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# Detailed Simulation of Near-Surface Effects on Arabian AEM and AGG Data

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## ABSTRACT

Part of the SEG's Advanced Modeling Corporation (SEAM) Phase 2 project consisted of computing anisotropic resistivity from seismic properties and using this to model ground MT and CSEM, and airborne time-domain EM. The seismic properties also included density, used to model gravity and gravity gradiometry effects. Here, we concentrate on the AEM and airborne gravity gradiometry (AGG) data. The volumes provided by SEAM were detailed (1.5 billion cells, each a 6.25m cube) and were of vp, vs, Thomsen parameters, and density. From a work-flow of classification, porosity calculation, and computation of resistivity using assumed salinities, we derived anisotropic resistivity. The models were extrapolated to compute airborne time-domain EM with flight lines spaced at 50m intervals and measurement points every 50m. Responses were computed at each measurement point over the time range 0.10 to 20.0 millisecs. The code used for the computations was CGG's proprietary adaptive 3D finite difference code. It was verified by comparison with the Australian CSIRO/AMIRA integral equation code MARCO. Gravity and AGG simulations were carried out with the same line and point spacing, using the original SEAM 6.25m 3D mesh. In this particular case, the so-called "Arid" model, the near-surface geology is complex, including karstic cavities, dry sand, and a paleo-valley. The targets are flat-lying gas reservoirs at depths of 2.5 to 3.5km below the flat land surface. Although topographic effects are not present in the Arid model (due to the flat land surface), both methods show much detail related to shallow features which, in their turn, are a cause of degradation of seismic images at reservoir depths. While the methods used here do not actually resolve the models at the reservoir levels, they appear to be suited for near surface characterisation, which in turn could help to obtain more reliable depth imaging. This hypothesis will be tested by 3D inversion.