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Uncertainty driven multi-method seismic analysis in near-surface imaging - case studies

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Near-surface imaging is often performed with a single method like multi-channel analysis of surface waves or first breaks traveltime tomography. This approach is easy to execute and gives fast results. However, such a limited approach use only a part of available data. This results in limited recognition of sub-surface structures with high uncertainties, that leads to difficult interpretations.
This work presents a multi-method approach that utilises both refraction and reflection components of seismic data. Moreover, it uses a sequence of interpretation techniques combining multi-channel analysis of surface waves, ground penetrating radar, wide-angle travel-time tomography, and reflection imaging to recognize details in sub-surface structures. Additionally, the uncertainty driven approach allows to estimate uncertainty at each processing stage and propagate it through the multi-method path to estimate its final value.
The application of this approach is presented for two case studies, one high arctic study to recognize the shape of the permafrost in the area between a retreating glacier and the seashore, the other one more typical geological study of Quaternary fluvial sediments. Both case studies clearly show that the combination of several methods gives better, more detailed and less uncertain results, while additional processing cost for already existing data is proportionally not significant. Additionally, all field works have been executed with different acquisition geometries, and this work presents the influence of the particular type of acquisition of each interpretation technique.
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