Geophysical Research Abstracts
Vol. 19, EGU2017-18281, 2017
EGU General Assembly 2017

Determining the hydraulic and fracture properties of the Coal Seam Gas well by numerical modelling and GLUE analysis

Sara Askarimarnani, Garry Willgoose, and Stephen Fityus

The University of Newcastle, Discipline of Civil, Surveying and Environmental Engineering, Callaghan, Australia (garry.Willgoose@newcastle.edu.au)

Coal seam gas (CSG) is a form of natural gas that occurs in some coal seams. Coal seams have natural fractures with dual-porosity systems and low permeability. In the CSG industry, hydraulic fracturing is applied to increase the permeability and extract the gas more efficiently from the coal seam. The industry claims that it can design fracking patterns. Whether this is true or not, the public (and regulators) requires assurance that once a well has been fracked that the fracking has occurred according to plan and that the fracked well is safe. Thus defensible post-fracking testing methodologies for gas generating wells are required. In 2009 a fracked well HB02, owned by AGL, near Broke, NSW, Australia was subjected to "traditional" water pump-testing as part of this assurance process. Interpretation with well Type Curves and simple single phase (i.e. only water, no gas) highlighted deficiencies in traditional water well approaches with a systemic deviation from the qualitative characteristic of well drawdown curves (e.g. concavity versus convexity of drawdown with time). Accordingly a multiphase (i.e. water and methane) model of the well was developed and compared with the observed data. This paper will discuss the results of this multiphase testing using the TOUGH2 model and its EOS7C constitutive model. A key objective was to test a methodology, based on GLUE monte-carlo calibration technique, to calibrate the characteristics of the frack using the well test drawdown curve.

GLUE involves a sensitivity analysis of how changes in the fracture properties change the well hydraulics through and analysis of the drawdown curve and changes in the cone of depression. This was undertaken by changing the native coal, fracture, and gas parameters to see how changing those parameters changed the match between simulations and the observed well drawdown. Results from the GLUE analysis show how much information is contained in the well drawdown curve for estimating field scale coal and gas generation properties, the fracture geometry, and the proponent characteristics. The results with the multiphase model show a better match to the drawdown than using a single phase model but the differences between the best fit drawdowns were small, and smaller than the difference between the best fit and field data. However, the parameters derived to generate these best fits for each model were very different. We conclude that while satisfactory fits with single phase groundwater models (e.g. MODFLOW, FEFLOW) can be achieved the parameters derived will not be realistic, with potential implications for drawdowns and water yields for gas field modelling. Multiphase models are thus required and we will discuss some of the limitations of TOUGH2 for the CSG problem.