Shear wave splitting in SplitLab
-plus other broadband imaging techniques

Meghan S. Miller
Shear wave splitting

http://garnero.asu.edu
PICASSO experiment

80 broadband instruments

additional 21 broadbands from Münster and Bristol

mantle and lithospheric structure at the westernmost extent of the Alpine-Himalayas orogen

understand the Alboran Sea, Betic-Rif and the Atlas formation
Shear wave splitting results

- New SKS results
- New S results from deep event
- Previous SKS results (Diaz et al., 2010 & Wuestefeld DB)

617 km deep event on April 11, 2010

Miller et al., EPSL 2013
P-wave tomography

Bezada et al., EPSL 2013
Shear wave splitting results

- New SKS results
- New S results from deep event
- Previous SKS results (Diaz et al., 2010 & Wuestefeld DB)

617 km deep event on April 11, 2010

Miller et al., EPSL 2013
P-wave tomography (Bezada et al., 2013) and ray paths of the April 11, 2010 deep focus event plus SKS events to station PM11 in the Rif.

Miller et al., EPSL 2013
P-wave tomography and ray paths to station PM13 in the Rif
P-wave tomography and ray paths to station PM20 between the Rif and the Middle Atlas.
P-wave tomography and ray paths to station PM22 in the Middle Atlas
P-wave tomography and ray paths to station PM25 in the Middle Atlas
P-wave tomography and ray paths to station PM34 on the Saharan Platform
A) SKS splitting results for PM25

Event: 23-Jul-2011 (204) 04:34  38.93N 141.91E 39km Mw=6.3
Station: PM25  Backazimuth: 25.8º  Distance: 101.86º
init.Pol.: 203.5º  Filter: 0.020Hz - 0.20Hz  SNR SC: 14.0

Rotation Correlation: 62º < 74º < 87º  1.6<1.9<2.2
Minimum Energy: 70º < 76º < 82º  1.7<1.9<2.2
Eigenvalue: 68º < 74º < 80º  1.7<1.9<2.1
Quality: good  IsNull: No  Phase: SKS

B) Direct S splitting result for PM25

Event: 11-Apr-2010 (101) 22:08  37.088N 141.87E 617km Mw=6.3
Station: PM25  Backazimuth: 7.0º  Distance: 53.26º
init.Pol.: 298.6º  Filter: 0.010Hz - 0.10Hz  SNR SC: 4.4

Rotation Correlation: 59º < 75º < 90º  1.5<1.8<2.2
Minimum Energy: 75º < 80º < 85º  1.7<1.9<2.1
Quality: good  IsNull: No  Phase: S

Miller et al., EPSL 2013
Mantle flow geometry from ridge to trench beneath the Gorda–Juan de Fuca plate system

Robert Martin-Short¹*, Richard M. Allen¹, Ian D. Bastow², Eoghan Totten¹,² and Mark A. Richards¹
S2: Map showing the splitting results and the locations of the station deployments

This map shows all seismic stations deployed as part of the Cascadia Initiative during phases 1 through 3 in addition to the X9 and NEPTUNE array seismometers used in this study. Black split ticks are plotted at all stations that produced one or more useable splitting results. Those stations not marked by a split tick either experienced technical problems or did not yield splitting results of sufficient quality.

Legend
- TA station
- CI Phase 1 OBS
- CI Phase 2 OBS
- CI Phase 3 OBS
- NEPTUNE OBS
- X9 OBS
- Split tick [dt = 1.0 s]

Martin-Short et al., Nature 2015
Event: 10-Feb-2011 (041) 14:41
Station: H04D
Backazimuth: 290.2°
Distance: 104.03"

init.Pol.: 116.3°
Filter: 0.050Hz - 0.20Hz
SNR: 9.4

Rotation Correlation: 43° < 63° < 86°
Minimum Energy: 60° < 62° < 68°
Eigenvalue: 58° < 66° < 80°
Quality: good
IsNull: No
Phase: SKS

Inc = 7.8°
Event: 10-Feb-2011, (041); Station: H04D; E
SKS: 65.8%
Mw = 6.5  Backazimuth: 290.28°  Distance: 104.11"  Depth: 531km

USArray TA example

Martin-Short et al., Nature 2015
Background – Database - Code

- **Shear wave splitting database – IRIS**

- **Montpellier Shear Wave Splitting Database**

- **Splitlab**
    • Now updated by Rob Porritt
  – [https://robporritt.wordpress.com/software/](https://robporritt.wordpress.com/software/)