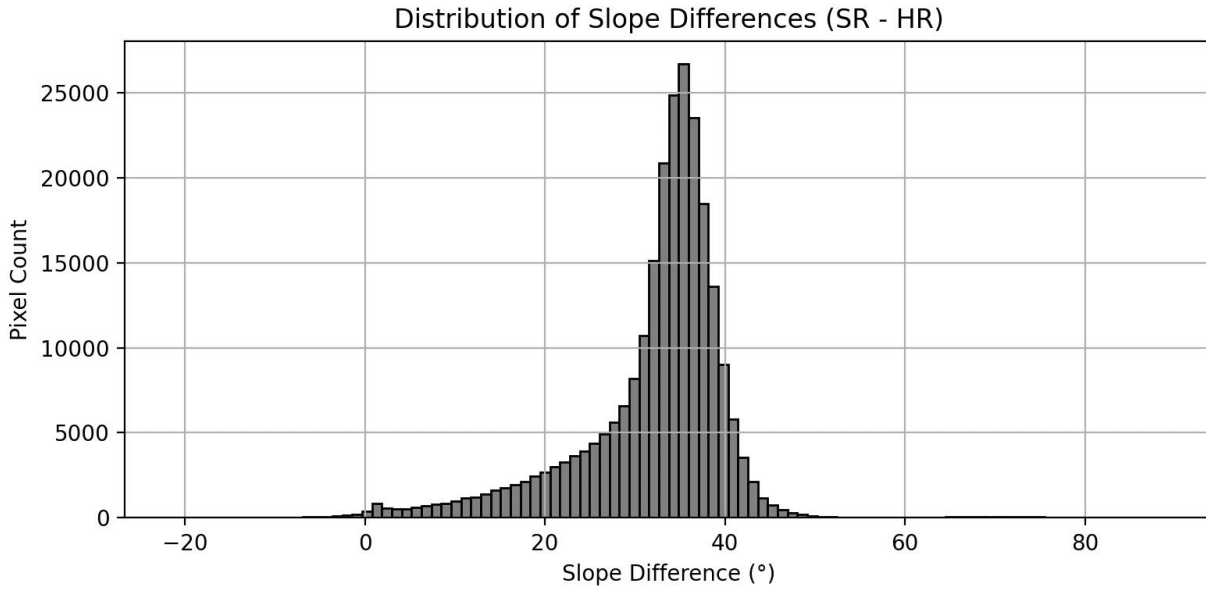
8x resolution 10 epochs (18 minutes 38 seconds)



Pretty fye for only 10 epochs, large details are captured while finer details are not fully converged in early training (as to be expected)

Pixel Size = (1.2500000000000000,-1.2500000000000000) hell yea

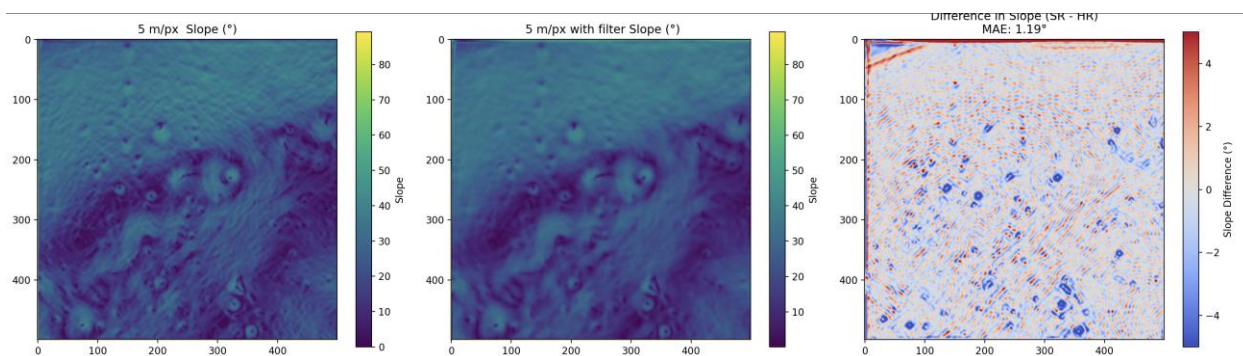




When going from 5 m/px to 1.25 m/px slopes are exaggerated due to finer detailing picking up on small craters or boulders that were smoothed in the lower resolutions.

