

JOHN H. SCHUENEMEYER

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Detailed resume lists 1) education, 2) professional experience, 3) research accomplishments, 4) scientific and public service, 5) honors and awards, 6) presentations, workshops, short courses, and publications, and 7) academic activities.

1. EDUCATION:

<u>School</u>	<u>Major</u>	<u>Dates Attended</u>	<u>Degrees, Year</u>
U of Georgia	Statistics	1972-1975	Ph.D., 1975
U of Colorado	Mathematics	1969-1971	MS, 1971
U of Colorado	Applied Mathematics/Eng	1965-1969	BS, 1969
Washington U	Electrical Engineering	1956-1958	

2. PROFESSIONAL EXPERIENCE:

- a. **2001 to present. President, Southwest Statistical Consulting, LLC.** Current projects include developing a statistical model to assess gas hydrate resources in the U.S. Federal Offshore for the U.S. Bureau of Ocean and Energy Management and developing a spatial model to investigate distribution of shale resources. Models were developed using R. Recent work includes methodology to aggregate CO2 storage resources given dependency. Other work includes developing methodology to assess resource in the Circum Arctic. Online faculty member at University of Phoenix (2003-2005) teaching MBA courses in statistics and research methods.
- b. **1998 to 2001. Research Mathematical Statistician, U.S. Geological Survey.** Developed models to investigate spatial trends and correlation for the assessment of over 50 coal beds and zones in the US as part of the National Coal Assessment, and to better understand groundwater behavior, especially in complex, fractured rocks. Served as the leader for the development of methodology and principal consultant to the United States Geological Survey (USGS) ANWR oil and gas assessment team on matters of methodology.
- c. **1976 – 1998 Assistant, Associate and Professor of Statistics,** Department of Mathematical Sciences, University of Delaware, Director of the Statistics Program (1992-1997) and Director, Statistical Laboratory (1983-1997). Joint appointments with *Dept. of Geology* and *Dept. of Geography*, a climate focused quantitative department. Taught undergraduate and graduate courses in statistics, supervised numerous graduate students, conducted research in applied statistics and developed methodology applicable to problems in the earth sciences and

other areas. Established and directed the University of Delaware's Statistical Consulting Center (1979-1997).

- d. **Computer Specialist** (1976), U.S. Geological Survey, Athens, GA
Developed algorithms for the analysis of drilling and discovery data.
- e. **Graduate Student & Computer Specialist** (1972-1975), University of Georgia, Athens, GA

3. SIGNIFICANT RESEARCH ACCOMPLISHMENTS

- a. **Mass balance stochastic models to assess gas hydrate resources.** Developed a large complex model programmed in R and FORTRAN to model the biologic generation of gas hydrate resources in the US Federal off shore areas.
- b. **Discovery process modeling system.** Major development work in discovery process modeling, a methodology used to assess undiscovered oil and gas deposits in partially explored areas. This system was used in the past two US National Assessments of undiscovered oil and gas resources, the USGS World Assessment, and in Canadian assessments. Among the innovative features of this modeling effort was estimation of small fields and incorporation of field appreciation.
- c. **Subjective probability estimation for oil and gas resources in frontier areas.** Extensively modified existing methodology to estimate oil and gas resources in frontier areas. This methodology uses subjective probability estimation procedures to characterize oil and gas accumulation sizes. It resulted in the successful 1998 assessment of oil and gas resources of the 1002-Area of ANWR. It is also applicable to resource assessment in other frontier areas.
- d. **Spatial statistics applied to uncertainty estimates.** Developed a new and innovative way to apply probability-based uncertainty estimates to coal-bed resources. This effort involved the integration of complex statistical and graphical procedures including spatial statistics, non-parametric regression, and contouring.
- e. **Uncertainty analysis.** Proposed procedures to investigate uncertainty in large-scale models, including that associated with input data streams, the choice of models, and forecasts. The procedures provide more complete understanding of the operation and complexity of large-scale models.
- f. **Statistical education and consulting** Played a leading role in advancing the state of knowledge in the areas of statistical consulting and statistical education through writing, teaching, the development of internship programs, and leadership in the statistics profession.

