

Welcome to CIVIL-510

“Quantitative Imaging for Engineers”

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Lecture One: 2022-09-20

This course

- ▶ Imaging is a measurement technique increasingly available to answer various civil engineering questions

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Pop quiz

Maths questions:

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Computer questions:

- ▶ `int`, `uint`, `float`?

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Computer questions:

- ▶ `int`, `uint`, `float`?
- ▶ Python's `list`, `dict`, `array`?

Lesson One

Objectives

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- ▶ Define some important terms (resolution, pixel size, ...)
- ▶ Get familiar with some forms of representation (heights, colours)
- ▶ Some initial image-based measurements

“Quantitative Imaging for Civil Engineers”

Why **quantitative**?

Quantitative means “as a measurement”, with units and error.

“Quantitative Imaging for Civil Engineers”
OK so what is an **image**?

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“an artefact that depicts visual perception”

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Representing a number by a colour... first B&W... then colour (stiffness matrix?) LUT or CM

What scalars do they represent?

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What scalars do they represent? Always scalars?

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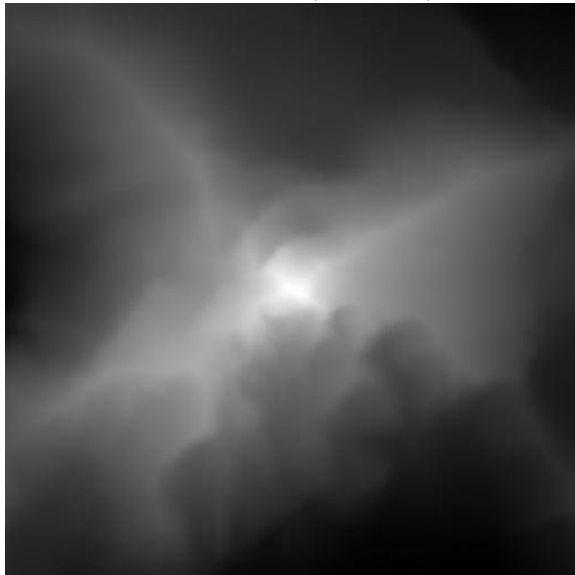
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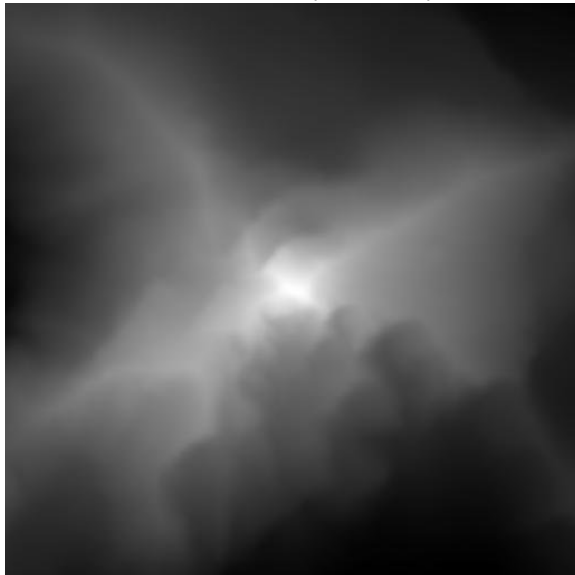
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Let's get the DHMs out (DHM.tif)!



A load of values, what physical space is represented?

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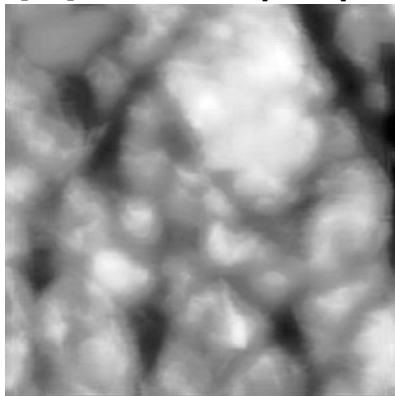
so... for Human interpretation

Two things are needed – a scale bar and a colour bar

Switch to:

spm-phase-HM.tif [units?]

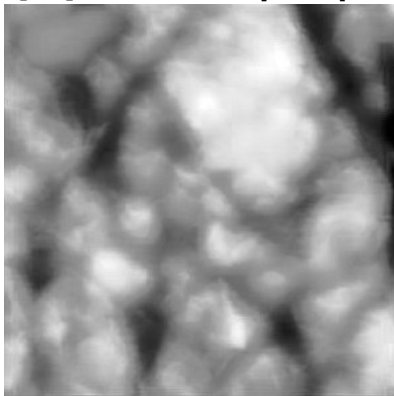
spm-phase-PM.tif [units?]



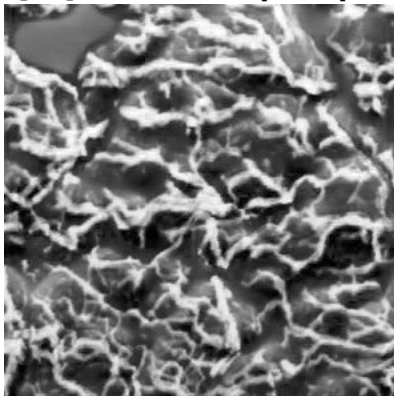
Two images of same sample...