Filter is needed to smooth slopes in order to create the best environment for the rover (super important for higher res solutions)

Can use gaussian post processing filter



Mean slope difference :  $-0.15^\circ$

Median slope difference :  $-0.22^\circ$

without gaussian post processing vs with post processing

Slope compare between 10 m/px and super res of 5 m/px. (40 epochs)

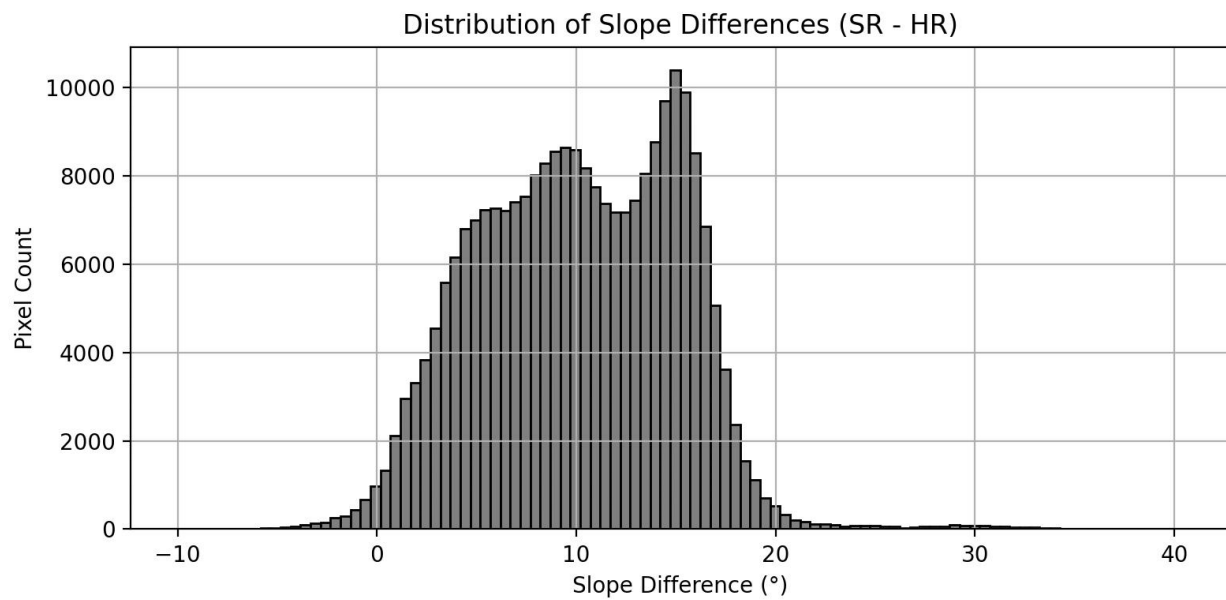
Percentage of pixels where SR has steeper slope: 98.86%

Mean slope difference (SR - HR): 10.12°

PSNR: 53.55 dB

SSIM: 0.9994

So slopes are still being increased on this hill ( to be expected)



Slope compare between 10 m/px and super res of 1.25 m/px. (40 epochs)

( to determine amount of smoothing needed and what deviation value should be used for gaussian filtering)

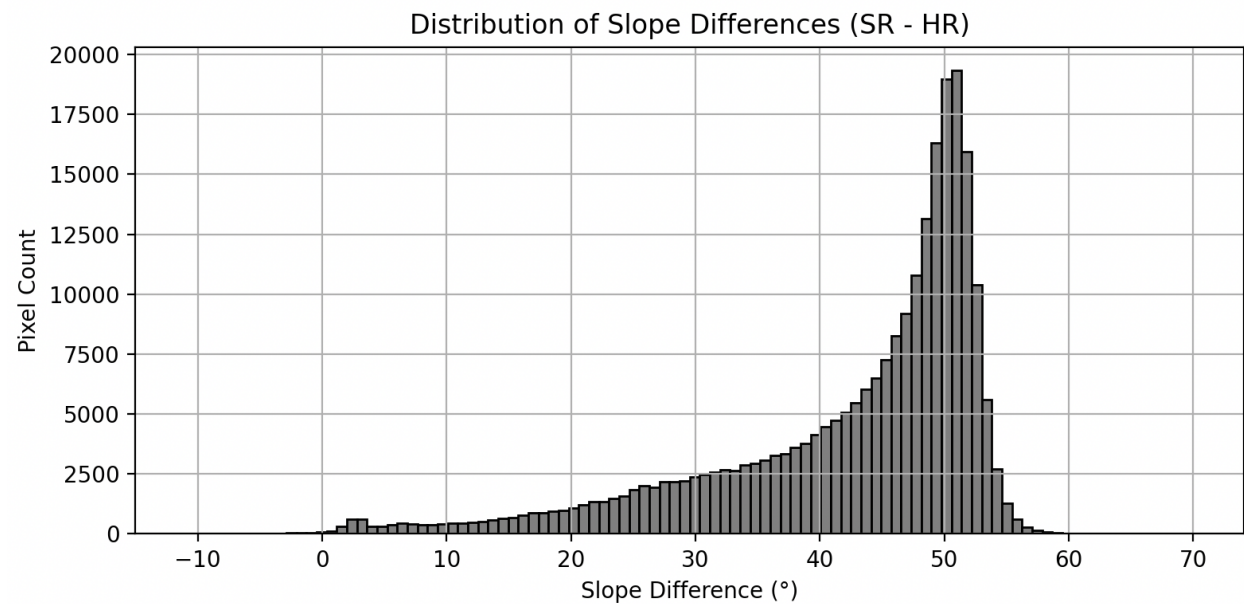
Percentage of pixels where SR has steeper slope: 99.91%

