

ISRSE-37 Symposium – Tshwane
Wednesday 10 May 2017

Using LiDAR derivatives to estimate sediment grain size on beaches in False Bay

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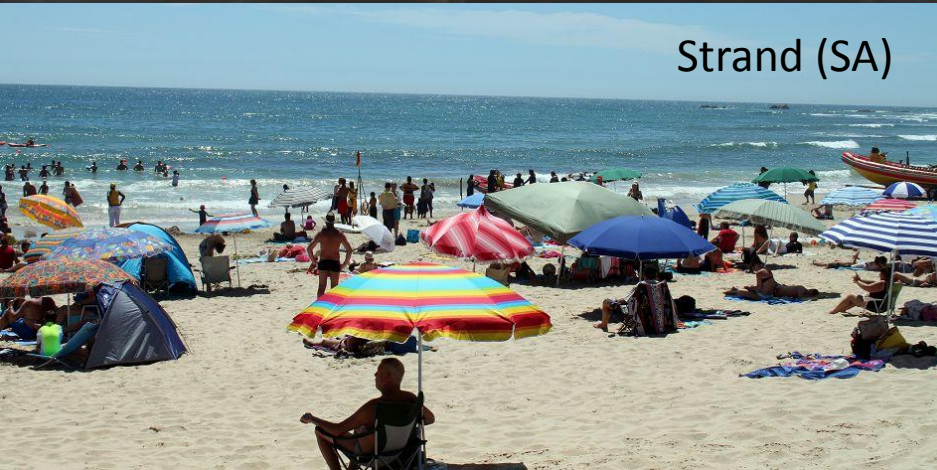
UNIVERSITEIT
STELLENBOSCH
UNIVERSITY



Kogel Bay (SA)



Strand (SA)



Strand (SA)

The coastal zone is an important asset to any coastal country:

- tourism
- recreation
- ports / harbours
- fishing and mining

But it is vulnerable to natural ocean processes



Kogel Bay (SA)



Strand (SA)



Spring high tide flooding in Strand



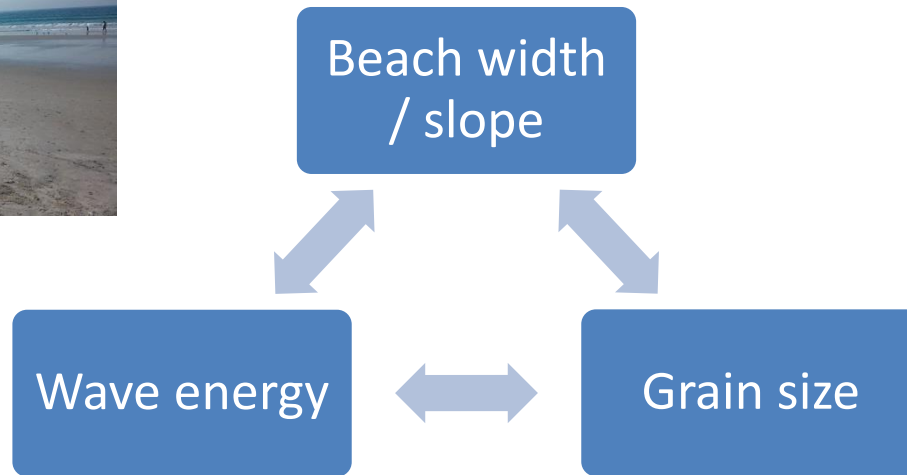
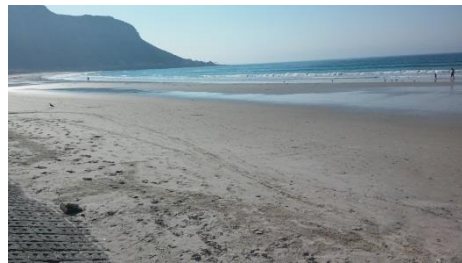
Strand (SA)



Coastal erosion at Monwabisi (SA)

