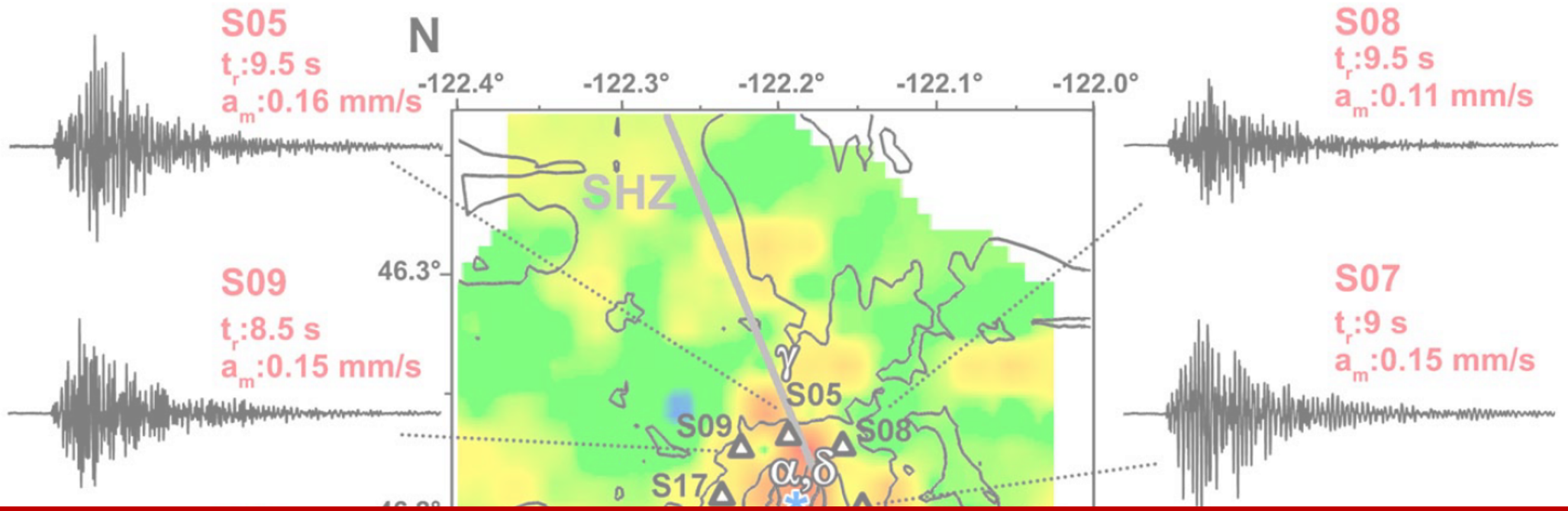
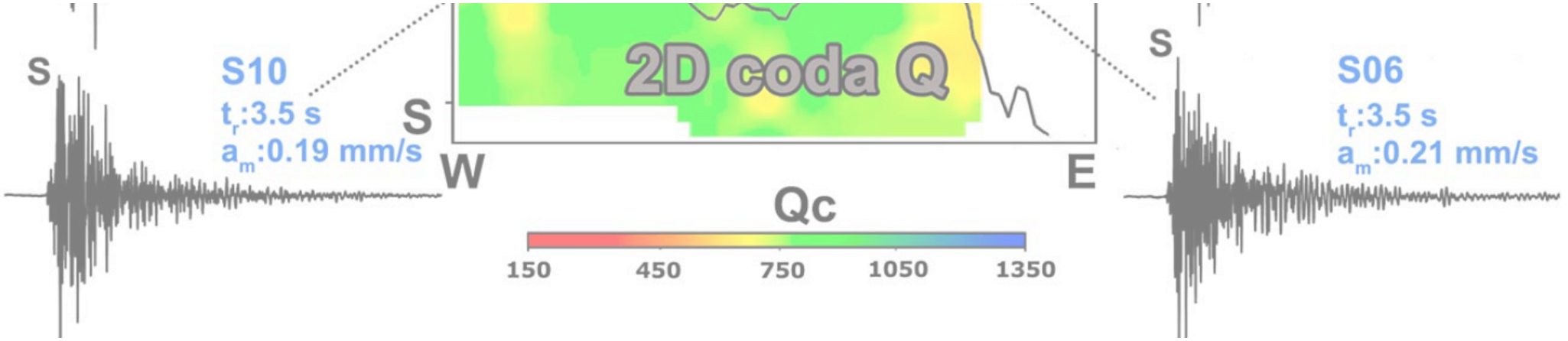