Mean slope difference (SR - HR):  $42.48^{\circ}$

Median slope difference (SR - HR):  $46.72^{\circ}$

PSNR: 52.20 dB

SSIM: 0.9995



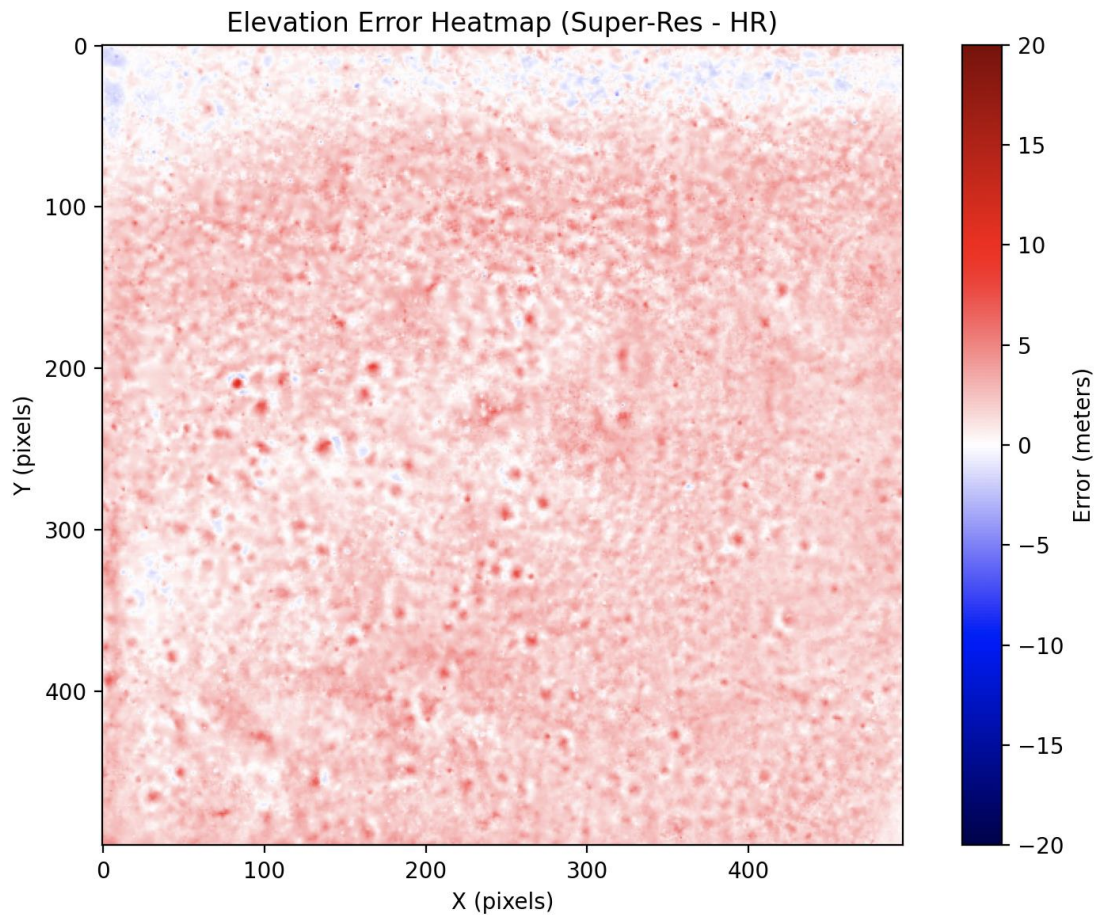
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Artifacts are still being a lot more exaggerated still for 8x enhancement

Need to experiment with sigma values for correct smoothing

Could be exaggerated due to resolution mismatch, less exaggeration than before however

Investigate alternatives in smoothing



Craters are more likely to be overexaggerated artifacts, Dr. Martin said this may just be the enhancement of edges, will run a full 100 epoch 1.25 enhancement on the 40 km<sup>2</sup> area

Gaussian blend post processing seemed to reduce slope exaggerations by a decent amount

Original 10 m/px



