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Seismic source configuration effects on imaging of near-surface onshore chalk

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Seismic imaging of carbonate rocks is challenging due strong velocity variations, heterogeneity and seismic contrasts. Seismic imaging of the Danish Chalk Group has been subject to several onshore studies for different purposes, such as fault identification, ground water exploration and hydrocarbon reservoir analogues characterization. Most such onshore surveys have been performed with compressional vibrators with relatively good imaging results. In areas where the Chalk Group is lying close to the surface, compressional vibrators, however, may suffer from poor data quality. Our comparison to shear-wave data sets indicates that the poor compressional-wave data quality may be caused by wave-mode conversion into shear- and surface-wave energy with little pure P-wave energy left. In the same areas, small impulse sources, such as a 45-kg accelerated weight drop, image the Chalk Group in high resolution and to relatively large depth (>900 m). Also SH-SH vibroseis acquisition with a small vibrator source does not suffer from unusually strong wave-mode conversion and image the shallow subsurface in high resolution. This study examines results from different field sites in Denmark where the overburden is less than 10 m thick or absent. Different field acquisition techniques are studied to identify causes for the differences in data quality linked to acquisition with compressional vibrators, impact sources and small shear-wave vibrators.