Switch to:

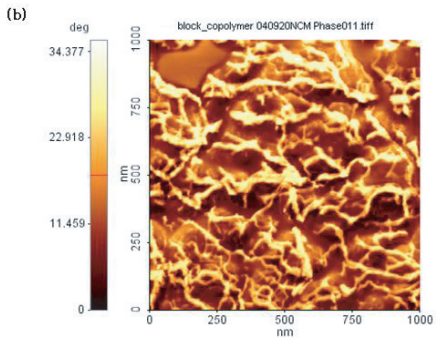
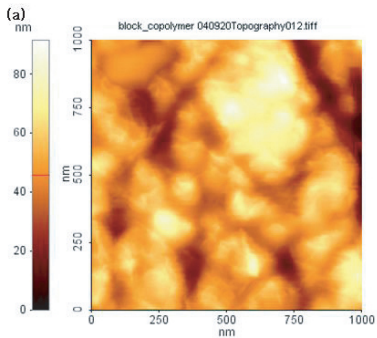
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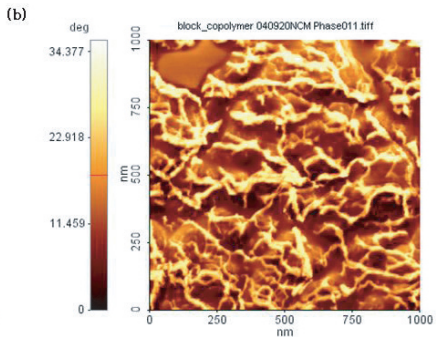
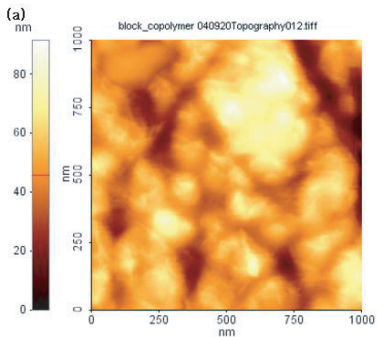


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from: https://parksystems.com/images/spmmodes/standard/3_

Phase-Imaging-and-Phase-Detection-Microscopy-(PDM).pdf



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...wait, how did I make it greyscale?

bear in mind “Image Quality”

We are going to do quantification, and so we need to be able to assess quality: “sharpness” and “noise”

Sharpness = how sharp the edges are (how to quantify?)

Noise = random variations of each pixel’s value – SNR

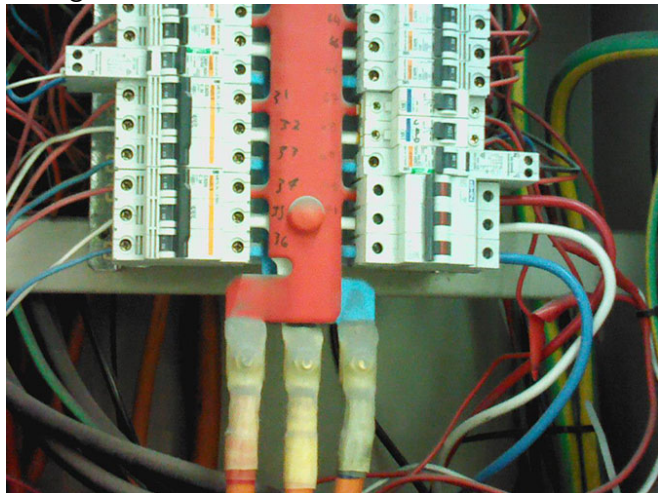
Image Gallery

Change of scalar now... ow2.tif

<https://thermalscanners.com.au/>

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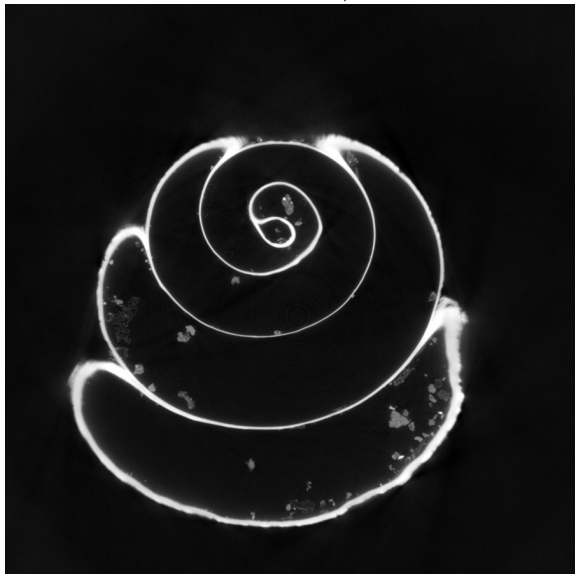
Change of scalar now... ow2.tif



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Another different scalar (question: how many different chambers?):
X-ray tomo slice at $17.5\text{ }\mu\text{m}/\text{px}$ in b4

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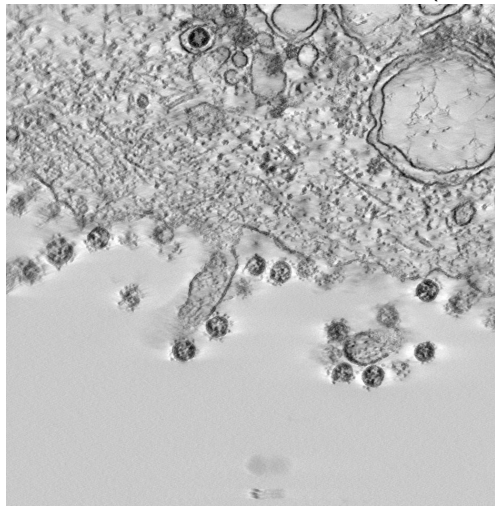


and now for something completely different, our enemy

Transmission Electron Microscopy (1 nm/px)

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from: <https://zenodo.org/record/3985424>

Next time:

Next Tuesday we'll see:

- ▶ Where does the pixel size come from?

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- ▶ What hardware's in your camera?

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