

Eric Harmsen, Ph.D., P.E.

Agricultural Engineer, Environmental Scientist

EDUCATION

- 1991 Post Doctorate, Soil Science, North Carolina State University
- 1989 Ph.D., Agricultural Engineering, University of Wisconsin-Madison
- 1984 M.S., Agricultural Engineering, Michigan State University
- 1981 B.S., Agricultural Engineering, Michigan State University

REGISTRATION

Professional Agricultural Engineer, Puerto Rico (No. 19994 PE) and Pennsylvania (No. PE 045051 E, Soil and Water)

PROFESSIONAL AFFILIATIONS AND RECOGNITIONS

Member American Society of Agricultural and Biological Engineers (U.S. and Puerto Rico Chapters), Member Caribbean Food Crop Society, Member Puerto Rico Society of Agricultural Scientists, Gamma Sigma Delta (Agricultural Honor Society). 2009 Membership Excellence and Engineer of the Year, ASABE (PR Chapter). Distinguished Professor, 2013, College of Agriculture Sciences, UPRM.

REVIEWER FOR THE FOLLOWINGS JOURNALS/PUBLISHERS

Journal of Hydroinformatics, International Journal of Water, International Journal of Climatology, Journal of Selected Topics in Applied Earth Observations and Remote Sensing, InTech - Open Access Company, Journal of Agriculture of the University of Puerto Rico, Journal of Agricultural Water Management, Journal of Irrigation and Drainage, Avances Técnicos Cenicafé, Comprehensive Research Journal of Agricultural Science, International Journal of Agricultural Resources, Governance and Ecology.

EXPERIENCE

Professor, 1999-Present, Agricultural Engineering Department, University of Puerto Rico, Mayagüez, PR.

Responsible for teaching courses in agricultural water management with emphasis in agricultural hydrology and agroclimatology. Courses include Agroclimatology, Agricultural Hydrology, Fluid Flow and Solute Transport in Soil, Drip Irrigation: Principles and Management, and Drainage of Agricultural Land. Current research project: GOES-Puerto Rico Water and Energy Balance Algorithm (NOAA-CREST)

Chief Engineer, 1994-1999, ICF Kaiser Engineers, Pittsburgh, Pennsylvania.

Responsibilities included planning, coordinating, conducting, and managing surface and subsurface flow and chemical transport studies. These projects included site characterizations, remedial investigations, and feasibility studies for hazardous waste sites within the US and abroad. Duties also include staff training and mentoring; development of new software and quantitative methodologies; development and implementation of modeling standards and procedures, and proposal development.

Manager, Pittsburgh Groundwater Modeling Section, 1991-1994, International Technology Corporation, Pittsburgh, Pennsylvania.

Responsibilities included managing and conducting hydrologic and solute transport modeling studies, staff development, and proposal preparation.

Post Doctoral Study, 1989-1991, Department of Soil Science, North Carolina State University.

Conducted research for improving management of subirrigation systems in the Coastal Plains of North Carolina. Modeled variably saturated, transient, two-dimensional, reactive nitrogen transport. Work involved converting USGS flow and solute transport model VS2DT from a single solute model to a multi-species solute transport model (VS2DNT). Designed, installed, and managed a nitrogen monitoring field

study for an experimental drainage/subirrigation system; assisted in maintenance of the automatic control and data acquisition system; sampled groundwater and soil; analyzed water chemistry and soil physical and hydraulic properties; and designed and implemented a groundwater tracer study.

Research Assistant, 1985-1989, Department of Agricultural Engineering, University of Wisconsin-Madison.

Teaching Assistant, 1988, Department of Agricultural Engineering, University of Wisconsin-Madison.

Course: *Private On-Site Waste Disposal Systems.*

Software Developer, 1985-1988, Diversified Software Co., Owner, Madison, WI.

Software development for agriculture and engineering.

Environmental Engineer, 1984-1985, State of Wisconsin Department of Natural Resources

Coordinated Wisconsin Animal Waste Management Program. Served as Department representative to State agencies, Federal agencies and public. Developed technical methodology for assessing environmental impacts from livestock facilities. Performed on-site investigations and reviewed plans for Animal Waste Management permits and for industries performing land disposal of waste.

Building Plan Examiner, 1983-1984, State of Wisconsin Department of Industry Labor and Human Relations, Safety and Buildings.

