

Chadi Sayde

North Carolina State University
Biological & Agricultural Engineering
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EDUCATION

Ph.D., Water Resources Engineering, Oregon State University, Corvallis, Oregon, USA, 2012.
Thesis Title: *Improving Soil Water Determination in Spatially Variable Field Using Fiber Optic Technology and Bayesian Decision Theory.*

M.S., Land and Water Resources Management: Irrigated Agriculture, Istituto Agronomico Mediterraneo di Bari, Bari, Italy, 2002.
Thesis Title: *Operation and Performance Analysis of a Pseudo-looped Irrigation Scheme.*

B.S., Agricultural Engineering, University of Holy Spirit, Kaslik, Lebanon, 1999.

RESEARCH and WORK EXPERIENCE

North Carolina State University – Department of Biological & Agricultural Engineering, Raleigh, North Carolina, 2017 to date
Assistant Professor –Water Resources Engineering

Oregon State University - Department of Biological & Ecological Engineering, Corvallis, Oregon, 2012 to date

Research Associate (Post Doc):

- Designed and installed 5000 m of fiber optic cables for distributed soil water monitoring. The installation is yielding >20,000 simultaneous measurements of soil water content along the fiber optic sensing cable path. The Actively Heated Fiber Optic Distributed Temperature Sensing (soil-AHFO) method is based on observing the thermal response of soils to heat perturbation to reveal soil water content every 0.125 m along a soil-AHFO cable that can exceed 10,000 m in length. The objectives of the project are to study the structure and the dynamics of soil water spatial variability in the field and to calibrate/validate soil moisture remote sensing data.
- Developed a new method for distributed measurements of wind speed using heated fiber optics (air-AHFO). This method allows practical continuous sub-meter measurements of wind velocity and temperature along a Fiber-Optic sensing cable that can extend kilometers in space. This continuous 3-D measurement of atmospheric turbulent flow simultaneously across 0.1-1000 m scales opens transformative opportunities to observe and understand fundamental fluid dynamics phenomena. Combined with the soil-AHFO, the air-AHFO will allow a better understanding of soil-plant-atmosphere interactions at a range of scales never attempted before.

- Trained personnel in environmental monitoring technologies at the undergraduate, graduate and postdoctoral levels.

Oregon State University - Department of Biological & Ecological Engineering, Corvallis, Oregon, 2005 – 2012.

Ph.D. Graduate Research:

- Developed innovative method to measure soil moisture based on thermal response of soil to a heat pulse using Distributed Fiber Optic Sensing technology (soil-AHFO).
- Proved the feasibility of the soil-AHFO method for soil moisture monitoring in lab and field; a method that can yield many thousands of simultaneous, distributed measurements of soil water content in the field.
- Developed a Bayesian statistical model to reduce uncertainty of crop water consumptive use estimates in agricultural fields.
- Contributed to development of the Irrigation Management Online (IMO) system; an advanced irrigation advisory service to optimize agricultural water management.
- Conducted extensive soil sampling and soil moisture measurement to validate soil-AHFO, IMO, and the Bayesian model.
- Analyzed irrigation efficiency in the field by accounting for spatial variability of soil properties and irrigation uniformity.

Litani River Authority - Rural Development Department, Beirut, Lebanon, 2004 – 2005.

Irrigation Engineer:

- Designed, and evaluated the performance of pressurized irrigation water distribution networks, using computer models and GIS applications.
- Planned, and analyzed the performance of advanced irrigation systems in Kherbit-Kanafar demonstration plots.
- Initiated methods to optimize water use efficiency in irrigation schemes.
- Developed methods to compute irrigation needs and crop water requirements of the different cultivated crops in the study areas.
- Conducted extension services and introduced new irrigation techniques into pilot project areas.
- Applied GIS methods to assess and improve performance of water management techniques in the project areas.

Co-operazione Italiana - Rural Development Project of the Upper Bekaa Valley, Bekaa Valley, Lebanon, 2004.

Consultant:

- Trained professionals and farmers in operation and maintenance of irrigation water delivery and application systems, and in computation of irrigation needs and crop water requirements.

Lebanese Agricultural Research Institute - Rural Development Project of the Upper Bekaa Valley, Bekaa Valley, Lebanon, 2003 – 2004.

Irrigation Engineer:

- Designed, installed, and evaluated performance of irrigation water storage, delivery and application systems in three pilot areas.
- Optimized irrigation water management, water delivery and water use efficiencies in the irrigation pilot schemes; The result was doubling the irrigated area without increasing the volume of water used.

Istituto Agronomico Mediterraneo di Bari - Land and Water Resources Management department, Bari, Italy, 1999 – 2001.

M.S. Graduate Research: Operation and Performance Analysis of a Pseudo-looped Irrigation Scheme

- Developed analytical tools to evaluate and optimize the operation and performance of Pseudo-looped irrigation water distribution networks.

