CHARACTERIZATION OF FRACTURED ROCKS BASED ON SEISMIC MEASUREMENTS AND GEOPHYSICAL BOREHOLE LOGS

Nicolas Barbosa[1] Ludovic Baron[1], Eva Caspari[1], Marco Favino[2], Andrew Greenwood[1], Jürg Hunziker[1], Rolf Krause[2], Tobias Müller[3], Beatriz Quintal[1], German Rubino[4]

1 Institute of Earth Sciences, University of Lausanne

2 Institute of Computational Science, USI

3 CSIRO, Perth, Australia

4 Bariloche Atomic Center, CONICET, Argentina

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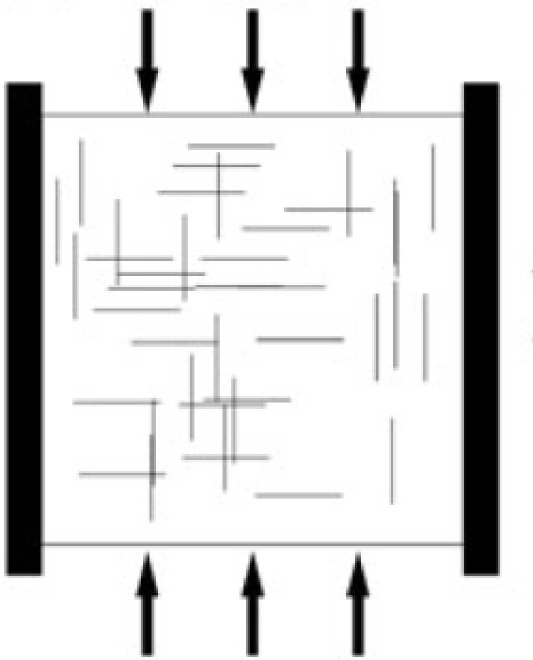
OUTLINE

- Numerical simulations
- Vertical seismic profiling
- Geophysical borehole logging

NUMERICAL SIMULATIONS



$$M_c(\omega) = \frac{\sigma(\omega)}{\varepsilon}$$

$$v_c(\omega) = \sqrt{\frac{M_c(\omega)}{\rho}}$$

$$v(\omega) = \left[Re\left\{ \frac{1}{v_c(\omega)} \right\} \right]^{-1}$$

$$\frac{1}{Q} = \frac{Im(v_c(\omega)^2)}{Re(v_c(\omega)^2)}$$

Rubino et al., 2009, Geophysics

AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Solid Earth

RESEARCH ARTICLE

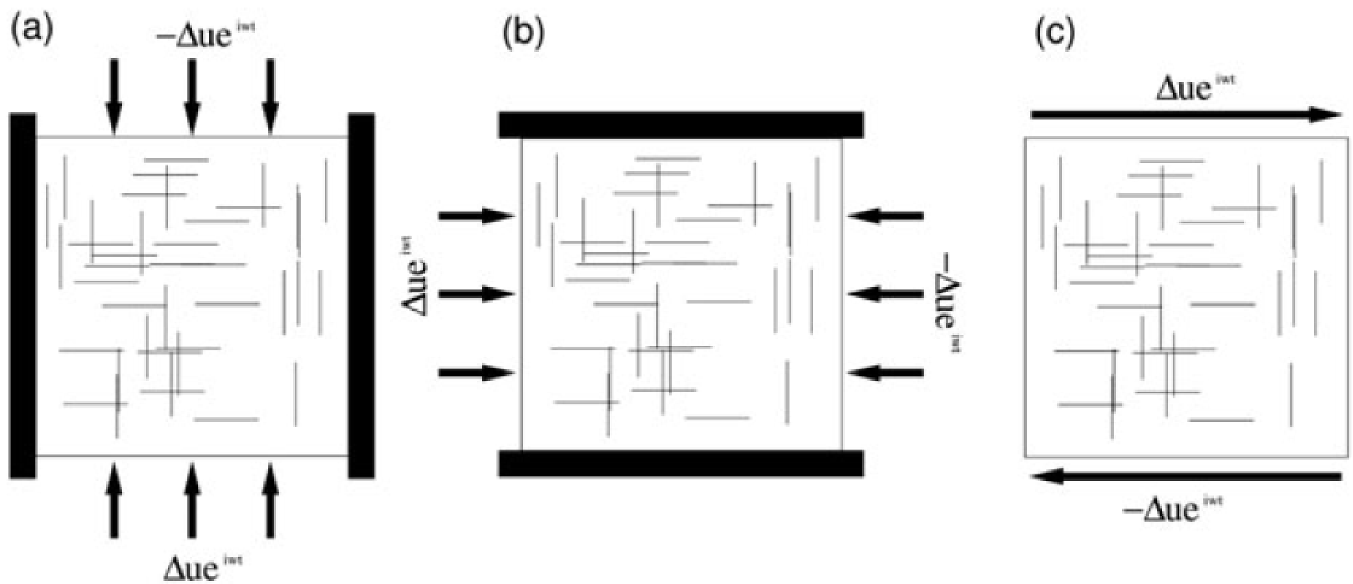
10.1002/2016JB013165

Key Points:
- We propose a numerical upscaling procedure for computing effective anisotropic seismic properties of 2-D heterogeneous porous rocks
- Unlike previous methodologies, our approach allows to compute equivalent seismic properties in

Numerical upscaling in 2-D heterogeneous poroelastic rocks: Anisotropic attenuation and dispersion of seismic waves

J. Germán Rubino[1,2], Eva Caspari[2], Tobias M. Müller[3], Marco Milani[2], Nicolás D. Barbosa[2], and Klaus Holliger[2]

[1]Now at Department of Earth Sciences, University of Western Ontario, London, Ontario, Canada, [2]Applied and Environmental Geophysics Group, Institute of Earth Sciences, University of Lausanne, Lausanne, Switzerland, [3]Commonwealth Scientific and Industrial Research Organization, Energy, Perth, Western Australia, Australia



Geophysical Journal International

Geophys. J. Int. (2017) **210**, 223–227
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GJI Marine geosciences and applied geophysics

doi: 10.1093/gji/ggx159

EXPRESS LETTER

Fracture connectivity can reduce the velocity anisotropy of seismic waves

J. Germán Rubino,[1] Eva Caspari,[2] Tobias M. Müller[3] and Klaus Holliger[2]

[1] *CONICET, Centro Atómico Bariloche - CNEA, San Carlos de Bariloche, Argentina. E-mail: german.rubino@cab.cnea.gov.ar*
[2] *Applied and Environmental Geophysics Group, Institute of Earth Sciences, University of Lausanne, Lausanne, Switzerland*
[3] *Commonwealth Scientific and Industrial Research Organization, Energy, Perth, Australia*