SEISMIC IMAGING OF MAGMATIC SYSTEMS FROM THE UPPER MANTLE TO THE SURFACE WITH ATTENUATION AND SCATTERING

De Siena L. – *Johannes Gutenberg Universität, Mainz, Germany*



Index

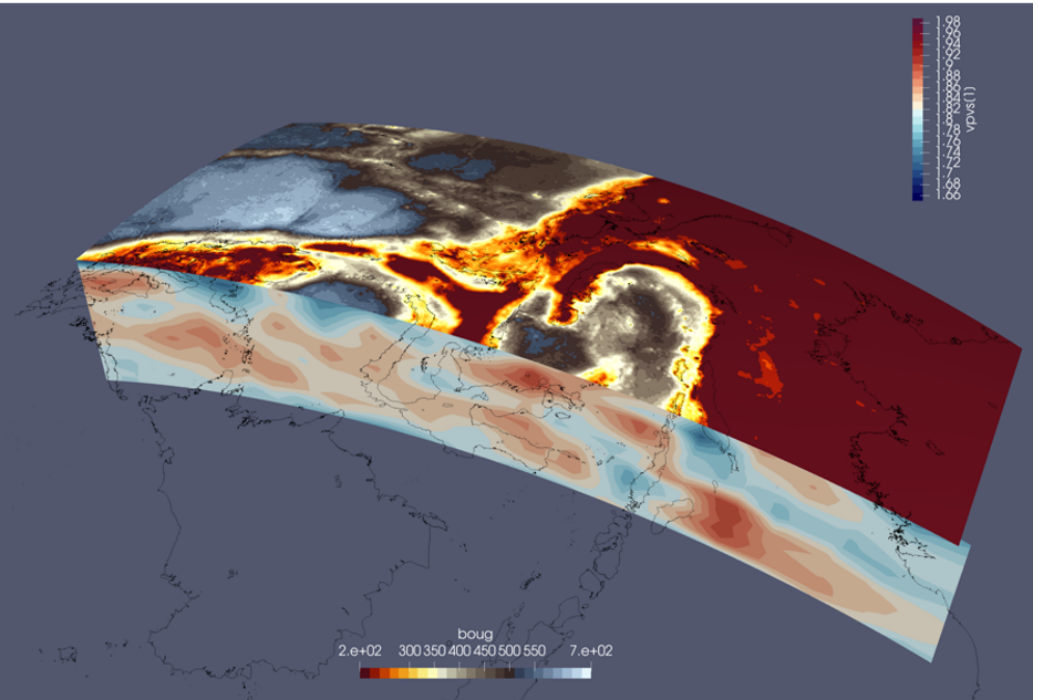
1 Imaging of the SE-Asia – Australia collision zone: Vp, Vs, and Vp/Vs

