Granular Properties from Digital Images of Sediment

Implications for Coastal Sediment Transport Modelling

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Coastal Sediments

Highly variable – models are poor

Have to measure:

- improve parameterisations
- improve models

Sediment size

↓

Bed Stress + Friction + Infiltration

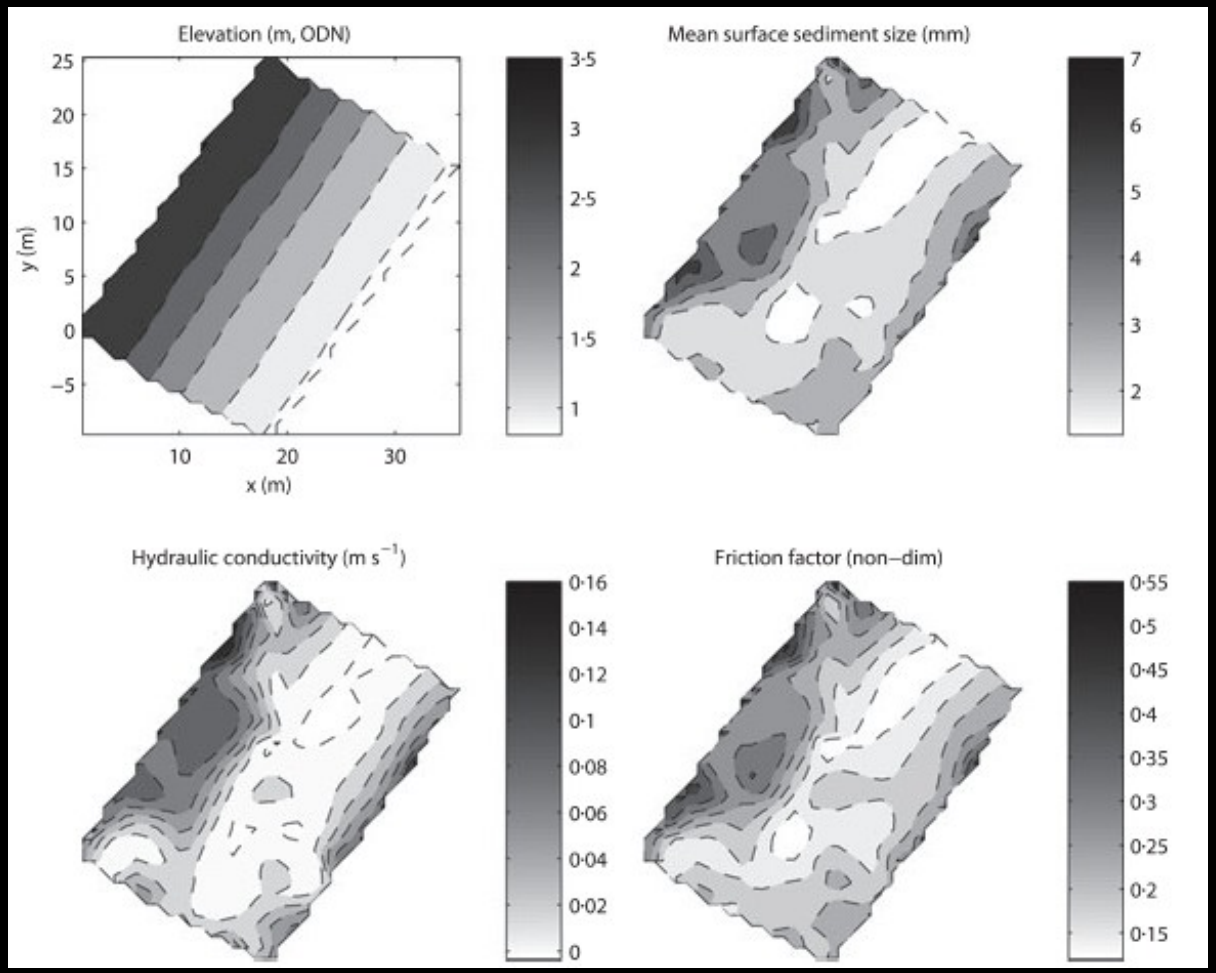
↓

Energy dissipation Sediment transport

↓

Coastal structures Morphological change

Modelling Sediment Transport



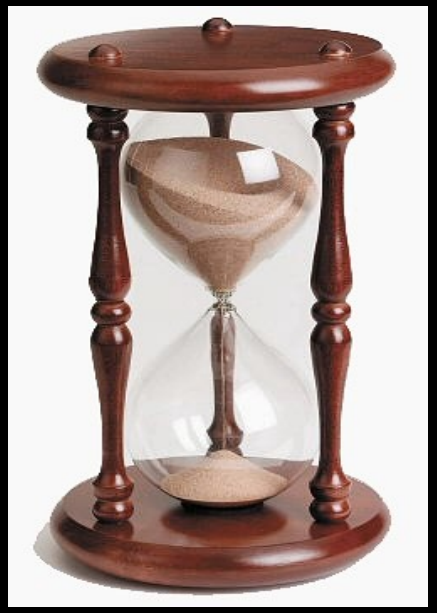
Models sensitive to sediment parameters

Estimates need to be robust

Mixed sediment environments

New generation of coastal transport models – account for feedbacks induced by sediments