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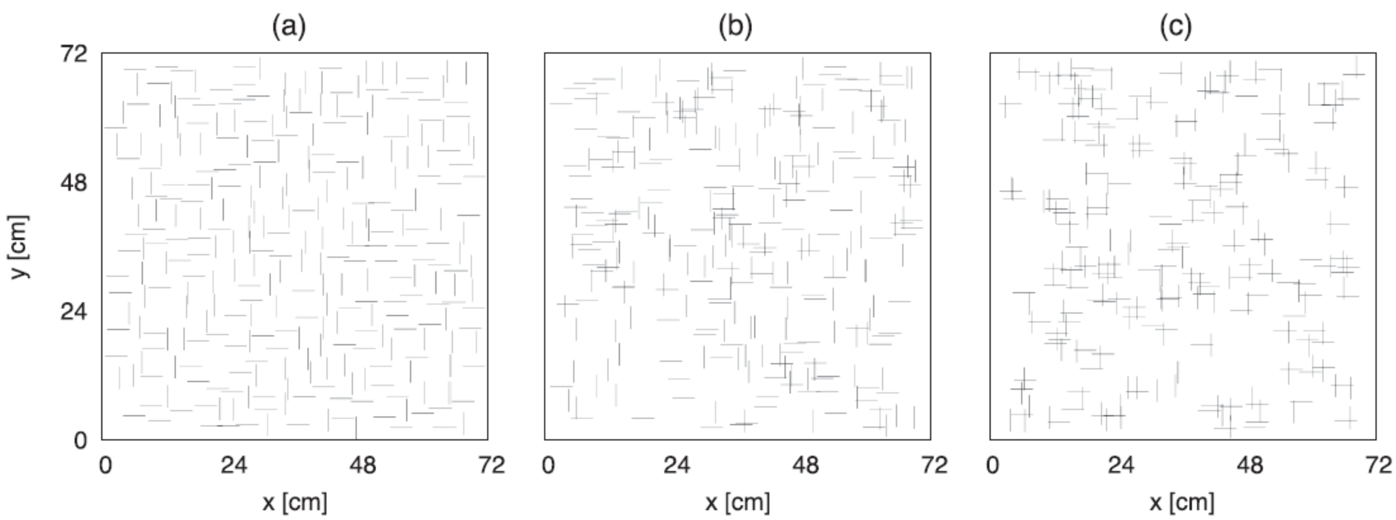
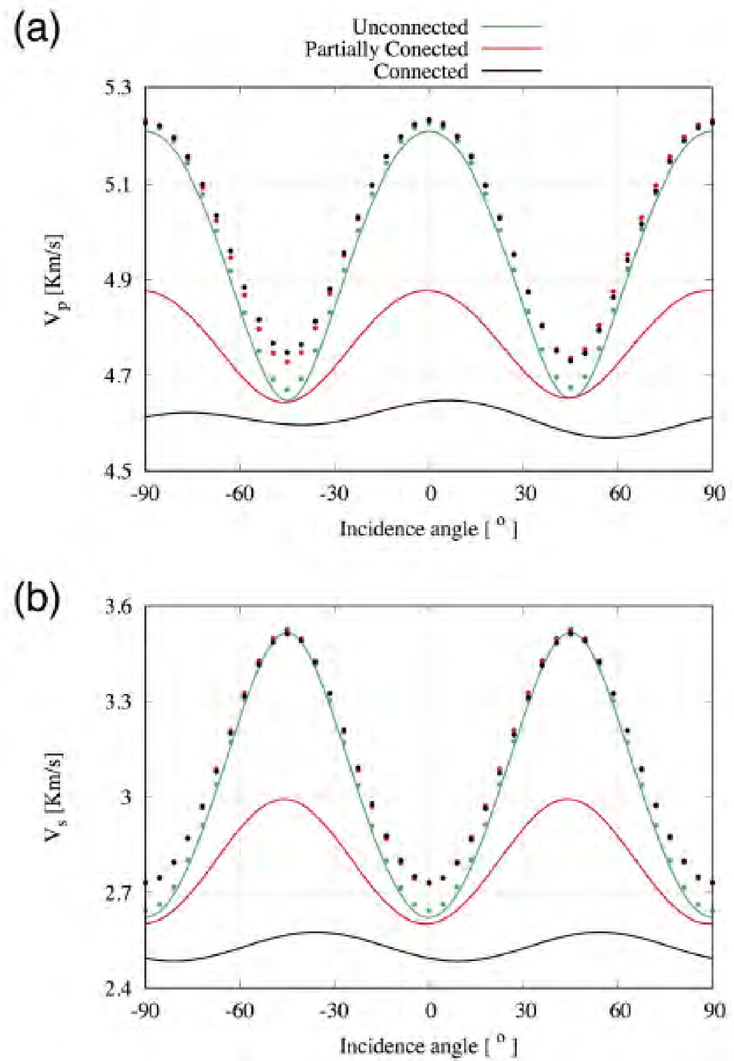
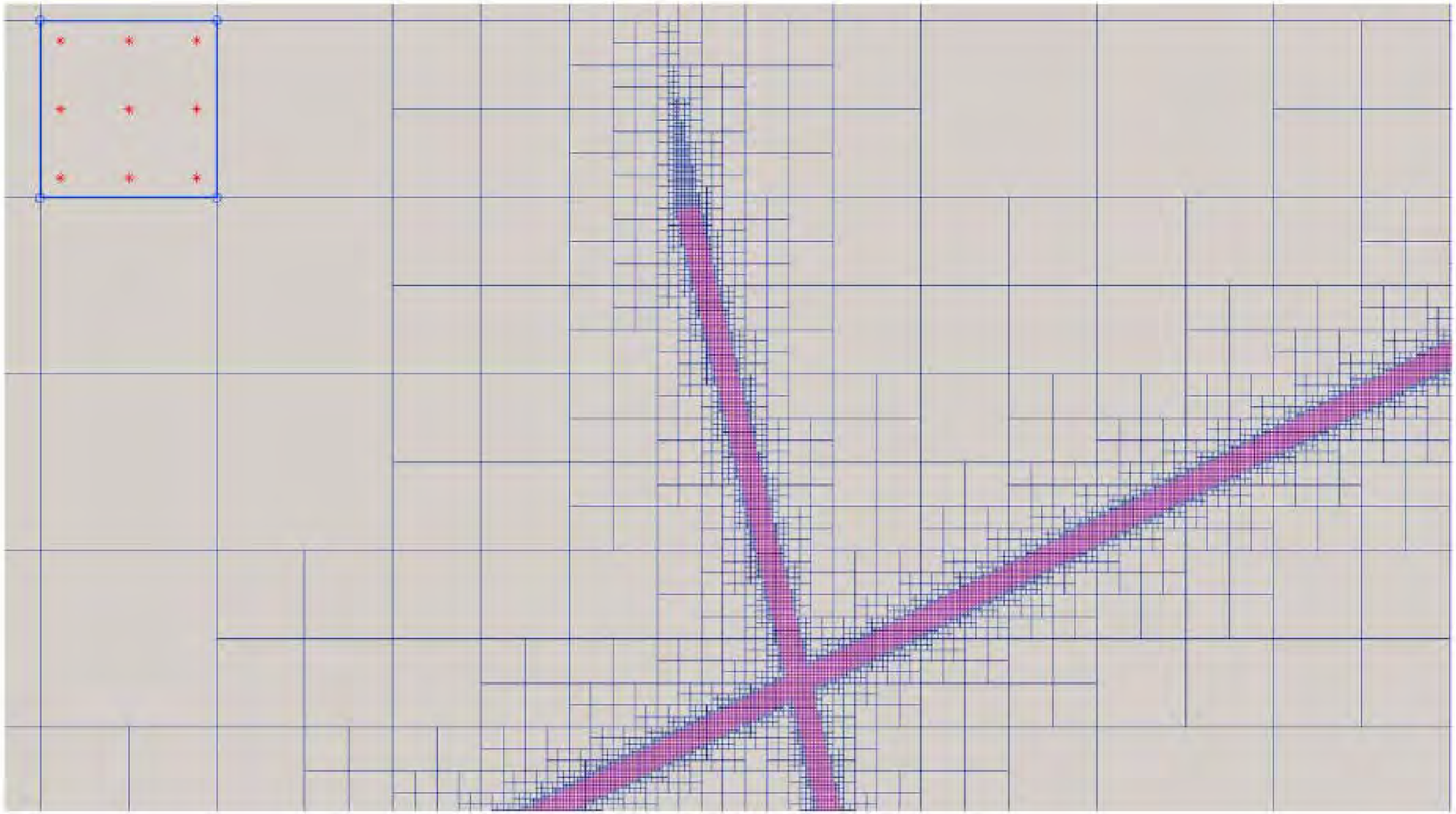