Examined structural, heating and ventilation and thermal performance plans, specifications and calculations for compliance with the Wisconsin Administrative Building Code.

Consultant, 1983, Department of Agricultural Engineering, Michigan State University

Performed solid-set irrigation system design and computerized irrigation scheduling for research at Kellogg Biological Station, Kellogg, Michigan.

Instructor, 1983, Department of Agricultural Engineering, Michigan State University

Course: *Irrigation Design and Water Management.* Lectured on pump design and selection, power requirements and selection, pipe flow hydraulics, and irrigation system design.

Research Assistant, 1981-1983, Department of Agricultural Engineering, Michigan State University

Designed, tested and computer modeled an experimental chamber apparatus for measuring crop evapotranspiration in the field. (M.S. research)

Teaching Assistant, 1981-1983, Department of Agricultural Engineering, Michigan State University.

- *Soil and Water Conservation Engineering.* Lectured on pipe and open channel flow principles, and the design of hydraulic structures for flood and erosion control.
- *Physioengineering Principles.* Lectured on energy transfer in crop environment and assisted students with term groundwater modeling computer project.
- *Basic Engineering Mathematics.* Reviewed lecture material and solved homework problems in discussions.

Soil and Water Technician, 1980-1981, Department of Agricultural Engineering, Michigan State University.

Developed instructional materials for undergraduate Agricultural Engineering courses. Performed soil analyses and irrigation scheduling for Departmental project in Southwest Michigan. Developed soil-water characteristic curves and evaluated soil moisture content in soils based on gravimetric and neutron probe methods.

Computer Programmer, 1980, Michigan State University Cooperative Extension Service.

Developed hand-held programmable calculator software for grain drying extension publication.

COMPUTER SOFTWARE

Familiarity with the following computer software: GOES-PRWEB (developer), MatLab, Vflo, WASH123D, MIKE SHE, ArcGIS, PRET (co-developer), MSU Irrigation Scheduler, AutoCAD, FLOWPATH, FLOWCAD, MODFLOW, MODPATH, PATH3D, MT3D, ModelCAD, ATTENU8 (developer), BIOF&T, AT123D, OILFLO (developer), ARMOS, MOTRANS, GEOFLOW (co-developer), FREESURF, SWIFT, HELP, ADEPT, VS2DT, VS2DNT (developer), PEST, MMS (developer), CHANNEL, Excel, Surfer, MathCAD, GMS, WMS, SiteGIS, FORTRAN, Visual BASIC, DOS and UNIX.

SPECIAL TRAINING

- Solar Energy Systems, University of Puerto Rico, División de Educación Continua y Estudios Profesionales, 30 hours., 1st Semester 2012/2013.
- Training course: Vflo, a real-time flash flood simulation model capable of using real-time radar rainfall estimates as input. University of Oklahoma, June, 2006.
- Regional Atmospheric Modeling System (RAMS), Data Downloading and Processing; the RAMS' DPREP package. University of Puerto Rico – Mayagüez Campus, July 24th, 2004.
- Training course: ENVI for Processing Remote Sensing Data., Short Course, July 6, 2005, University of Puerto Rico, Mayaguez, PR.
- ENVI ATLAS USERS WORKSHOP, July 6, 2005. GSI Laboratory, Geology Department, University of Puerto Rico – Mayagüez Campus. Sponsored by UPRM NASA-EPSCoR Project.
- Decentralized Wastewater System for Puerto Rico. UPR Agricultural Engineering Extension Short course, Dec. 2, 2004, San Juan, PR.
- Training course: Ground Penetrating Radar, GSSI, Inc. New Hampshire, August 2002.
- 40-Hour OSHA Health and Safety Training
- Training course: *Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Use of Models for Site Assessment and Remediation*, Short Course International Groundwater Modeling Center, Denver, Colorado, 1992.
- *Assessment, Control and Remediation of LNAPL Contaminated Sites*, Workshop, Sponsored by American Petroleum Institute and US Environmental Protection Agency.
- A training course: *DRAINMOD - Drainage and Subirrigation Evaluation and Design Computer Program*, Training Course, University of Wisconsin, Madison, WI, Aug, 1985.

