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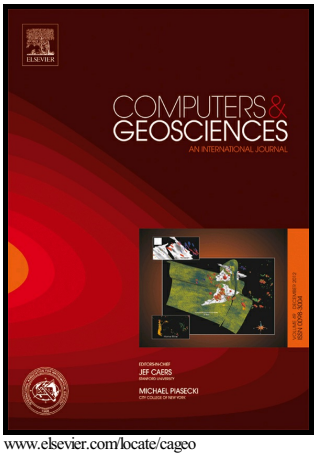

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An integrated workflow for stress and flow modelling using outcrop-derived discrete fracture networks

K. Bisdom[1], H. M. Nick[1,2], G. Bertotti[1]

[1]Department of Geoscience & Engineering, Delft University of Technology, Delft, Netherlands

[2]The Danish Hydrocarbon Research and Technology Centre, Technical University of Denmark, Copenhagen, Denmark

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Abstract

Fluid flow in naturally fractured reservoirs is often controlled by subseismic-scale fracture networks. Although the fracture network can be partly sampled in the direct vicinity of wells, the inter-well scale network is poorly constrained in fractured reservoir models. Outcrop analogues can provide data for population of domains of the reservoir model where no direct measurements are available. However, extracting relevant statistics from large outcrops representative of inter-well scale fracture networks remains challenging. Recent advances in outcrop imaging provide high-resolution datasets that can cover areas of several hundred by several hundred meters, i.e. the domain between adjacent wells, but even then, data from the high-resolution models is often upscaled to reservoir flow grids, resulting in loss of accuracy. We present a workflow that uses photorealistic georeferenced outcrop models to construct geomechanical and fluid flow models containing thousands of discrete fractures covering sufficiently large areas, that does not require upscaling to model permeability. This workflow seamlessly integrates geomechanical Finite Element models with flow models that take into account stress-sensitive fracture permeability and matrix flow to determine the full

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