Dr. W. Scott Meddaugh

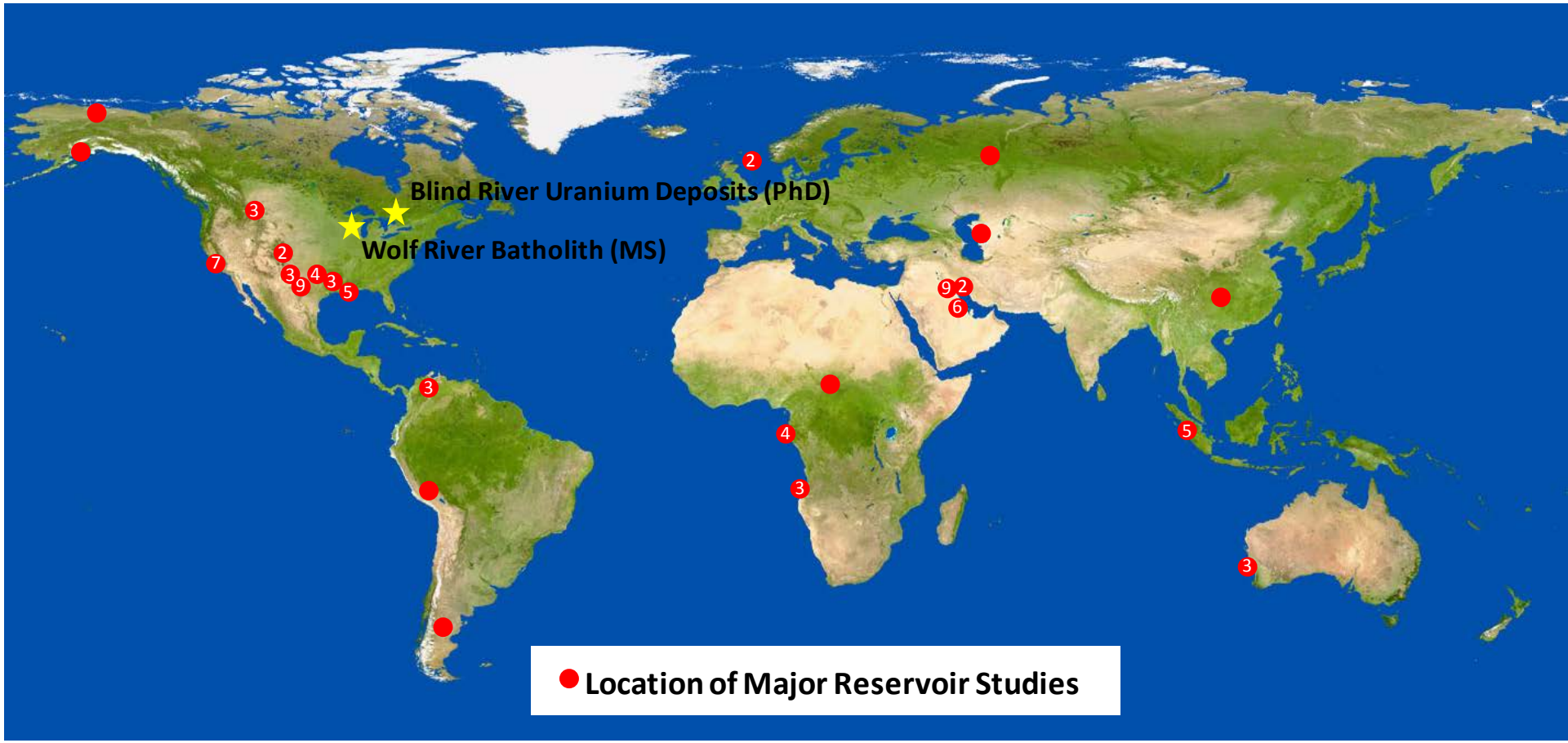
RL Bolin Distinguished Professor of Petroleum Geology

