Interpolation of GPR profiles (in 3D datasets) through Fourier Interpolation. Application to the case study of Roman Villa of Horta da Torre (Fronteira, Portugal)

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GPR subsampling problem

Roman Villa of Horta da Torre (Fronteira, Portugal)

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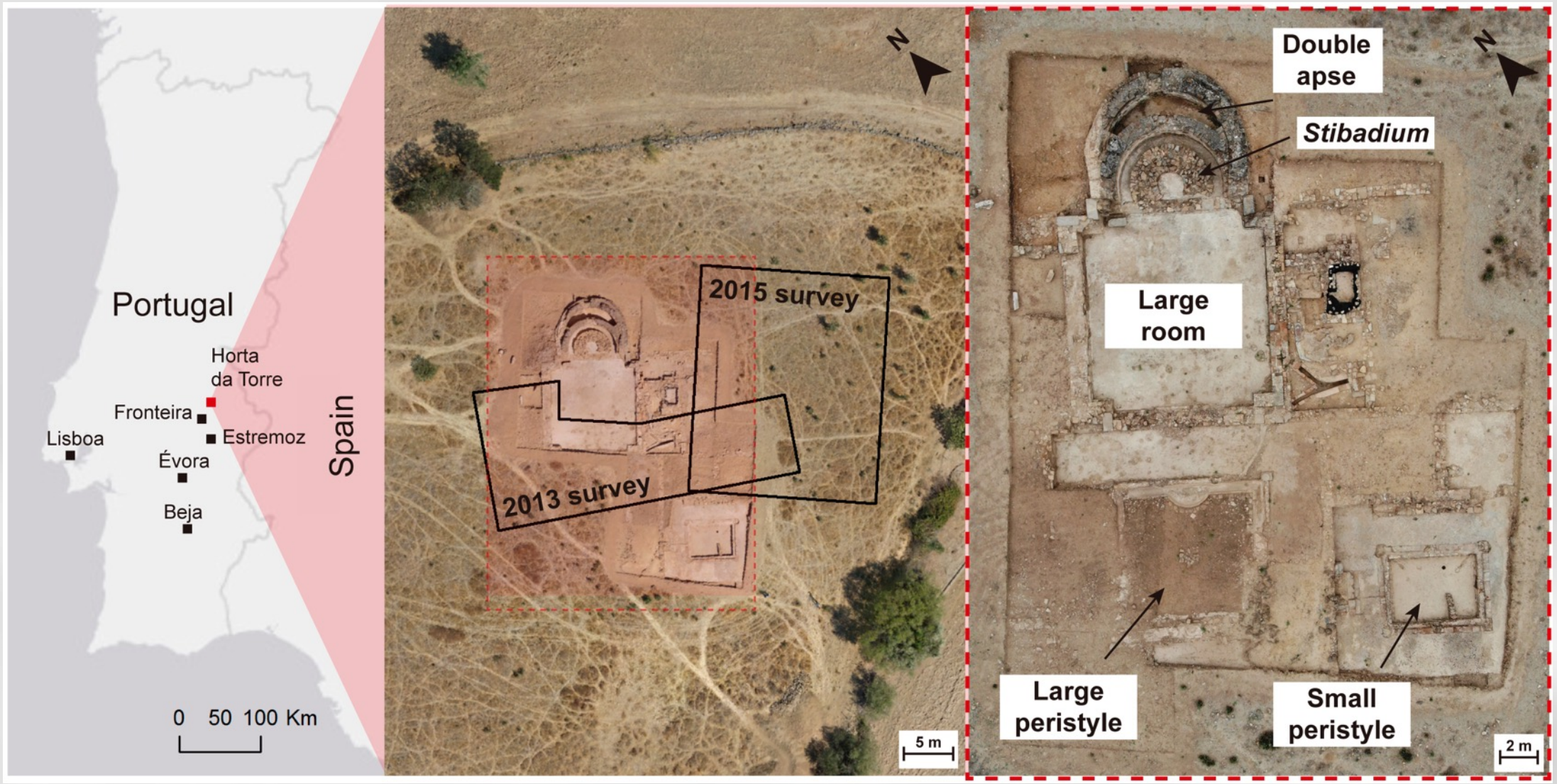