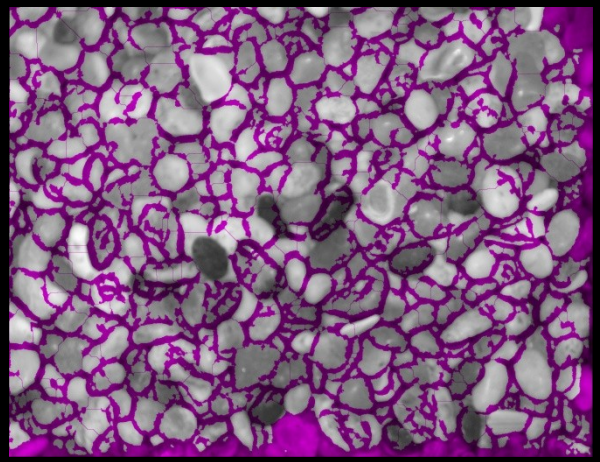
Grain-Size Analysis

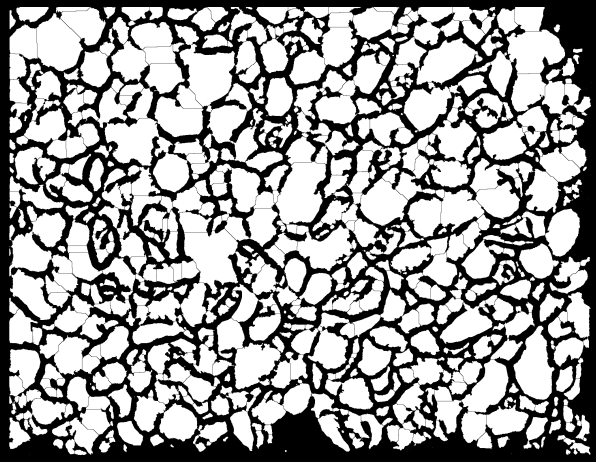


Slow, expensive, time-consuming

Limited coverage

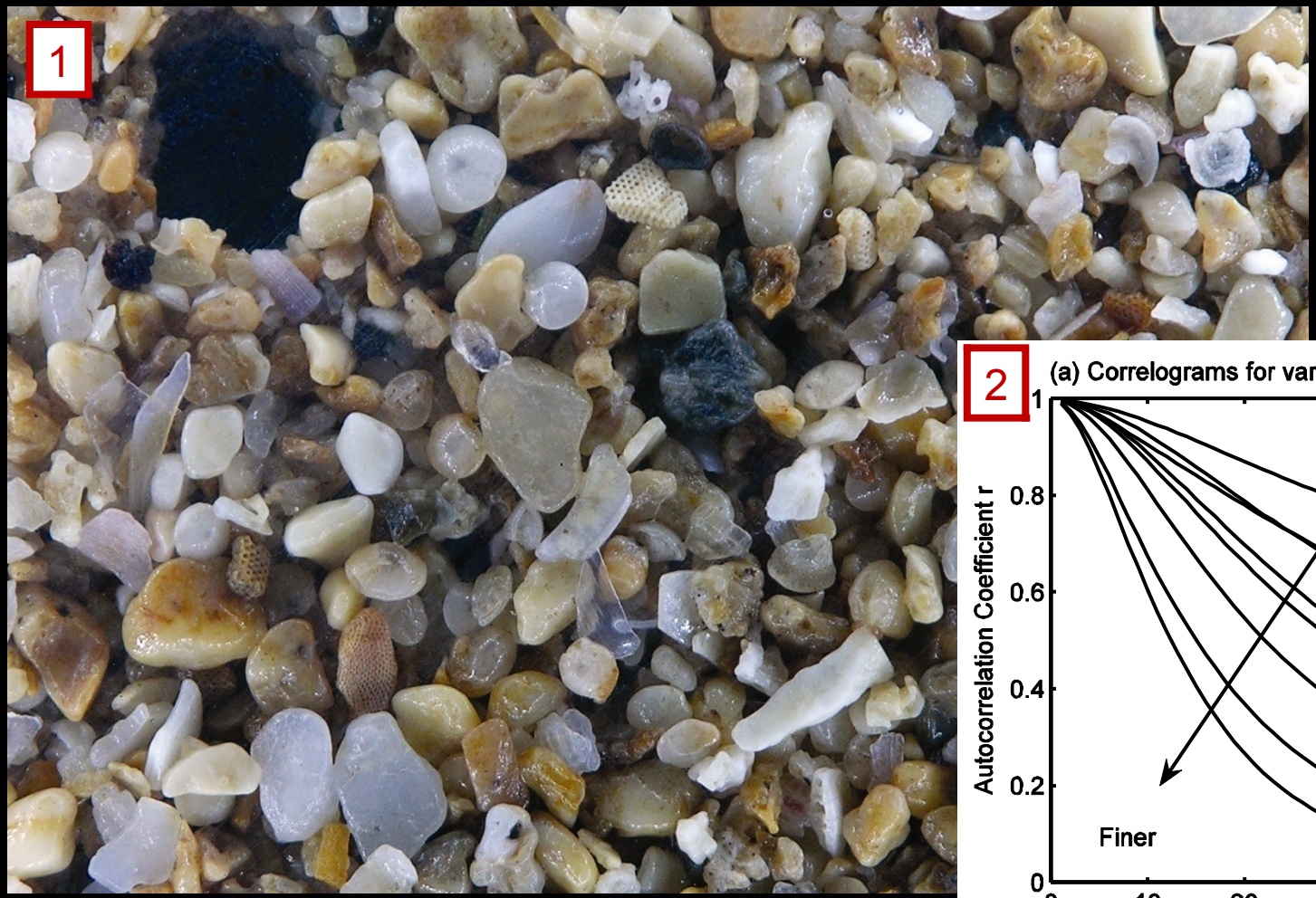
Most existing photographic methods not suitable for coastal sediments