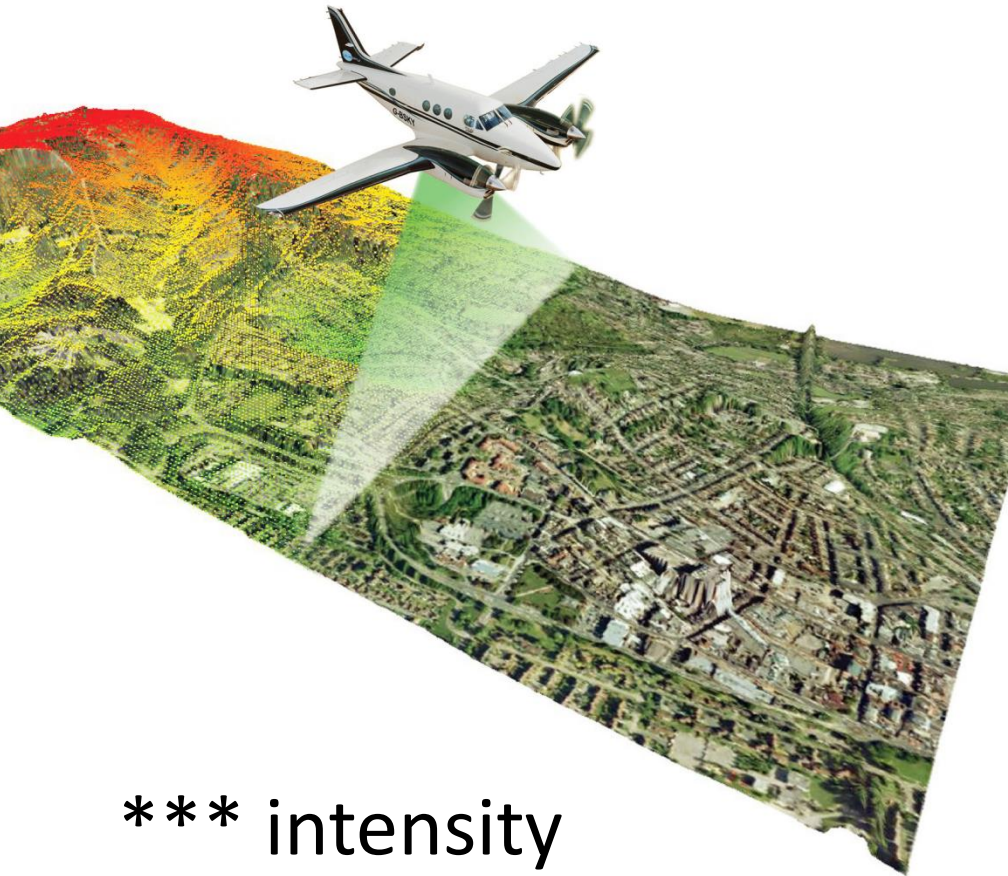
Role of beaches in coastal protection

Vulnerability of the coast to erosion or flooding depends on:



Can one be used as a proxy for another?

Light Detection and Ranging (LiDAR)



Each point in the point cloud has:

x-coordinate (longitude)

y-coordinate (latitude)

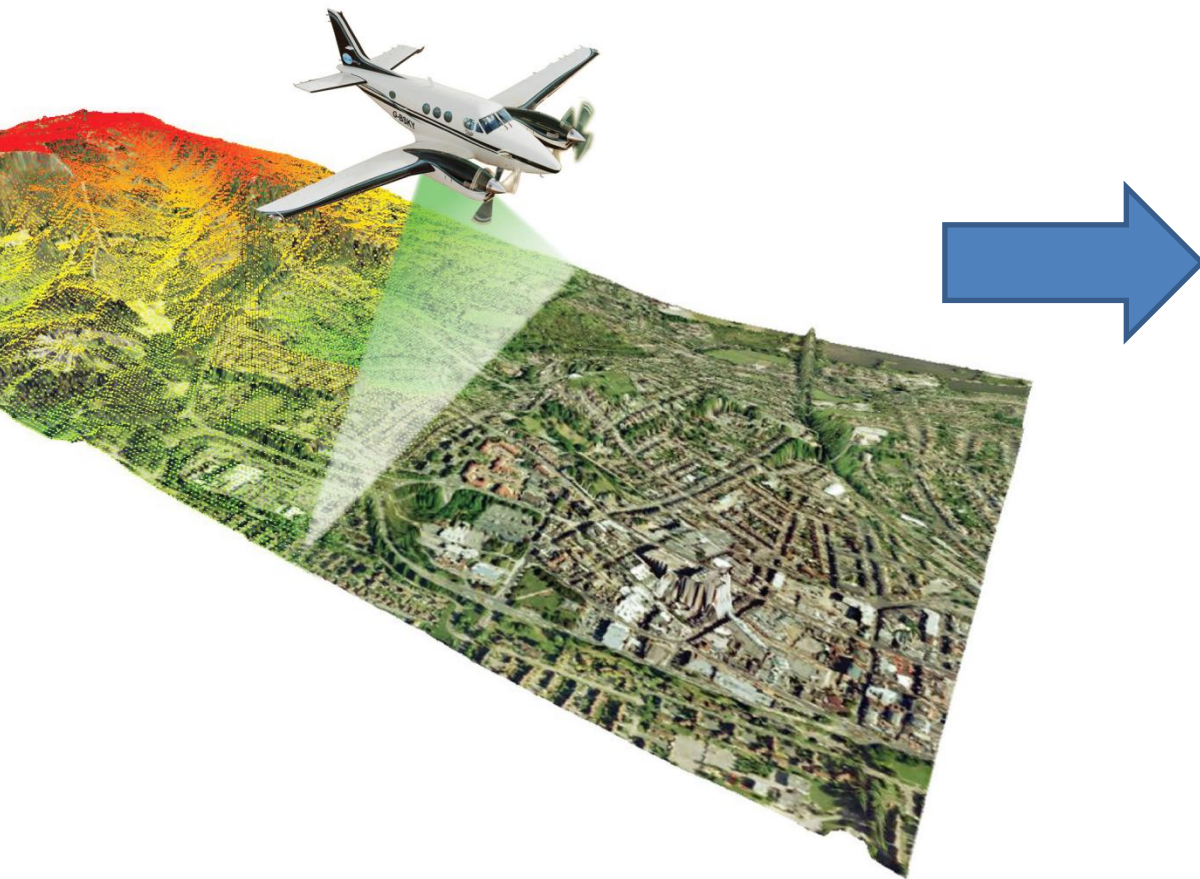
z-coordinate (elevation)

