Title: Seismic waves in inhomogeneous, weakly dissipative, anisotropic media

Author: Mgr. Miłosz Wcisło

Department: Department of Geophysics

Supervisor of the doctoral thesis: RNDr. Ivan Pšenčík, CSc

Abstract:

The thesis consists of two parts: theoretical and part devoted to applications. In the theoretical part, it is shown that the so-called Weak Attenuation Concept (WAC), in which attenuation is considered as a perturbation of a reference elastic state, guarantees applicability of the ray method to most models of realistic, laterally varying layered, isotropic or anisotropic attenuative media. This conclusion follows from comparisons of ray results with an independent full-wave method, which is, unfortunately, applicable only to isotropic media. Another important finding is that the so-called correspondence principle, broadly used in studies of attenuative media, must be used with care because in some situations, it may lead to incorrect results. In the part devoted to applications, the important results are presentations of successful applications of the peak-frequency method. The method is shown to be a useful tool in studying attenuation using microseismic events. It allows relatively simple estimate of the so-called global attenuation factor t^*, from which estimates of attenuation can be made. In general, estimated values of t^* can be used for attenuation tomography which can be done using similar principles as in the tomography of seismic velocities. The peak-frequency method is mostly used in the thesis to estimate effective Q values over a studied region. The presented results indicate that the analysis of peak frequencies can be useful in studies of source properties as well, particularly in studies of source directivity due to direction of rupture propagation. The analysis of peak frequencies is performed using datasets collected in three different regions of the world. One dataset is taken from western Bohemia, where it was recorded during one of the frequently observed natural earthquake swarms. Another dataset comes from Italy from the region with intensive microseismicity caused by the wastewater injection. The last dataset comes from

China from the region with microseismicity caused by hydraulic stimulation of shales. All the above results, both theoretical and observational, form a useful base for further more detailed studies.