‘Digital’ Grain-Size Analysis

1



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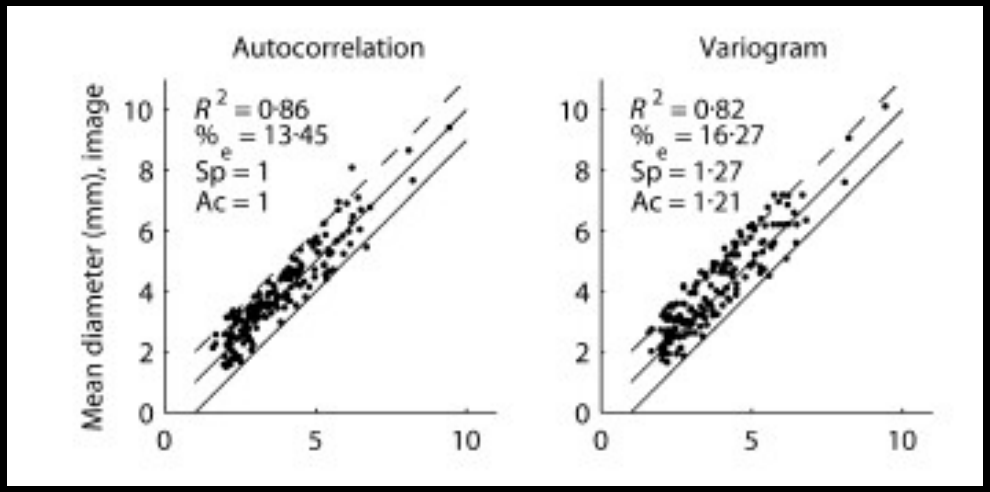
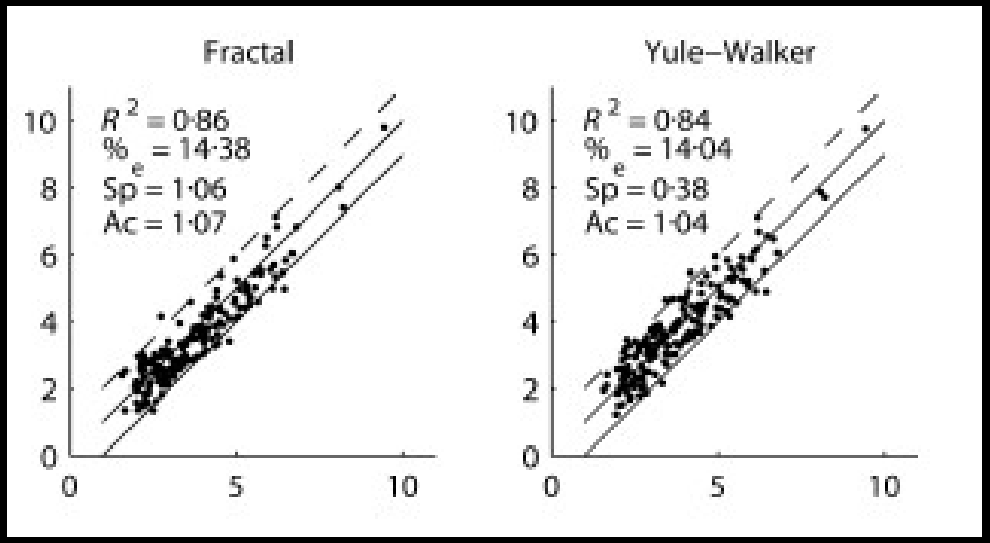
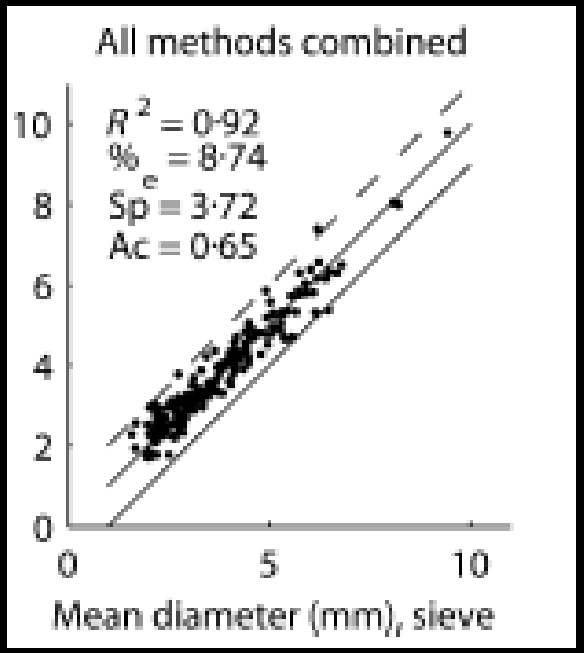