intensity (strength of returning signal) ***

*** intensity

- affected by a number of factors
- composition of the target or surface

Aim



Derive:

- Elevation
- Topography
- Slope
- Grain size from intensity ?

1. lab approach (presented here)

2. using airborne LiDAR (analysis ongoing)



CAPE TOWN

WESTERN CAPE

FISH HOEK

STRAND

FALSE BAY

KOGEL BAY

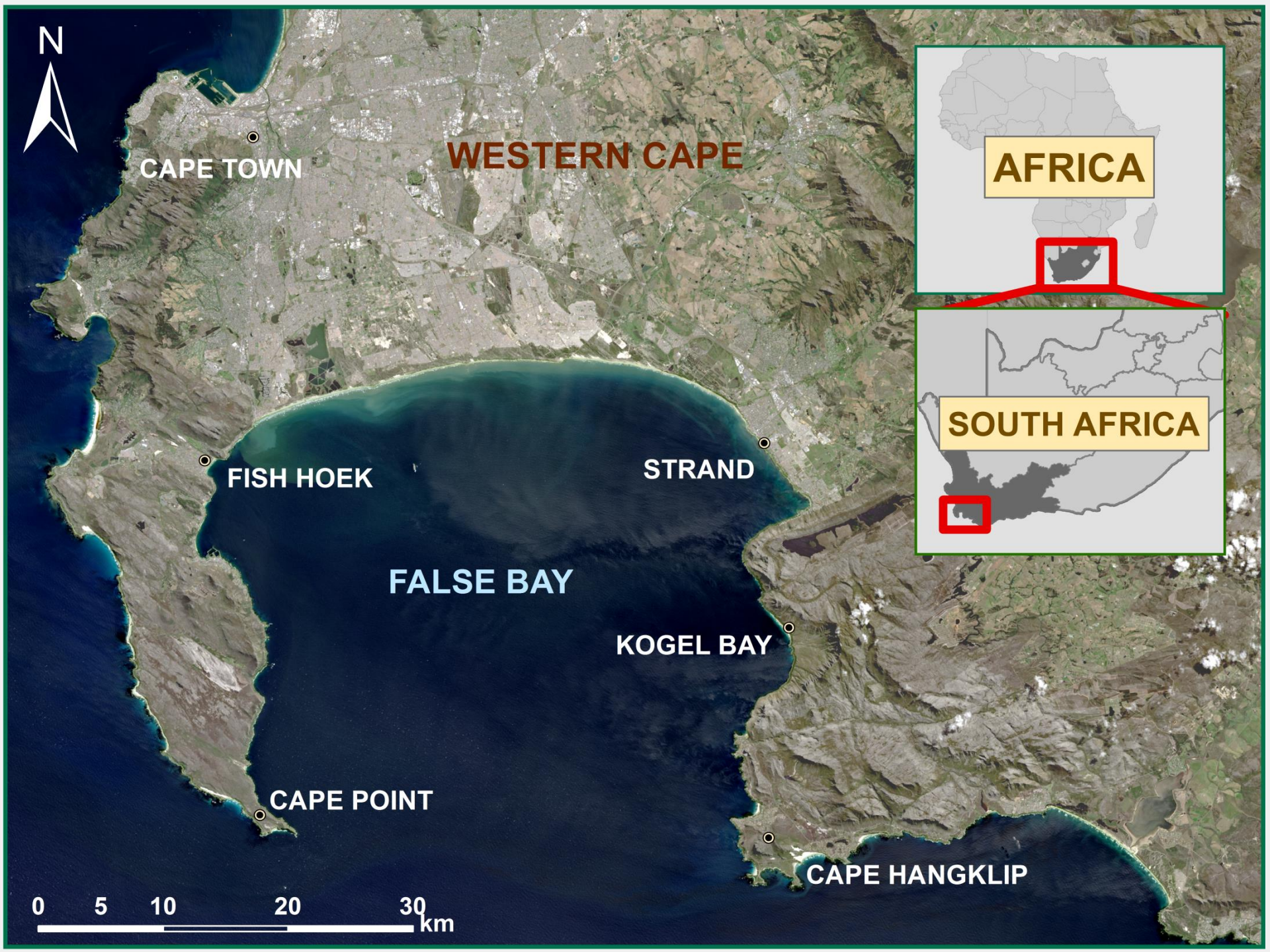
CAPE POINT

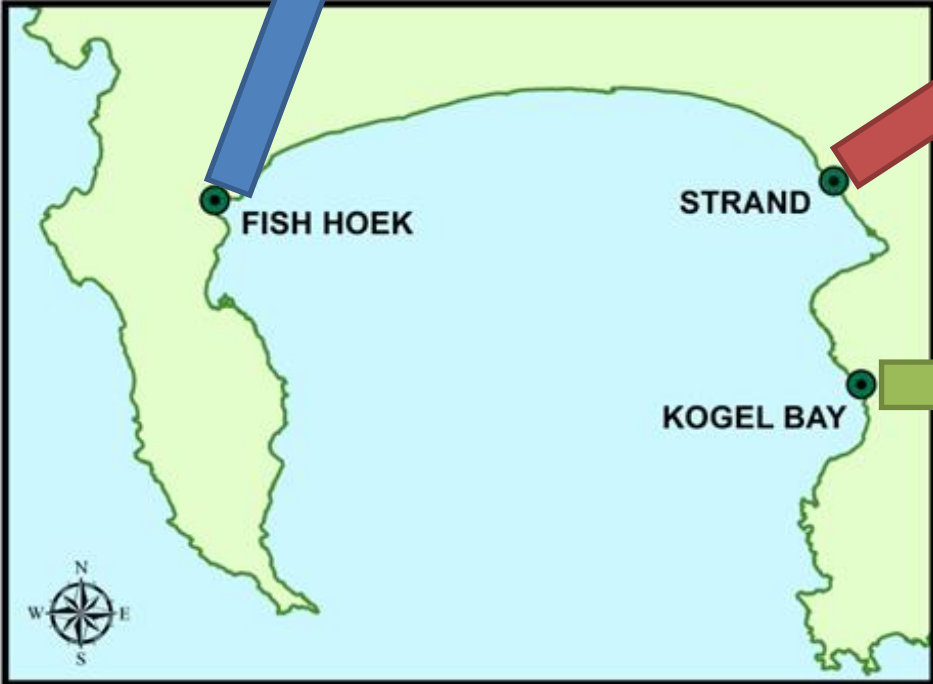
CAPE HANGKLIP

0 5 10 20 30 km

AFRICA

SOUTH AFRICA





Sample collection at Strand



Sample drying



Mechanical sieves

Sieve results

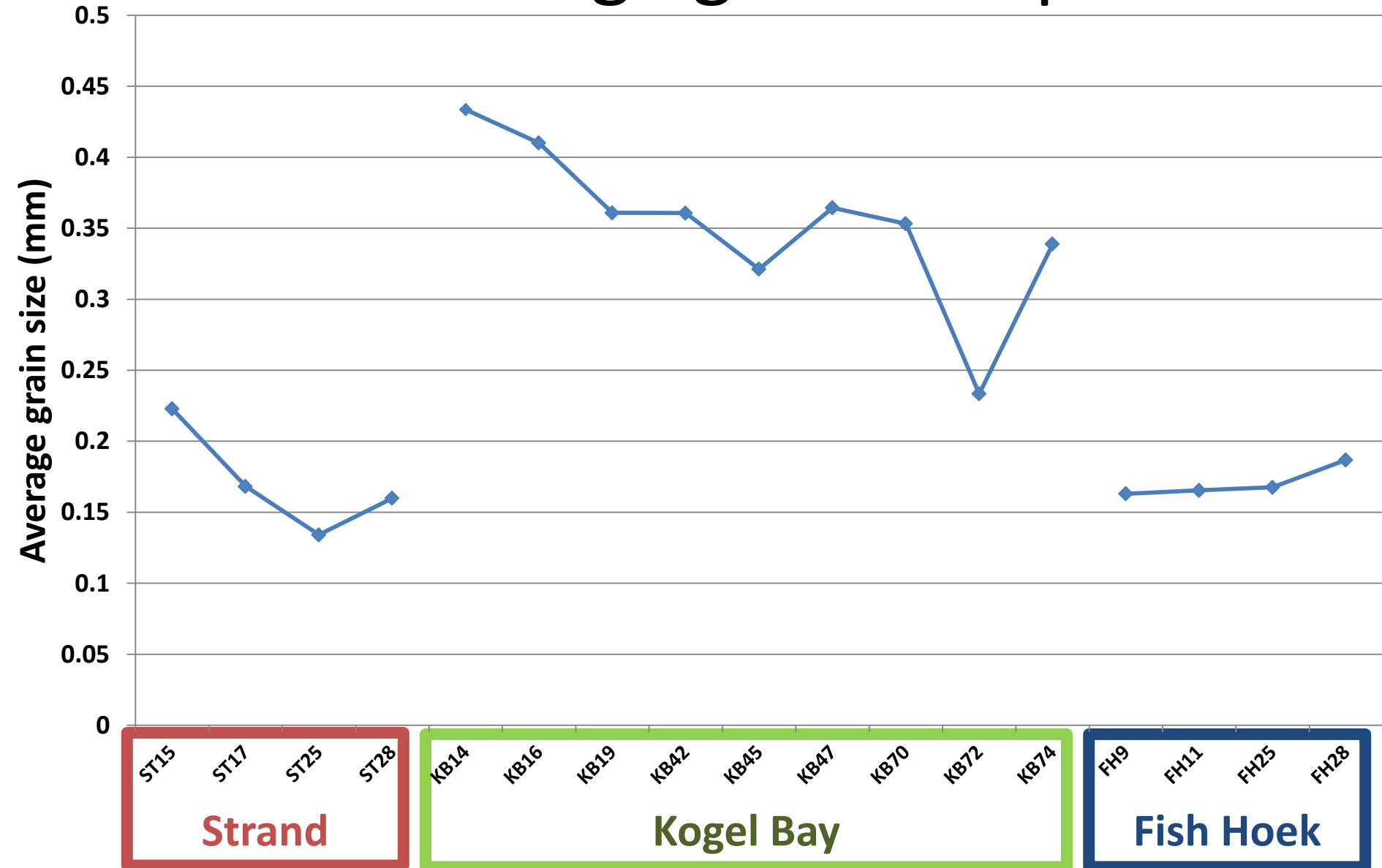
| Hologic cup 32 79 | | | | | | | | | | |
|-------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| KONKELBÄN | | | | | | | | | | |
| KB1 | KB2 | KB3 | KB4 | KB5 | KB6 | KB7 | KB8 | FH0 | FH1 | FH2 |
