GSH – Potential Fields SIG Meeting

Thursday, November 17, 2016

Location: HESS Club (Houston Engr. & Science Society)
5430 Westheimer, Houston, TX 77056

Dinner meeting timings::

5:30 Registration / Cash Bar
6:30 Dinner Served
7:30 Presentation Begins
8:30 Adjourn

Registration Schedule

	Pre-Registered	Late/Walk-Up
Member	$30	$40
Non-Member	$35	$45
Student Member	$15	$25

Using Gravity to Determine Basement Geology between the Mid-Continent Rift (MCR) and the Southern Oklahoma Aulacogen (SOA)

In this study, the upper crystalline basement lies between the basement topography and 16 km below mean sea level. The residual gravity anomaly of the upper basement is estimated by stripping the gravity effects of known and geologically consistent 3D model density distributions of known and expected geologies above and below the upper crystalline basement. Modeling the geology as piecewise continuous density distributions allows me to model 100 square degrees of mapped and expected surface and subsurface geologies from the topographic surface to 100 km below sea level. Then inverting these expected density distributions I minimize the misfit between the observed and estimated free-air gravity. This residual free-air anomaly reflects the density distribution in the upper basement.

The observed gravity data are 3D free-air gravity point data collected at unique spatial locations and times, and the free-air gravity measures the gravity effect of the Earth's unique 3D density distribution. Modeling the Earth's 3D density distribution consist of representative 3D geology models containing observed, expected, and geologically consistent 3D formation and lithology boundaries. Then using lithology to density relationships, I build an expected 3D density distribution. The gravity effect of the model 3D density distribution is calculated at each 3D gravity data point using SIGMA, a recently developed gravity and gravity gradiometry algorithm.

Then, using a geologically and statistically constrained density inversion, the expected density model is adjusted to minimize the misfit between the observed and estimated free-air gravity. The residual free-air anomaly, RFAA, represents the basement geology mass distribution and indicates a complex basement geology and geologic structure that appear to be consistent with earthquake seismicity and thermal maturity sources as reflected in the Woodford Shale vitrinite reflectance data. ■

Speaker Biography

Kevin Crain earned his BS in geophysics from New Mexico Institute of Mining and Technology and his MS and PhD in Geosciences from The University of Texas at El Paso. His research interest have focused on atmospheric electric-field studies, then later studying surface wave and ultrasonic non-destructive test techniques of geomedia, as well as 3D gravity modeling for minerals, and petroleum exploration. Currently he is working as a Research Scientist for the Oklahoma Geological Survey focusing on 3D gravity modeling associated with Oklahoma earthquakes.