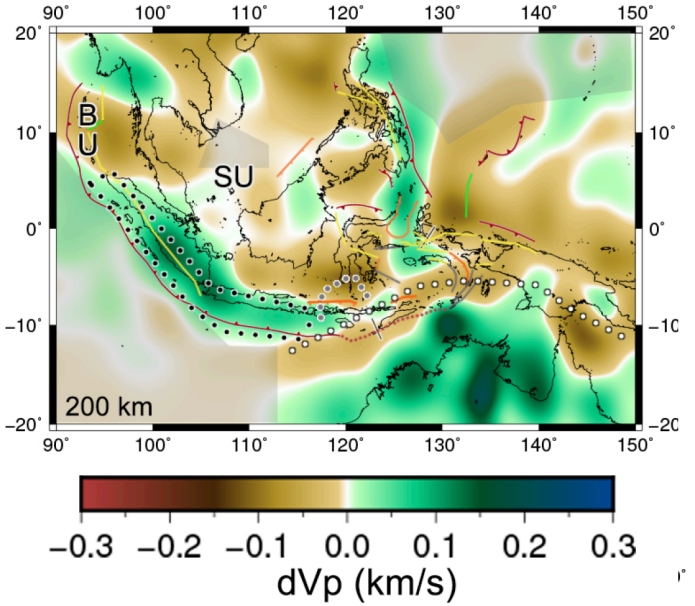
2 Attenuation and scattering tomography using stochastic wavefields

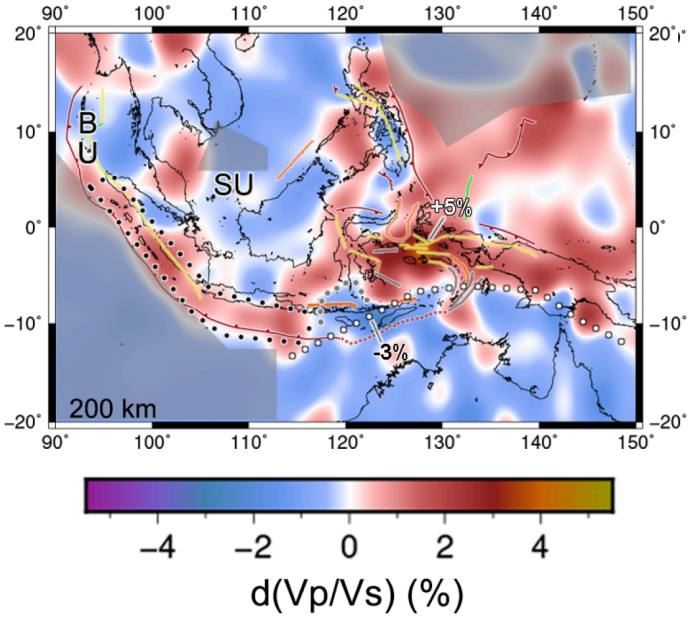
3 Joint wave-equation and radiative transfer forward modelling

1

- THE FIRST REGIONAL VP, VS AND VP/VS MODEL OF THE SE ASIA – AUSTRALIA COLLISION ZONE.
- THIS IS THE HIGHEST RESOLUTION AVAILABLE ON MANTLE SOURCES OF VOLCANIC ACTIVITY.
- THE BOUNDARY BETWEEN CONTINENTAL AUSTRALIAN LITHOSPHERE AND SUBDUCTING JAVA SLABS MARKS THE INTERRUPTION IN VOLCANIC ACTIVITY ACROSS THE BANDA ARC.
- CAN THIS CHANGE BE RECONSTRUCTD BY FORWARD AND INERSE GEODYNAMIC MODELLING?







Boundaries and interpretations: Pownall et al. 2013; Hall, 2017

- Thrust fault
- Strike slip fault
- Subduction
- Normal fault
- Spreading centre
- Timor Trough

-3% Corresponding to: highest Neogene extension and location of the Argo block

+5% Corresponding to: compression followed by extreme extension and mantle upwelling

- Volcanic forearc in Java/Sumatra
- Microcontinental salient
- Northern limit of the Australian continental lithosphere

Zenonos et al. 2020, JGR: Solid Earth

De Siena et al. in prep.