| 64,75 | 7,7341 | 2,6788 | 2,5766 | 2,7946 | 2,6652 | 2,6128 | 2,6201 | 2,5740 | 2,6771 | 2,6597 |
| X | X | X | X | 2X | X | X | X | X | X | X |
| 1,8 | 1,78 | 0,97 | 0,46 | 0,39 | 0,05 | 0,000 | 0,11 | 0,06 | 0 | 0,03 |
| 2,25 | 6,85 | 5,52 | 2,06 | 3,73 | 5,37 | 0,33 | 2,28 | 0,11 | 0,08 | 0,16 |
| 9,4 | 10,58 | 7,61 | 7,78 | 7,30 | 2,62 | 0,17 | 3,98 | 0,16 | 0,07 | 0,48 |
| 1,77 | 68,45 | 41,20 | 20,87 | 54,68 | 37,58 | 3,81 | 34,86 | 0,71 | 1,06 | 3,20 |
| 1,48 | 52,07 | 24,51 | 15,78 | 41,02 | 42,42 | 7,20 | 32,07 | 0,88 | 0,59 | 1,77 |
| 2,51 | 30,35 | 87,20 | 100,07 | 88,35 | 107,16 | 54,7 | 93,87 | 4,29 | 2,57 | 6,75 |
| 7 | 18,39 | 2,588 | 2,12 | 20,25 | 27,40 | 24,43 | 20,72 | 2,14 | 1,61 | 3,06 |
| 1,56 | 21,56 | 57,51 | 73,58 | 59,90 | 45,54 | 167,16 | 72,56 | 117,49 | 144,26 | 132,12 |
| 38 | | | 0,7 | | | | | 94,52 | 32,05 | 126,65 |
| | | | | | | | | 0,30 | 0,08 | 0,07 |

