EGU General Assembly 2020

Online | 4–8 May 2020

NELSON MANDELA UNIVERSITY

EGU 2020 Presentation

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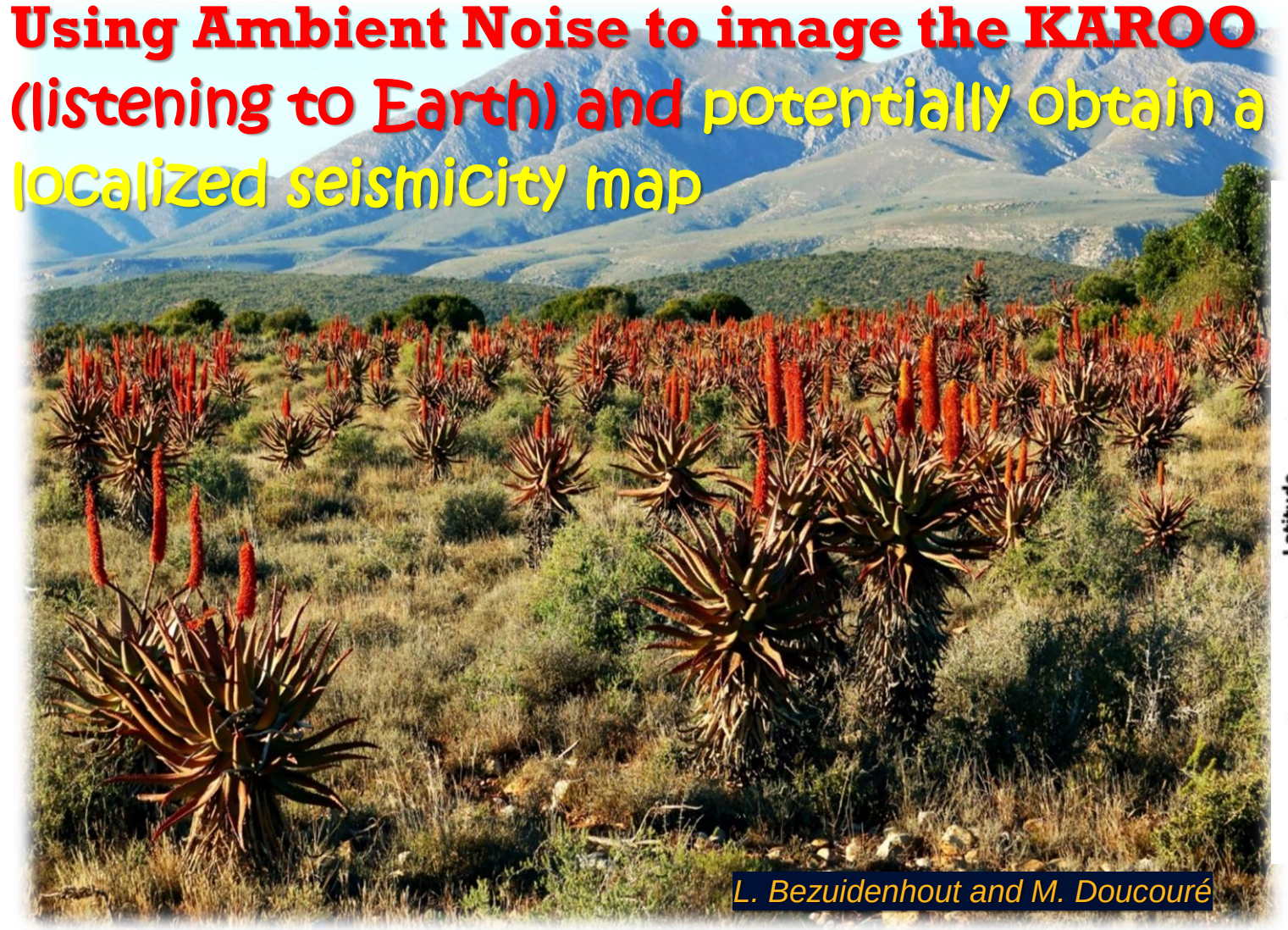
Polarisation based interferometric optical fiber geophone sensor designed for high resolution seismic detection

Outline

1. Introduction (Geological Applications of Sensors)
2. Sensors in Geology: Mechanism, Advantages & limitations
   - Geophone Sensors
   - Optical Fiber Sensors
3. Optical fiber Sensor vs Geophone Sensor (Experiments & Results)
4. Conclusion
5. Acknowledgements