4. SCIENTIFIC AND PUBLIC SERVICE

a. Rendering Scientific Judgement

American Statistical Association Committee on Energy Statistics, an advisory committee to the US Energy Information Administration. Member (1986-91), Vice Chair (1989), Chair (1990-91), Member (2010-present)

Committee on Resource Evaluation, Am Assoc of Petroleum Geologists (2007-2015)

Norwegian Petroleum Directorate (2014) Expert consultant on dependency aggregation of petroleum resources.

U.S. Committee for the International Association for Mathematical Geology, Subcommittee U.S. National Committee on Geology, National Research Council. (1982-1988)

Energy Information Administration (1991-95) Expert consultant on National Energy Modeling System.

Editorial correspondent for Computers & Geosciences (1992-95).

Associate Editor, Mathematical Geology (1997-2004)

Princeton University (1975) Expert consultant on study to evaluate oil and gas resource assessment models.

Office of Technology Assessment (1977) Expert consultant on resource assessment models.

Scientific expert reviewer for organizations including the National Science Foundation, and the US Dept. of Energy.

Scientific expert reviewer for journals including Mathematical Geosciences, Nonrenewable Resources, Technometrics, Journal of the American Statistical Association, Journal of Statistical Computation and Simulation, and the Bulletin of the American Association of Petroleum Geologists.

b. Membership in Professional Societies

- International Association for Mathematical Geosciences (1978-present)
 - Awards Committee Chair (2010-present)
 - Student Affairs Committee (1998-2004)
- American Statistical Association (1975-present)
 - National committees, offices and assignments:

Committee on Energy Statistics

Section on Statistical Consulting. Organizer and first chair of the Committee on Statistical Consulting, now the Section on Statistical Consulting.

ASA/MAA Committee on Statistics

Section on Physical & Engineering Science, 1993 National Meetings program chair.

Section on Statistics and the Environment (member 2016)

-Delaware Chapter

Principal organizer of the chapter (1980)

- American Association of Petroleum Geologists (2002-2015)

5. HONORS, AWARDS, RECOGNITION, ELECTED MEMBERSHIPS

- Elected member (2015) of the International Statistical Institute.
- 2012 International Association of Mathematical Geosciences Distinguished Lecturer.
- John Cedric Griffiths Award, 2004, for excellence in teaching mathematical geology, presented by the International Association for Mathematical Geosciences.
- Professor Emeritus, University of Delaware, 1998.
- American Statistical Association, Council of Chapters, Chapter Service Recognition Award, 1995.
- Elected a Fellow of the American Statistical Association, 1991. The citation read, *“for fundamental contributions in resource estimation problems of national importance, for outstanding leadership of the statistics profession in the areas of energy and education, and for excellence as an educator and consultant.”*
- Winner of the 1989 EDUCOM NCRIPTAL national award for Best Tutorial package for a set of 25 interactive computer assisted statistics lessons.

6. PRESENTATION, WORKSHOPS, SHORT COURSES AND PUBLICATIONS

Presentations (since 2000)

Hierarchical Bayesian spatial discovery modeling & resource costs in oil shale plays, US Energy Information Administration, American Statistical Association, Energy Statistics Meeting, Nov. 6, 2014, Washington, DC.

Aggregation issues, Norwegian Petroleum Directorate, Workshop on petroleum aggregation, Stavanger, Norway, Nov. 2014 (with Don Gautier).

Modeling gas hydrate resources in the US Federal Offshore regions, Mar. 22, 2014, Dallas Geophysical Society.

Why earth scientists should care about statistics, University of Twente, Netherlands, Apr. 2012.