FB low
150. 8,33g
90

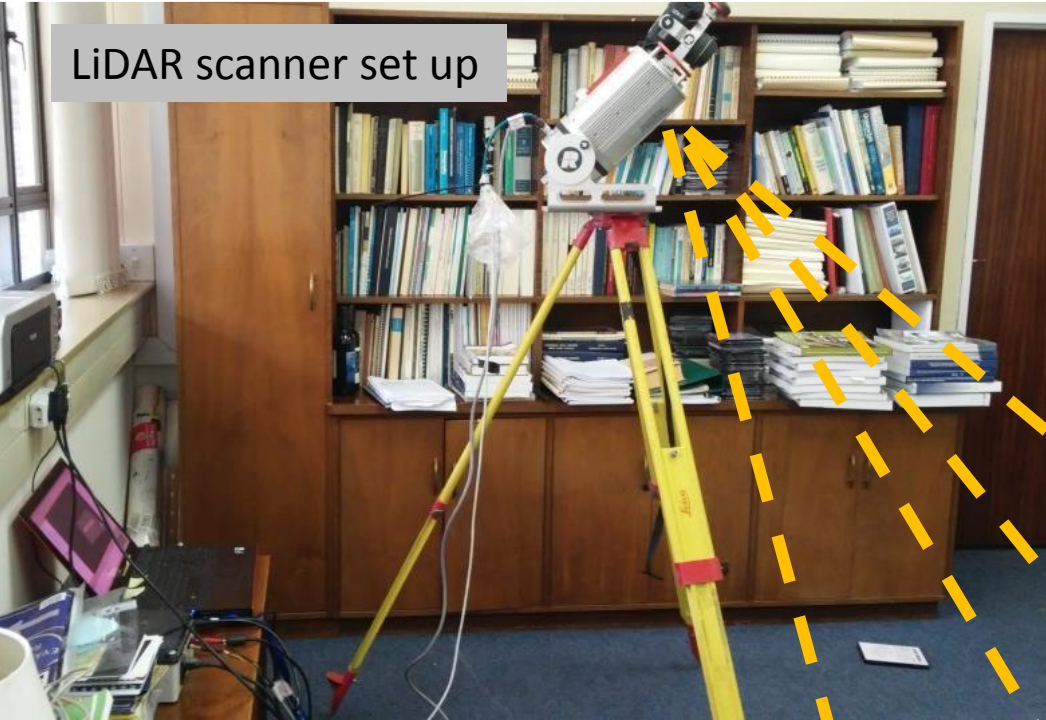
Results: sand fractions per beach

| | | Strand | Kogel Bay | Fish Hoek |
|------------|-------------|-------------------|--------------|--------------|
| Sieve size | | % of total weight | | |
| 1 | 1.4 mm | 0.04 | 0.29 | 0.01 |
| 2 | 850 microns | 0.25 | 1.92 | 0.04 |
| 3 | 710 microns | 0.37 | 2.61 | 0.07 |
| 4 | 500 microns | 1.88 | 16.23 | 0.59 |
| 5 | 425 microns | 1.92 | 13.07 | 0.55 |
| 6 | 355 microns | 6.41 | 31.96 | 2.81 |
| 7 | 300 microns | 2.86 | 8.45 | 1.41 |
| 8 | 180 microns | 31.88 | 25.43 | 49.48 |
| 9 | 150 microns | 16.99 | 0.05 | 34.68 |
| 10 | 90 microns | 36.76 | 0.00 | 10.31 |
| 11 | 63 microns | 0.65 | 0.00 | 0.04 |