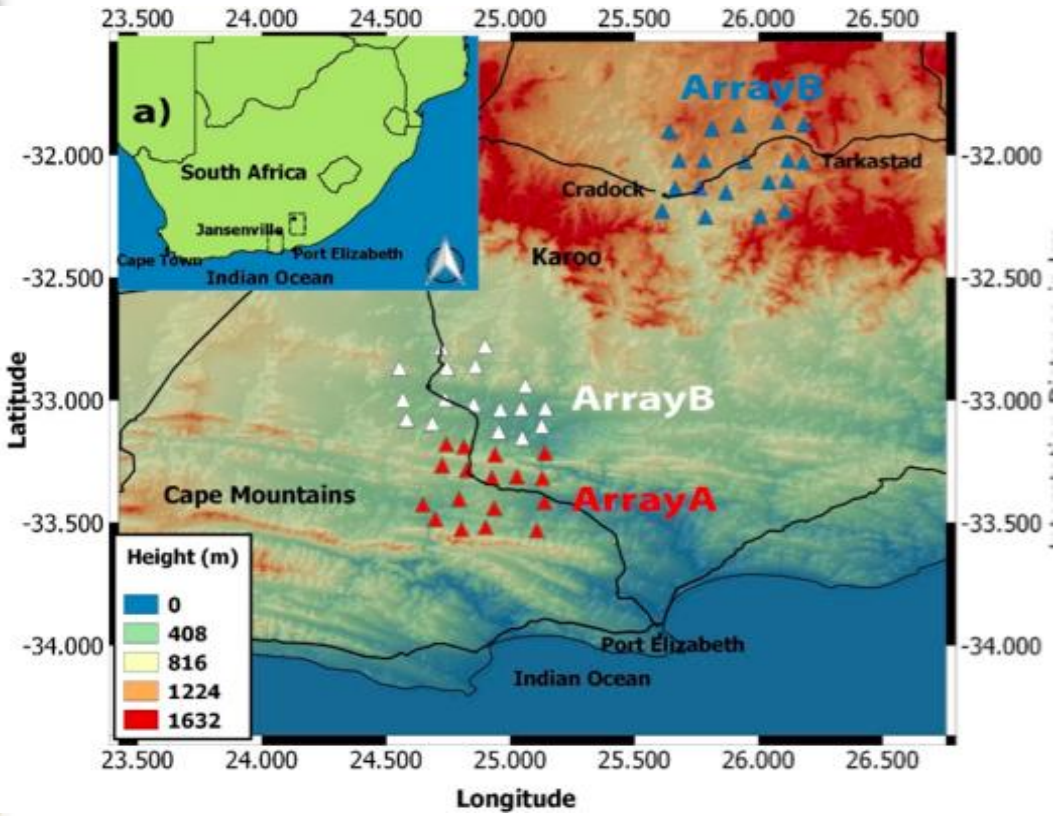
Introduction

Using Ambient Noise to image the KAROO (listening to Earth) and potentially obtain a localized seismicity map



L. Bezuidenhout and M. Doucouré

- Seismicity mapping



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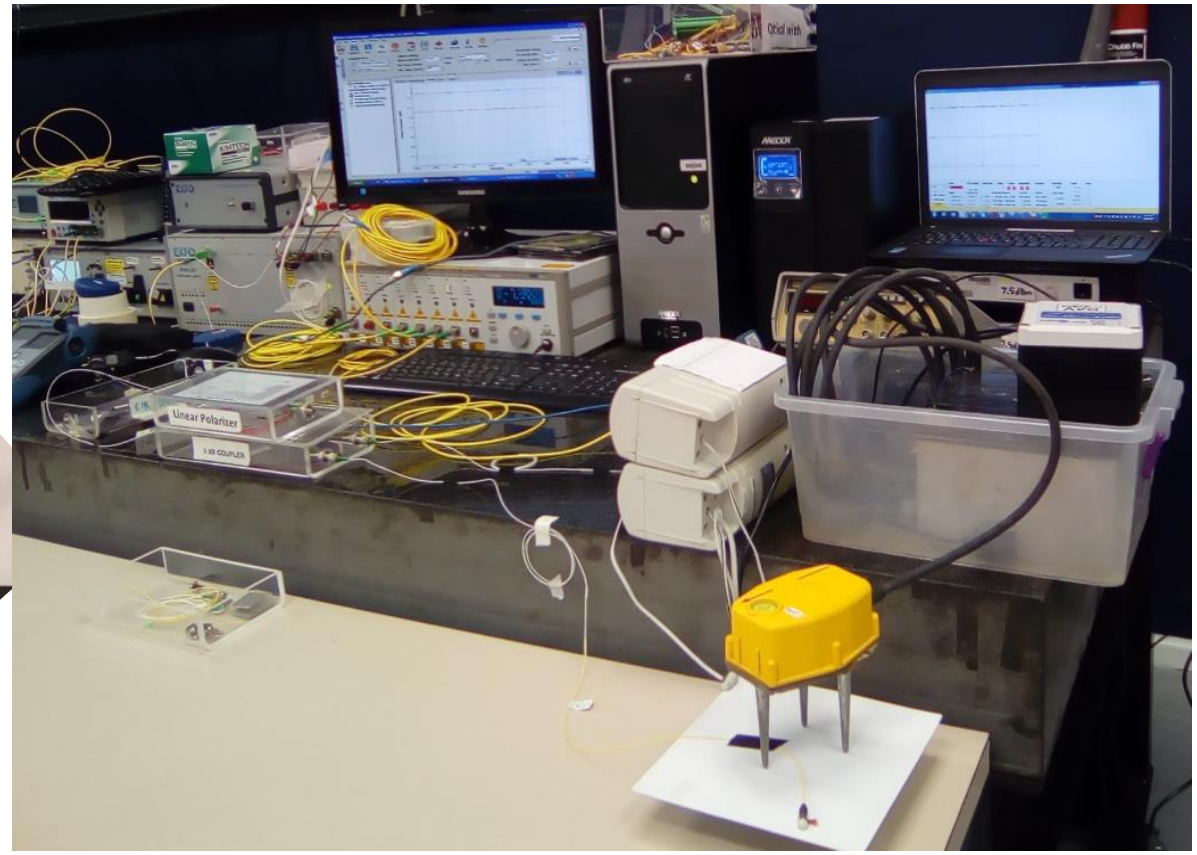
Sensors for Geological Applications