Accurate to within <10% over all size ranges tested

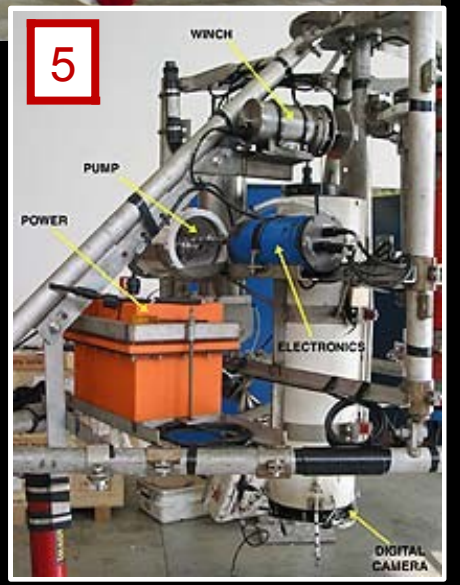


2

1

3

4



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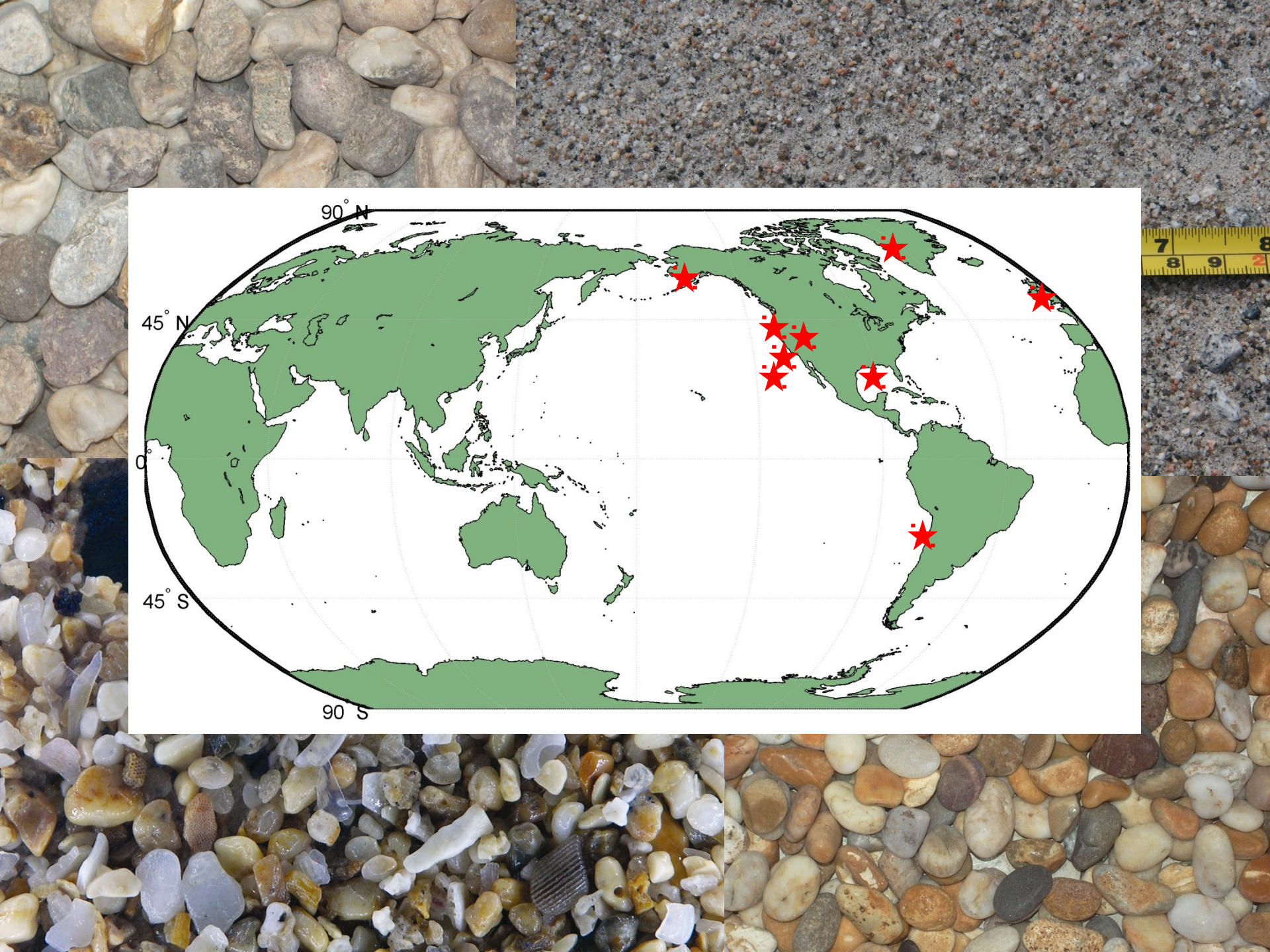
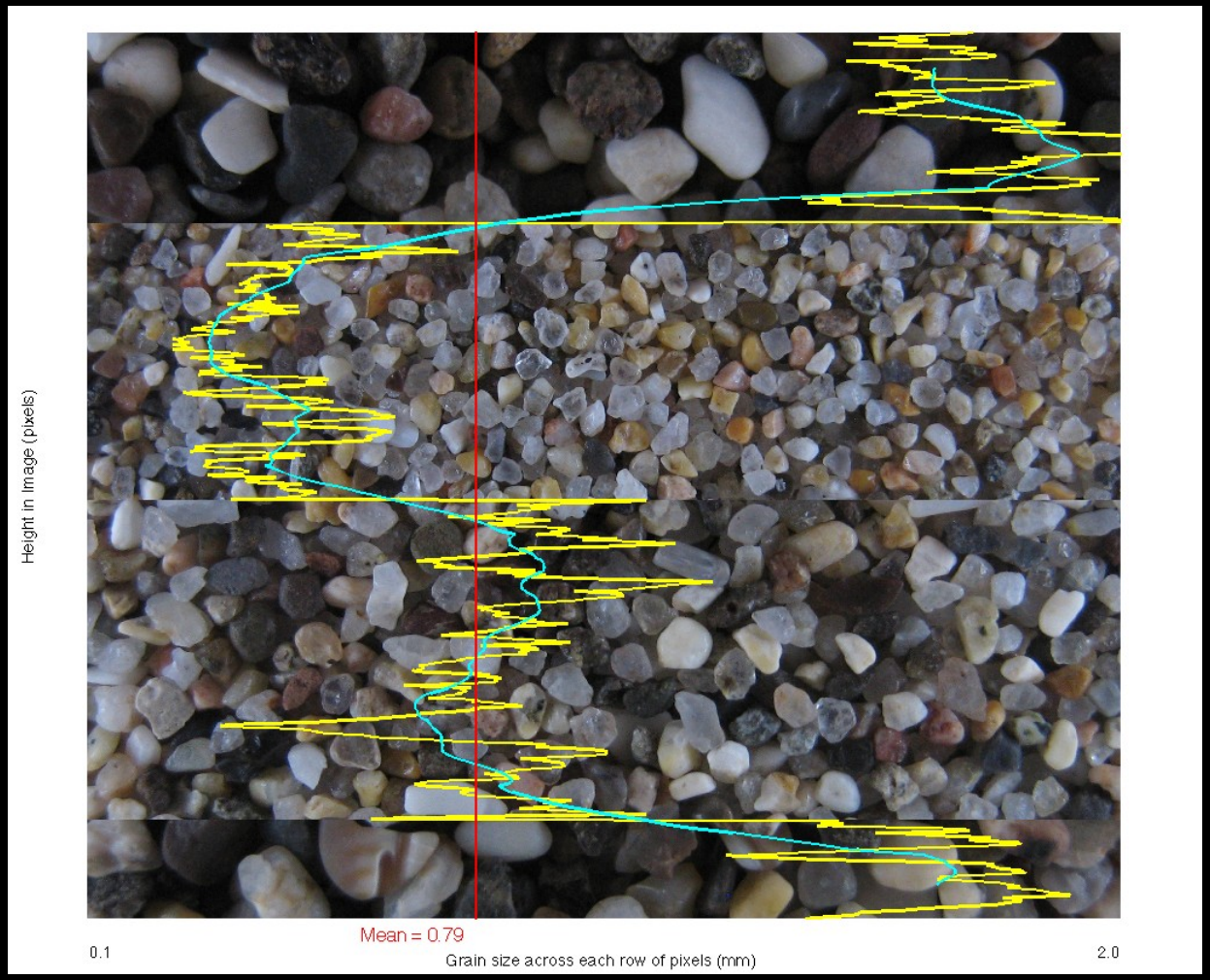