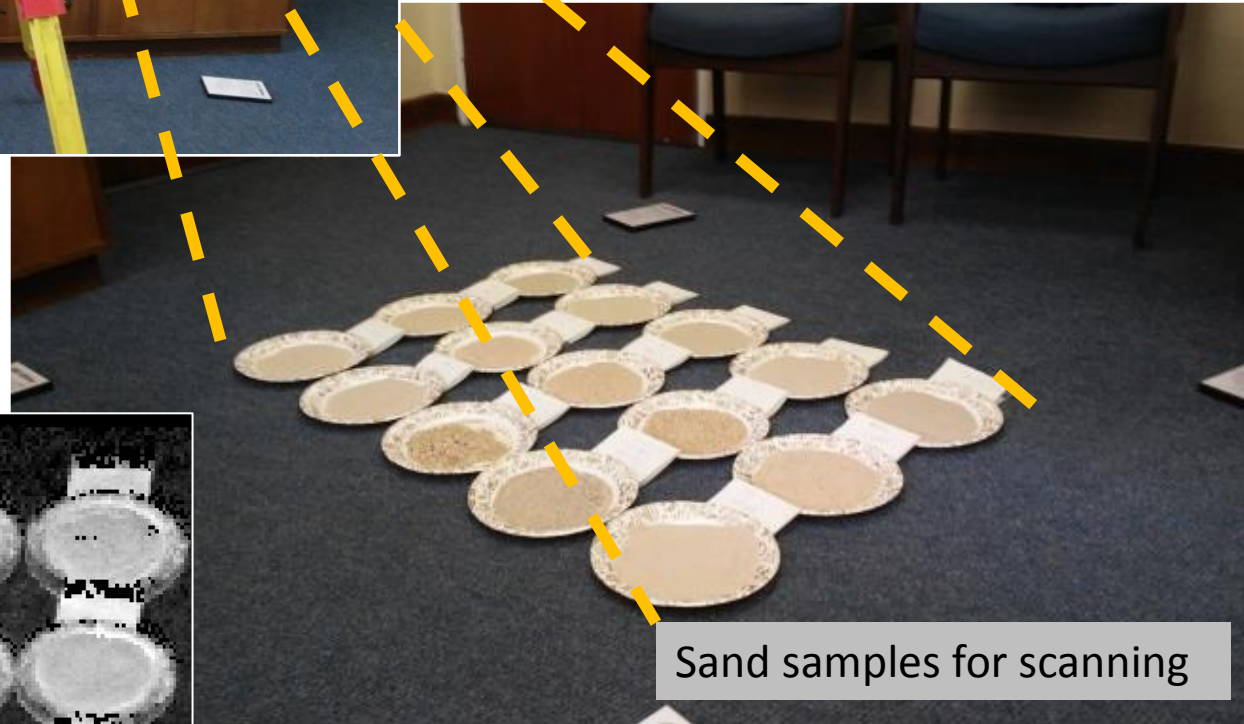
Results: average grain size per site



LiDAR scanner set up

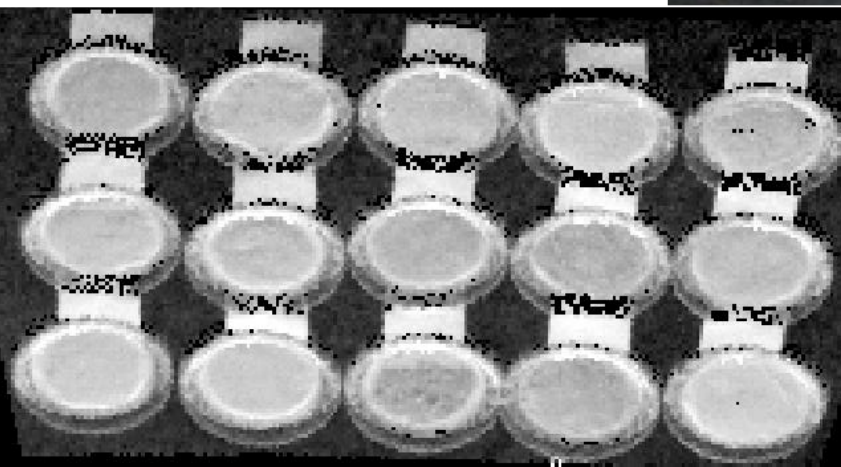


Each plate contains sand fractions of the **same size** (resulting from the sieving)