TEACHING and ACADEMIC ACTIVITIES

- Reviewer for the following Journals: *Water Resources Research*, *Canadian Water Resources Journal*, *Environmental & Engineering Geoscience*, *Smart Materials and Structures*.
- Co-Convener for session “Understanding Hydrogeophysical States and Fluxes: Connecting Point Scale Information with Remote Sensing” at AGU fall meeting, San Francisco, 2015.
- Member of PhD examination committee of Javier Benitez-Buelga, Polytechnical University of Madrid, 2015.
- Advised 3 undergraduate students from The École Nationale Supérieure d'Electronique, d'Electrotechnique, d'Informatique, d'Hydraulique et des Télécommunications, Toulouse, France, 2013 and 2014.
- CTEMPS DTS workshop at Stanford University, December 2014, 2016. Co-Instructor.
- BEE 439 Irrigation Principles and Practices, Spring 2008, Biological & Ecological Engineering, Oregon State University - Co-instructor.
Subjects covered: Survey of irrigation systems, system configurations, factors that influence irrigation efficiency, crop water requirements, energy requirements, irrigation scheduling.
- BEE 439 Irrigation Principles and Practices, Spring 2007, Biological & Ecological Engineering, Oregon State University – Lecturer.

REFEREED JOURNAL ARTICLES

- Sayde, C., D. Moreno, J. Dong, T. Ochsner, S. Steele-Dunne, C. Hatch, S. Tyler, N. Van de Giesen, and J. Selker, 2016. In Situ Distributed Calibration of High-Resolution DTS Soil Water Content. Submitted to *Water Resour. Res.*
- Sigmund, A., L. Pfister, C. Sayde, and C. K. Thomas, 2016. Measuring centimeter-resolution air temperature profiles above land and water using fiber-optic Distributed Temperature Sensing. Accepted in *Atmos Meas Tech*.
- Dong, J., S. Steele-Dunne, T.E. Ochsner, C. Hatch, C. Sayde, J. Selker, S. Tyler, M. Cosh, and N. van de Giesen, 2016. Mapping high resolution soil moisture and properties using distributed temperature sensing data and an adaptive Particle Batch Smoother. Accepted in *Water Resour. Res.*
- Benítez-Buelga, J., L. Rodríguez-Sinobas, R. Sánchez-Calvo, M. Gil-Rodríguez, C. Sayde, and J. S. Selker (2016), Calibration of soil moisture sensing with subsurface heated fiber optics using numerical simulation, *Water Resour. Res.*, 52, 2985–2995, doi:10.1002/2015WR017897.
- Cosh, M.H., T.E. Ochsner, L. McKee, J. Dong, J. Basara, S.R. Evett, C. Hatch, E. Small, S. Steele-Dunne, M. Zreda, and C. Sayde, 2016. The Soil Moisture Active Passive Marena Oklahoma In Situ Sensor Testbed (SMAP-MOISST): Design and Initial Results. *Vadose Zone J.* doi:10.2136/vzj2015.09.0122
- Sayde, C., C. K. Thomas, J. Wagner, and J. Selker, 2015. High-resolution wind speed measurements using actively heated fiber optics, *Geophys. Res. Lett.*, 42, 10,064–10,073, doi:10.1002/2015GL066729.

- Sayde, C., J. Benitez-Buelga, J., L. Rodriguez-Sinobas, L. El Khoury, M. English, N. van de Giesen, and J. Selker, 2014. Mapping Variability of Soil Water Content and Flux across 1-1,000 m scales using the Actively Heated Fiber Optic Method. *Water Resour. Res.*, 50,7302–7317, [doi:10.1002/2013WR014983](https://doi.org/10.1002/2013WR014983).
- Benitez-Buelga, J., C. Sayde, J., L. Rodriguez-Sinobas, and J. Selker, 2014. Heated fiber optic distributed temperature sensing for measuring soil volumetric heat capacity and water content: A dual heat-pulse probe approach. *Vadose Zone J.* [doi:10.2136/vzj2014.02.0014](https://doi.org/10.2136/vzj2014.02.0014).
- Sayde, C., C. Gregory, M. Gil-Rodriguez, N. Tufillaro, S. Tyler, N. van de Giesen, M. English, R. Cuenca, and J. Selker, 2010. Feasibility of soil moisture monitoring with heated fiber optics. *Water Resources Research*, vol. 46 [doi:10.1029/2009WR007846](https://doi.org/10.1029/2009WR007846).
- Selker, J.S. J. Gabrielli, C. Gregory, C. Sayde, N. Tufillaro, R. Haggerty, A. Kennedy, R. Harris, E. Hester, S. Tyler, M. Hausner, F. Day-Lewis, J. Lane, R. Henderson, R. Tanner, S. Senften, C. Soto, A. Sawyer, A. Marzadri, P. Gerla, B. Gungl. Taking the Temperature of Ecological Systems with Fiber Optics, *Eos Trans. AGU*, 89(20). 2008.

