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Please fill in your 5-digit IPTC manuscript number and IPTC Control number.	IPTC-19439-MS 19IPTC-P-1334 -IPTC
Please fill in your abstract title.	Depth Imaging from Topography Using Vertical Seismic Arrays

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Abstract

Objective:
Complex near-surface and rough topography adversely affect depth seismic imaging results on land. Conventional time-domain solutions based on vertical statics corrections often do not resolve these issues and bring additional bias into the results. Direct incorporation of the near-surface model and topography into the depth imaging workflow is essential for resolving complex stratigraphic traps and low-relief structures. Classical methods based on refracted arrivals and conventional upholes do not always allow for the building of reliable near-surface models in challenging areas. The objective of this work is to propose a solution to this problem based on a grid of vertical seismic arrays that can be used to simultaneously resolve near-surface complexities and to image deeper target horizons.

Methods and Procedures:
We use a novel land seismic acquisition scheme in which shallow wells are equipped with continuous fiber-optic cable and form a grid of smart distributed acoustic sensing (DAS) upholes that allow recording of seismic signals simultaneously along the whole cable length. Combined with carpet shooting at the ground surface, such vertical arrays provide information sufficient for detailed estimation of near-surface velocities and seismic depth imaging. The near-surface velocity model is obtained from the direct-arrivals observed in the upholes. Reverse-time migration from topography is used to build depth seismic images from the recorded reflected arrivals.

Results and Conclusions:
The proposed depth imaging scheme in which seismic data from vertical arrays is used for near-surface modeling and deeper seismic imaging shows very promising results. Based on synthetic and real-data examples we illustrate the capabilities of such a system and present improvements in seismic images that can be obtained by accurately incorporating the near-surface model and topography into the imaging workflow. Direct imaging in depth from source and receive locations without redatuming result in imaging without errors from unresolved statics issues. This system can be used to mitigate uncertainties in depth seismic images related to complex near-surface conditions.

Novel and Additive Information:
The paper presents a new method for resolving of depth imaging uncertainties in areas with complex near-surface conditions. We show how a grid of smart DAS upholes can be used for building near-surface velocity models and at the same time for deeper imaging using seismic migration from topography.