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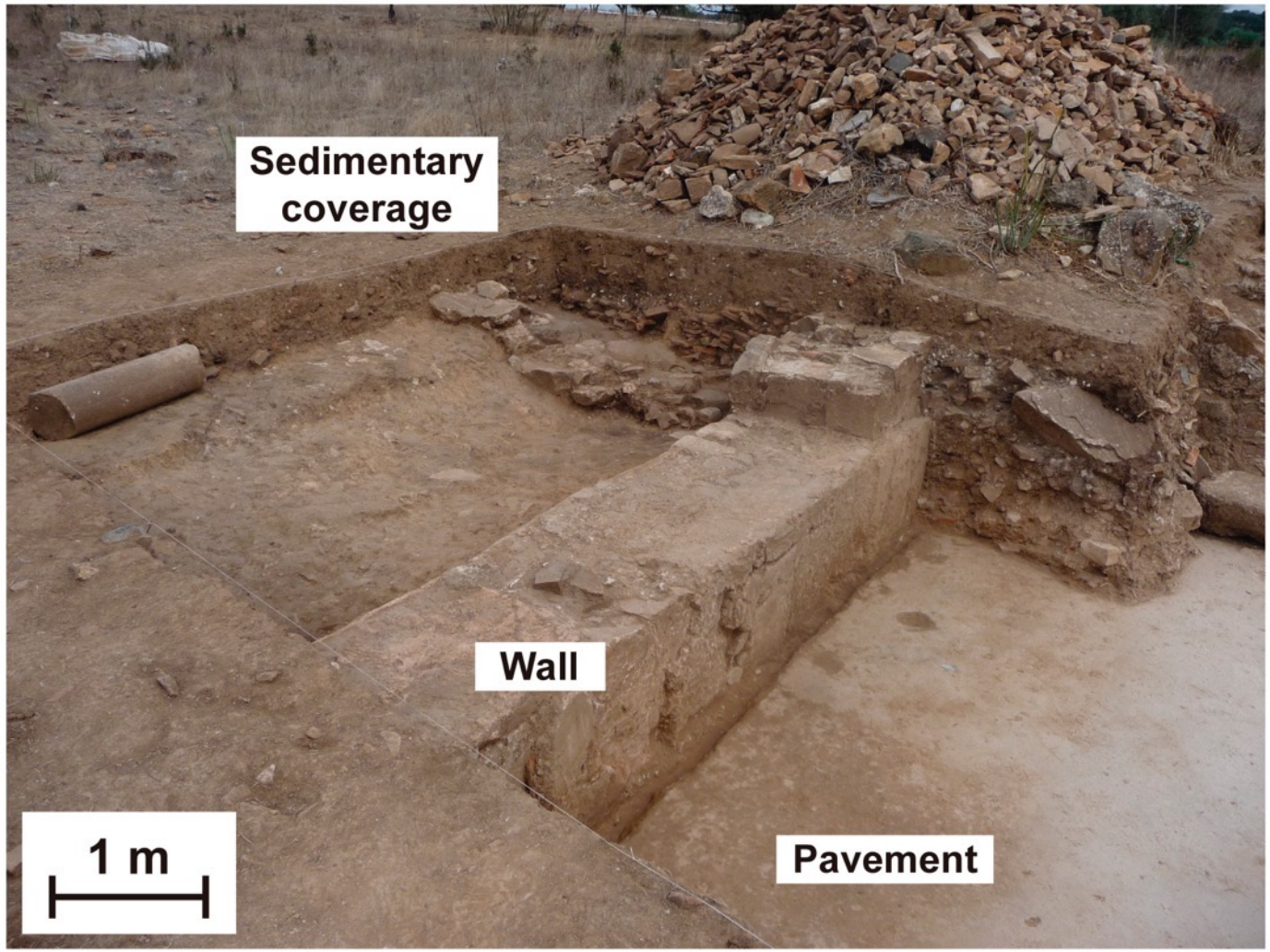

