

# ERASMUS K. OWARE

Department of Geology  
SUNY at Buffalo  
126 Cooke Hall  
Buffalo, NY 14260

office: 716-645-4260  
fax: 716-645-3999  
email: [erasmuso@buffalo.edu](mailto:erasmuso@buffalo.edu)  
<http://www.geology.buffalo.edu/people/faculty/dr-erasmus-k-oware>

## RESEARCH INTERESTS

---

My research interest is in the development of innovative inverse methods for improved geophysical characterization of subsurface properties and processes. My research group is subdivided into two broad thematic research areas:

Research Area 1 (RA1): focuses on the development of novel inversion schemes to enhance hydrogeophysical characterization and monitoring of subsurface processes.

Research Area 2 (RA2): comprises the development of innovative stochastic (geostatistical) imaging strategies to improve hydrogeophysical quantification of aquifer hydraulic parameters (e.g., spatial variations in permeability and porosity distributions).

My research efforts in *RA1* have resulted in the development of the Proper Orthogonal Decomposition (POD) inversion framework. To improve the monitoring of subsurface processes, the POD-based imaging strategy seeks to incorporate physics-based (e.g., hydrological process-based) prior information to constrain the inversion of the geophysical measurements while reducing the number of inversion parameters. We have recently developed a POD Markov chain Monte Carlo (McMC) version of the POD algorithm that parameterizes the McMC method in the reduced dimensional space. On the *RA2* front, my research group has recently developed the Markov Random Field (MRF) based stochastic inversion (SI) scheme. The MRF-based SI technique is a data-driven SI strategy with the primary goal of avoiding the conventional use of prior multiple-point statistics borrowed from training images (TIs), which may bias outcomes if the hypotheses underlying the generation of the TIs are inaccurate.

My students and I are currently working on a 3-D version of the MRF-based SI algorithm and on a field-scale demonstration of the strategy. We are also working on electrical resistivity thermography (ERT<sub>h</sub>) to employ ER monitoring of a heat tracer experiment to characterize lab-scale hydraulic conductivity (K) distributions. The primary goal here is to demonstrate the potential application of ER monitoring of heat tracer experiments to estimate spatial variations in K, which is intuitively appealing for field applications in contrast to the use of saline tracers, especially, in regions where the injection of saline tracers into the groundwater system is not permitted.

## EDUCATION

---

2014 **Ph.D. Environmental Engineering and Science**, Clemson University, Clemson-SC,  
**Dissertation Title:** *"Incorporating physics-based patterns into geophysical and geostatistical estimation algorithms."*

**Doctoral Advisor:** S.M.J. Moysey.

*Developed and demonstrated a novel physics-based modality to regularize geophysical (electrical resistivity) imaging problems; Formulated and illustrated an adaptive inversion approach to estimate spatial moments of solute plumes; Developed a dynamic imaging framework for improved monitoring of transient hydrogeological processes. Wrote a Matlab program for numerical modeling of flow and solute transport in heterogeneous media.*

2010 **M.S. Hydrogeology**, Illinois State University, Normal-Illinois,  
**Thesis Title:** *"The impacts of storm on thermal transport within the hyporheic zone of a low gradient, third-order, sand and gravel bedded stream."*

**Thesis Advisor:** E.W. Peterson.

Erasmus K. Oware

*Built a predictive (statistical) model to quantify the propagation of temperature in the hyporheic zone during a storm event; Demonstrated how hyporheic thermal transport is impacted by manifold intensities of storm episodes given varying antecedent wetting conditions.*

- 2010 **Certificate Petascale Programming Environments and Tools**, Virtual School of Computational Science and Engineering, University of Illinois, Urbana-Champaign.
- 2010 **Graduate Certificate Hydrogeology Geographic Information Systems**, Illinois State University, Normal-Illinois.
- 2002 **B.Sc. Geological Engineering**, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
- 1997 **Certificate in Urban Water Treatment**, Ghana Water Company Training School, Accra, Ghana.