Analogs, expert judgment, dependency, and aggregation, University of Ottawa, Canada, Mar. 2012.

Gas hydrate modeling, a statistician's perspective, University of Georgia, USA, Statistics Lecture Series, Oct. 2012.

Gas hydrate modeling, Chinese National Conference of Prediction of Mineral Resources in Covered Areas, Beijing, China, Dec. 2011

Statistical Applications in Earth and Environmental Sciences using R, Institute of Geographical Sciences and Natural Resources Research, Beijing, China, Dec. 2011.

Handling Probabilistic Dependencies Among Petroleum Assessment Units, Inter. Assoc. for Math Geosciences, Salzburg, Austria, 2011 (with Gordon Kaufman).

Assessing Alaskan gas hydrates and beyond-how to handle probabilistic dependencies, Thrid Symposium on Resource Assessment Methodologies, Canmore, Canada, Sept, 2010, (with Gordon Kaufman).

The Tract Aggregation Problem in Probabilistic Mineral Resource Assessment, IAMG, Budapest, 2010, (with Keith Long, LJ Drew, and David Sutphi).

Gas hydrate resource assessment: U.S. Atlantic Outer Continental Shelf, Mass Balance Analysis using a stochastic model: Am. Assoc. of Petroleum Geologists, Denver, CO, 2009, (with M Frye, G Kaufman and B Shedd).

Aggregation methodology for the Circum Arctic petroleum assessment, IAMG conference, Stanford, CA, 2009, (with Don Gautier).

A statistician's journey through the world of earth sciences. International Association for Mathematical Geology, International Geological Congress, Florence, Italy on August 25, 2004

The new frontier – a probabilistic assessment of the petroleum potential of the Circum Arctic (with Gordon Kaufman), Aug. 3, 2004, Ilulissat, Greenland.

Expert judgment in petroleum assessment, Canadian Gas Potential Committee, Apr 10-12, 2002, Calgary, Canada.

The impact of technology on statistical consulting, Joint Statistical meeting, Aug. 2001, Atlanta, GA.

Workshops (since 2000)

- Gas hydrate assessment workshop, Minerals Management Service, Sept. 27-28, 2004, Herndon, VA (invited participant & presenter)
- Hard versus soft data, Canadian Gas Potential Committee, Apr 10-12, 2002, Calgary, Canada (invited participant & presenter)
- Comments on Prof. Watkins' paper and other aspects of reserve appreciation: Nov 16-17, 2000 MIT Energy and Environmental Policy Workshop, Boston, MA (invited participant)

Short courses

- R-Project Short course (3 days - for earth and environmental graduate students), University of Freiberg, Germany, Apr. 2012.

Published Works

Kaufman, G.M., Faith, R, and Schuenemeyer, J.H., 2016, Has the Largest Field Been Discovered Yet? PETRIMES and GRASP 25 Years Later, Mathematical Geosciences, accepted for publication.

Schuenemeyer, J.H. and Gautier, D., 2014, Probabilistic Resource Costs of Continuous Oil Resources in the Bakken and Three Forks Formations, North Dakota and Montana, Unconventional Resources Technology Conference, Denver, Colorado, USA, 25-27 August 2014, 6 p., <https://www.onepetro.org/conference-paper/SPE-2014-1929983-MS>

Frye, M., Shedd, W. and Schuenemeyer, J., 2013, Gas hydrate resource assessment Atlantic Outer Continental Shelf, spatial analysis of inputs & outputs +

graphical & mathematical description of models and sub-models, U.S. Bureau of Ocean Energy Management, Report RED 2013-01, 57 p.