90° N
45° N
0°
45° S
90 S

Recent and Future Advances



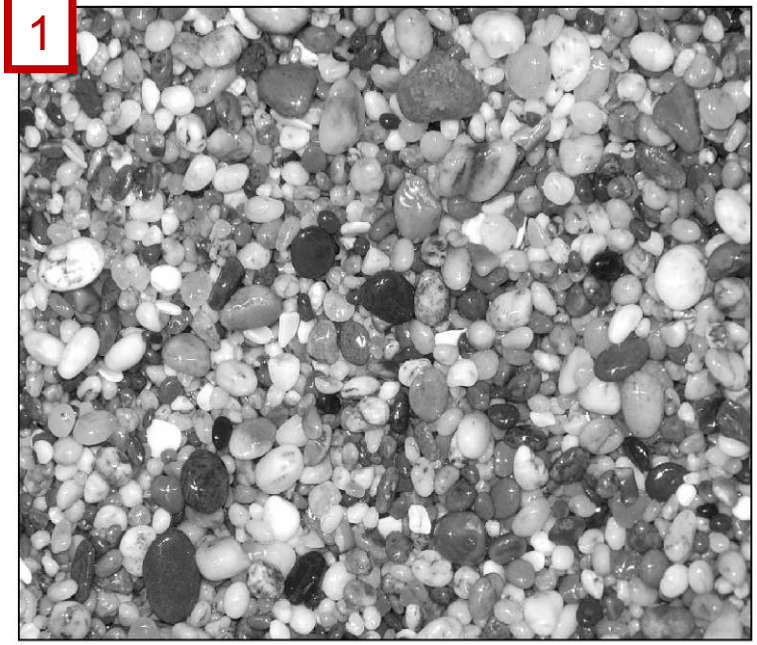
'Real-time' field assessment of surface grain-size

– macro camera and weatherproof tablet computer

Bank of calibration catalogues for different sites?

Prior mean-size estimates for threshold/segmentation algorithms

1



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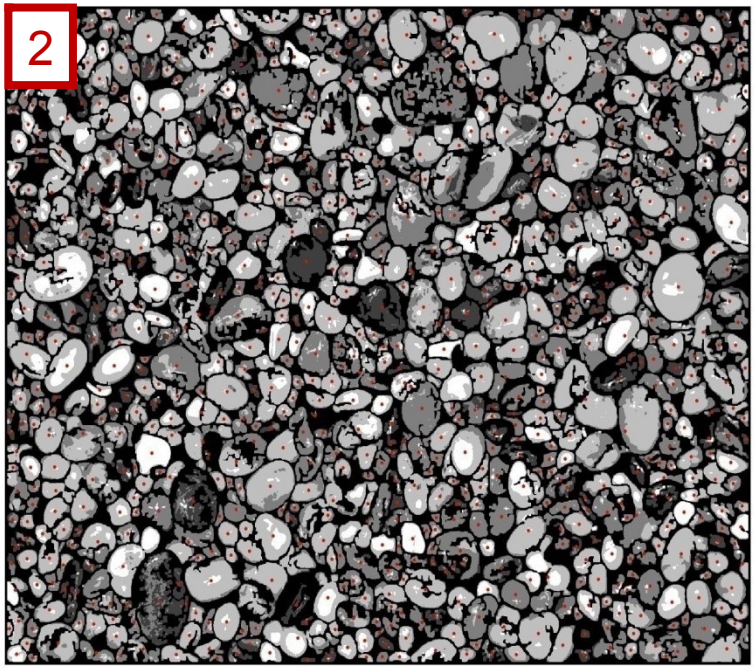

