

Introduction to Earthquake Seismology

Assignment 5

Department of Earth and Atmospheric Sciences

EASA-452

Instructor: Robert B. Herrmann

Office Hours: By appointment

Office: O'Neil Hall 203

Email: rbh@eas.slu.edu

Trace Rotation

Goals:

- Given vertical, north-south and east-west seismograms, rotate the horizontals to create vertical, radial and transverse seismograms

Background:

Interpretation of seismic arrivals is made simpler by studying the radial and transverse time histories rather working with the north-south and east-west components.

This is accomplished by applying the following formula for each time sample:

$$UR = -C * UN - S * UE$$

$$UT = S * UN - C * UE$$

where $C = \cos(\text{back_azimuth})$ and $S = \sin(\text{back_azimuth})$, UN is the amplitude on the north-south component (positive is north) and UE is the amplitude in the east-west component (positive is east). Note that the angle must be expressed in radian (angle in radians = angle in degrees * $3.1419927/180$)

What you must do:

- Get <http://www.eas.slu.edu/People/RBHerrmann/Courses/EASA462/f001.csv>
- Use EXCEL or OpenOffice to read this [File->Open]
- Column 1 will be time, Column 2 is E, Column 3 is N and Column 4 is Z
- In these files, a positive number represents ground motion in the E, N and up directions, respectively.
- Rotate the horizontals to form the R (radial) and T (transverse components) using the formula given above. The Back Azimuth is 123 degrees.

Note: When doing this with EXCEL you will use $\sin(123*3.1415927/180)$ and similarly for the $\cos(\text{back_azimuth})$

- Plot the Z, N, R and T traces as a function of time
- Identify the significant phases on the Z, R and T components

What you must submit:

- A short documentation on what you did, to include the plots and the identification of

phases.