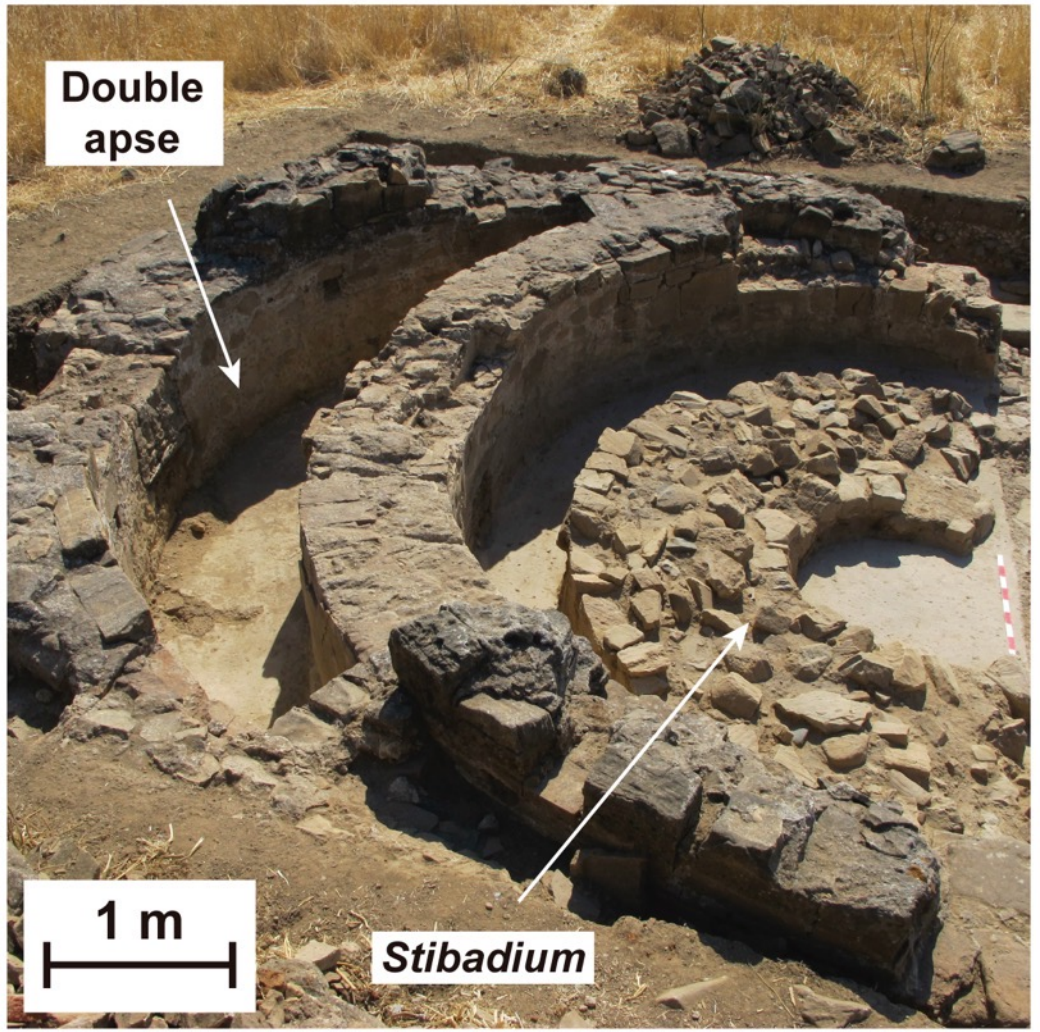

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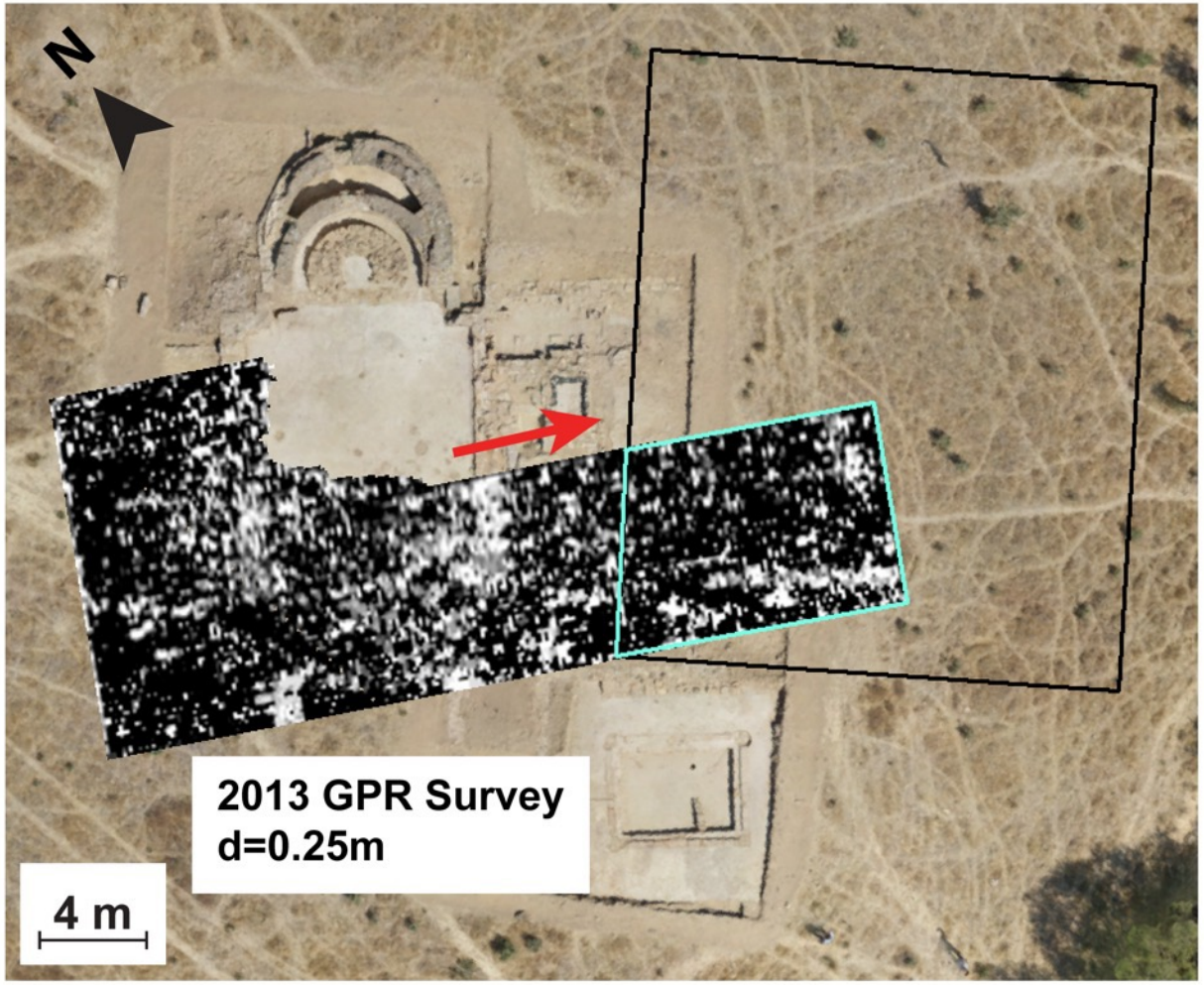