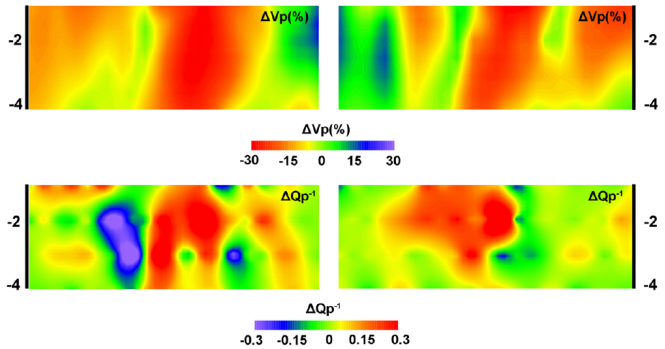
2 VOLCANO IMAGING WITH ATTENUATION AND SCATTERING

It crunches SACs with fully-populated headers!

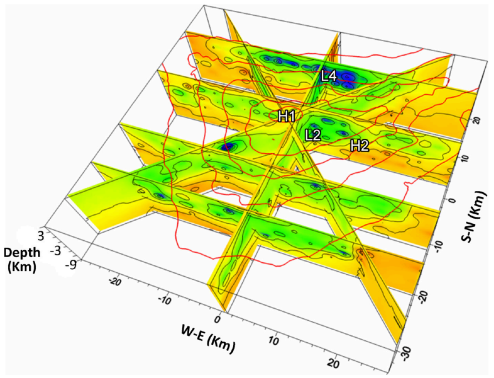
MuRAT

MuRAT - Multi-Resolution Seismic Attenuation Tomography

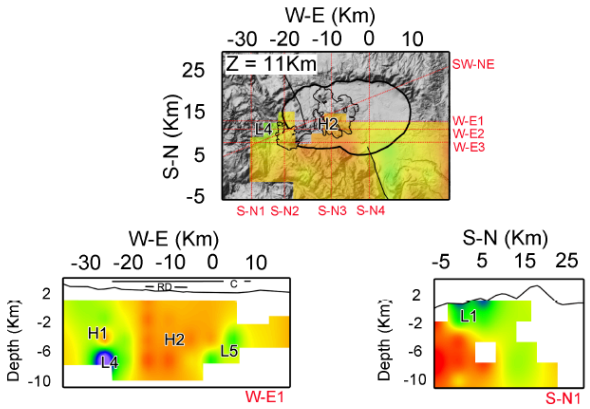
Deception, Prudencio et al., 2015, Surv. in Geoph.



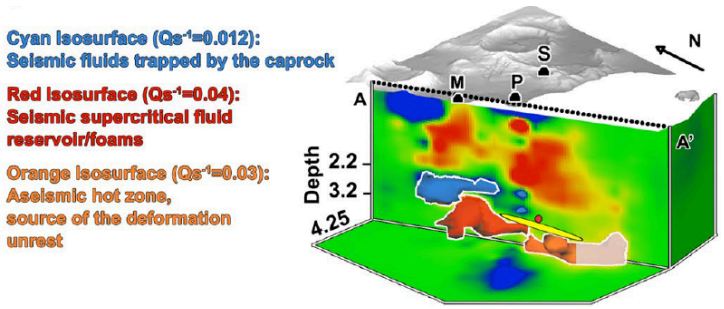
Tenerife, Prudencio et al., 2015, Surv. in Geoph.



Long Valley, Prudencio & Manga, 2019, GJI



Campi Flegrei, De Siena et al. 2017, Sci. Rep.



- Challenge: can we link these crustal maps with the deeper mantle sources?

- Published 2D and 3D models of attenuation, absorption and scattering available at 14 crustal magmatic systems in the approximation of bulk-wave and surface diffusion.

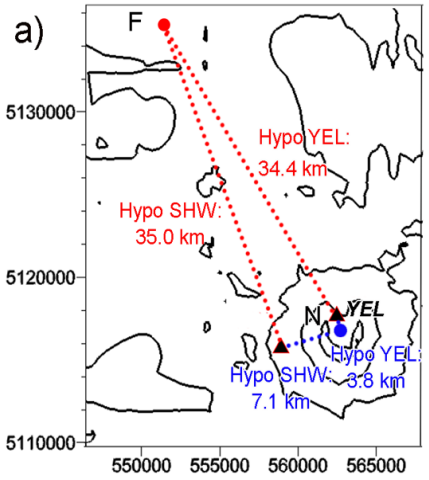
- Can be based on simplistic approximations (ray-sensitivity, no spatial variations in coda attenuation).