point sensor



distributed sensor

Experimental Setup: characteristics testbed

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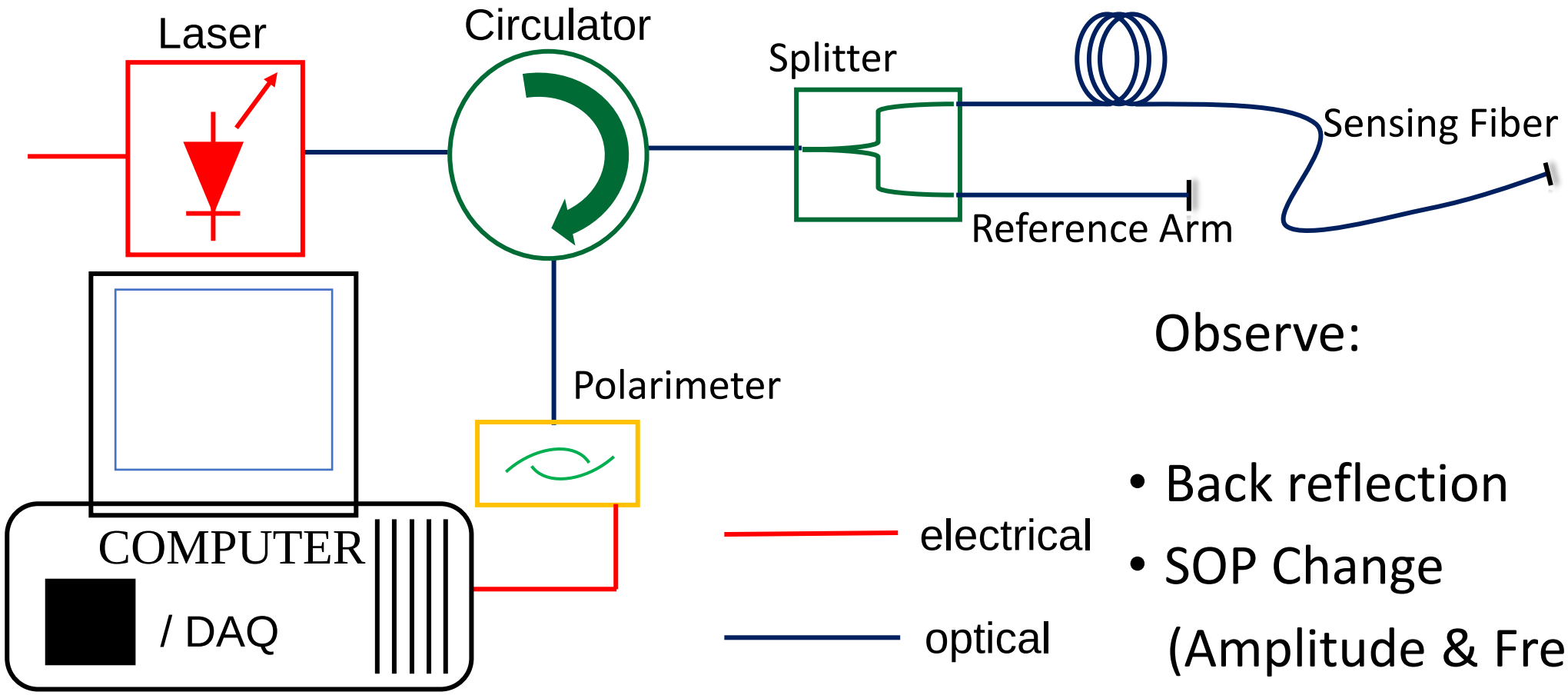
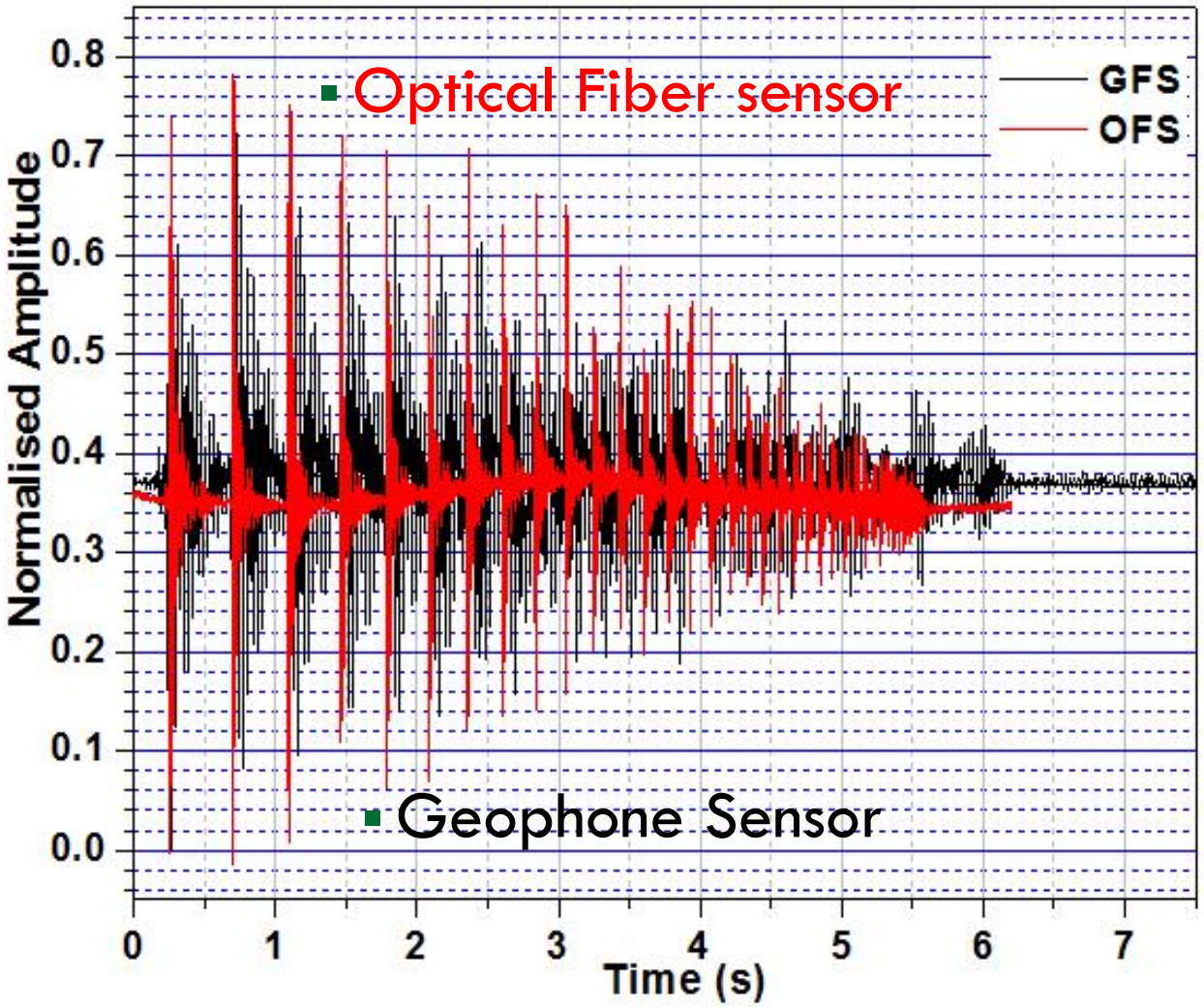
Polarization based interferometric sensor setup