MIDWESTERN STATE UNIVERSITY

Personal History

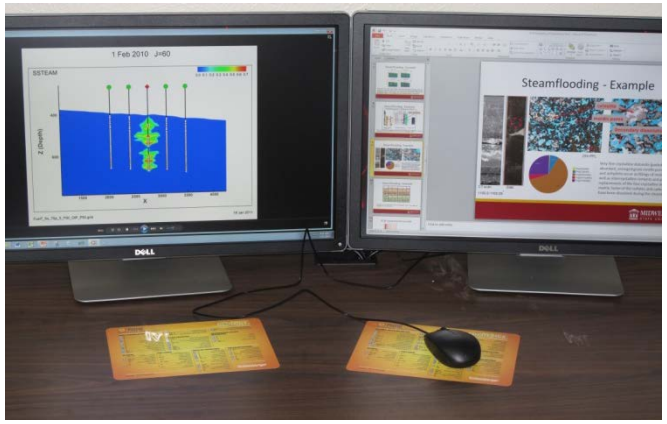
- Education
  - BA, MS in Geology – University of Wisconsin-Milwaukee
  - PhD in Geology – Harvard University
- Professional
  - Chevron (1981-2013)
    - Research Geologist to Earth Science Consultant/Major Capital Project Subsurface Technical Team Leader
  - Midwestern State University (2013)
    - RL Bolin Distinguished Professor of Petroleum Geology
- Personal
  - Married, three adult children
  - Hobby is marathon running

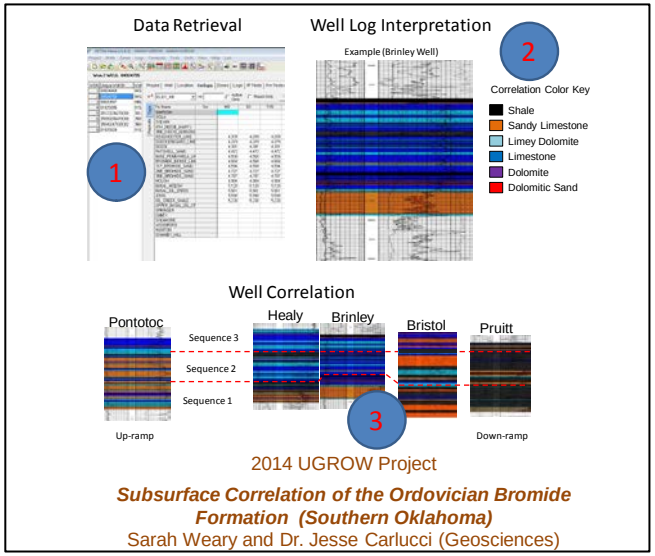
32 Years with Chevron – Worldwide Petroleum Project Experience



Midwestern University Recent Activities

- New Courses
  - Applied Petroleum Geology, Solid Earth and Exploration Geophysics, Economic Geology
  - Online Physical Geology course for Fall 2015
- RL Bolin Petroleum Geology Lab
  - Secured service company donations of industry state of the art software with a “street value” for the software is well over $5 million
  - Used for coursework and student/faculty research
- Proposal for Graduate Degree Program in the Geosciences





2014 UGROW Project

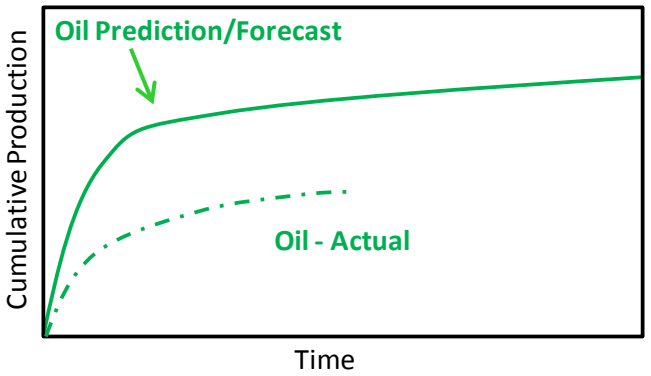
Subsurface Correlation of the Ordovician Bromide Formation (Southern Oklahoma)

Sarah Weary and Dr. Jesse Carlucci (Geosciences)

