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Surface wave imaging of the Mas d'Avignonet landslide with ambient noise cross-correlation analysis

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The Mas d'Avignonet landslide is a 2*2 km slide affecting clayey deposits in the Trièves area (Isère, France). Its sliding velocity is comprised between a few cm/y at the top of the landslide, to 15 cm/y in the most deformed areas. Previous studies enlighted the fact that on this landslide, the shear wave velocity (Vs) is spatially related to the displacement rate: the fastest the slide, the lowest Vs.
The present study analyses the possibility to use the ambient noise cross-correlation method to derive a 3D surface wave group velocity image of the landslide, strongly related to Vs. This method was developped at larger scales to image geological objects such as volcanoes or continental crust below the Alps.
With this aim in mind, ambient noise was recorded during 10 days with eleven 3-component stations on the southern part of the landslide. The frequency spectrum of the signal shows two main frequency bands : 1-10 Hz and 30-60 Hz. We computed the cross-correlation of the sign of the signals whitened in the 1-10 Hz frequency band. The evolution of the signal to noise ratio with correlation time shows that the recording time was sufficient to saturate the cross-correlated signals. Resulting waveforms are in good agreement with direct signals generated with explosive shots. In order to check the hypothesis of sources uniformly distributed around the area, we both look at beamforming analysis and azimuthal dependance of slowness, showing that for frequencies above 1.5 Hz, the correct propagation times are retrievd for all azimuths. Finally, using an S-transform, we compute the slowness-frequency image of the cross-correlations, determining the group velocity dispersion curve of surface waves from 1.5 to 5 Hz for about half pairs of stations. A group velocity image of the basement of the landslide is derived from these dispersion curves.