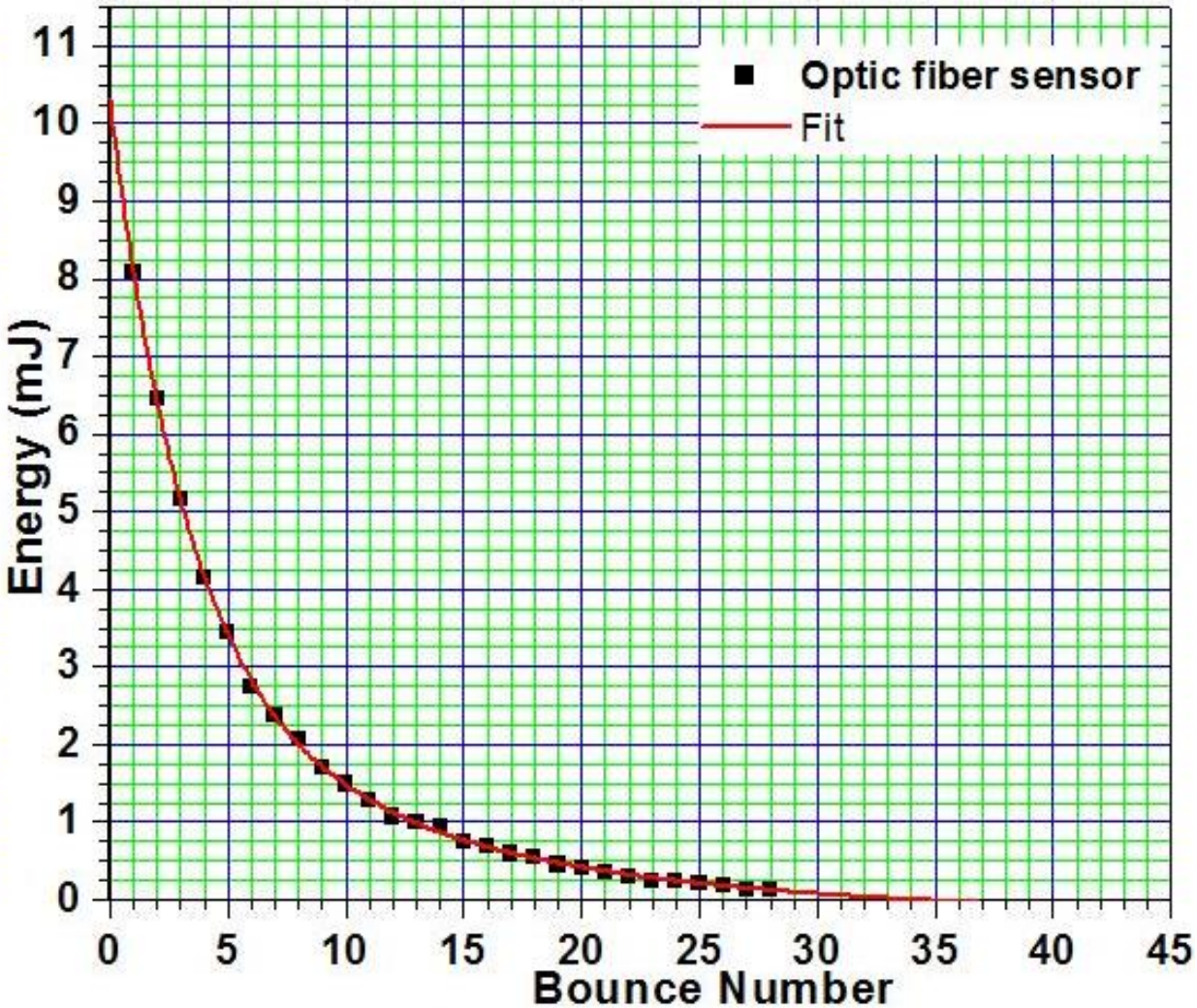
Observe:

- Back reflection
- SOP Change
  (Amplitude & Frequency)