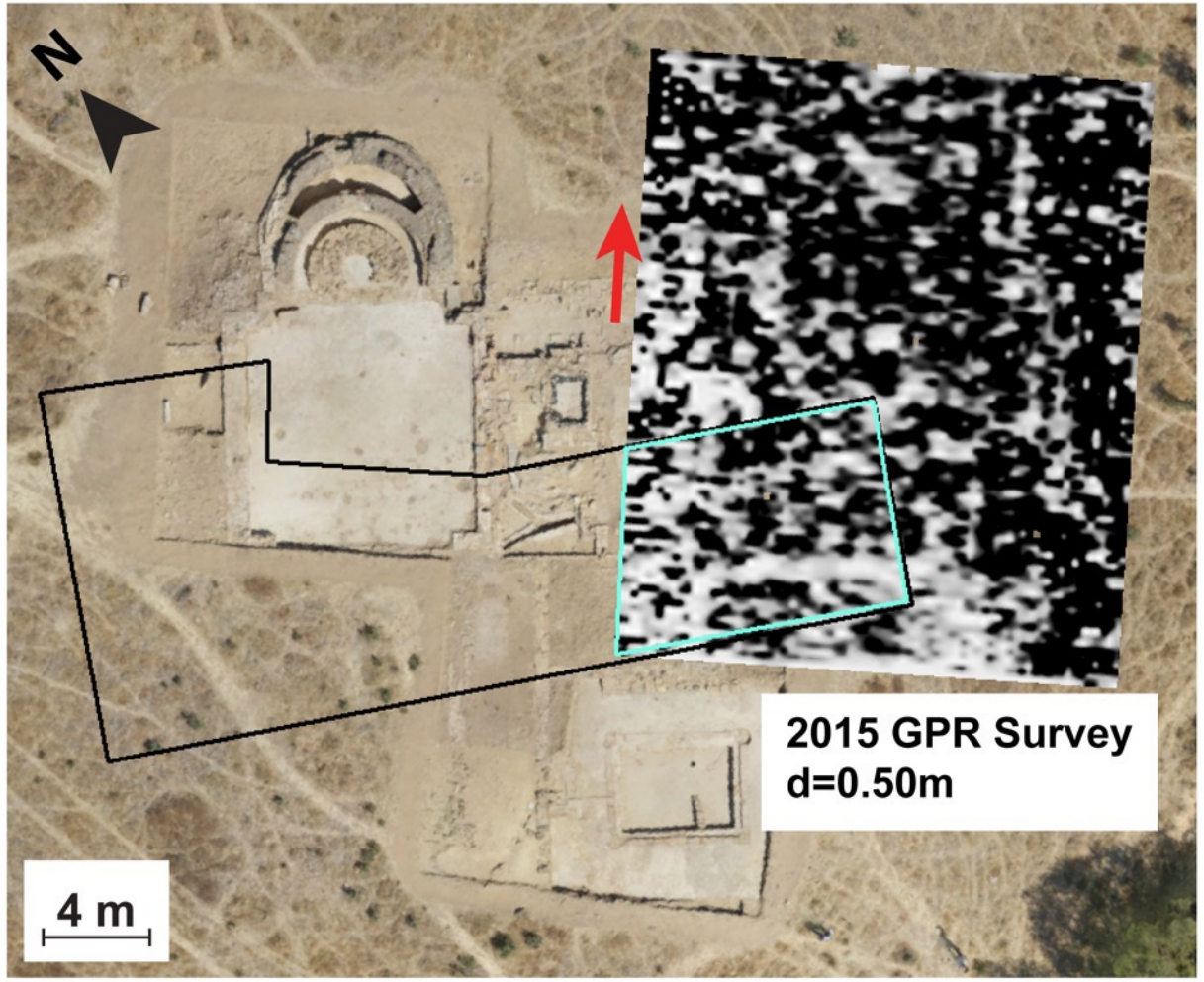

Possible solutions

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- **Decreasing the profile spacing**
  - Increases the survey time

- **Post-processing**
  - Recovery of missing data
    - Widely used in Seismic
      - SUINTERP algorithm (CWP-CSM)
      - Automatic event identification
      - Fourier interpolation

INT-FFT Algorithm

Using SUINTERP algorithm

Seismic Unix package – CWP-CSM

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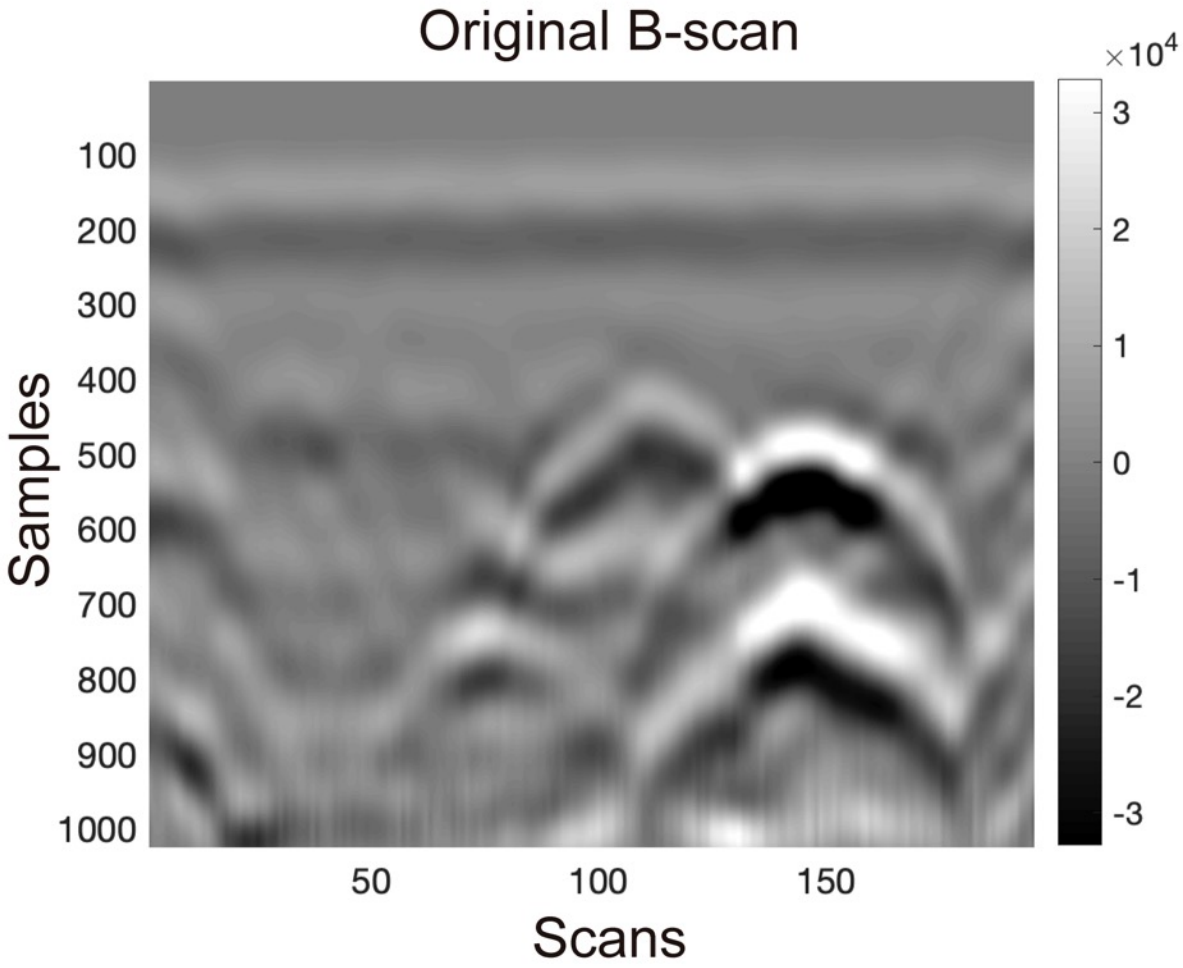