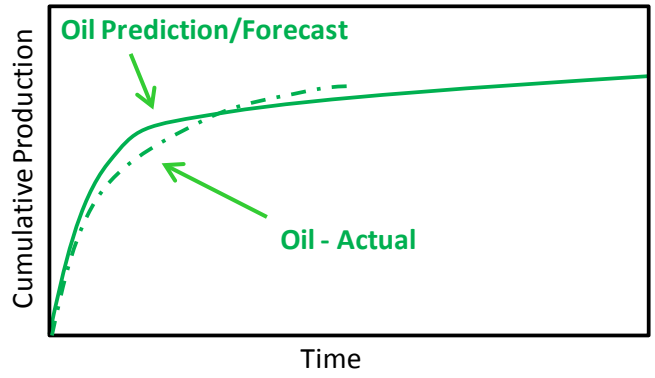
Primary Research Interest

- Impact of geostatistics, reservoir modeling, heterogeneity, uncertainty, and human bias on reservoir performance forecasting
  - Currently, the petroleum industry produces only about 75% of what is forecast when development projects are sanctioned
  - Projects with subsurface (geology) “issues” produce only about 55% of what is forecast

Actual State



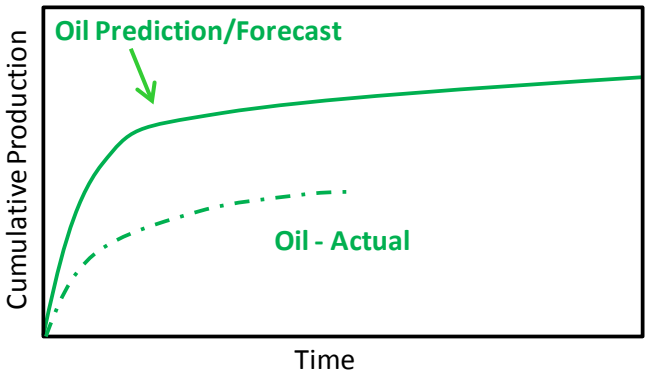
Desired State



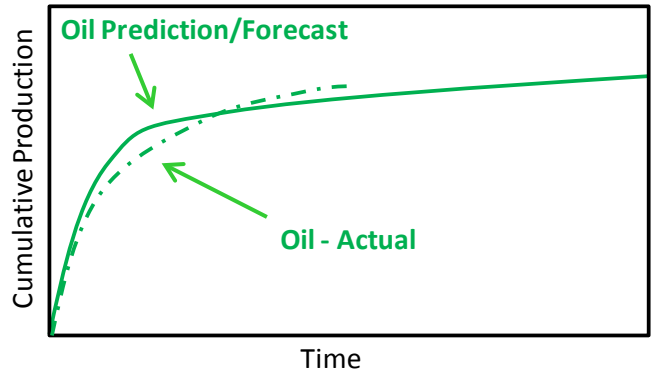
Some Reasons Why Oil Industry Production Forecasts Are Optimistic

- **Well optimization workflows appear to "force" significant forecast optimism**
- Limited subsurface information as the better parts of reservoirs tend to be sampled early in appraisal leading to oil in place estimates that are too high
- Biased use of analog reservoir data
- Poor assessment of uncertainty

