

# **Exploring Reasons Of Shale Gas Production Induce Surface Deformation And Accurate Modeling Of Numerical Simulation of Poroelasticity**

**Abstract:** The observed InSAR deformation in the Sichuan basin is probably caused by hydraulic fracturing for shale gas production. Some speculations are made based on such deformation patterns. Firstly, the surface deformation could be caused by long-term fluid injection or pumping which lasted several months in poroelasticity medium. Secondly, such deformation may be due to multiple induced seismicities caused by pore pressure diffusion or fluid migration to vulnerable faults. Thirdly, long-term shale gas development could change the underground fluid mass. Loss or gain of fluids would change upper crustal gravity and produce the elastic response of the crust. We test these hypotheses based on numerical analysis of surface deformation patterns. Currently, the poroelasticity effects may exist in many geophysical exploitation activities, including underground water extraction, shale gas development, enhanced geothermal systems, etc. There are two main methods for poroelasticity forward modeling. One is the analytic solution or semi-analytical solution. The other one is the numerical simulation. The former cannot model spatially complicated medium, while the numerical method could approximate the poroelasticity problem of the real stratum as much as possible. Following Rongjiang Wang's poroelasticity semi-analytical solution, we enhance the accuracy of the numerical method and verify the consistency of the parameters in both solutions. We then make numerical simulations to model the observed InSAR deformation in the Sichuan basin.