

README for computing shear-wave velocity (Vs) by r/z ratio method

Tools needed:

SAC <http://www.iris.edu/dms/nodes/dmc/software/>

Tau-P <http://www.seis.sc.edu/taup/>

ARAIC <http://www.knmi.nl/~sleeman/software/software.html>

trav(fk) <http://www.eas.slu.edu/People/LZhu/home.html>

crust2.0 <http://igppweb.ucsd.edu/~gabi/crust2.html>

Steps to compute Vs:

1. Arrange sac files by event and rename as STATION.BH[ENZ]
2. Rotate waveforms to great circle path, change to the same delta and filter them
3. Use Tau-P and ARAIC to pick P phase or just pick manually
4. Compute SNR for r and z component, and discard waveforms with low SNR
5. Use crust2.0 model and trav to compute ray parameter
6. Do cross-correlation between r and z component, compute r/z amplitude ratio, and get Vs finally

How to run the scripts:

1. Make sure the tools needed have been properly installed
2. Modify necessary parameters and path for your case, including filter parameters in filter.m, and path of crust2.0 directory in model.sh
3. Run computeVs.sh

Note:

1. The cross-correlation coefficient and amplitude ratio are computed by

$$\text{coef} = \frac{\sum_{i=1}^n [(A(i) - \bar{A})(B(i) - \bar{B})]}{\sqrt{[\sum_{i=1}^n (A(i) - \bar{A})^2] * [\sum_{j=1}^n (B(i) - \bar{B})^2]}}$$

$$\text{ratio} = \sqrt{\frac{\sum_{j=1}^n (B(i) - \bar{B})^2}{\sum_{i=1}^n (A(i) - \bar{A})^2}}$$

$$\text{with } \bar{A} = \frac{1}{n} \sum_{i=1}^n A(i) \text{ and } \bar{B} = \frac{1}{n} \sum_{i=1}^n B(i)$$

2. An example with screenshots can be found in **example.pdf**