Adjoint tomography applied to Love wave traveltimes in Czech Republic

Lubica Valentova
DAPEM Faculty of Mathematics, Physics and Informatics, Comenius University[1]

Frantisek Gallovic
Dep. of Geophysics, Faculty of Mathematics and Physics, Charles University in Prague[2]

Bohuslav Ruzek
Institute of Geophysics, AS CR[3]

Josep de la Puente
Department of Computer Applications in Science and Engineering (CASE), BSC[4]

A b s t r a c t : With recent development of finite frequency tomography, the necessity of using so called "sensitivity kernels" emerged. The kernels represent some generalization of raypaths, they reveal areas which mostly influence the data misfit. Adjoint method proved to be very efficient in the calculation of kernels. It is based on two computations - forward calculation of wavefield by solving elastodynamic equation in an apriori initial model and calculation of adjoint wavefield, which is generated by residuals between synthetic and real data in the recievers' positions and which propagates backward in time. We employed this method to invert Love wave group traveltimes between pairs of stations in Czech Republic and adjacent regions. The traveltimes were obtained by crosscorelations of ambient seismic noise and filtered for different periods between 2 and 20s. The numerical solver of elastodynamic equation uses Discontinuous Galerkin method with Arbitrary high order Derivatives (ADER-DG), which was developed at LMU in Munich. The adjoint version was implemented only for 2D cases, therefore we are approximating the propagation of surface waves by so called

[1] Mlynska dolina F1, Bratislava 84248, SR, valent@karel.troja.mff.cuni.cz
[2] V Holesovickach 2, Praha 18000, CR, gallovic@karel.troja.mff.cuni.cz
[3] Bocni II/1401, Praha 14131, CR, b.ruzek@ig.cas.cz
[4] C/ Jordi Girona 29, Barcelona 08034, Spain, josep.delapuente@bsc.es

Figure 0.1: Normalized sensitivity kernel for 20 s SH wave traveltime between two stations in Czech Republic. Traveltime kernels are also called banana-doughnut because of the zero values on the raypath.

membrane waves. Resulting distributions of group velocity obtained separately for each frequency may therefore give additional information about its depth extent.

Key words: group velocities, Love waves, seismic tomography, adjoint method