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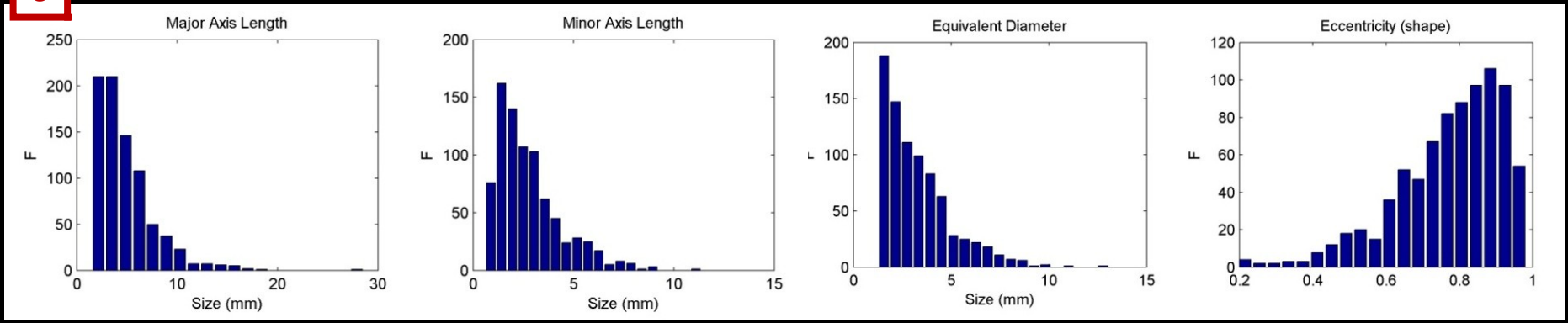
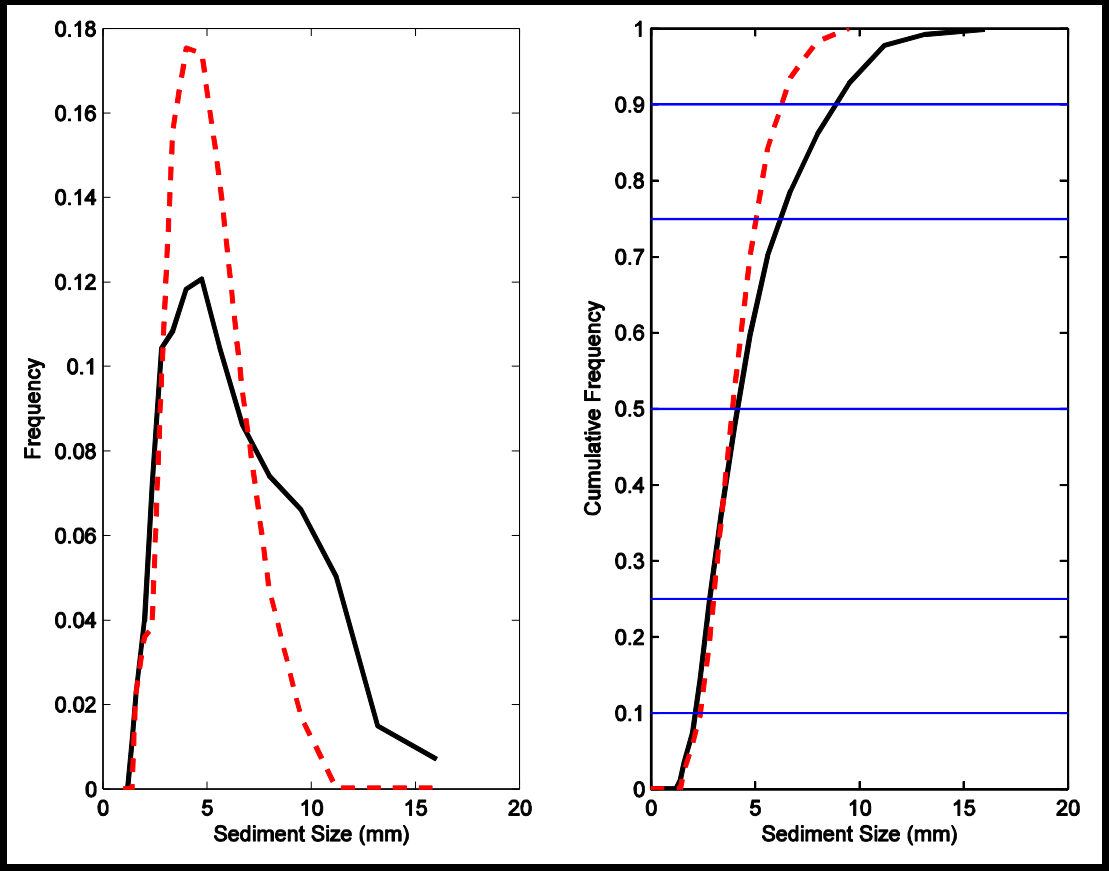


Algorithm development:

Grain-size distribution

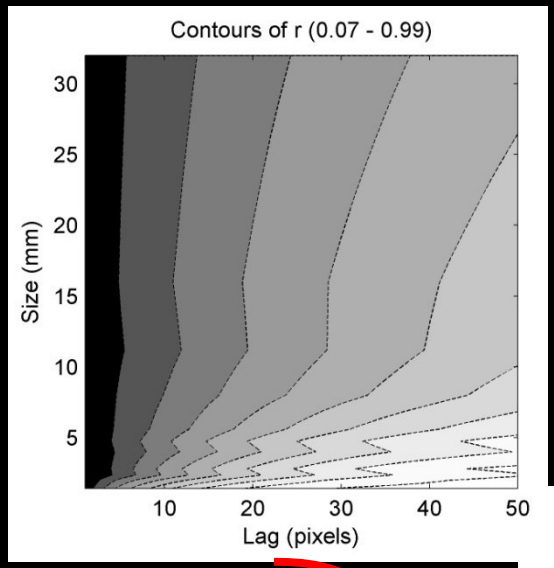
Kernel density functions

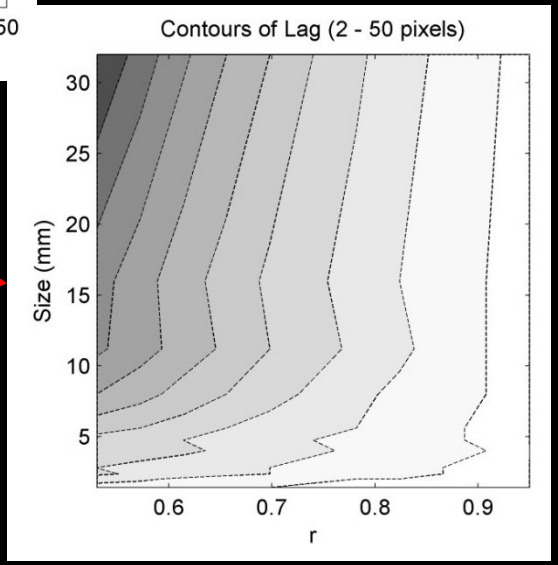
Works well for mean, mode, and sorting.