Fiber Sensor vs Geophone Sensor



Trace Resolution



Fiber Signal Response

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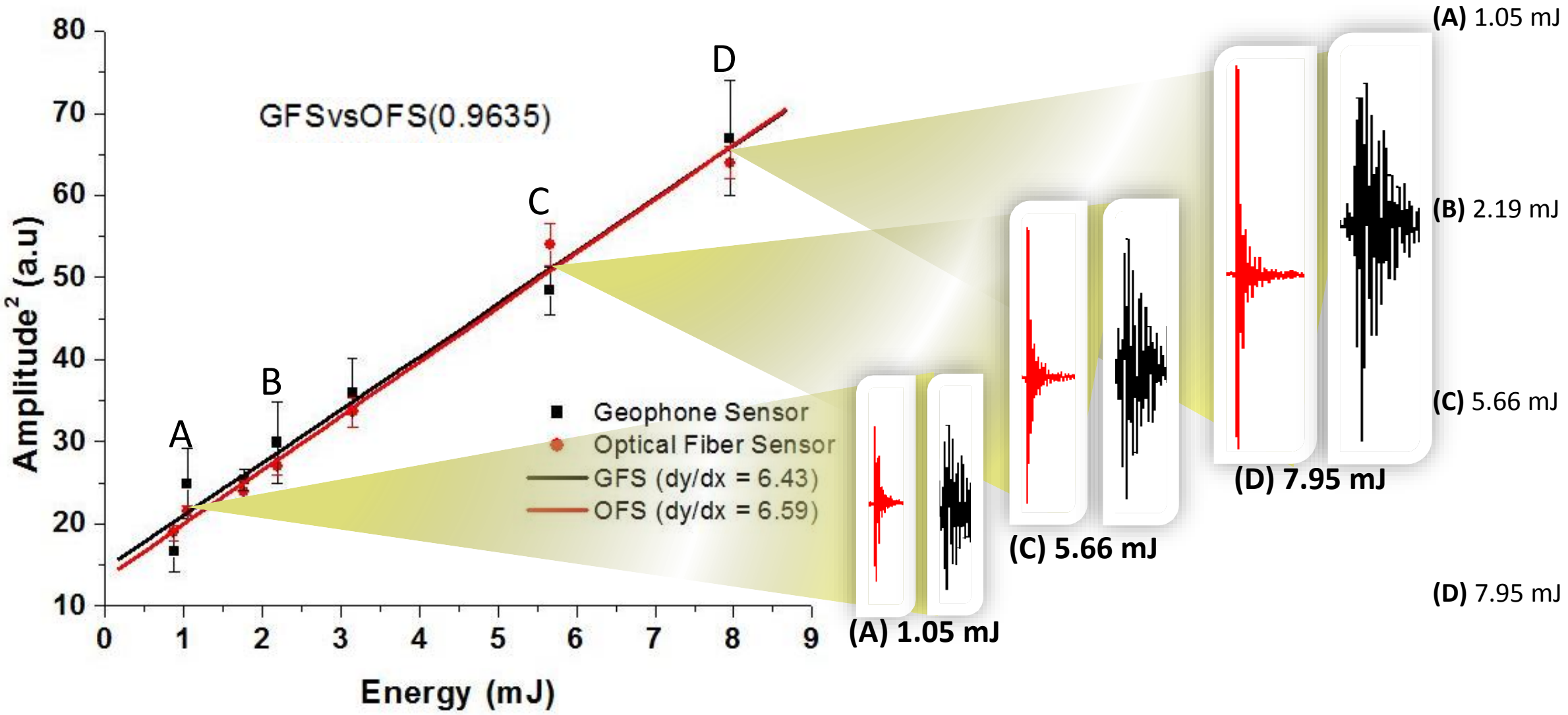
Precision, Resolution and Sensitivity