NUMERICAL SIMULATIONS

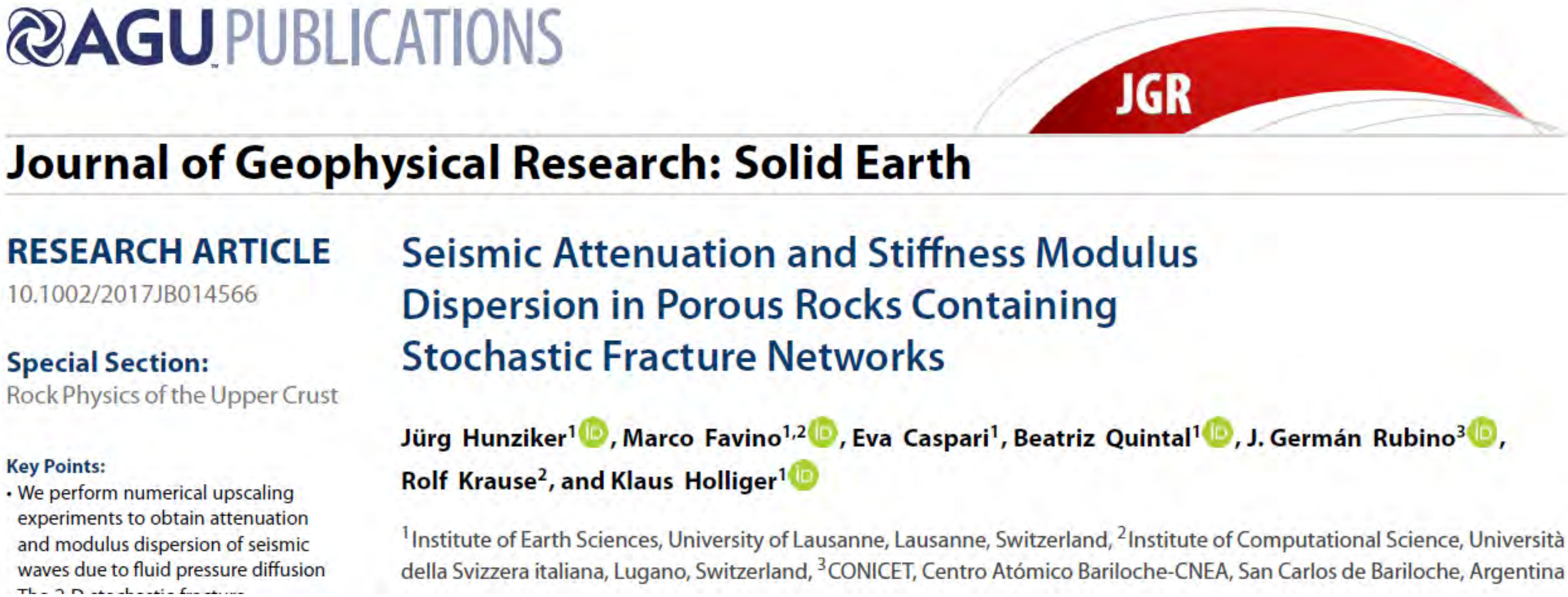


Rubino et al., Geophysical Journal International, 2017

NUMERICAL SIMULATIONS



Hunziker et al., Journal of Geophysical Research, 2017
Favino et al., Journal of Computational Physics, under review


AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Solid Earth

RESEARCH ARTICLE

10.1002/2017JB014566

Special Section:

Rock Physics of the Upper Crust

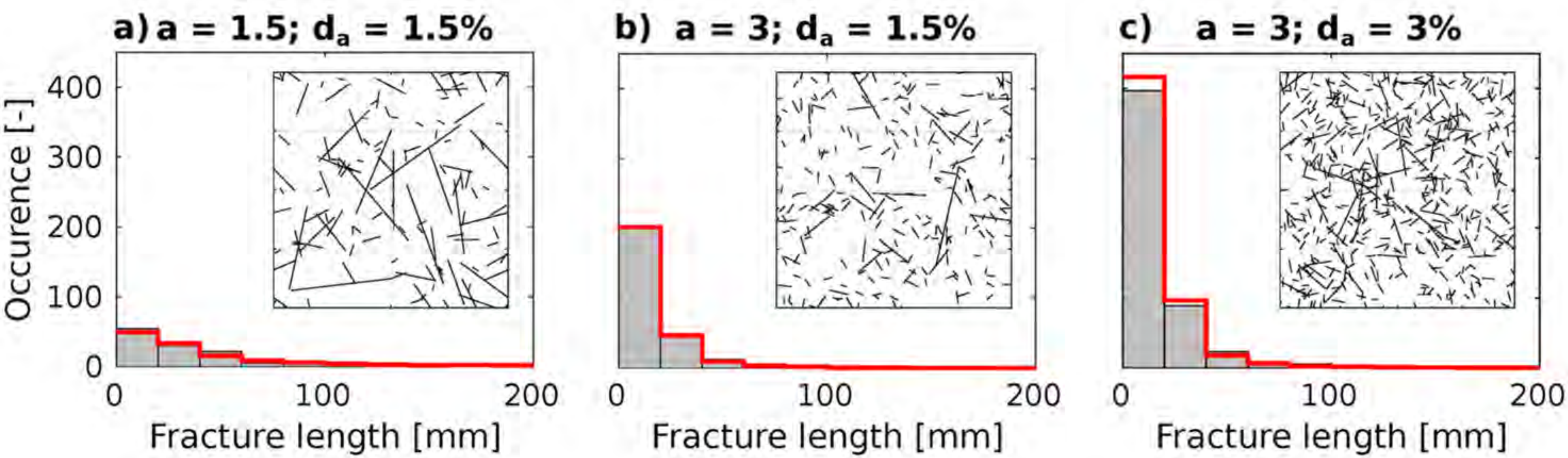
Key Points:

- We perform numerical upscaling experiments to obtain attenuation and modulus dispersion of seismic waves due to fluid pressure diffusion

Seismic Attenuation and Stiffness Modulus Dispersion in Porous Rocks Containing Stochastic Fracture Networks

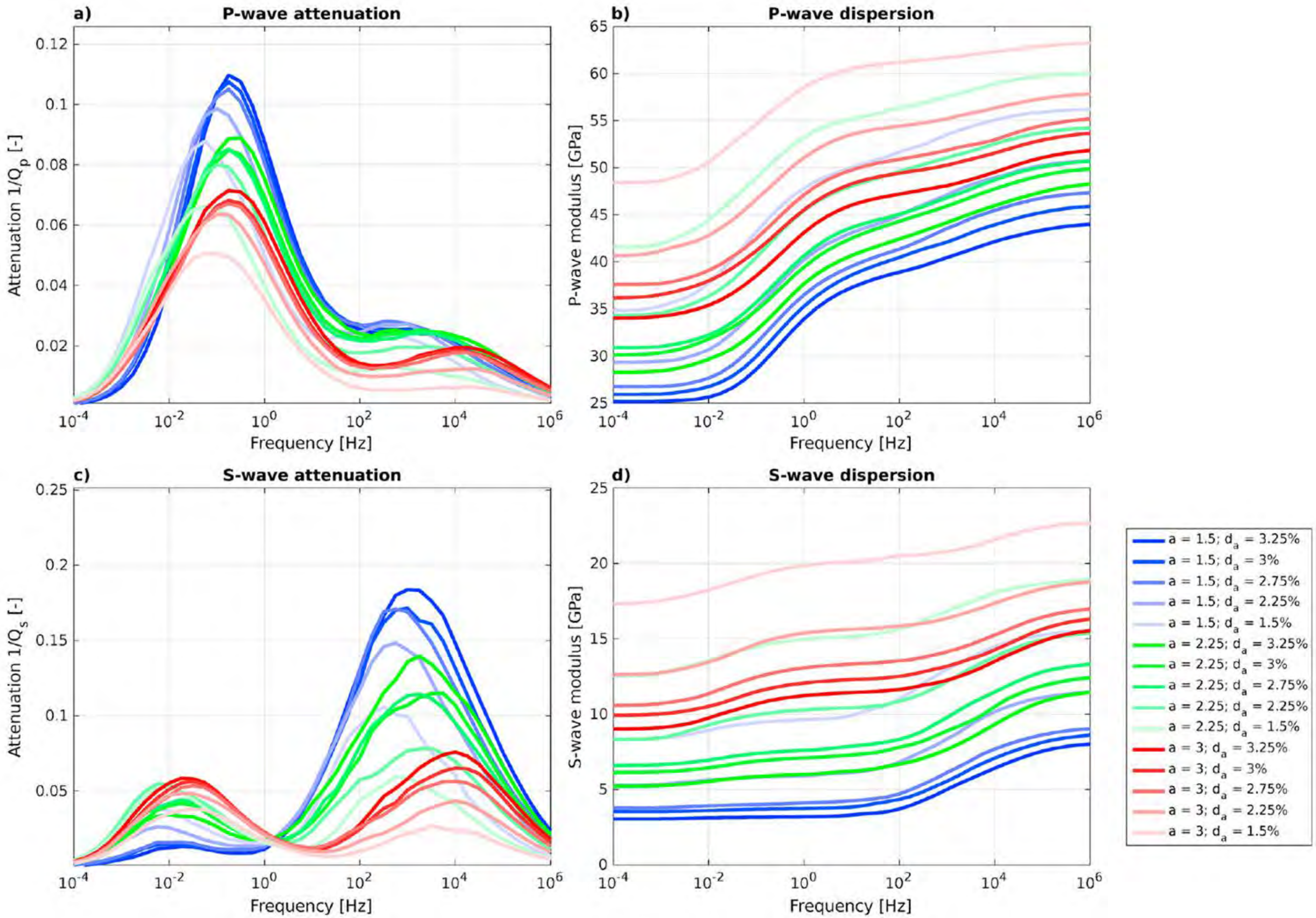
Jürg Hunziker[1], Marco Favino[1,2], Eva Caspari[1], Beatriz Quintal[1], J. Germán Rubino[3], Rolf Krause[2], and Klaus Holliger[1]