EMPLOYMENT HISTORY

- 2014- present: **Assistant Professor**, Department of Geology, University at Buffalo, SUNY, Buffalo, NY.  
*Setup a new Environmental Geophysics Lab and established the UB's Environmental Geophysics Imaging Site (UBEGIS) within the first year of my appointment.*
- 2010-2014: **Graduate Research Assistant** (three years) and **Teaching Assistant** (one year), Clemson University, Clemson, SC.  
*Worked on sand-tank flow and transport experiments with electrical resistivity monitoring to investigate mechanisms that control preferential flow processes. Formulated novel approaches to incorporate physics-based prior information into geophysical inverse problems via spectral decomposition techniques, such as Proper Orthogonal Decomposition (POD), wavelet transformations, and Maximum Covariance Analysis (MCA).*
- 2008-2010: **Graduate Teaching Assistant**, Illinois State University, Normal, Illinois.  
*Duties: Tutored undergraduate students in the laboratory section of an introduction to geology class. Graded and proctored laboratory and lecture exams.*
- 2007-2008: **Project Hydrogeologist/geophysicist**, Beza-lel Water & Agro Services Ltd., Accra, Ghana.  
*Utilized DC electrical and electromagnetic geophysical methods for aquifer exploration in mainly World Bank, African Development Bank, and European Union funded rural water supply projects in Ghana. My duties included supervision of borehole drilling and logging; supervision of pumping test and analysis of pumping test data; preparation of project reports to funding agencies; and verification and approval of payment claims filed by project construction contractors.*
- 2005-2008: **Consulting Hydrogeologist/geophysicist**, China Geo-Engineering Corporation, Ghana.  
*Responsible for the preparation of proposals and bidding documents to seek projects. Preparing project reports to project consulting companies for subsequent reporting to funding agencies.*
- 2004-2007: **Project Hydrogeologist/geophysicist**, AY&A Consult Ltd. (now SAL Consult), Accra, Ghana.  
*Utilized DC electrical and electromagnetic geophysical methods for aquifer exploration in mainly World Bank, African Development Bank, and European Union funded rural water supply projects in Ghana. My duties included supervision of borehole drilling and logging; supervision of pumping test and analysis of pumping test data; preparation of project reports to funding agencies; and verification and approval of payment claims filed by project construction contractors.*
- 2003-2004: **Assistant Production Manager**, John Harris Salt Industries Ltd., Accra, Ghana.

## Erasmus K. Oware

*In charge of monitoring the movement of brine between appropriate production ponds according to brine concentration to ensure optimal fractional-crystallization for quality salt production. Managed the harvesting and packaging of the finished products. Supervised the day-to-day running of the production plant.*

- 2001-2001: **Student Internship**, Community Water and Sanitation Division (CWSD), Ho, Ghana.  
*Participated in CWSD's facilitation and training of rural communities on rural water and sanitation delivery in Ghana. Participated in the appraisal of bidding documents submitted by contractors. Inspected completed projects by contractors under mainly World Bank, African Development Bank, and European Union water and sanitation sponsored projects in Ghana.*
- 1997-1998: **Water Treatment Attendant**, Ghana Water Company Ltd., Accra, Ghana.  
*Managed pump operations at the water intake and treatment plants. Responsible for raw water filtering, water treatment, chemical dosing for pH control, and water quality analysis.*

### HONORS, AWARDS, AND FELLOWSHIPS

---

- 2010 - 2014: Graduate Research Assistant Fellowship, Clemson University, Clemson, SC.  
2012: Society of Exploration Geophysicists and Near-surface Geophysics (SEG-NSGS) Student Travel Grant.
- 2008 - 2010: Graduate Teaching Assistant Fellowship, Illinois State University, Normal, IL.

### SERVICE

---

#### Professional

- 2016 *Primary convener*, Advances in data integration, inverse methods, and data valuation across a range of scales in hydrogeophysics, 2016 American Geophysical Union (AGU) Fall Meeting.
- 2016 *Co-convener*: Integrating surface geophysical methods into multi-scale investigation of surface and ground water connectivity, 2016 AGU Fall Meeting.
- 2016-Present *Peer reviewer*, Geophysics.
- 2016-Present *Peer reviewer*, National Science Foundation Hydrologic Sciences Program grant proposals.
- 2015-2015 *Judge*, Outstanding Students Paper Award, Fall Meeting, AGU, Dec. 2015.
- 2015-Present *Member*, Hydrogeophysics Technical Committee, AGU.
- 2014-present *Peer reviewer*, Water Resources Research.
- 2013-Present *Peer reviewer*, Society of Exploration Geophysicists Technical Program Extended Abstract.