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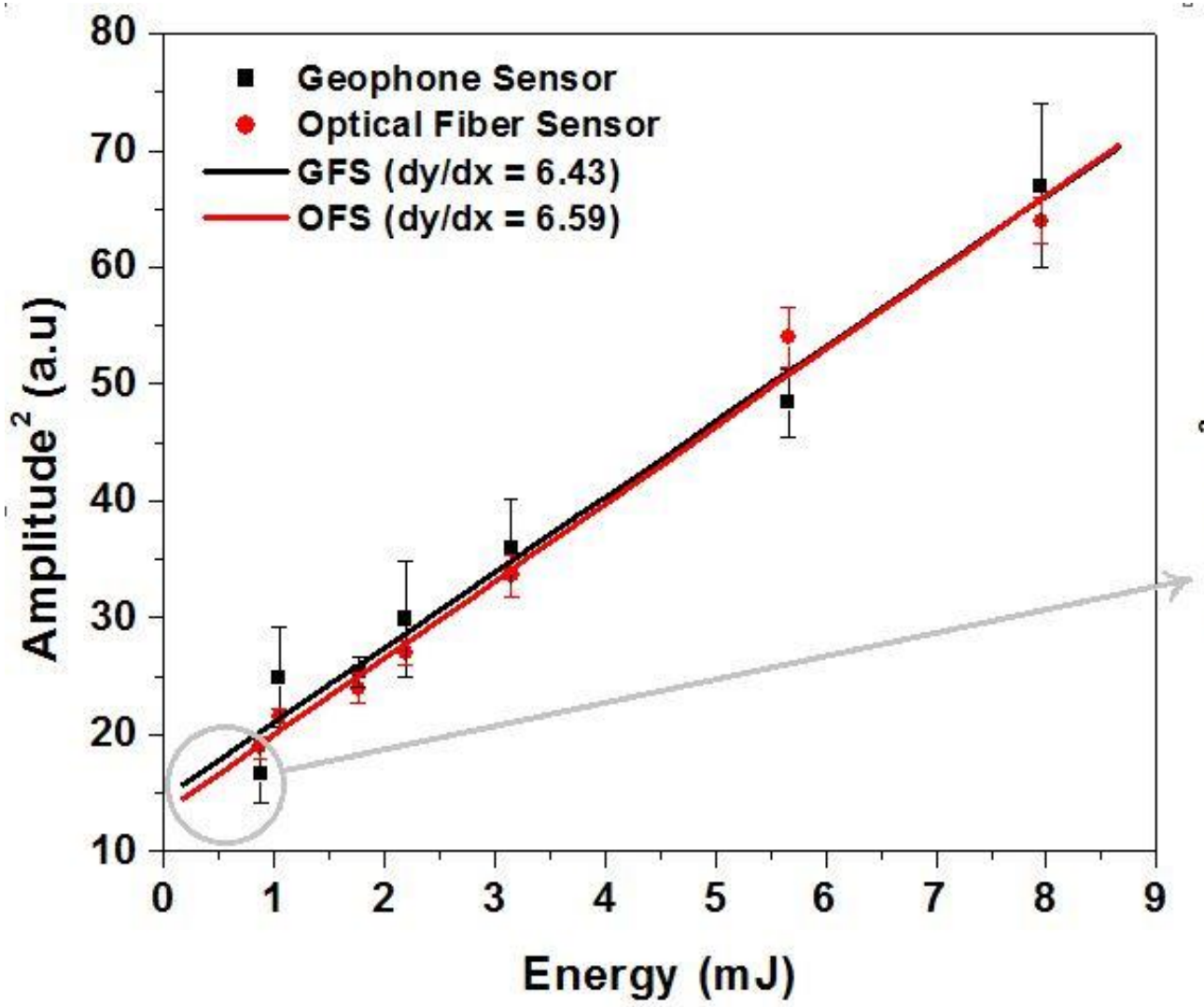
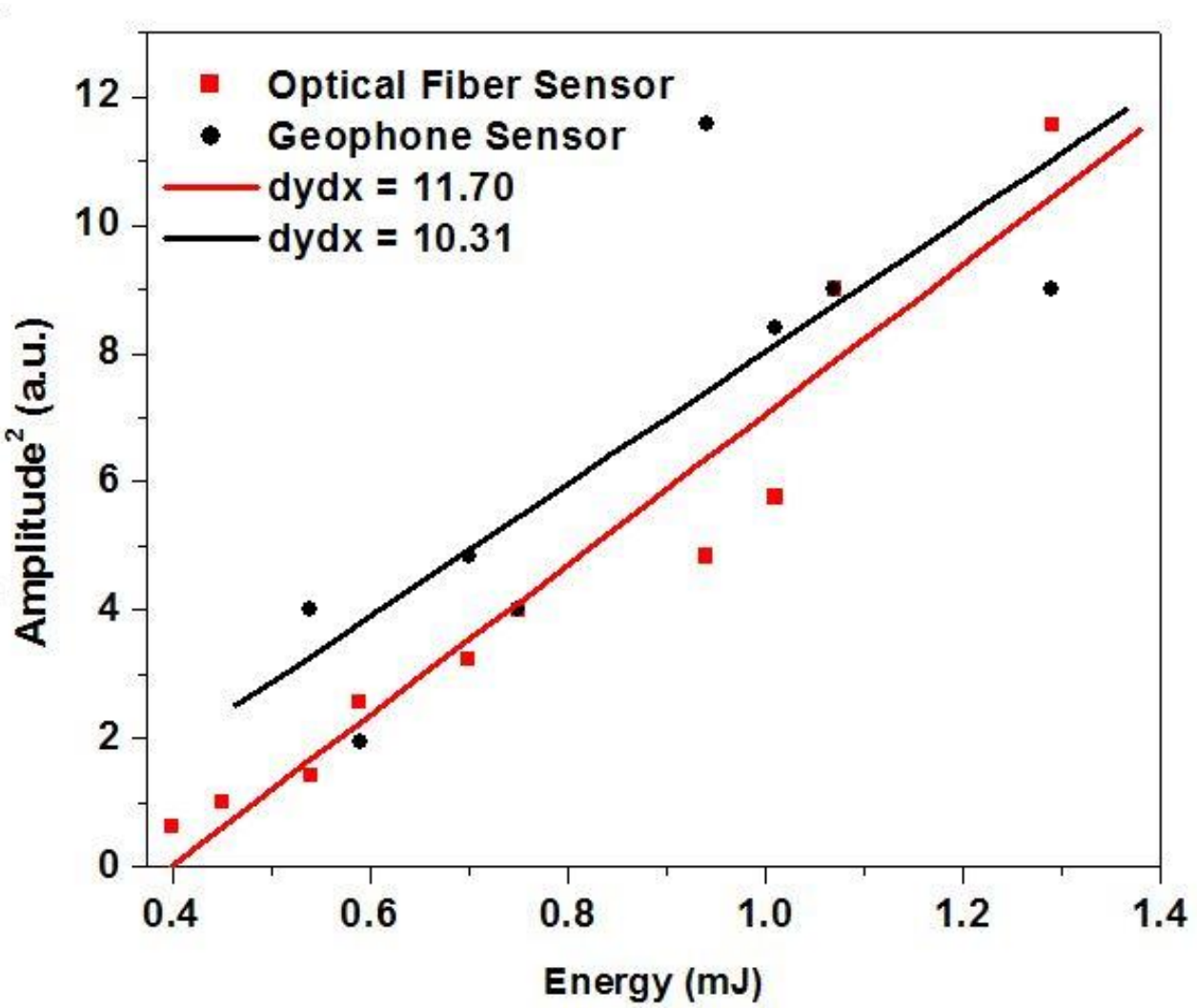
Sensitivity Analysis





