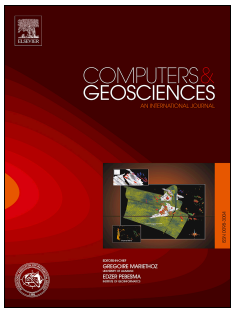
Accepted Manuscript



GSpecDisp: A matlab GUI package for phase-velocity dispersion measurements from ambient-noise correlations

Hamzeh Sadeghisorkhani, Ólafur Gudmundsson, Ari Tryggvason

PII: S0098-3004(17)30119-X

DOI: 10.1016/j.cageo.2017.09.006

Reference: CAGEO 4020

To appear in: *Computers and Geosciences*

Received Date: 1 February 2017

Revised Date: 5 September 2017

Accepted Date: 11 September 2017

Please cite this article as: Sadeghisorkhani, H., Gudmundsson, Ó., Tryggvason, A., GSpecDisp: A matlab GUI package for phase-velocity dispersion measurements from ambient-noise correlations, *Computers and Geosciences* (2017), doi: 10.1016/j.cageo.2017.09.006.

GSpecDisp: a Matlab GUI package for phase-velocity dispersion measurements from ambient-noise correlations

Hamzeh Sadeghisorkhani[a,*], Ólafur Gudmundsson[a], Ari Tryggvason[a]

[a]*Department of Earth Sciences, Geophysics, Uppsala University, Villavägen 16, 75236 Uppsala, Sweden*

Abstract

We present a graphical user interface (GUI) package to facilitate phase-velocity dispersion measurements of surface waves in noise-correlation traces. The package, called GSpecDisp, provides an interactive environment for the measurements and presentation of the results. The selection of a dispersion curve can be done automatically or manually within the package. The data are time-domain cross-correlations in SAC format, but GSpecDisp measures phase velocity in the spectral domain. Two types of phase-velocity dispersion measurements can be carried out with GSpecDisp; (1) average velocity of a region, and (2) single-pair phase velocity. Both measurements are done by matching the real part of the cross-correlation spectrum with the appropriate Bessel function. Advantages of these two types of measurements are that no prior knowledge about surface-wave dispersion in the region is needed, and that phase velocity can be measured up to that period for which the inter-station distance corresponds to one wavelength. GSpecDisp can measure the phase velocity of Rayleigh and Love waves from all possible components of the noise correlation tensor. First, we briefly present the theory behind the methods that are used, and then describe different modules of the package. Finally, we validate the developed algorithms by applying them to synthetic and real data, and by comparison with other methods. The source code of GSpecDisp can be downloaded from: https://github.com/Hamzeh-Sadeghi/GSpecDisp.

Keywords: Seismic Interferometry, Ambient Noise, Phase Velocity Dispersion Curve, Matlab, GUI, Seismology

1. Introduction

Seismic interferometry and particularly the cross correlation of ambient noise is a rapidly growing topic in the seismological community. It has been shown by Shapiro and Campillo (2004) and Sabra et al. (2005) that surface-to-surface Green's functions can be recovered from the cross correlations of random noise fields provided that they are equipartitioned or that their source distribution is uniform (Sánchez-Sesma et al., 2006; Wapenaar, 2004). Extracted travel-time information can be used in seismic tomography (e.g., Shapiro et al., 2005; Gudmundsson et al., 2007; Lin et al., 2008; Ekström et al., 2009). This method is called ambient-noise tomography (ANT). Availability of continuous recordings of noise and powerful processing computers makes this method a robust and powerful technique to

*Corresponding author

Email address: hamzeh.sadeghisorkhani@geo.uu.se (Hamzeh Sadeghisorkhani)