#### Departmental

- 2016-present Coordinator, Pegrum (departmental) Lecture Series.

### PROFESSIONAL MEMBERSHIPS

---

1. Geological Society of America (GSA), since 2009.
2. American Geophysical Union (AGU), since 2010.
3. Society of Exploration Geophysicists (SEG), since 2012.
4. National Society of Black Engineers (NSBE), since 2012.

### PUBLICATIONS

---

#### Referred Journal Publications

*In Review*

1. **Oware, E. K.** (in-revise and resubmit to WRR), MRF-based stochastic joint inversion of hydrological and geophysical datasets to characterize aquifer heterogeneities.

2. **Oware, E. K.**, and S. M. J. Moysey, Physics-based regularization for improved geoelectrical monitoring of a lab-scale saline tracer experiment, *in review at Geophysical Journal International*.

*Published*

1. **Oware, E. K.** (2016), Estimation of hydraulic conductivities using higher-order MRF-based stochastic joint inversion of hydrogeophysical measurements, *The Leading Edge (Society of Exploration Geophysicists)* 35 (9), 776-785.
2. Herman, T, **E. K. Oware**, and J.K. Caers (2016), Direct prediction of spatially and temporally varying physical properties from time-lapse electrical resistance data, *Water Resources Research*, doi.org/10.1002/2016WR019126.
3. **Oware, E. K.**, and S. M. J. Moysey (2014), Geophysical evaluation of solute plume spatial moments using an adaptive POD algorithm for electrical resistivity imaging, *Journal of Hydrology*, 517, 471-480, doi:10.1016/j.jhydrol.2014.05.054.
4. **Oware, E. K.**, S. M. J. Moysey, and T. Khan (2013), Physically-based regularization of hydrogeophysical inverse problems for improved imaging of process-driven systems, *Water Resources Research*, 49 (10), 6238-6247, doi:10.1002/wrcr.20462.
5. **Oware, E. K.**, Moysey, S.M.J., and Khan, T. (2012), Improved imaging of electrically conductive solute plumes using a new strategy for physics based regularization of resistivity imaging problems, *Society of Exploration Geophysicists Technical Program Extended Abstract*, November 2- 4, Las Vegas, NV, Proceedings, 4 p.

**Non-referred Journal Publication**

1. Hydrogeological Investigation, Drilling, Design, and Construction reports on over 1000 Boreholes in Ghana (2003-2008). Technical Reports submitted to donor agencies including the World Bank, African Development Bank, and European Union (*Participated in writing multiple versions of these reports*).

**Major Conferences** [\* indicates student author]

1. \*Zhang, G., and **E.K. Oware**, Application of MRF-based stochastic joint inversion of transient hydraulic head and electrical resistivity measurements to identify 2-D fracture zone connectivity, AGU Fall Meeting, San Francisco, Dec. 2016.
2. \*Awatey, M., J. Irving, and **E.K. Oware**, Hydrologic process parameterization of electrical resistivity imaging of solute plumes using POD MCMC, AGU Fall Meeting, San Francisco, Dec. 2016.
3. **Oware E.K.**, MRF-based stochastic joint Inversion of hydrological and geophysical datasets to evaluate aquifer heterogeneities, AGU Fall Meeting, San Francisco, Dec. 2016.
4. \*Adetokunbo, P., T. Hermans, and **E.K. Oware**, Electrical resistivity monitoring of heat tracer to characterize lab-scale hydraulic conductivity distributions, AGU Fall Meeting, San Francisco, Dec. 2016.
5. **Oware E.K.** and S. M. J. Moysey (2016), Hydrologic process regularization for improved geoelectrical monitoring of a lab-scale saline tracer experiment, AGU Fall Meeting, San Francisco, Dec. 2016.
6. **Oware E.K.**, Bayesian Gibbs Markov chain: MRF-based stochastic joint inversion of hydrological and geophysical datasets for improved imaging of aquifer heterogeneities, Abstract #H H13E-1591, 2015 Fall Meeting, AGU, San Francisco, Dec. 2015.