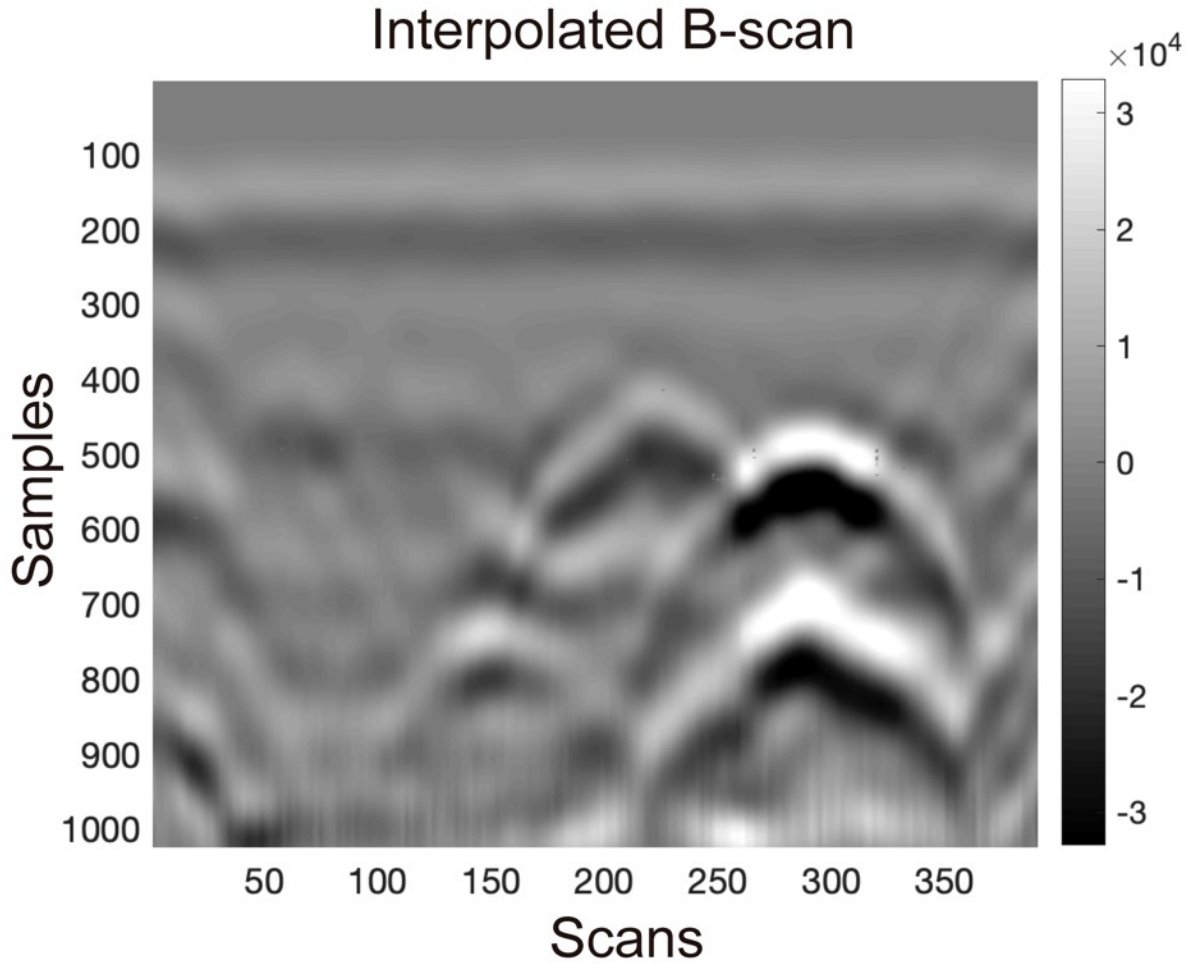

INT-FFT Algorithm

Using SUINTERP algorithm

Seismic Unix package – CWP-CSM

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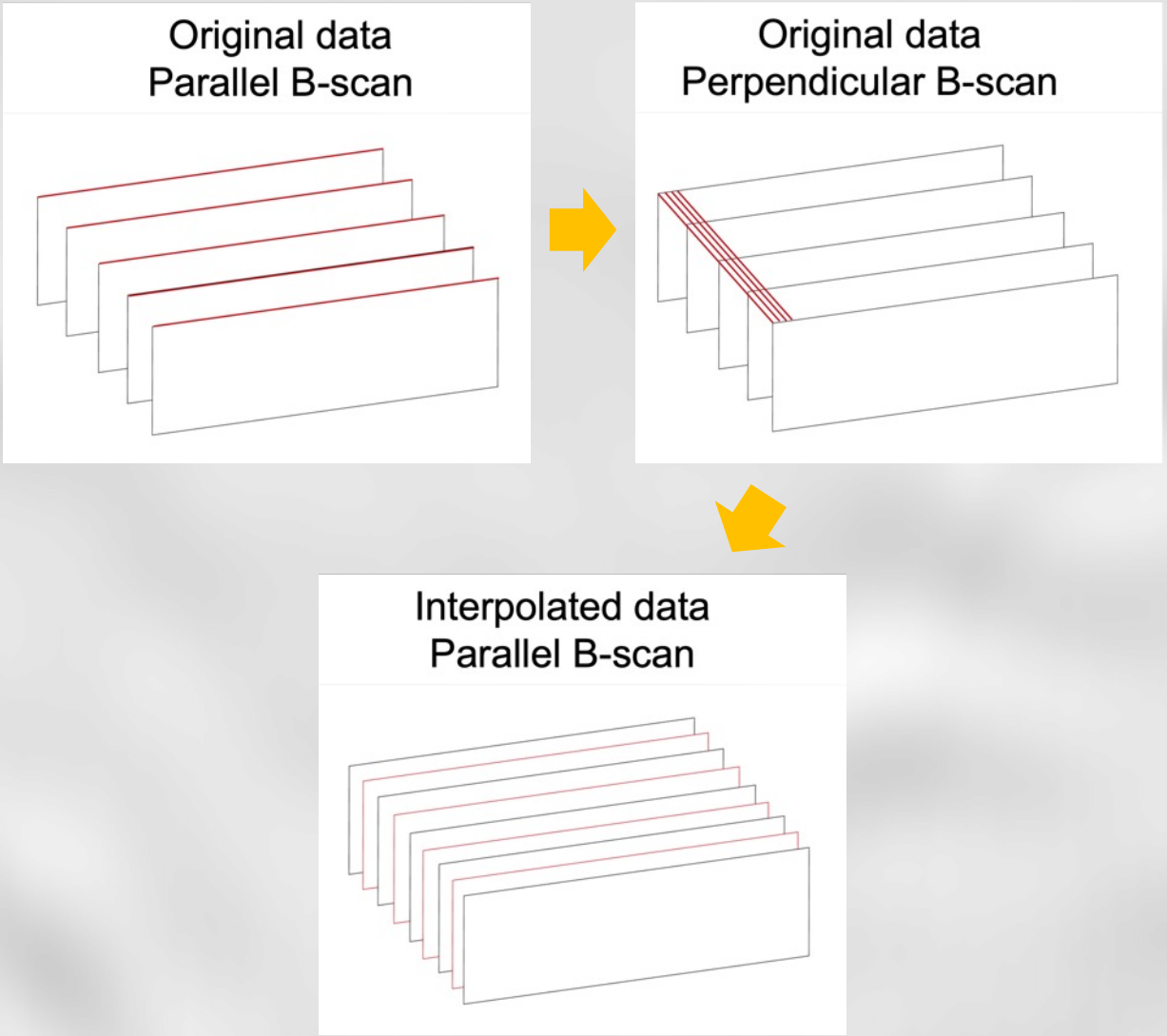