Actual State



Desired State

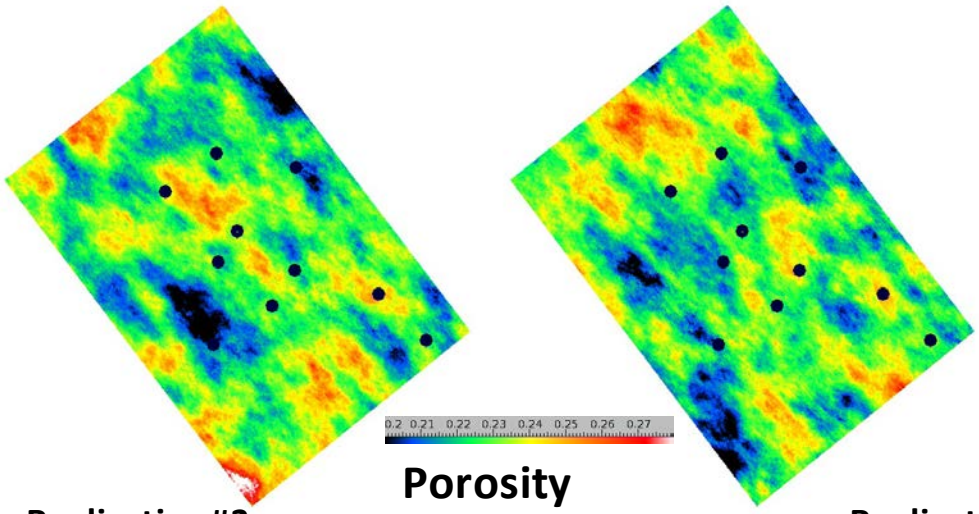


Impact of Well Optimization

- Well Optimization Workflow
  - Process used to obtain well locations that maximize recovery based on capital available, number of wells, or other financial parameter
  - Well locations may be based on a particular oil or gas reservoir model, usually the mid-case or most likely probabilistic model

Well Optimization Impact

- Geological models

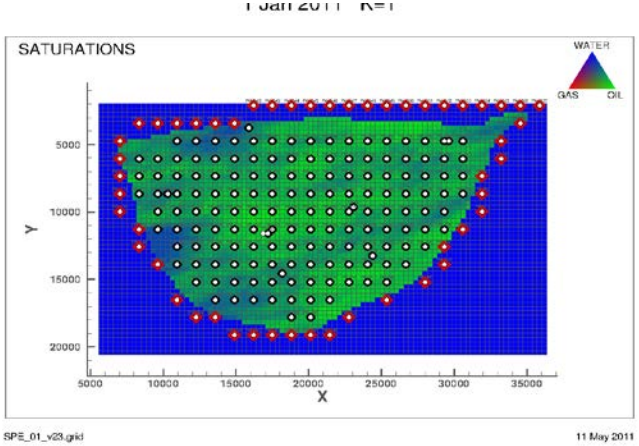


Average porosity maps for two of the 25 realizations generated for the for the well optimization study. Note the significant difference in the porosity distribution in the two realizations. Hypothetical well locations with data used to build models shown by black circles (after Meddaugh et al., 2011).