Success depends on calibration:

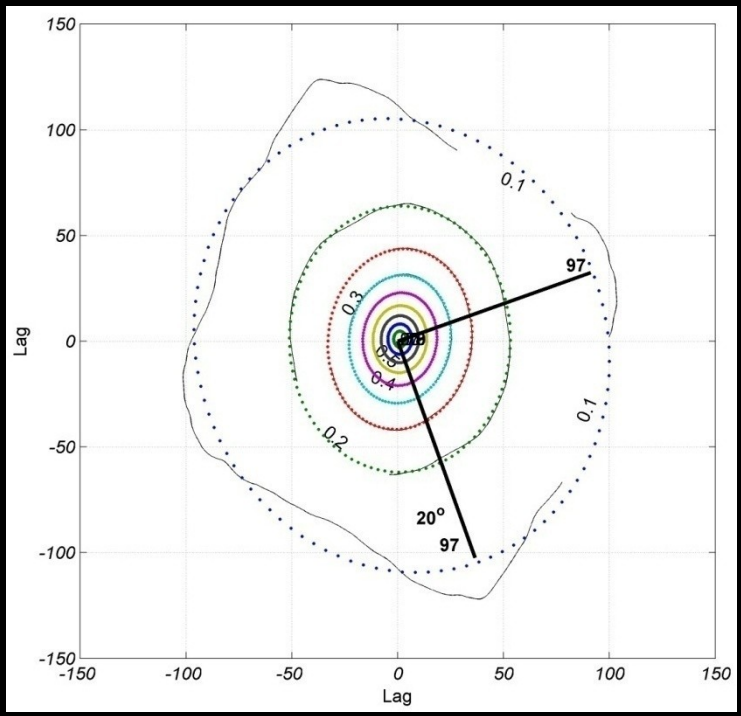
- Design of calibration catalogue
- Numerical error analysis
- Alternative form of calibration





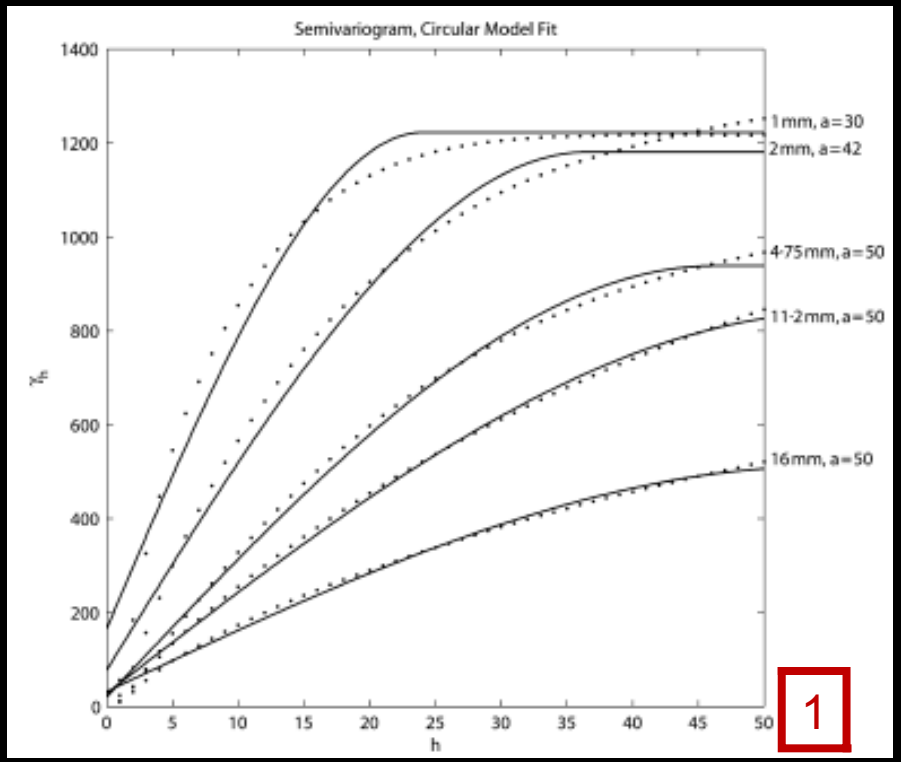
Extension in 2D

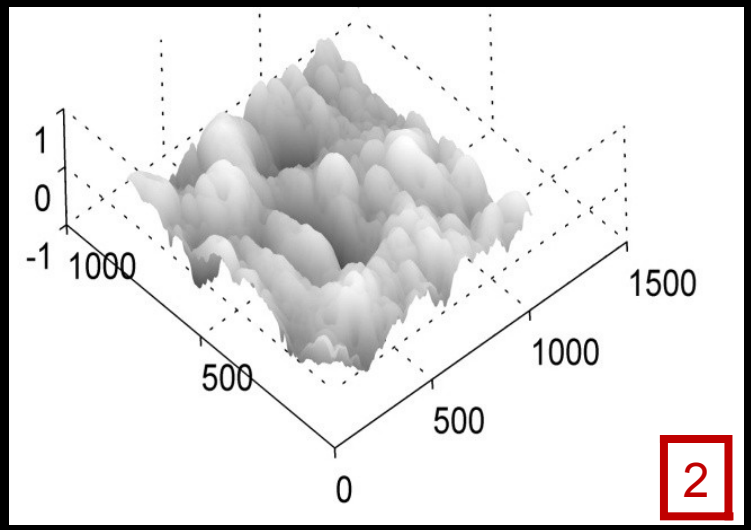
- Minor and major axes
- Shape
- More control over calibration design