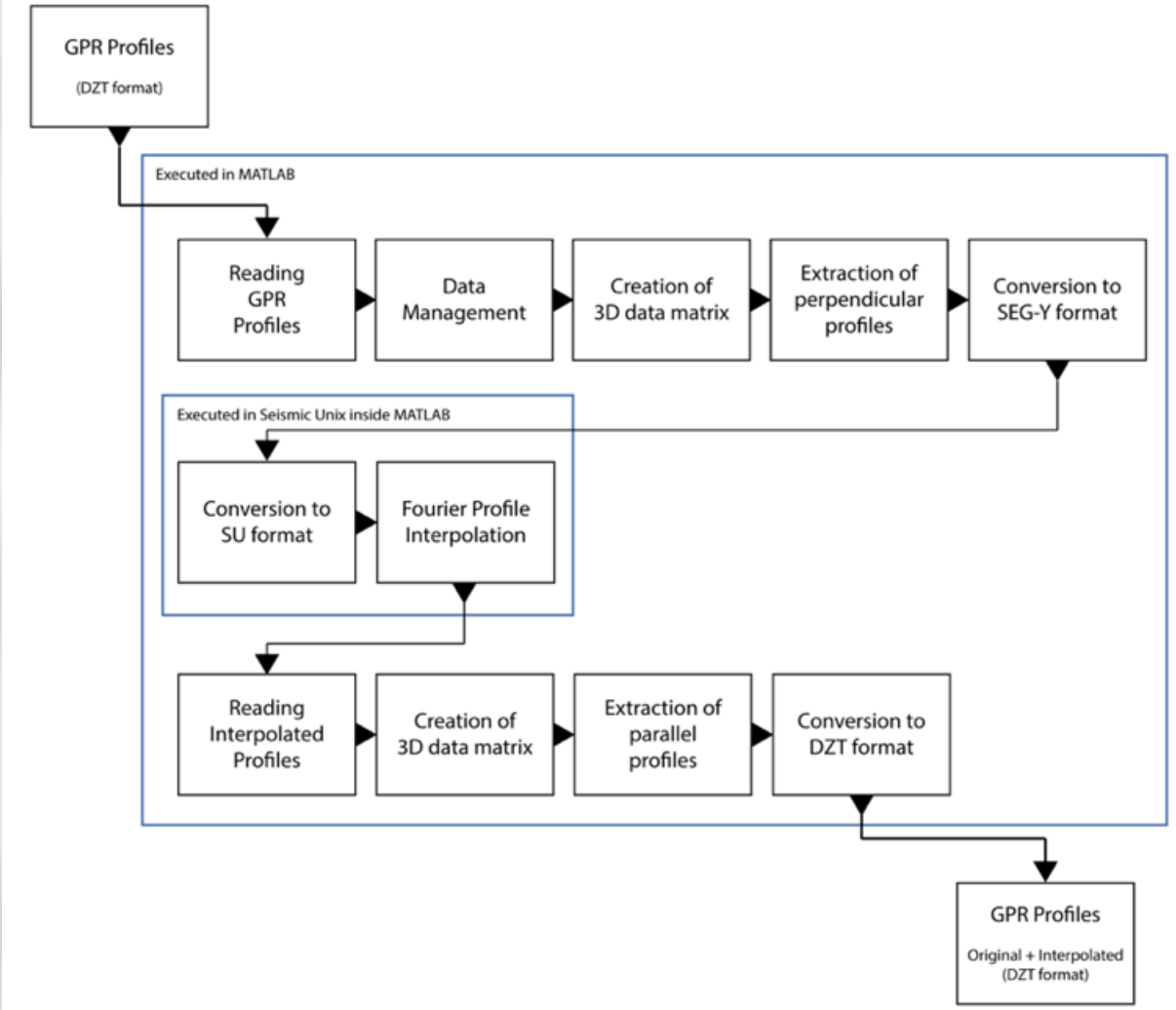

Results

Evaluated by: SSIM – Structural Similarity Index & SI – Sharpness Index

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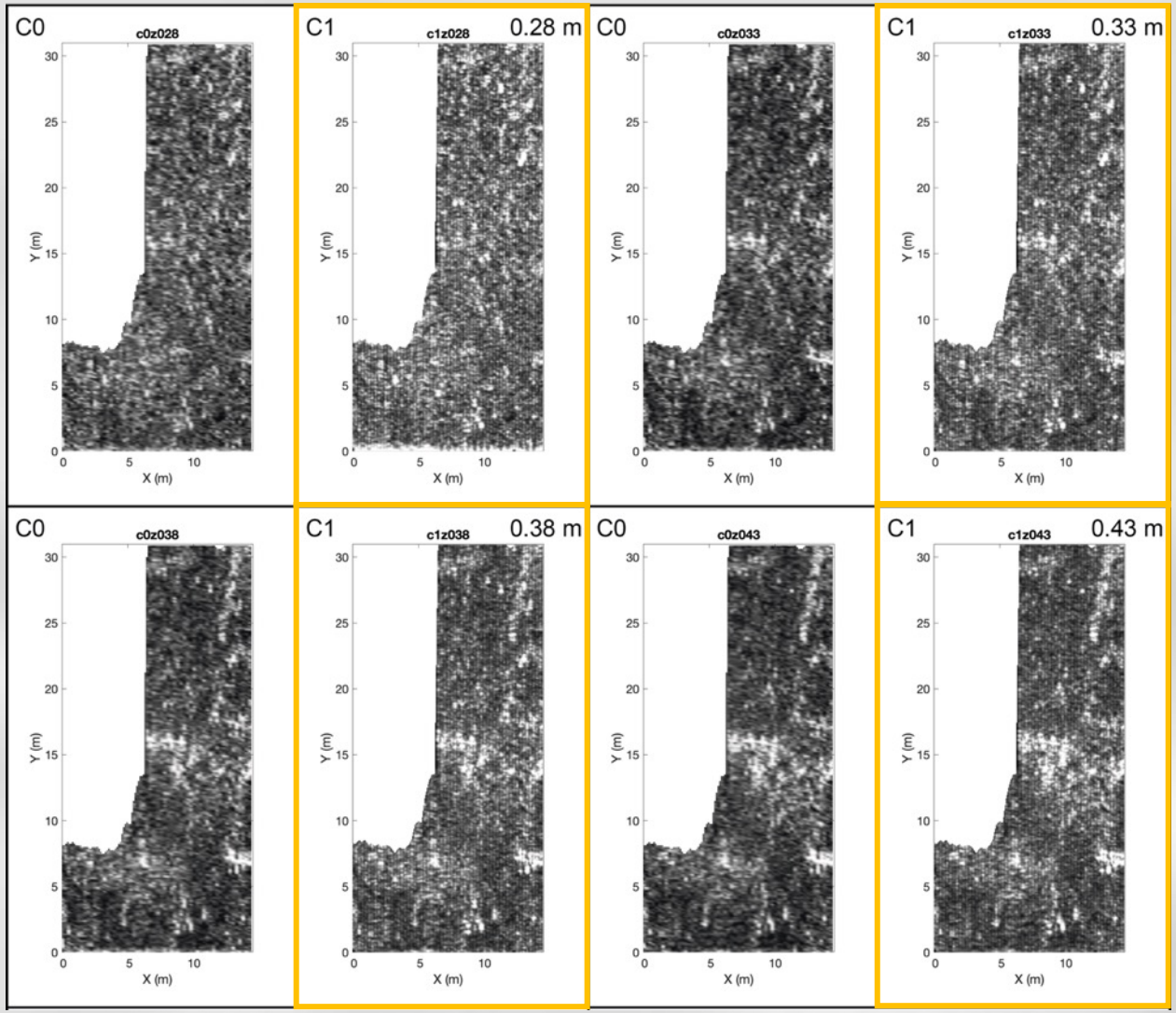
Depth slices (m)	SSI (%)
	C0 vs C1
0.28	81.17
0.33	82.50
0.38	82.44
0.43	82.65
0.48	82.66
0.53	82.62
Average	**82.34**

Depth slices (m)	SI (%)	
	C0	C1
0.28	13.14	17.80
0.33	12.13	15.79
0.38	11.22	14.96
0.43	10.64	14.23
0.48	10.93	14.43
0.53	10.60	14.60
Average	**11.44**	**15.30**

Original data (C0) vs interpolated data (C1)