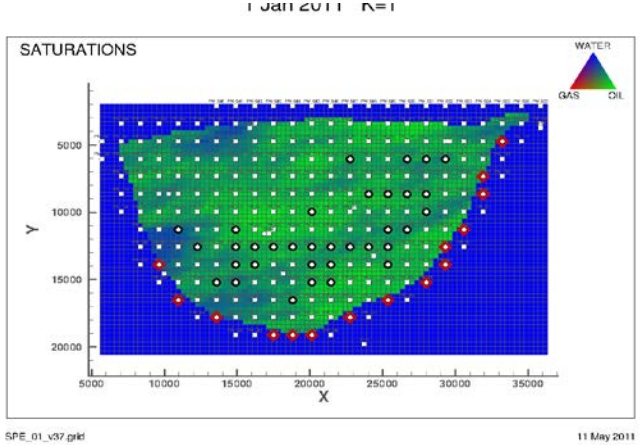
Well Optimization Impact

- Well locations

Initial Locations

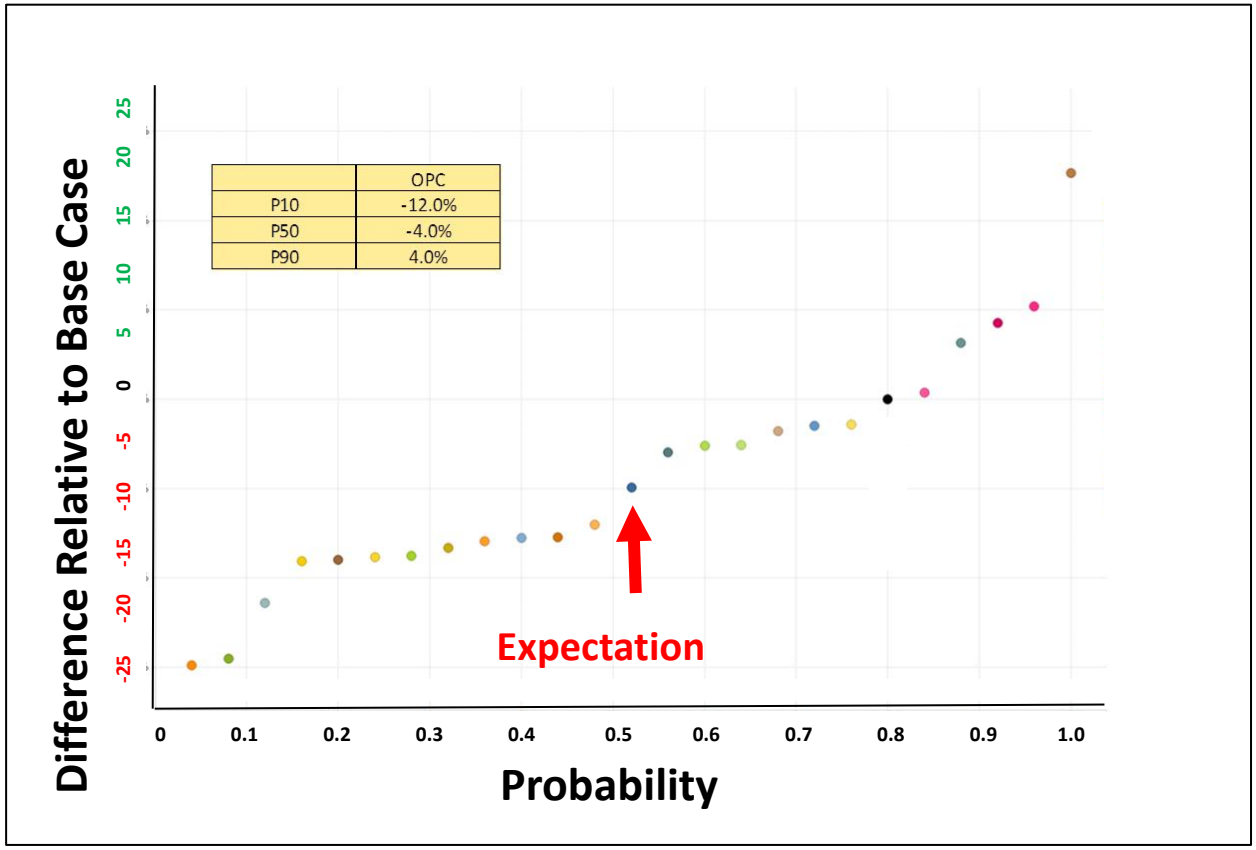


Optimized Locations