SELECT CONFERENCE PROCEEDINGS

- Sayde, C., A. Gitelman, C. Hillyer, and L. El Khoury. 2010. Reducing the uncertainty of soil moisture water determinations. ASABE Paper No: IRR10-9853. IN: 5th National Decennial Irrigation Conference, Phoenix, Arizona. December 5-8, 2010.
- Hillyer, C. and C. Sayde. 2010. A Web Based Advisory Service For Optimum Irrigation Management. ASABE Paper No: IRR10-9854. IN: 5th National Decennial Irrigation Conference, Phoenix, Arizona. December, 2010.
- Sayde, C., J. Selker, M. English. 2009. Measuring soil moisture in a heterogeneous field. IN: Proceedings of World Environmental & Water Resources Congress, Great Rivers, MO. 2009.
- Sayde, C., L. El Khoury, A. Gitelman, and M. English. 2008. Optimizing estimates of soil moisture for irrigation scheduling. ASABE Paper No. 084699. IN: 2008 ASABE Annual International Meeting, Providence, Rhode Island. June, 2008.
- English, M., C. Sayde, A. Gitelman, and L. El Khoury. 2008. A feedback system to optimize crop water use estimates in irrigation scheduling. IN: Proceedings of the World Environmental & Water Resources Congress 2008, Honolulu, Hawaii. May, 2008.
- Abourached, C., C. Hillyer, C. Sayde, M. English, and J. Bush. 2007. A web-based advisory service for optimum irrigation management, Proceedings of the 2007 ASABE Annual International Meeting, 17-2 June. ASABE, Paper No. 072253, Minneapolis, Minnesota, pp. 1-12.

INVITED TALKS

- Oklahoma State University, MOISST Workshop, June 2013, 2014, 2015, and 2016. Soil moisture estimation using active DTS at MOISST.
- Oregon State University, Winter Water Resources Seminar, Feb 2014. Hotting up: interrogating the environment with heat pulses and fiber optics.
- American University of Beirut, Jan 2014. High resolution environmental sensing using heated fiber optics technology.
- Oregon State University, Winter Water Resources Seminar, Feb 2013. Distributed soil moisture monitoring using fiber optics.
- Polytechnical University of Madrid, Dec 2012.

SELECT CONFERENCES PRESENTATIONS

- [High Resolution Mapping of Wind Speed Using Active Distributed Temperature Sensing](#). C. Sayde, C.K. Thomas, J. Wagner, J.S. Selker. AGU Fall Meeting, 2013- Oral presentation.
- [A high resolution method for soil moisture mapping at large spatial and temporal scales](#). D. Moreno, C. Sayde, T.E. Ochsner, C. Sorin, J.S. Selker. AGU Fall Meeting, 2013- Poster presentation.
- [Latest Advances in Distributed Soil Water Content and Fluxes Monitoring Using Heated Fiber Optics](#). C. Sayde, J. Benítez-Buelga, L. Rodríguez-Sinobas, M. Gil Rodriguez, J.S. Selker. EGU General Assembly Conference, 2012- Oral presentation.
- [Actively Heated Fiber Optic Method for Distributed Soil Moisture Monitoring](#). C. Sayde, J.S. Selker, L. Rodriguez-Sinobas, M. Gil-Rodriguez, R.H. Cuenca, S.W. Tyler, M. English. AGU Fall Meeting, 2010- Poster presentation.
- [Measuring Soil Moisture in a Heterogeneous Field](#). C. Sayde, J.S. Selker, M. English. World Environmental and Water Resources Congress, 2009- Oral presentation.
- [Reducing the uncertainty of soil moisture water determinations](#). C. Sayde, A. Gitelman, C. Hillyer, L. El Khoury. 5th National Decennial Irrigation Conference, Phoenix, Arizona, 2010- Oral presentation.

FUNDED PROPOSALS

- Interpretation of satellite soil moisture products with ultra-high resolution fiber optic and cosmic ray ground-based measurements. NASA Proposal #10-THP10-0054. Solicitation NNH10ZDA001N-THP

AWARDS/SCHOLARSHIPS

- OSU Wade Rain Irrigation Scholarship (2006 and 2011)
- OSU Edward S. Allen Endowment Award (2009)
- OSU Williamson Water Prize (2008)
- OSU Ron Miner Memorial Bioengineering Scholarship (2008)

SKILLS

Foreign Languages: Native Arabic speaker, fluent in French and English, good in Italian

Technical skills: COMSOL, ArcGIS, HEC-HMS, Hydrus, Matlab, MIKE SHE, MODFLOW, AutoCAD, S-PLUS.

ASSOCIATIONS/SERVICES

- Syndicate of Engineers, Lebanon
 - American Geophysical Union (AGU)
 - Technical Committee – Unsaturated Zone, member, AGU
 - Task Committee - On-Farm Irrigation Systems, member, ASCE-EWRI
 - Task Committee - Evapotranspiration in Irrigation and Hydrology, Member, ASCE-EWRI
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