[1]Institute of Earth Sciences, University of Lausanne, Lausanne, Switzerland, [2]Institute of Computational Science, Università della Svizzera italiana, Lugano, Switzerland, [3]CONICET, Centro Atómico Bariloche-CNEA, San Carlos de Bariloche, Argentina



Hunziker et al., Journal of Geophysical Research, 2017

NUMERICAL SIMULATIONS



Hunziker et al., Journal of Geophysical Research, 2017

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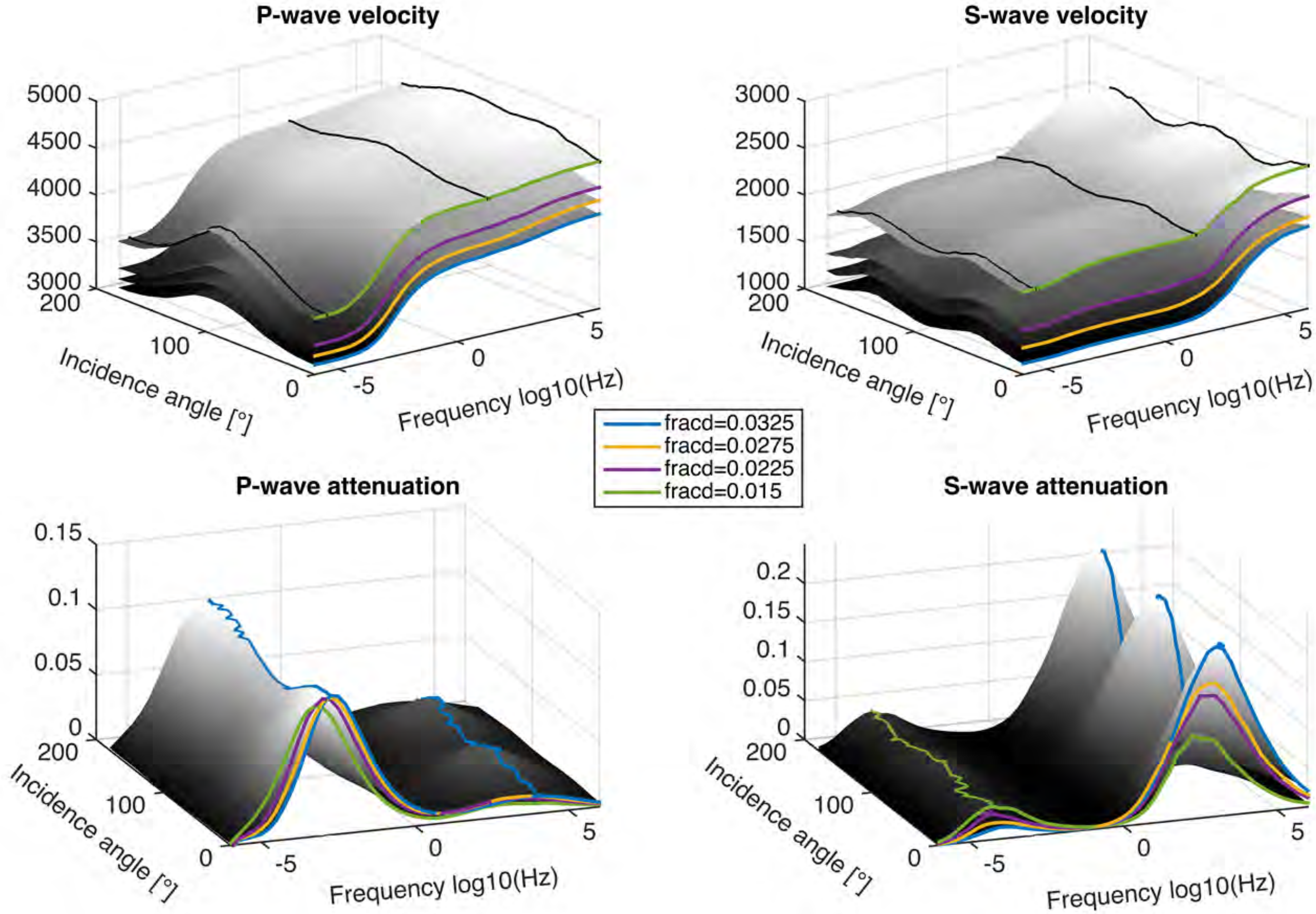
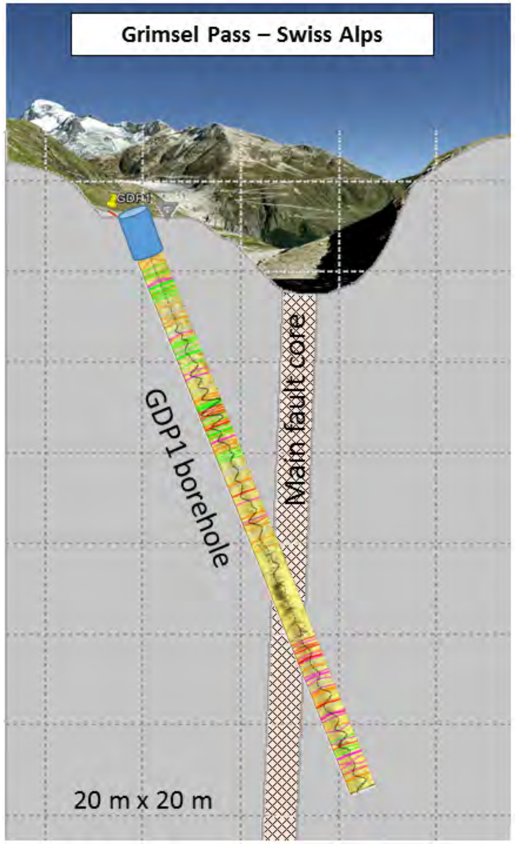
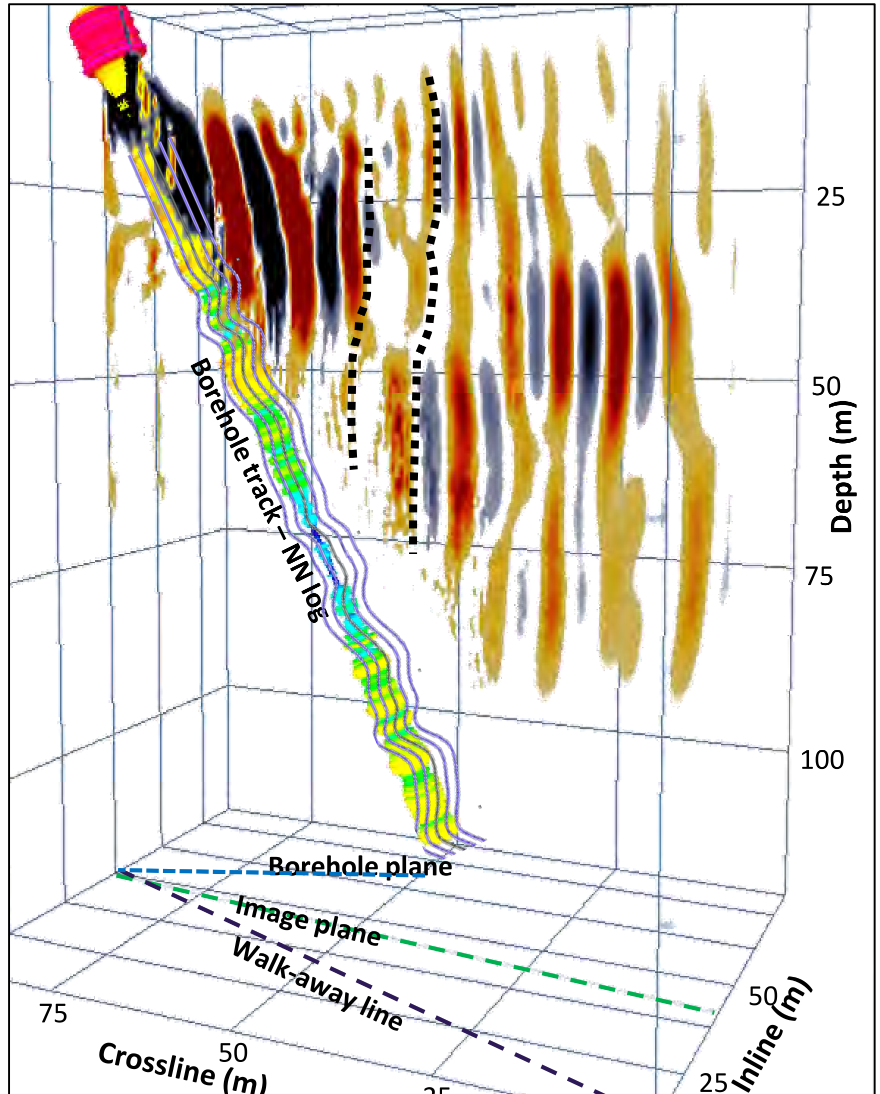
NUMERICAL SIMULATIONS