7. **Oware, E. K.**, and S.M.J. Moysey, Assessing the robustness of a POD-based inversion framework for resistivity imaging of solute plumes, Abstract #H44D-05 presented at 2013 Fall Meeting, AGU, San Francisco, Dec. 2013.
8. **Oware, E. K.**, Moysey, S.M.J., and Khan, T., Physically based regularization of inverse problems for improved imaging of process-driven systems, presented at 2012 Fall Meeting, AGU, San Francisco, Dec. 2012.
9. Moysey, S.M, **E.K. Oware**, and T. Khan, Picture-based physics: Using proper orthogonal decomposition derived process constraints to enhance imaging of groundwater systems, Abstract #H33A-1281 presented at 2012 Fall Meeting, AGU, San Francisco, Dec. 2012.
10. **Oware, E.K.**, and E.W. Peterson, The impacts of storm on thermal transport within the hyporheic zone of a low gradient third-order sand and gravel bedded stream: Abstract with programs - *Geological Society of America*, April 2010, Vol. 42, NO. 2, p. 103.
11. **Oware, E.K.**, and E.W. Peterson, E.W., The impacts of storm on thermal transport within the hyporheic zone of a low gradient third-order sand and gravel bedded stream: Abstract with Programs - *Geological Society of America*, April 2010, Vol. 41, Issue 4, pp. 14.

#### **Invited Talks, Workshops, and Symposia**

1. **Oware, E. K.** (2016), Novel geophysical imaging tools for quantifying subsurface properties and processes. **Invited talk:** Geophysics department seminar, Stanford University, Palo Alto, CA.
2. **Oware, E. K.** (2015), Leveraging geophysical tools for improved assessment of hydrogeological problems. **Invited talk:** 2015 Foster Lecturer, Illinois State University, Normal, Illinois.
3. **Oware, E. K.** (2015), Novel imaging techniques for geophysical characterization of subsurface processes for environmental applications, **Invited talk:** Rutgers University, Newark, NJ.
4. **Oware, E. K.**, and S.M.J. Moysey (2014), Quantification of spatial moments of subsurface plumes: a comparison of geophysical and direct sampling approaches, *Snipes Hydrogeology Symposium, Clemson University, Clemson, SC.*
5. **Oware, E. K.**, and S.M.J. Moysey (2013), Improved solute concentration estimation using a pattern matching approach to capture site-specific plume morphologies, *Snipes Hydrogeology Symposium, Clemson University, Clemson, SC.*
6. **Oware, E. K.**, Moysey, S.M.J., and Khan, T. (2012), Improved imaging of electrically conductive solute plumes using a new strategy for physics-based regularization of resistivity imaging problems, *SEG-AGU Joint Hydrogeophysics workshop*, July 8-12, Boise State, ID, 2 p.
7. **Oware, E. K.**, Moysey, S.M.J., and Khan, T. (2012), Improved imaging of electrically conductive solute plumes using a new strategy for physics-based regularization of resistivity imaging problems. *Snipes Hydrogeology Symposium, Clemson University, Clemson, SC.*

TEACHING

---

**Undergraduate Level Course**

1. GLY 325 Geophysics, Spring 2015 and Spring 2016.

**Combined Senior Level Undergraduate and Graduate Level Courses**

2. GLY 415/515 Hydrogeology, Fall 2014.
3. GLY 419/519 Environmental Geophysics, Fall 2015 and Fall 2016.

STUDENT ADVISEMENT

---

**Major Advisor**

*Current PhD Students with Expected Degree Dates*

Guoqun Zhang (2021), Michael Awatey (2021)

*Current MS/MA Students with Expected Degree Dates*

Peter Adekotunbo (2017), Lena Lai (2017), Yutong Meng (2017).

*Undergraduate Research*

Tasha Mumbroe (2015)

Alexander Percy (2016)

**Thesis Committee Member**

Thomas Glose (PhD 2019), Mackenzie Adamson (MS 2017), Ryan Frederiks (MS 2018).

PROFESSIONAL REFERENCES

---

*Available upon request.*