Pore-pressure prediction based on seismic velocities

coupled with geomechanical modeling

Maria A Nikolinakou, Research Associate, The University of Texas at Austin

ABSTRACT

We present a new pore-pressure prediction approach that couples seismic velocities with geomechanical modeling.

We show that the mean stress better represents the stress state of basin sediments. This is because the commonly used Vertical Effective Stress (VES) can only represent uniaxial stress states, and hence cannot account for complex geologic loadings, such as salt movements or lateral thrust loading.

We demonstrate the new approach using data from the Mad Dog field. We use a static geomechanical model to obtain total mean stress values around salt. We use measured data along a well in front of the salt to establish a velocity – mean-effective-stress relationship. And we calculate pore pressures as the difference between the total and effective *mean* stresses.

The resulting pore pressures illustrate that the coupling with the geomechanical modeling incorporates the salt-sediment interaction into the pressure prediction: the new approach predicts overpressures within the mini-basin and in front of the salt (Fig. 1). The traditional VES approach cannot account for the lateral salt loading, and therefore, it underpredicts overpressures near salt (Fig. 2).

CLICK ON IMAGE FOR LARGER VIEW

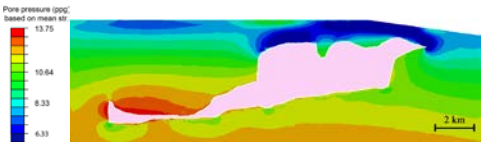


Figure 1: Pore pressure prediction near Mad Dog salt, based on velocity measurements coupled with static geomechanical modeling. The geomechanical model provides values for the mean stress around salt; hence the approach incorporates the lateral load from the salt in the pressure prediction.

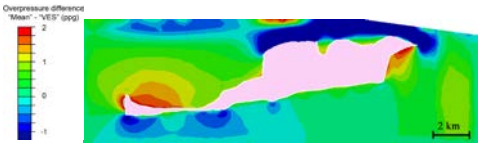
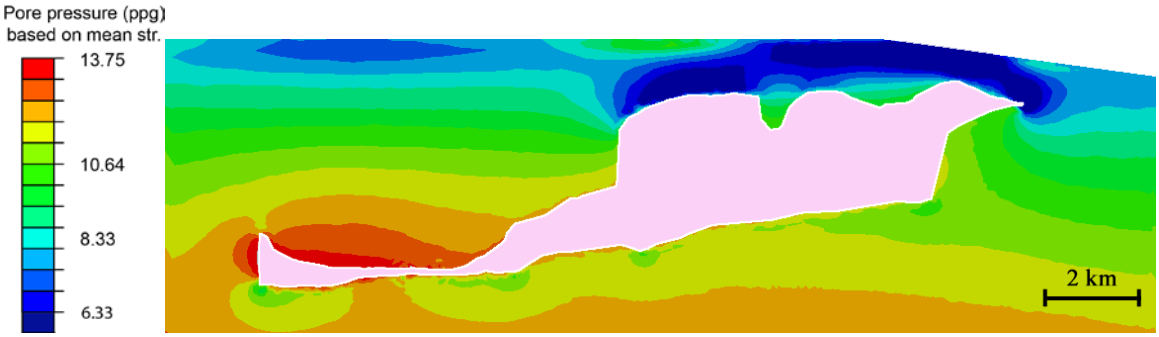


Figure 2: Difference in pore-pressure prediction between proposed approach, based on mean effective stress, and traditional approach, based on vertical effective stress. The traditional approach cannot account for the lateral stress loading from the salt, and hence underpredicts pore pressures near salt.



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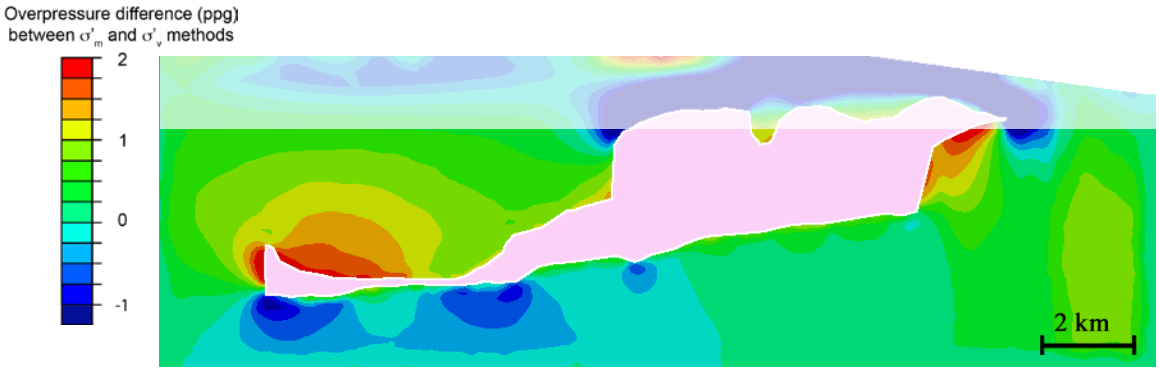

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