Poster Caspari et al.

VERTICAL SEISMIC PROFILING





Greenwood et al., Tectonophysics, under review

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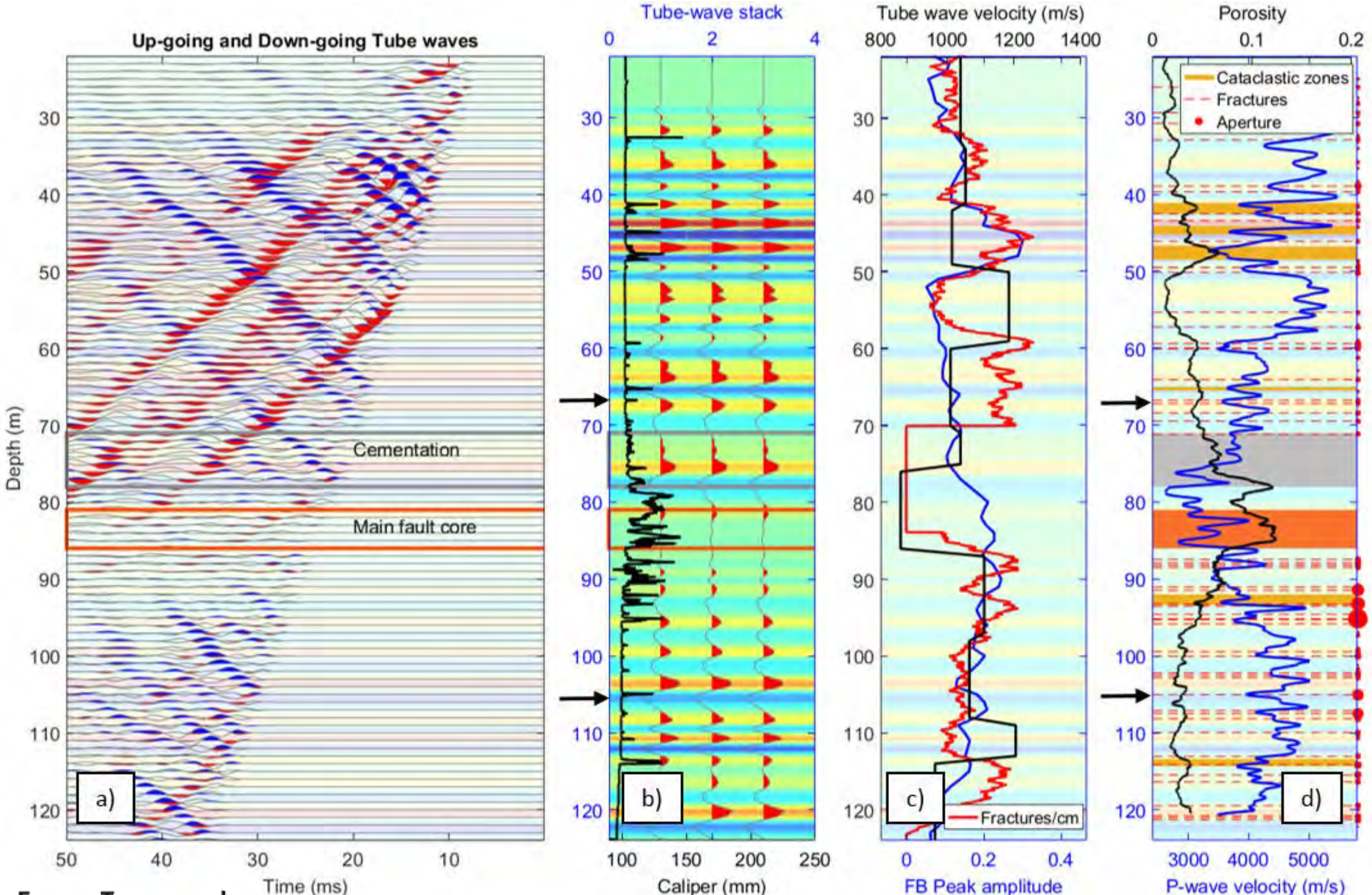

