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## Characterizing glacial processes applying classical beamforming and machine learning

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The cryosphere is a highly active and dynamic environment that rapidly responds to changing climatic conditions. processes behind are poorly understood they remain challenging to observe. Glacial dynamics are strongly intermittent in time and heterogeneous in space. Thus, monitoring with high spatio-temporal resolution is essential. In course of the RESOLVE project, continuous seismic observations were obtained using a dense seismic network (100 nodes, Ø 700 m) installed on the Argentière Glacier (French Alps) during May in 2018. This unique data set offers the chance to study targeted processes and dynamics within the cryosphere on a local scale in detail.

We classical beamforming within the of the array (matched field processing) and unsupervised machine learning techniques to identify, cluster and locate seismic sources in 5D (x, y, z, velocity, time). Sources located with high resolution and accuracy related to processes and activity within the ice body, e.g. the geometry and dynamics of crevasses or the interaction at the glacier/bedrock interface, depending on the meteorological conditions such as daily temperature fluctuations or snow fall. Our preliminary results indicate strong potential in poorly resolved sources, which can be observed with statistical consistency reveal new insights into structural features/ physical properties of the glacier (e.g. analysis of scatterers).