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# Addressing the Effects of Sand Dunes on Seismic Data from the Rub Al Khali

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## ABSTRACT

The Rub' Al-Khali desert, in the South Eastern part of Saudi Arabia is characterized by the presence of extensive sand dunes separated by corridors of salt flats (i.e. Sabkhas). These sand dunes present a challenge for processing of seismic data acquired in such an environment especially when the objective is to deliver a product suitable for AVO analysis. The low velocity of sand induce significant delays on seismic wave propagation in the dunes. Those delays can be removed by the application of sand dune statics correction using the sand-curve method (Robinson and Al-Husseini, 1982). This method works in areas with well defined, flat base of sand, visible around the sand dunes, but would be inadequate otherwise. In addition, the high contrast in acoustic impedance between the dune base and the underlying formation results in an amplification of the seismic waves recorded at stations on the surface of sand dunes. This near-surface amplification, if not correct for, alters the relative strength of deeper reflections and thus compromises the suitability of the processed data for AVO analysis. Furthermore, seismic waves trapped within the sand dune, bounce back and forth between its boundaries (i.e., top and base), and generates multiples referred here as sand-dune signature that contaminate reflection arrivals from target zones. In land seismic processing, surface consistent correction methods (Taner and Kohler 1981; Cambois and Stoffa, 1992, Carey and Lorentz, 1994) are the standard tools used to deal with the undesired effects of near-surface features on the amplitudes of seismic reflections from the zone of interest. However, application of these methods on dataset from Rub'Al Khali region have in general failed to produce reflection amplitudes that are free from the imprint of these sand dunes. In this contribution, we propose a multi steps approach to deal with the sand dune effects. In the first step, we apply variable gap deconvolution to attenuate the sand-dune signature. In the second step, we use a deterministic approach to derive surface consistent, frequency dependent de-amplification functions for source and receiver stations on sand-dune elevations. In addition, we propose a new method of data driven sand-dune statics estimation, which could serve as an alternative approach to the sand-curve method in regions where the base of sand may be non-uniform and unknown.