Greenwood et al., Tectonophysics, under review

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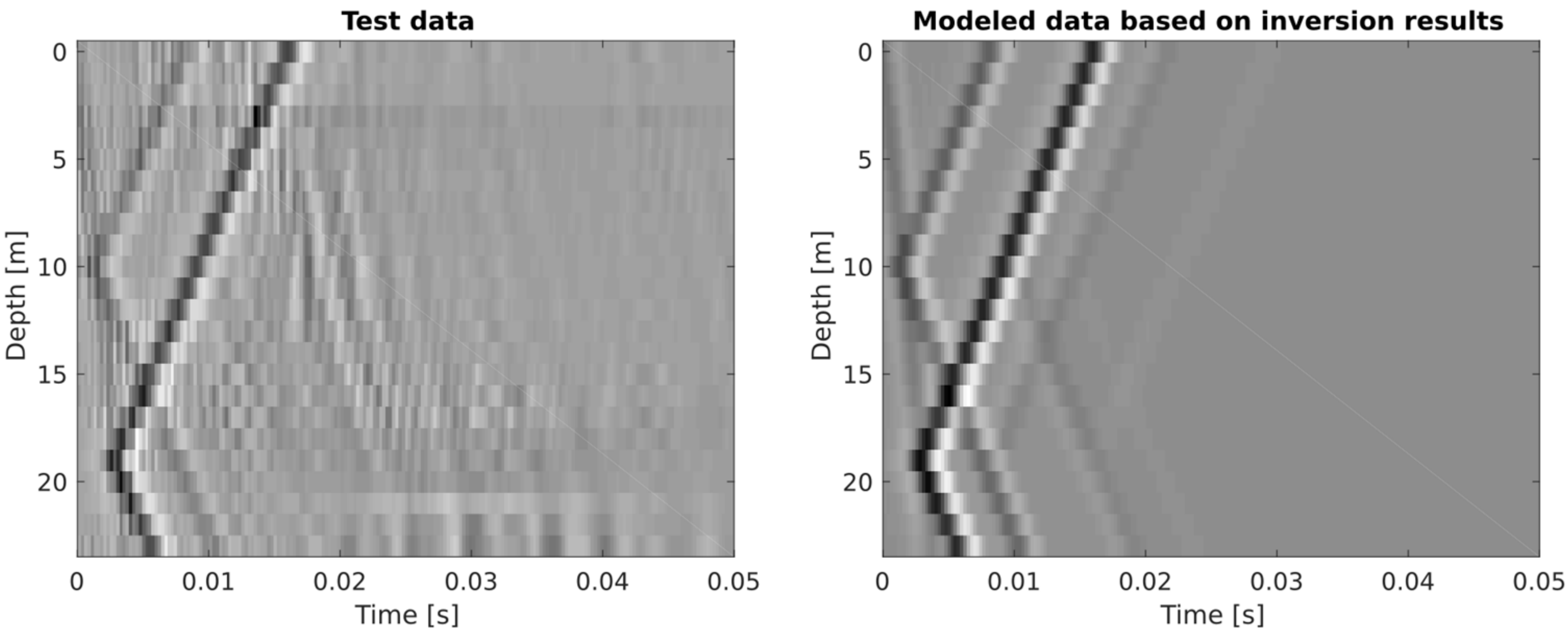

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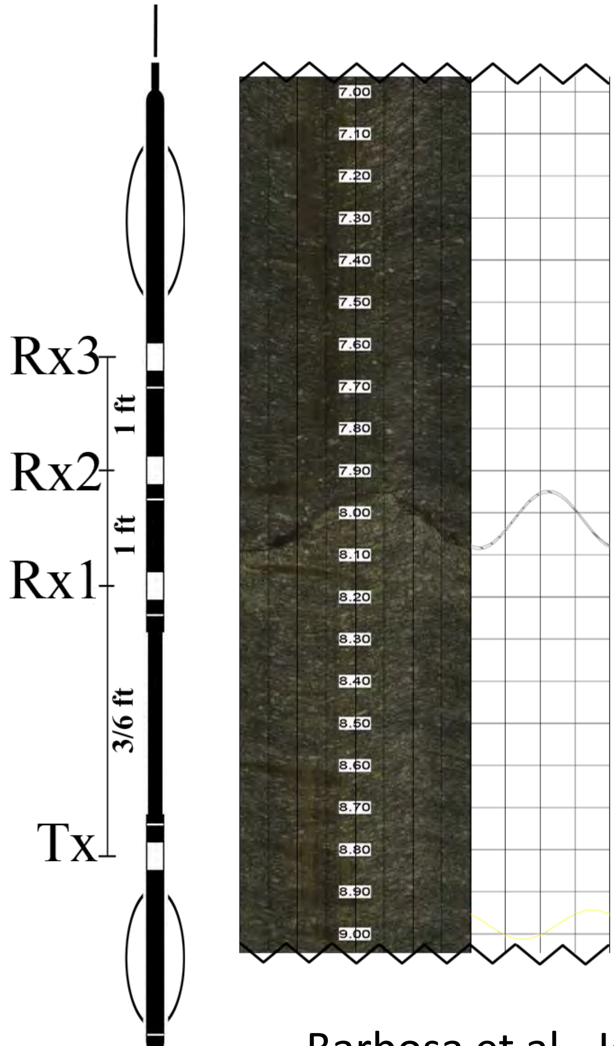
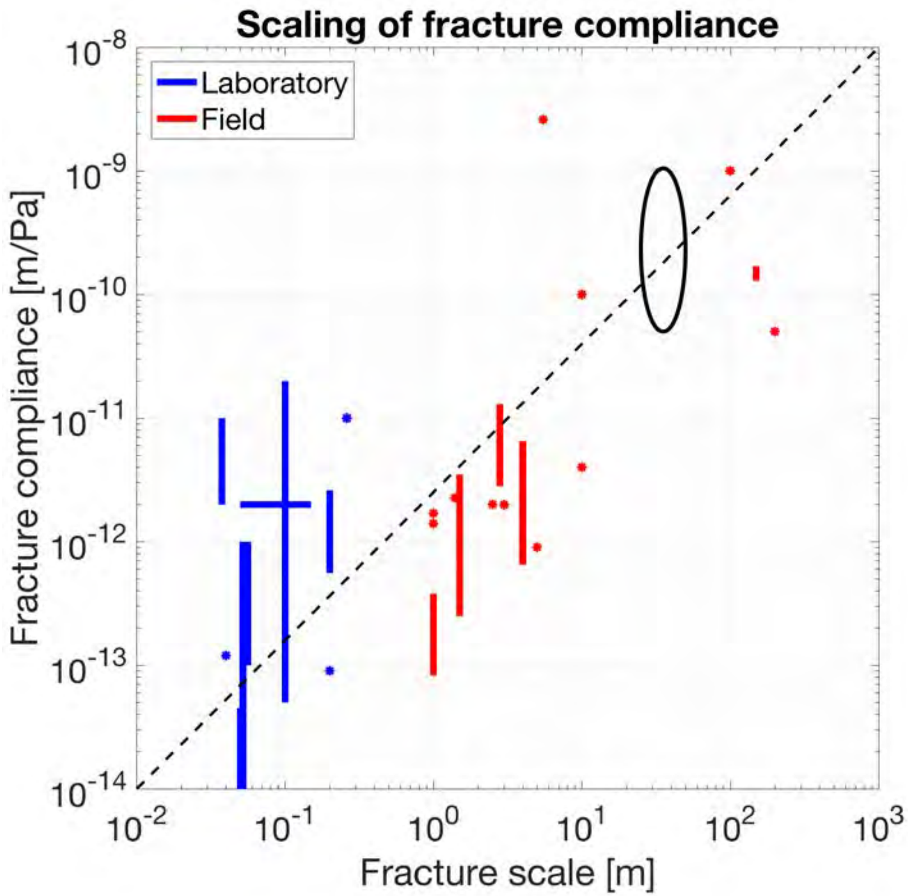
GEOPHYSICAL BOREHOLE LOGGING