- Gough, L.P., Lamothe, P.J., Sanzalone, Drew, L.J., Maier, J.A.K., and Schuenemeyer, J.H., 2013, Cadmium geochemistry of soils and willow in a metamorphic bedrock terrain, Alaska, and its possible relation to moose health: *Alces*, v. 49, p. 1-13.
- Kaufman, G.M., Faith, R.E., and Schuenemeyer, J.H., 2013, Predictive probability distributions for petroleum unit resource projections via hierarchical modeling, Massachusetts Institute of Technology Sloan Research Paper No. 4981-12.
- Blondes, MS, Schuenemeyer, JH, Olea, RA, and Drew, LJ, 2013, Aggregation of carbon dioxide sequestrations storage assessment units, *Stochastic Environmental Research and Risk Assessment*, v. 27, p. 1839-1859.
- Frye, M, Shedd, W, Piper, K., and Schuenemeyer, JH, 2013, BOEM Releases Assessment of In-Place Gas Hydrate Resources of the Lower 48 United States Outer Continental Shelf, US Dept. of Energy, *Fire in the Ice*, v. 12, no. 1.
- Haines, S. S., Diffendorfer, J. E., Balistrieri, L., Berger, B., Cook, T., DeAngelis, D., Doremus, H., Gautier, D. L., Gallegos, T., Gerritsen, M., Graffy, E., Hawkins, S., Johnson, K. M., Macknick, J., McMahon, P., Modde, T., Pierce, B., Schuenemeyer, J. H., Semmens, D., Simon, B., Taylor, J., Walton-Day, K., 2013, A Framework for Quantitative Assessment of Impacts Related to Energy and Mineral Resource Development, *Natural Resources Research*, DOI: 10.1007/s11053-013-9208-6. Available at <http://link.springer.com/article/10.1007/s11053-013-9208-6>.
- Blondes, MS, Schuenemeyer, JH, Olea, RA, and Drew, LJ, 2013, Aggregation of carbon dioxide sequestrations storage assessment units, *Stochastic Environmental Research and Risk Assessment*, v. 27, p. 1839-1859, <http://www.springerlink.com/openurl.asp?genre=article&id=doi:10.1007/s00477-013-0718-x>.
- Frye, M, Shedd, W, Piper, K., and Schuenemeyer, JH, 2013, BOEM Releases Assessment of In-Place Gas Hydrate Resources of the Lower 48 United States Outer Continental Shelf, US Dept of Energy, *Fire in the Ice*, v. 12, no. 1.
- Frye, M., Schuenemeyer, J.H., Shedd, W., Piper, K., and Herman B., Gas hydrate resource assessment on the United States outer continental shelf: a mass balance model, *Proceedings of the 7th International Conference on Gas Hydrates (ICGH 2011)*, Edinburgh, Scotland, United Kingdom, July 17-21, 2011, 12 p.