Sensitivity: OFS slope > GFS slope

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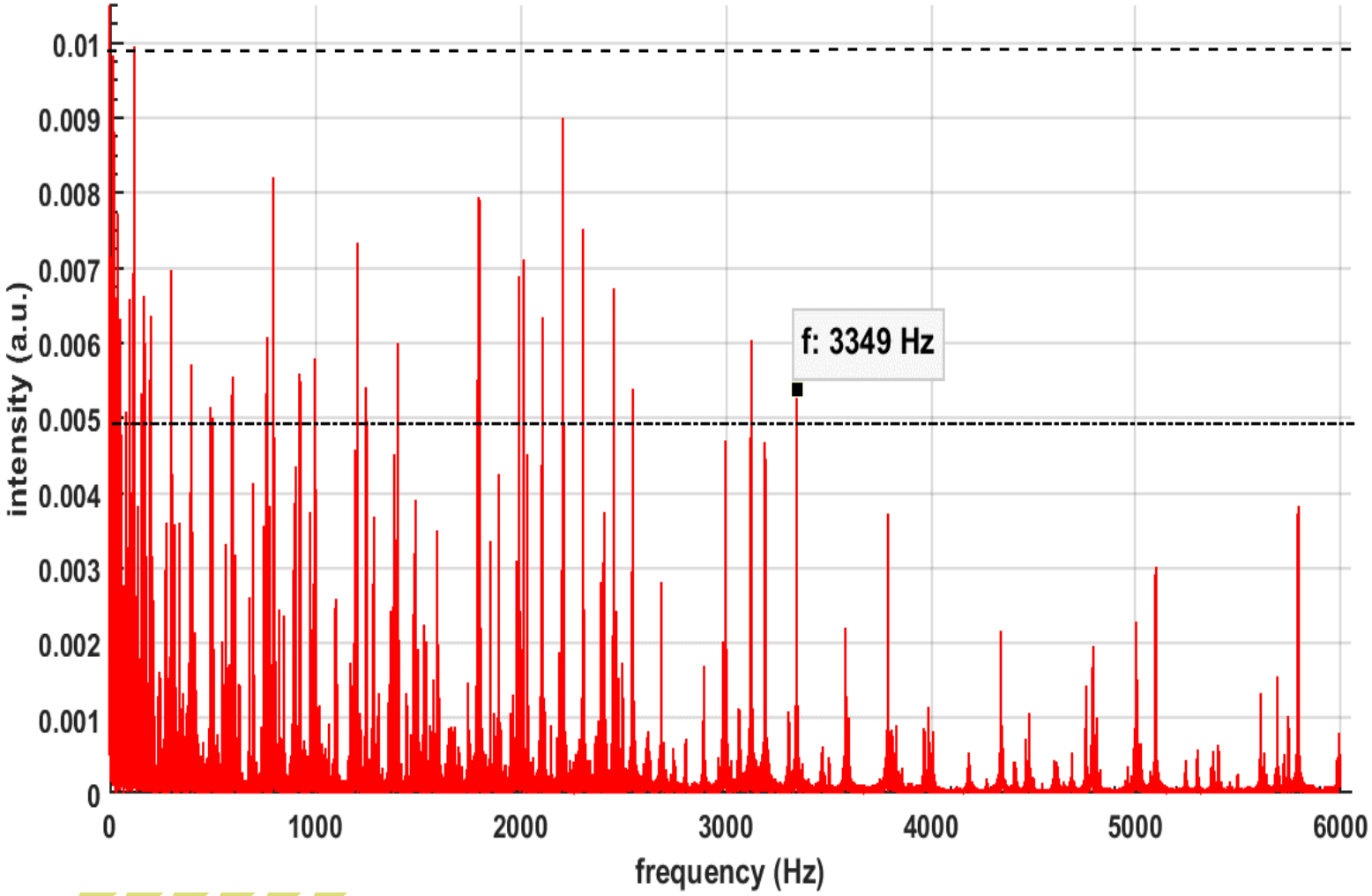
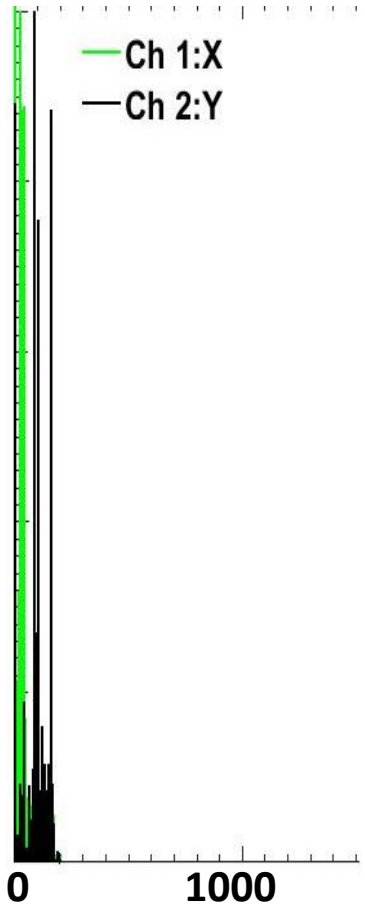
Frequency Response & Bandwidth