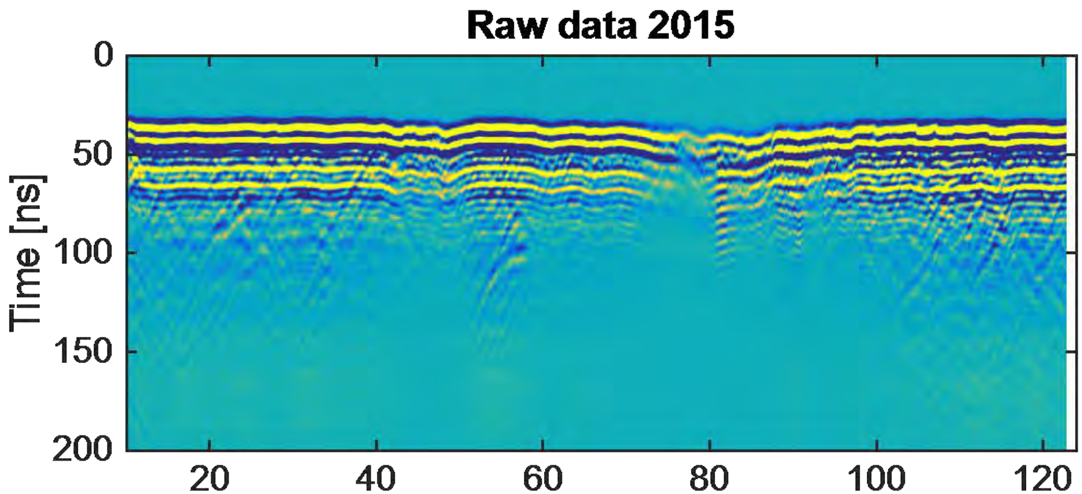


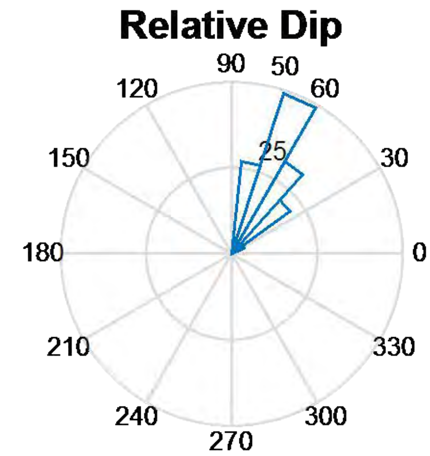


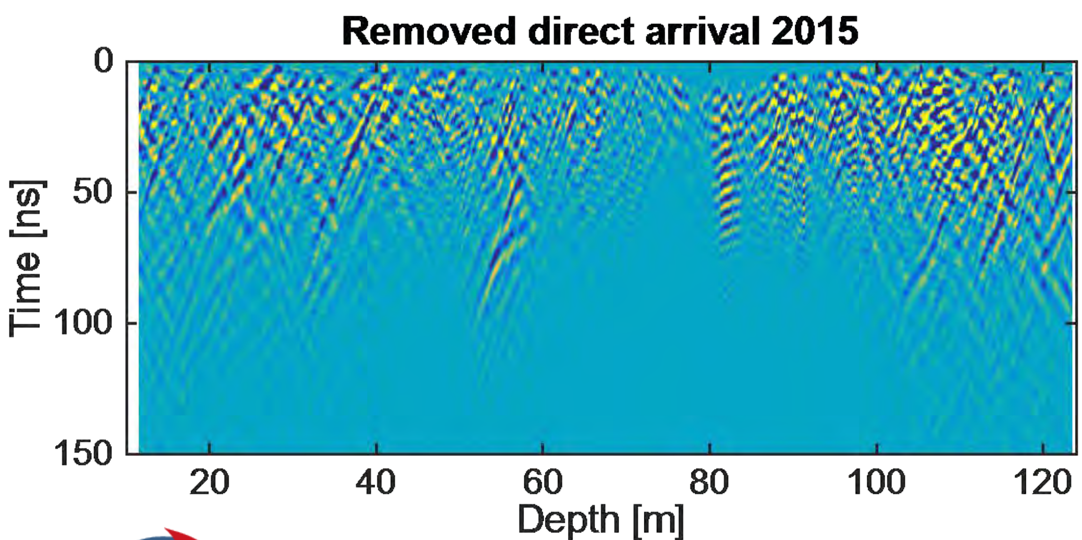
Barbosa et al., Journal of Geophysical Research, under review

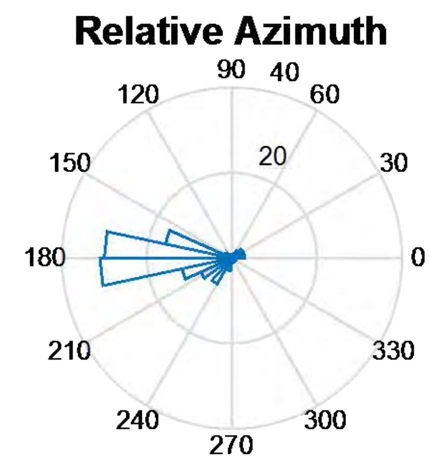
Poster Barbosa et al.

GEOPHYSICAL BOREHOLE LOGGING



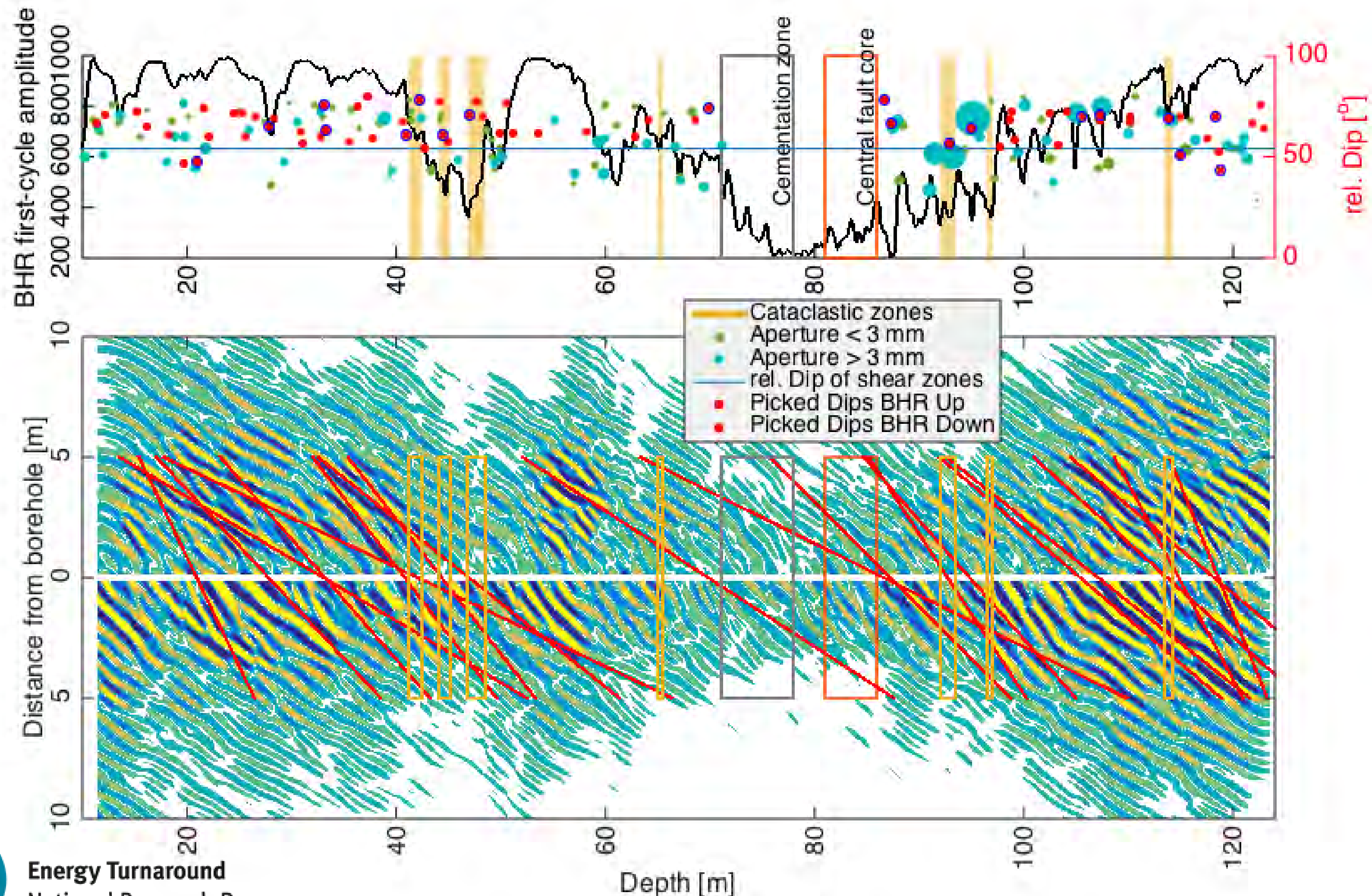






Poster Caspari et al.