- Schuenemeyer, J.H, and Drew, L.J., 2011, *Statistics for Earth and Environmental Scientists*, John Wiley, 407 p.
- Schuenemeyer, J.H., Michael L. Zientek, and Stephen E. Box, 2011, Aggregation of Estimated Numbers of Undiscovered Mineral Deposits—An R-Script with an Example from the Chu Sarysu Basin, Kazakhstan, U.S. Geological Survey Scientific Investigations Report 2101-5090 B. Available at <http://pubs.usgs.gov/sir/2010/5090/b/>
- Schuenemeyer, JH and Donald L. Gautier, 2010, Aggregation Methodology for the Circum-Arctic Resource Appraisal: *Mathematical Geosciences* v.42, n. 5, p. 583-594.
- Gautier, Donald L., Kenneth J. Bird, Ronald R. Charpentier, Arthur Grantz, David W. Houseknecht, Timothy R. Klett, Thomas E. Moore, Janet K. Pitman, Christopher J. Schenk, John H. Schuenemeyer, Kai Sørensen, Marilyn E. Tennyson, Zenon C. Valin, and Craig J. Wandrey, 2009, Assessment of Undiscovered Oil and Gas in the Arctic: *Science* **324** (5931), 1175. [DOI: 10.1126/science.1169467]
- Drew, L.J., Grunsky, E.C., M.R., and Schuenemeyer, J.H., 2008, Investigation of the structure of geological process through multivariate statistical analysis – the creation of a coal: *Mathematical Geosciences*, v. 40, n. 7, p. 789-821.
- Frye, M., Grace, J., Hunt, J., Kaufman, G., Schuenemeyer, J., and Shedd, W., 2008, Methane hydrate resources assessment of the Outer Continental Shelf: In-place Gulf of Mexico results. Proceedings of the 6th International Conf on Gas Hydrates, Vancouver, British Columbia, July 6-10, 2008.
- Schuenemeyer, J.H. Methodology for the 2005 USGS assessment of undiscovered oil and gas resources, Central North Slope, Alaska: U.S. Geological Survey Open File Report 2005-1410. Available on line at <http://pubs.usgs.gov/of/2005/1410/>
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- Schuenemeyer, J.H., 2003, Methodology and results from the assessment of oil and gas resources, National Petroleum Reserve, Alaska: U. S. Geological Survey Open-File Report 03-118. Available online at: <http://geopubs.wr.usgs.gov/open-file/of03-118/of03-118.pdf>
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- Drew, L.J., Sutphin, D.M., and Schuenemeyer, J.H., 2002, Geology and medicine-recovery and use of a large set of chemical data for soil and plant samples collected in the 1960s and the 1970s, Proceedings of 2002 International Association for Mathematical Geology, Berlin, Germany.
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Pinardville Quadrangle, New Hampshire: Ground Water, v. 39, no. 5, p 1-9.

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Schuenemeyer, J.H., and Power, Helen C., 2000, Uncertainty estimation for resource assessment-an application to coal: *Mathematical Geology*, v. 32, no. 5, p. 521-541.

Schuenemeyer, J. H., 2000, Uncertainty in coal resource assessment: Variability among and within coal zones, The Proceeding of the 25th International Technical Conference on Coal Utilization & Fuel Systems, March 6-9, 2000, Coal Technology Association, Rockville, MD, p. 319-329.

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Ellis, M.S., Gunther, G.L., Ochs, A.M., Cavaroc, Jr., V.V., Schuenemeyer, J.H., Power, H.C., Stricker, G.D., and Blake, D., 1999, Coal resources of the Hanna and Carbon basins, U.S. Geological Survey, Professional Paper 1625-A, 99 p.

Ellis, M.S., Gunther, G.L., Ochs, A.M., Keighin, C.W., Goven, G.E., Schuenemeyer, J.H., Power, H.C., Stricker, G.D., and Blake, D., 1999, Coal resources, Williston River Basin, U.S. Geological Survey, Professional Paper 1625-A, 74 p.

Roberts, S.B., Wilde, E.M., Rossi, G.S., Blake, D., Bader, L.R., Ellis, M.E., Stricker, G.D., Gunther, G.L., Ochs, A.M., Kinney, S.A., Schuenemeyer, J.H., and Power, H.C., 1999, Colstrip Coalfield, Powder River Basin, Montana: Geology, coal quality, and coal resources, U.S. Geological Survey, Professional Paper 1625-A, 41 p.

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- Roberts, S.B., Gunther, G.L., Taber, T.T., Ochs, A.M., Blake, D., Ellis, M.E., Stricker, G.D., Wilde, E.M., Schuenemeyer, J.H., and Power, H.C., 1999, Decker Coalfield, Powder River Basin, Montana: Geology, coal quality, and coal resources, U.S. Geological Survey, Professional Paper 1625-A, 54 p.
- Ellis, M.S., Flores, R.M., Ochs, A.M., Stricker, G.D., Gunther, G.L., Rossi, G.S., Bader, L.R., Schuenemeyer, J.H., and Power, H.C., 1999, Sheridan Coalfield, Powder River Basin: Geology, coal quality, and coal resources, U.S. Geological Survey, Professional Paper 1625-A, 61 p.
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- Ellis, M.S., Gunther, G.L., Ochs, A.M., Roberts, S.B., Wilde, E.M., Schuenemeyer, J.H., Power, H.C., Stricker, G.D., and Blake, D., 1999, Coal resources, Powder River Basin, U.S. Geological Survey, Professional Paper 1625-A, 32 p.
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- Drew, L.J. and Schuenemeyer, J.H., 1997, Composition of oil, gas field discovery rates and it's bearing on resource assessment: *The North Sea: Proceeding of IAMG'97*, CIMNE, Barcelona, p. 427-432.
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7. LECTURESHIPS AND OTHER ACADEMIC SERVICE