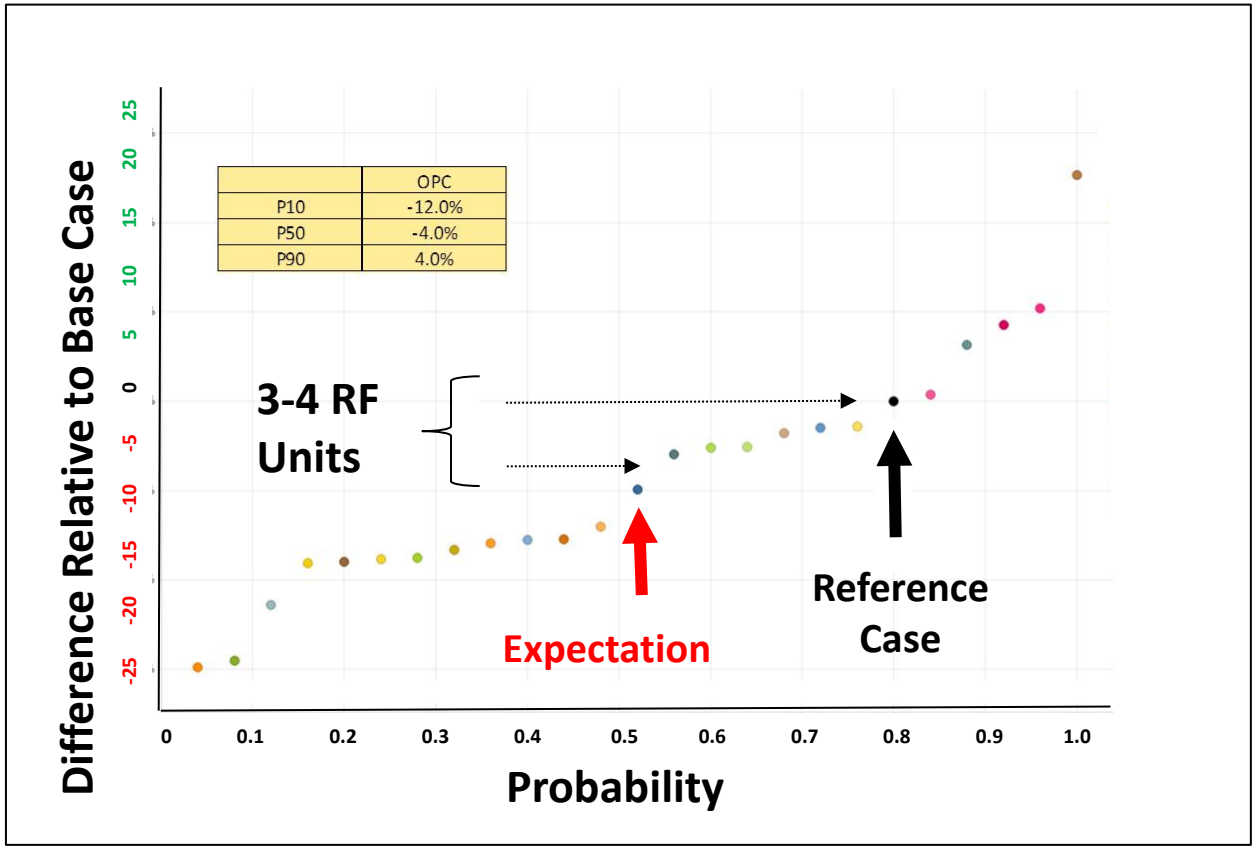
Black circles = active producers, red diamonds = active injectors, white square= shut in producers, injectors based on cumulative oil/EUR (after Meddaugh et al., 2011).