- Can invert for spatial variations of seismic absorption and scattering using diffusive sensitivity kernels, and correct direct-wave attenuation for heterogeneous coda-wave attenuation.

3 ESTABLISHING A LINK VIA IMPROVED FORWARD MODELLING

Radiative3D (Sanborn et al. 2017 - GJI) envelope modelling of volcanic waveforms

Finite difference modelling of (an)isotropic viscoelastic volcanic media

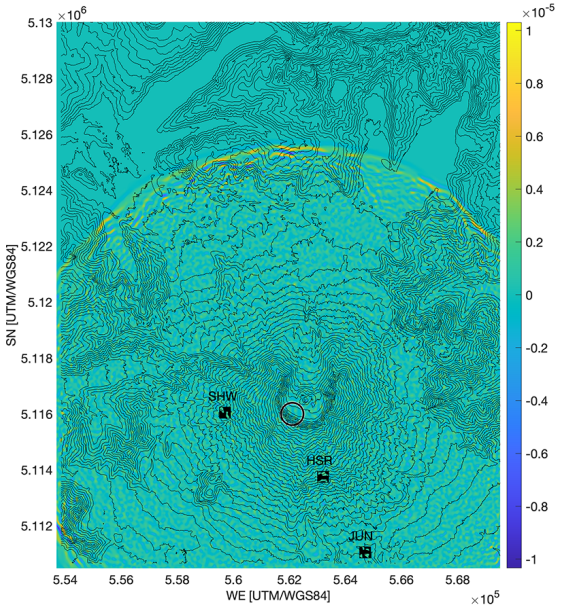


Model LS
ε = 0.06
a=0.2
$\varepsilon^2/a = 1.8 \times 10^{-4}$
Qs = 1000
Vp= 5.20t
Vs= 3.05
Time bin = 0.1 s

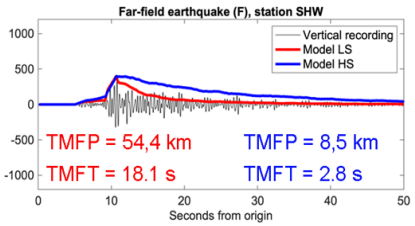
Model HS
ε = 0.15
a=0.2
$\varepsilon^2/a = 1.8 \times 10^{-4}$
Qs = 1000
Vp= 3.40
Vs= 2.00
Time bin = 0.1 s

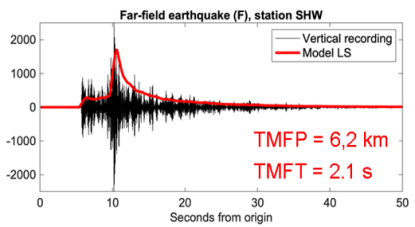
Far earthquake (F)
APR 06 2000
21:49:59:000
Event depth: 19.9 km
Type: Strike slip

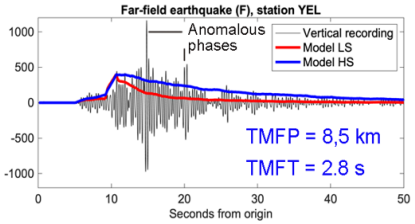
Use the results to establish magnitude and spatial correlation of velocity fluctuations

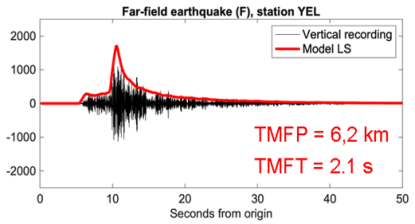


b)









Mount St Helens, Gabrielli et al. 2020, GJI and in preparation