



Passive seismic interferometry and the influence of environmental forcings across scales

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We explore the application of passive seismic interferometry across multiple spatial and temporal scales to investigate hydro-mechanical processes in mountainous terrain. At the larger scale, we analyze continuous seismic data from multiple stations in the Swiss Seismological Network spanning over two decades to investigate long-term trends and seasonal patterns in seismic velocity across the Swiss Alps. Our results reveal clear seasonal cycles for all investigated stations, likely due to environmental influences, such as temperature and precipitation, as well as coupled mechanisms that potentially influence subsurface water systems. These observations are part of an ongoing effort to establish an understanding of mass-balance changes driven by glacier retreat and altered precipitation patterns, which are directly affecting slope stability and groundwater recharge dynamics in a rapidly changing Alpine environment.

Complementing the insights of this large-scale study across Switzerland, we present a detailed case study from the Åknes rockslide in Western Norway, to highlight the potential of passive seismic interferometry (Bogner et al. 2026) to monitor rapid groundwater level rises and pore pressure induced reductions in rock mass stiffness. We show that a significant decrease in seismic velocity in 2024 correlates with accelerated displacement in the landslide shear zone, demonstrating the method's sensitivity to both reversible environmental effects and irreversible structural changes.

Together, the studies are showing the versatility of passive seismic monitoring for hydro-mechanical processes from smaller scale site-specific hazard assessment to large-scale regional characterization of climate driven subsurface changes in the Alps.

Bogner, L., Bruland, C., Hadziioannou, C., Obermann, A. and Langet, N. (2026). Seismic noise interferometry to disentangle environmental effects from irreversible subsurface changes at the Åknes rockslide in Western Norway. Submitted to Seismological Research Letters. *1 bXYf fYj JYk "*