Well Optimization Impact – Oil Production



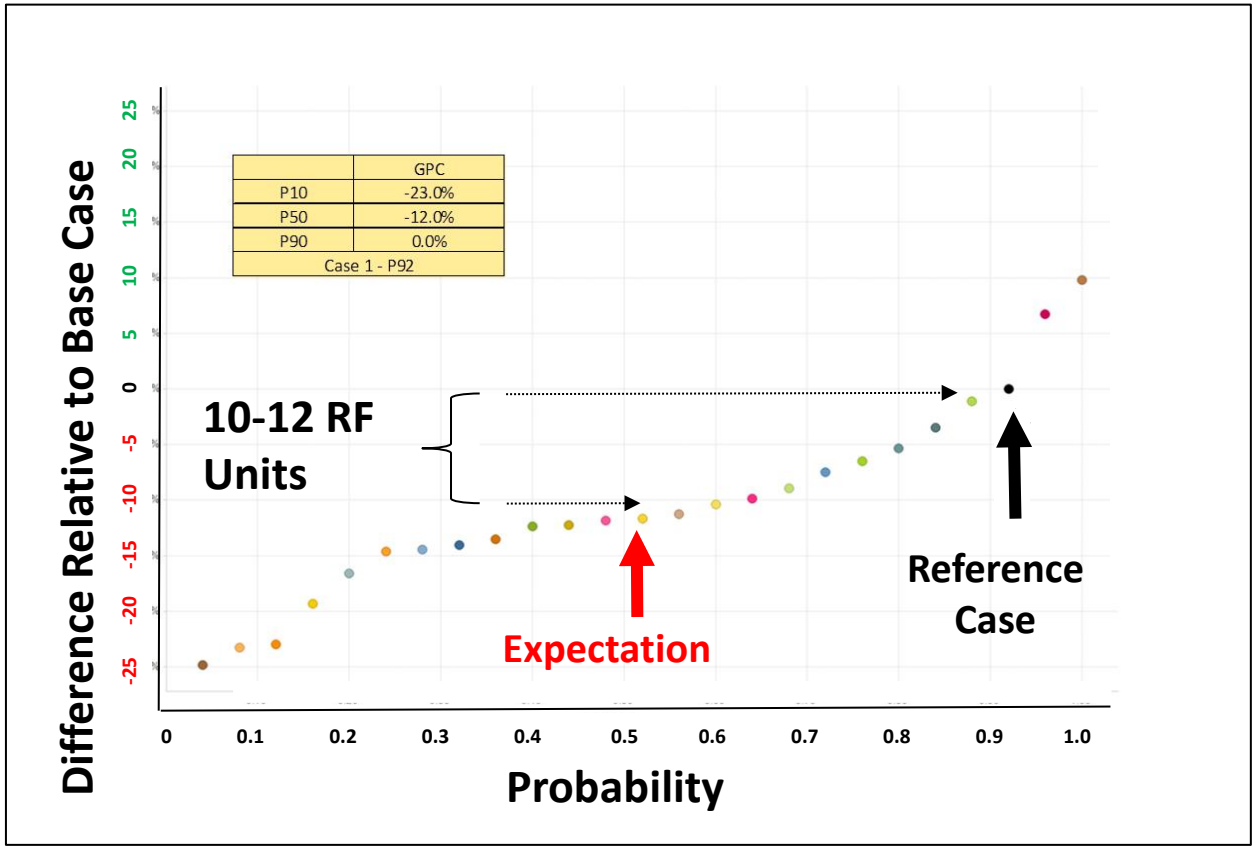
Delta cumulative produced oil compared for the 25 models run using the same optimized well locations for producers (after Meddaugh et al., 2011). If well optimization does not significantly bias the forecast towards optimistic recovery, the base case (Case 1) "expectation" should plot near the mid-point of the probability plot.

Well Optimization Impact – Oil Production



Delta cumulative produced oil compared to Case 1 (black arrow). Note that most of the forecasts (19 of the 25 realizations) give less oil using the same "optimized" well locations as Case 1. Thus, suggesting that well location optimization "forces" an optimistic recovery estimate (after Meddaugh et al., 2011). RF = Recovery factor.

Well Optimization Impact – Gas Production



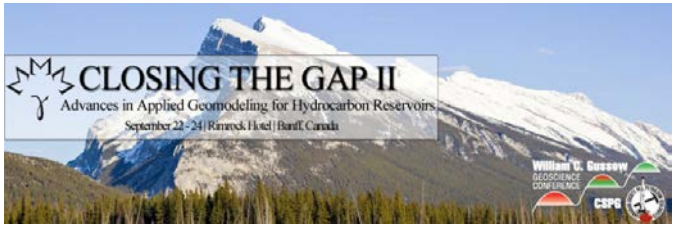
Delta cumulative produced gas compared to Case 1 (black arrow). Note that most of the forecasts (23 of the 25 realizations) give less gas using the same "optimized" well locations as Case 1. Thus, suggesting that well location optimization "forces" an optimistic recovery estimate (after Meddaugh et al., 2011). RF = Recovery factor.

Production Forecast Optimism

- Ideal project for collaborative, interdisciplinary student involvement in research
  - Reservoir models (real or synthetic data)
    - Geological/reservoir models – mainly geology students
    - Flow simulation models – geology and engineering students
  - Human bias impact
    - Decision behaviors and bias – STEM and non-STEM students (and faculty!)

Other Activities

- Organizing Committee for the 2014 Gussow Conference on Advances in Applied Geomodeling for Hydrocarbon Reservoirs
- Appointed to the Energy Sector Working Group for the State of Texas, Texas Homeland Security, Texas Department of Public Safety in 2014
- Preliminary Judge for the 2014 Jackson Hole Festival Science Media Competition (Earth Sciences Category)
- Associate Editor for the SPE Reservoir Evaluation and Engineering Journal
- Nominated for 2015/2016 SPE Distinguished Lecturer (final selection in progress)



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