Geophysical Research Abstracts
Vol. 14, EGU2012-7565, 2012
EGU General Assembly 2012

Mapping buried parts of a megalithic tomb with multichannel analysis of Rayleigh-waves and GPR

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The objective of the presented study was to image buried parts of a megalithic tomb in northern Germany with GPR and multichannel analysis of surface-waves (MASW). The latter method was applied with the aim of testing its feasibility when used on intermediate scale archaeological targets. As we do not expect MASW of being able to resolve archaeological objects in terms of inverted velocity structure, we look for spectral effects due to subsurface heterogeneity. Identifying and mapping these effects would give a distribution of possibly archaeological objects. The presented seismic dataset shows an amplitude shift between normal and a guided Rayleigh-wave mode. When mapped along parallel profiles the spatial distribution of this effect matches the geometry of the grave. The observed anomalies show good correlation to GPR results that included strong reflectors inside the grave border. Elastic finite difference modelling of the surface-wave propagation showed that the spectral effect can be reproduced by a compacted or bulked column above the GPR anomaly depth indicating that the observed anomalies may be caused by construction activities or load effects during multiple construction phases of the tomb. Observed GPR reflectors thus indicate the bottom of the disturbed zones and MASW effects map the distribution of disturbed subsoil columns.