Potential Implications for Coastal Sediment Transport

- Better parameterisation & inclusion in sediment transport models
- Simulation of sediment beds/stratigraphy

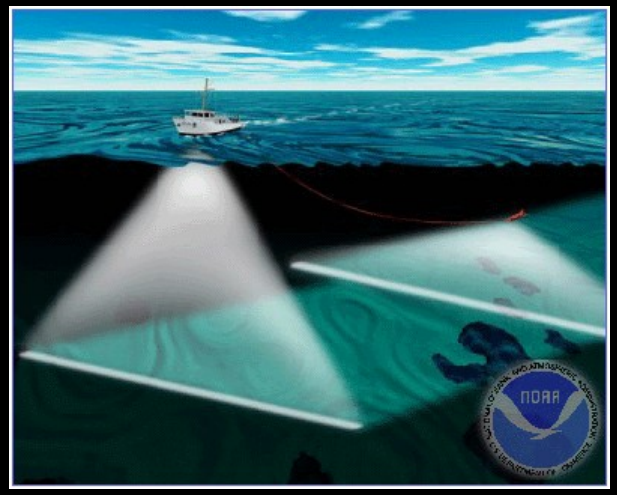




Potential Implications for Coastal Sediment Transport

- Development / validation of instrumentation:

- Acoustic sensors
- Hydrophones for coarse-grain transport
- Multibeam sonars, etc













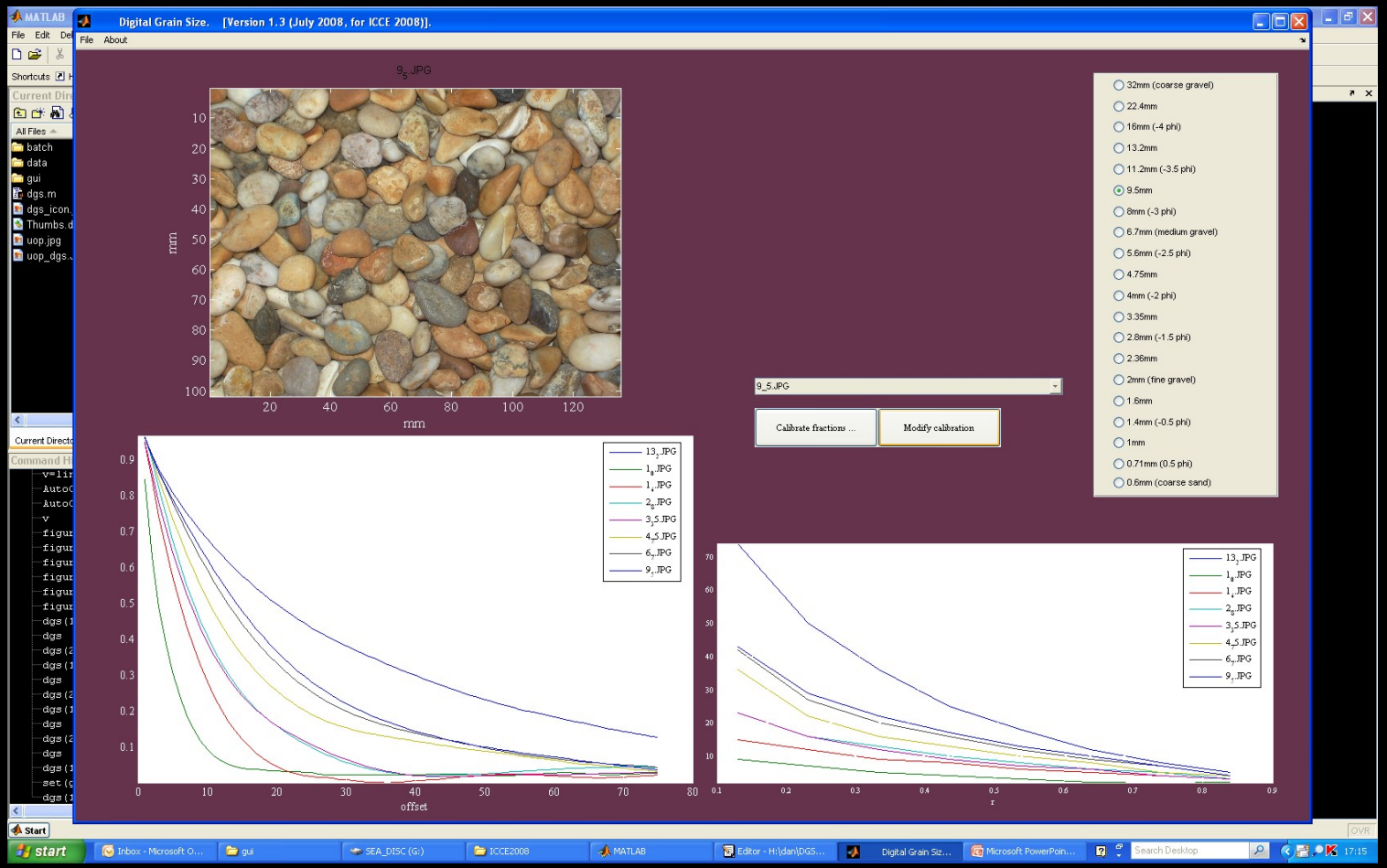





Computer Program

Matlab® code available by email request (d.buscombe@plymouth.ac.uk)

Graphical User Interface



Thanks for listening

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- Barnard et al. (2007) ***Sedimentary Geology* 201** (1-2), 180–195
- Buscombe (2008) ***Sedimentary Geology*, in press**
- Buscombe & Masselink (2008) ***Sedimentology*, in press**
- Rubin (2004) ***Journal of Sedimentary Research* 74** (1), 160–165
- Rubin et al (2007) ***Sedimentary Geology* 202** (3), 402–408