Graduate courses taught at the University of Delaware

ST601 Introduction to Prob. Theory & Its Applications
ST615 Design and Analysis of Experiments I
ST616 Design and Analysis of Experiments II
ST617 Multivariate Methods
ST618 Sampling
ST640 Statistical Consulting (developed course)
ST657 Statistics for Earth Scientists (developed course)
ST815 Linear Statistical Inference I
ST816 Linear Statistical Inference II
ST818 Multivariate Analysis
ST831 Time Series Analysis
ST840 Statistical Computing
Geog667 Spatial Statistics

Undergraduate courses taught at the University of Delaware

ST201 Introduction to Statistics I

ST202 Introduction to Statistics II
ST370 Introduction to Statistical Analysis I
ST371 Introduction to Statistical Analysis II
U89 Honors Introduction to Research (statistics component)

Graduate students supervised

- 1998 Monyak, John, An investigation of the LPM using ridge regression, Ph.D. dissertation, (co-supervised with Rajaram Gana).
Hugari, Ibrahim, Analysis of the generalized lambda distribution and it's application, Ph.D. dissertation.
- 1997 Chitra, Rohini, A two stage approach to unbalanced split plot designs, Ph.D. dissertation, (co-supervised with Diccon Bancroft)
- 1996 Bhore, Rafia, Uncertainty analysis in energy models, Ph.D. dissertation.
- 1995 Fatanani, Sangita, Statistical assessment of hazardous waste sites, Ph.D. dissertation (co-supervised with J. Lucas).
- 1994 Ganju, Jitendra, Diagnostics for inherent split-plotting in designed experiments, Ph.D. dissertation (co-supervised with J. Lucas).
- 1993 Lambroli, Dominic, A multiple regression model to assess treatment effects in efficacy assessments for clinical research, Ph.D. dissertation (co-supervised with S.M. Free).
- 1992 Tao, Qi, Robust quantile estimation using the generalized Tukey-lambda distribution, Ph.D dissertation.
- 1990 Sinurat, Sahala, Predicting blood supply at the Blood Bank of Delaware, M.S. thesis in OR.
- 1989 Tung, Sarah, An expert system for ANOVA based on the study of statistical consulting processes, Ph.D. dissertation.
- 1988 Altekar, Maneesha, Shift detection in two-way arrays, Ph.D. dissertation.
- 1985 Joglekar, Gitanjali, A method of grouping observations for a near neighbor lack of fit test in regression, Ph.D. dissertation.
- 1984 Stoner, Marcia, Discriminant analysis for the selection of treatment for accounts receivable, M.S. thesis.
- 1983 Hoerl, R. W., A simulation of biased estimation and subset selection regression techniques, Ph.D. dissertation.
- 1980 Srivastava, Rita, Statistical analysis of photovoltaic cell data, M.S. thesis.
- 1979 Roy, Meetra, An analysis of pattern drilling, M.S. thesis.

Other major academic activities at the University of Delaware

Co-chair, Center for Teaching Effectiveness Advisory Board (1996-97)

Established a statistical consulting laboratory in 1983 at the Univ. of Delaware.

Co-developed in 1983 an internship masters program in statistics between the University of Delaware and the DuPont Company. This program was internationally recognized.