VISCOELASTIC SEISMIC MODELING: PARAMETRIC EVALUATION FOCUSED ON OIL EXPLORATION SCENARIO.

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As a seismic wave propagates in a real material, its energy is dissipated due to different loss mechanisms. Due to the reduction of high frequency content and phase shift of the initial pulse, a gradual deformation of the signal is observed. Elastic approximations do not incorporate these effects and, depending on the characteristics of the medium, do not adequately represent the signal propagation, either. The seismic absorption phenomenon can be introduced in the viscoelastic approach through mechanical models constructed by springs and dampers association. Nowadays, the most accepted model to represent the rheology of rocks is the Zener model and its application depends on the adequate parameterization of some variables, whose choice is not fully consonant among publications on the subject. For a better understanding of the main parameters of the viscoelastic approximation, a finite difference viscoelastic modeling code was implemented for isotropic 2D media. In a homogeneous model, we evaluated the choice of the elastic limit, the positioning of the peak dissipation frequency for one Zener mechanism, the interval between peak dissipation frequencies in arrangements with three mechanisms and the number of mechanisms, from 1 to 6, distributed over a frequency range. In this step we observed that for an adequate representation of the viscoelastic behavior, the elastic limit must be chosen at high frequencies, the peak frequency of the mechanism must be close to the dominant frequency of the seismic source, the optimum interval between peak frequencies of the Generalized Zener model is between 1 and 3 octaves, and low absorption scenarios are well modeled using only 1 Zener engine. In more absorptive media, the arrangement with 2 Zener mechanisms presents satisfactory results in the seismic frequency band. After analyzing the optimization of these parameters, a second stage was carried out, in which the effect of the number of mechanisms was tested in 3 geological scenarios of relevance for oil exploration. Arrangements with 1, 2 or 4 Zener mechanisms were evaluated. The results agreed with the conclusions reached for homogeneous models. Even in scenarios with more complex properties distributions and in the presence of strong absorption, the arrangement with 2 mechanisms was sufficient to adequately represent the effect of seismic absorption.