



Time-lapse coherence panels for earthen dams monitoring

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Summary

We propose a method for continuous monitoring of earthen dams by evaluating the variation of seismic velocities using passive seismic data. The method is developed from classical velocity analysis techniques used in seismic exploration. We apply the seismic interferometry technique through the cross-correlation of passively acquired seismogram traces to calculate the coherence, given by the semblance (Neidell and Taner, 1971), for each transit time curve generated by velocity/depth pairs. The Semblance values obtained are synthesized in velocity analysis panels displayed in a time-lapse, and the blurs generated in each panel moves whenever a change in the structure happens. To test the application of the method, we used the 2D finite-difference modeler *fdelmodc*, by Thorbecke and Draganov (2011), which simulates long-term passive seismic acquisitions from the modeling of random sources in the subsurface. We generate simple two- and three-layer horizontal geological models and complex geological models that simulate the structure of earthen dams. It was possible to simulate processes of layer saturation and test the sensitivity of the monitoring panels to variations in seismic velocities.

Results and Conclusions

The proposed monitoring panels are sensitive to variations in seismic velocities. It was possible to notice the displacement of the blur along the time-lapse panels, which indicated the increase of V_p simulated in the models to reflect a saturation process of the superficial layers. The velocity and depth values that generate the highest coherence values were smaller than the parameters defined for the models. In addition, the panels indicated a decrease in the thickness of the layers, although the thickness of the layers were kept fixed in the models. These minor discrepancies might be adjusted with better parameter tuning. The method has good prospects as it is sensitive to variations in physical properties of synthetic models. Future studies will use passive data acquired in an earthen dam to test the feasibility of the method in field data.