Results

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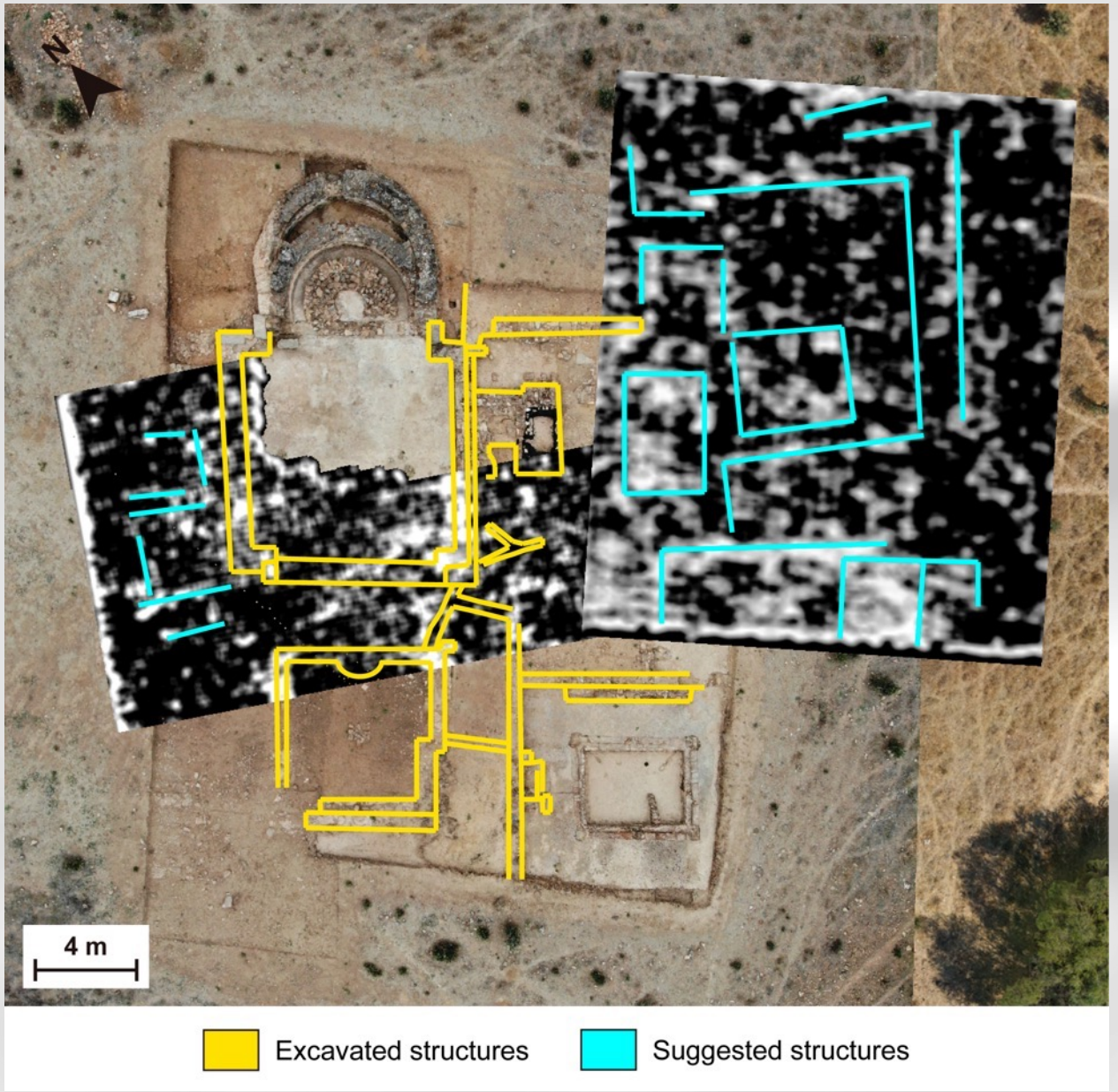

Final remarks

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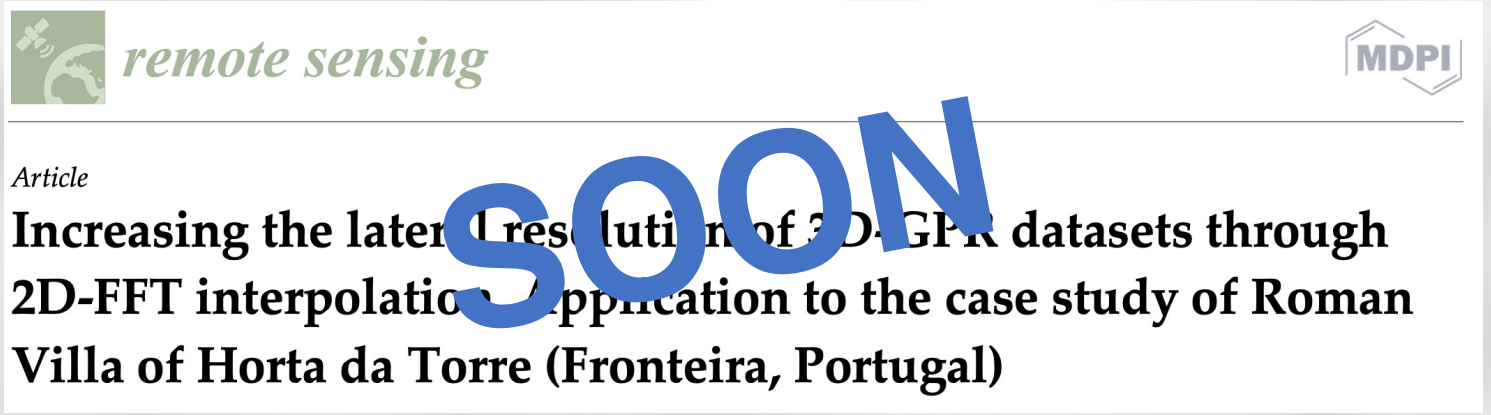
- INT-FFT algorithm show that the proposed approach effectively increases the lateral resolution of 3D-GPR datasets
- Data densification through 2D Fourier Interpolation allowed the creation of a new GPR B-scan between each pair of existent
- This approach increased the sharpness of the obtained GPR models



Thank you!

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Near Surface Geophysics I Digital Signal Processing

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