GEOPHYSICAL BOREHOLE LOGGING



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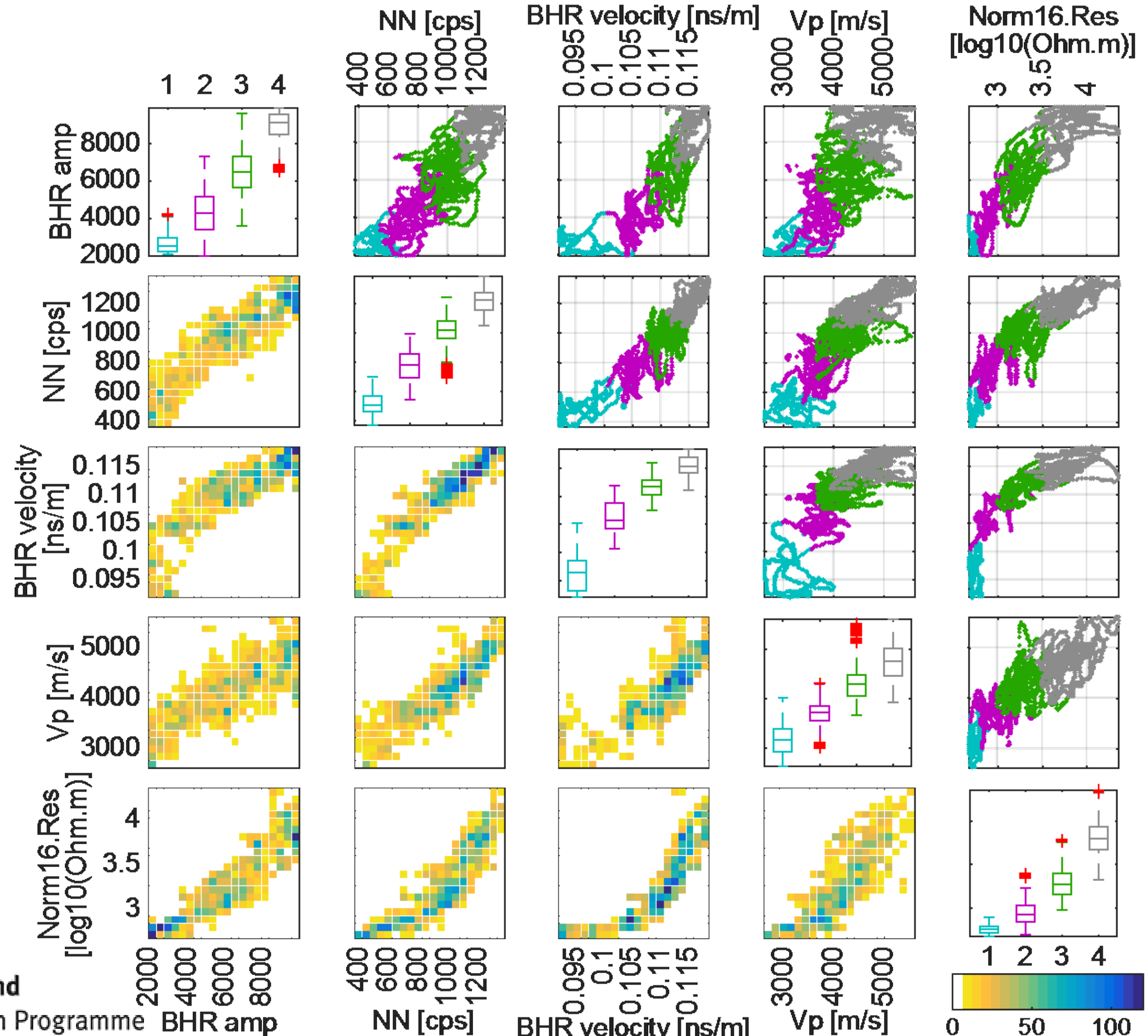

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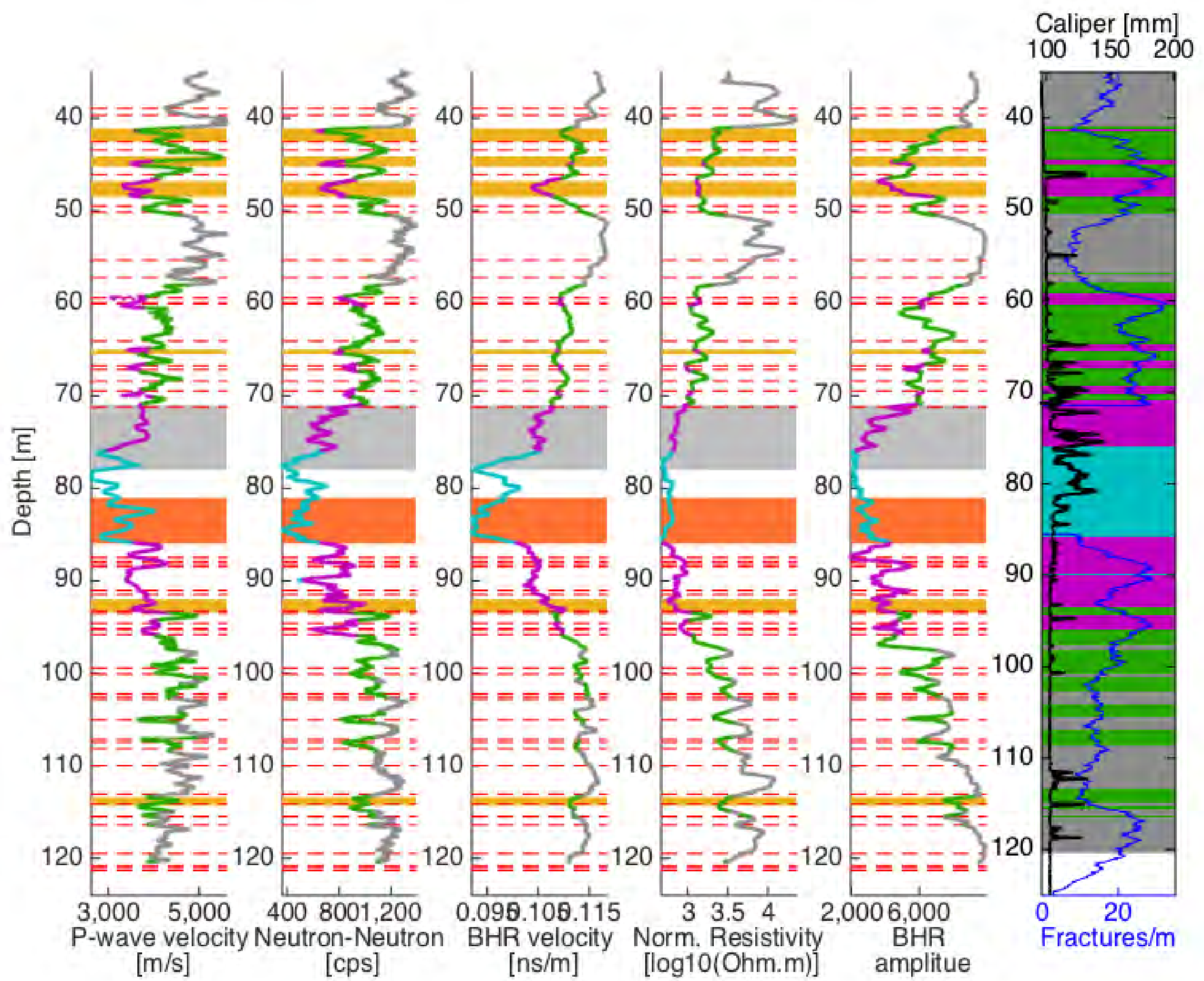

1. Main fault core

2. Intensely fractured/ cataclastic

3. Highly fractured/ large aperture fractures

4. Moderately fractured

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CONCLUSIONS

- Numerical simulation of seismic wave interaction with fractures and fracture networks of realistic complexity
- Imaging and waveform inversion of vertical seismic profiling data
- Estimation of fracture compliance from sonic log data
- Petrophysical characterization of fractured crystalline rocks based on geophysical borehole logs