- Optical Fiber sensor
- Geophone Sensor

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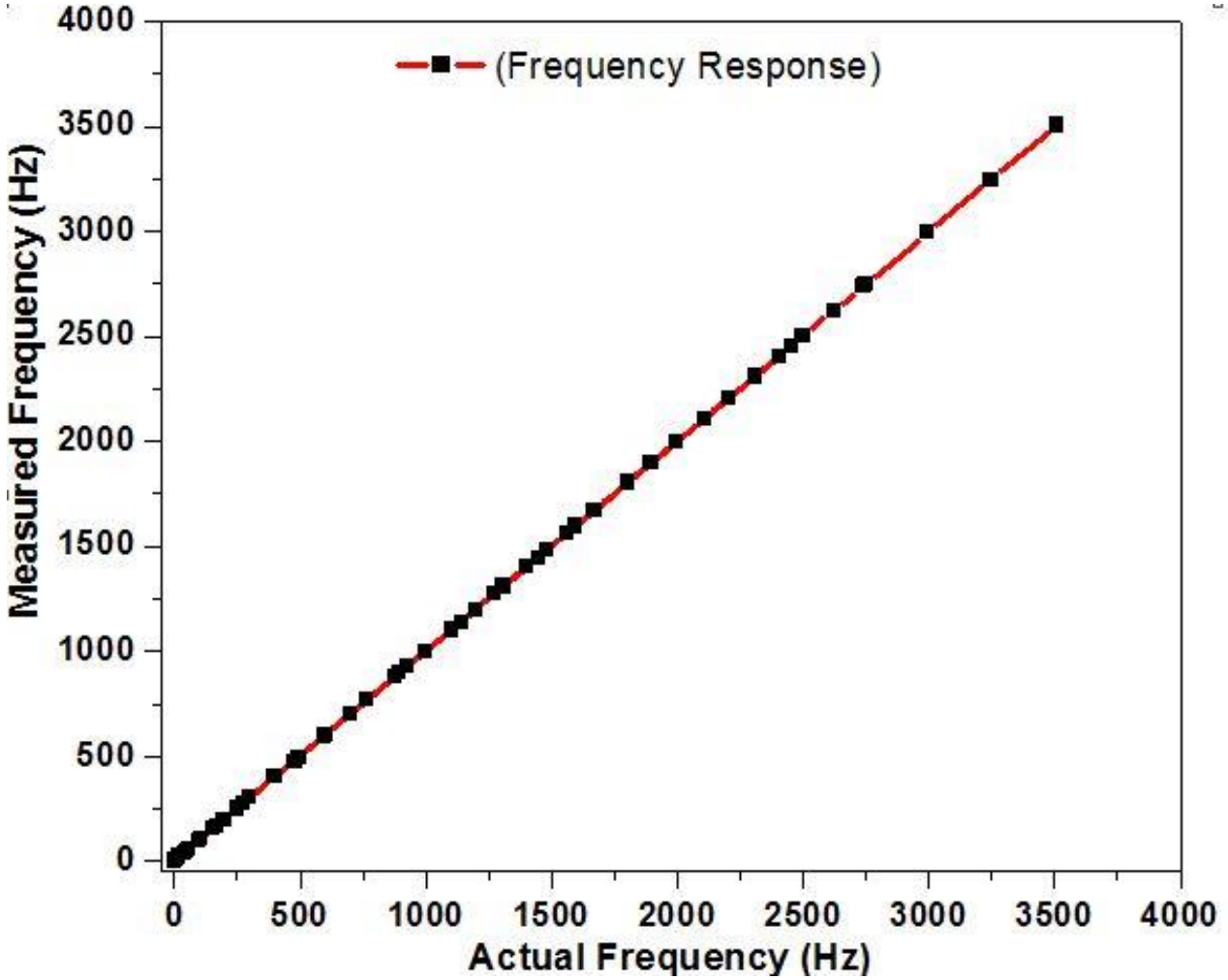
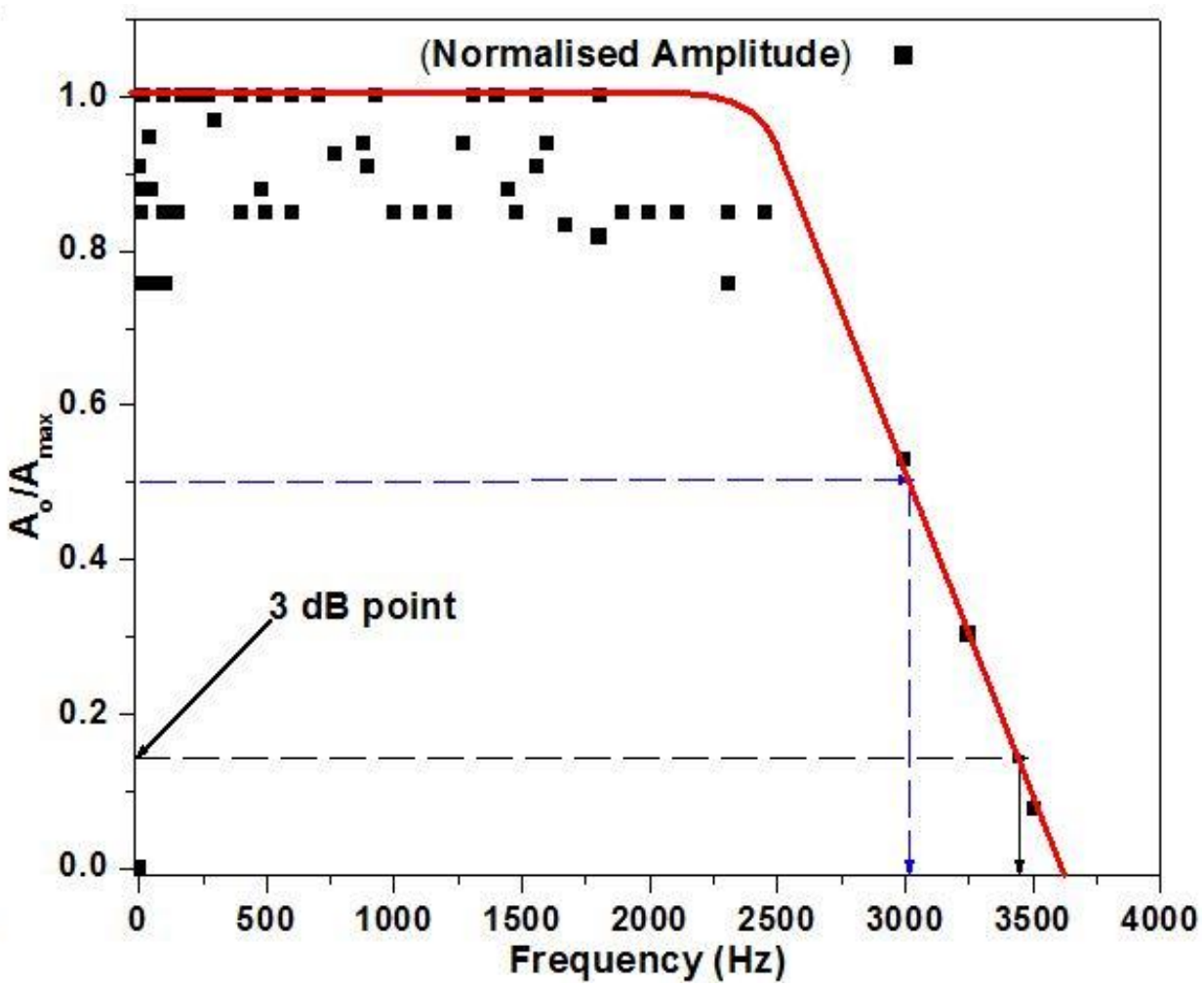
Frequency Response & Bandwidth





- Max 3% relative error

Bandwidth: 3447 Hz

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Summary

- Fiber Sensor has superior performance:
  resolution, precision and sensitivity
  effective for very weak rapidly varying signals
  (reliable for detection, monitoring and quantifying fields for measurement)
- Optical fiber sensing mechanism supports short response and recovery times
- Trace content/data: more information and finer detail of monitored field variables
- Sensor Bandwidth is 3.447 kHz, >21 times that of the geophone

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Thank you!

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acknowledgements

Telkom

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