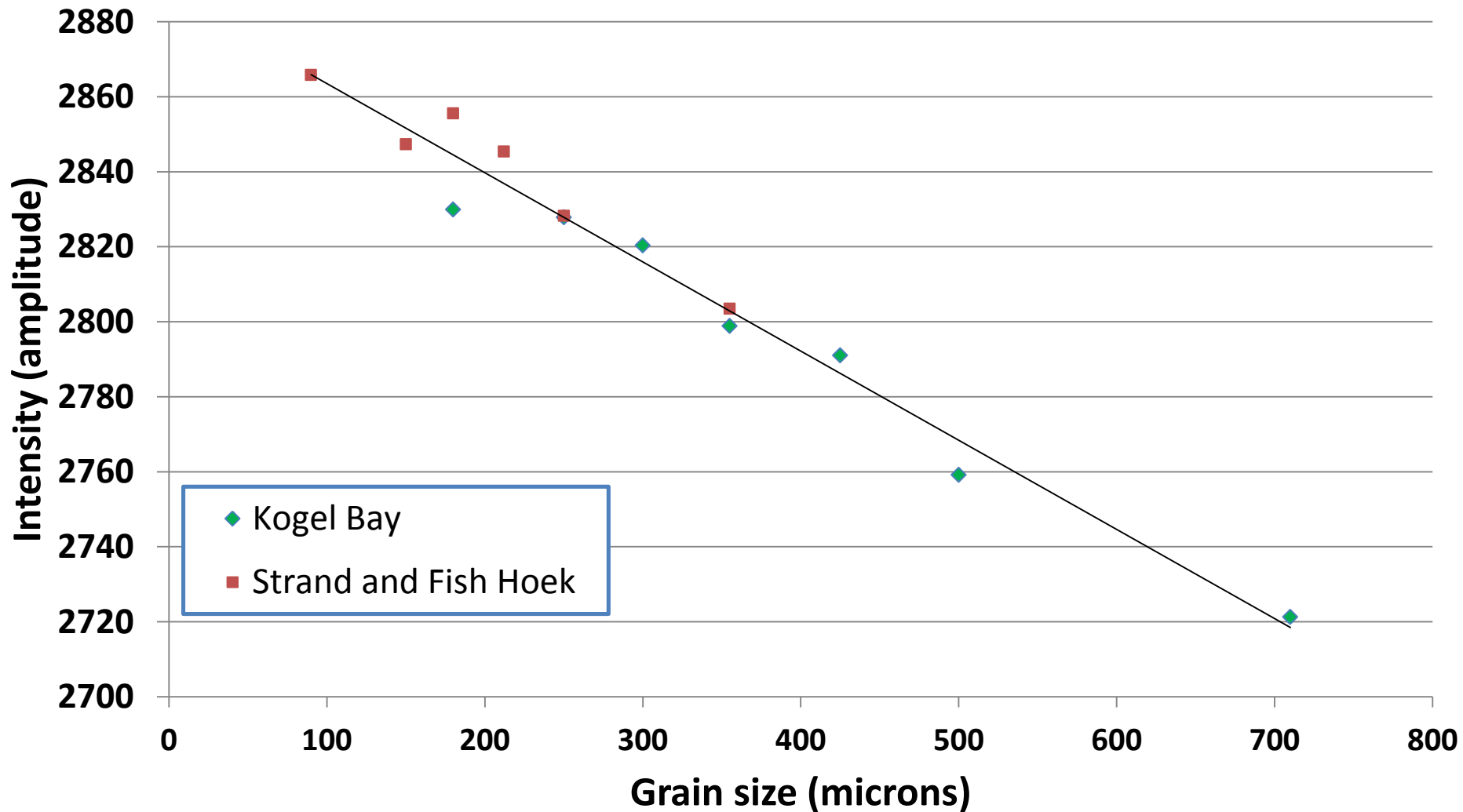


Sand samples for scanning

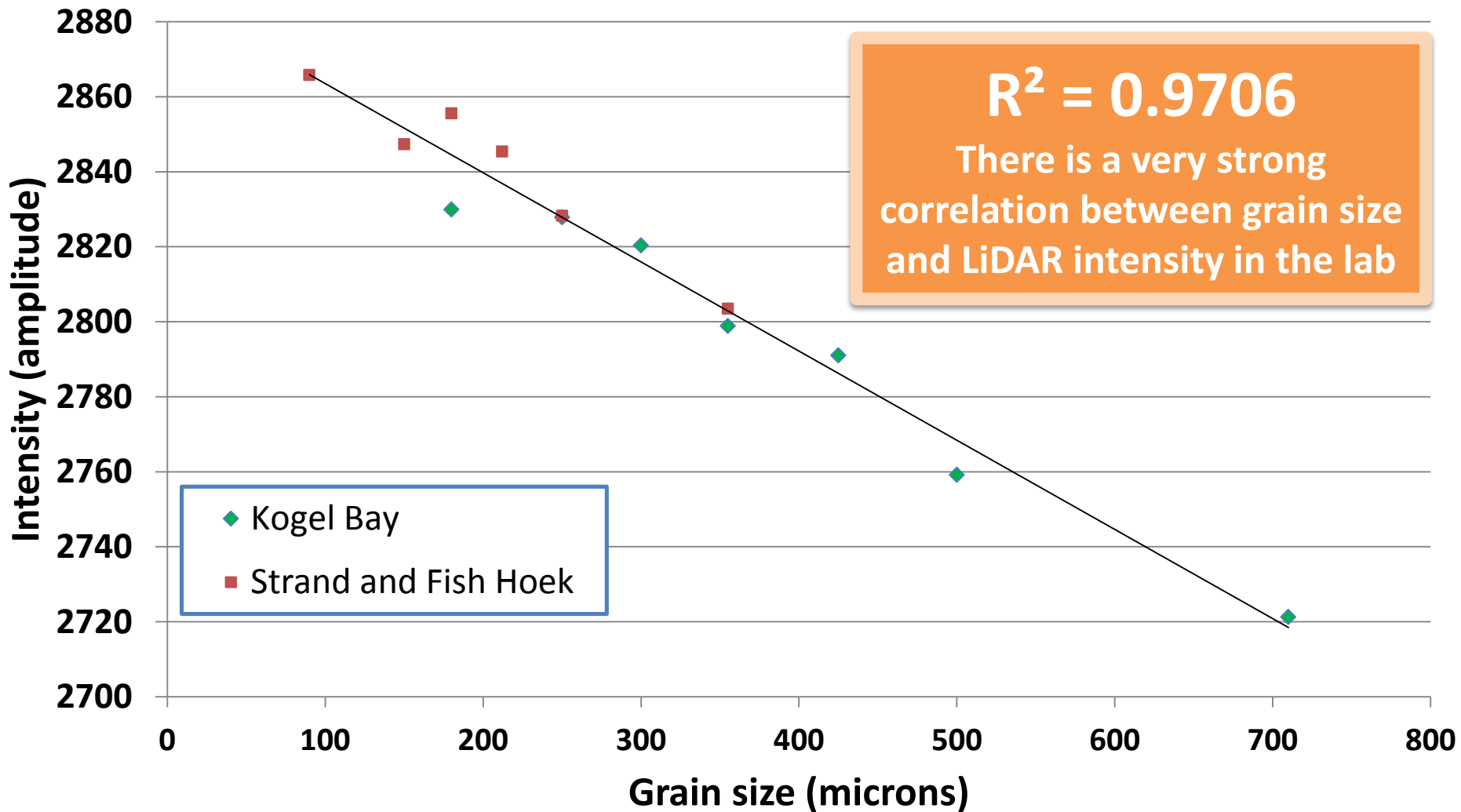
LiDAR intensity



Results: intensity per grain size



Conclusion



Planned next steps

Take to the sky ...

... using airborne LiDAR data to find a similar correlation between LiDAR derivatives

- Anticipated challenges:
 - Different acquisition dates
(airborne 2014 and field 2016)
 - Radiometric pre-processing of intensity
(discussions/advice would be appreciated)

Thank you

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