PUBLICATIONS

Books (career total =5)

1. Goyal, M. and **E. W. Harmsen** (Co-Editors), 2014, *Evapotranspiration: Principles and Applications for Water Management*. Apple Academic Press. 525pp. ISBN: 9781926895581
2. **Harmsen, E. W.** and A. González, 2002. *Puerto Rico Evapotranspiration Estimation Computer Program PR-ET Version 1.0 USER'S MANUAL*. Prepared for the University of Puerto Rico Experiment Station-Rio Piedras. Grant SP-347. August 2002.
3. **Harmsen, E. W.**, 1989, "Siting and Depth Recommendations for Water Supply Wells in Relation to On-Site Domestic Waste Disposal Systems," Ph.D. Dissertation, University of Wisconsin, Madison.
4. **Harmsen, E. W.**, 1986, "Manure Management System User's Guide," Diversified Software, Middleton, WI.
5. **Harmsen, E. W.**, 1983, "A Portable Chamber to Measure Plant Water Use: Design Considerations and Analysis," M.S. Thesis, Michigan State University, East Lansing, MI.

Peer Reviewed Publications (career total =27)

1. **Harmsen E.W.**, 2012. TECHNICAL NOTE: A Simple Web-Based Method for Scheduling Irrigation in Puerto Rico *J. Agric. Univ. P.R.* 96 (3-4) 2012.
2. **Harmsen, E.W.**, P. Tosado and J. Mecikalski, 2014. Calibration of Selected Pyranometers and Satellite Derived Solar Radiation in Puerto Rico. *International Journal of Renewable Energy and Technology*. 5(1):43-54.
3. Ramirez, V. H., T.G. Porch and **E.W. Harmsen**, 2011. Genotypic differences in Water Use Efficiency of Common Bean under Drought Stress. *Agronomy Journal* Vol. 103, Issue 4, pgs. 1206-1215.
4. Ramírez-Builes, V. H. and **E. W. Harmsen**, 2011. Water Vapor Flux in Agroecosystems: Methods and Models Review, published in the book *Evapotranspiration* edited by Leszek Labeledzki, ISBN: 978-953-307-251-7, InTech, Publishing.
5. **Harmsen, E. W.**, J. Mecikalski, A. Mercado and P. Tosado Cruz, 2010. Estimating evapotranspiration in the Caribbean Region using satellite remote sensing. *Proceedings of the AWRA Summer Specialty Conference, Tropical Hydrology and Sustainable Water Resources in a Changing Climate*. San Juan, Puerto Rico. August 30-September 1, 2010. Pages 42-47.
6. Ramírez Beltran, N.D, C. Calderon-Arteaga, **E. W. Harmsen**, R., Vasquez, and J. Gonzalez, 2010. An Algorithm to estimate soil moisture over vegetated areas based on in situ and remote sensing information.. *International Journal of Remote Sensing*, 1366-5901, Volume 31, Issue 10, 2010, Pages 2655 – 2679.
7. **Harmsen, E. W.**, J. Mecikalski, M. J. Cardona-Soto, A. Rojas Gonzalez and R. Vasquez, 2009. Estimating daily evapotranspiration in Puerto Rico using satellite remote sensing. *WSEAS Transactions on Environment and Development*, Vol. 6(5):456-465.
8. Rojas-González, A. M., **E. W. Harmsen** and S. Cruz Pol, 2009. Performance evaluation of MPE rainfall product at hourly and daily temporal resolution within a Hydro-Estimator pixel. *Transactions on Environment and Development*, Vol. 7(5):478-487.
9. Jury, M., S. Chiao and **E. W. Harmsen**, 2009. Mesoscale Structure of TradeWind Convection over Puerto Rico: Composite Observations and Numerical Simulation. *Boundary-Layer Meteorol.* DOI 10.1007/s10546-009-9393-3
10. Porch, T. G, V.H. Ramirez, D. Santana and **E.W. Harmsen**, 2009. Evaluation of drought tolerance in common bean germplasm in Juana Díaz, Puerto Rico. *Journal of Agronomy and Crop Science* 195:1-7.
11. **Harmsen, E. W.**, V. H. Ramirez Builes, M. D. Dukes, X. Jia, J. E. Gonzalez And L. R. Pérez Alegría, 2009. A Ground-Based Method for Calibrating Remotely Sensed Surface Temperature for use in Estimating Evapotranspiration. *WSEAS TRANSACTIONS on ENVIRONMENT and DEVELOPMENT*. Issue 1, Volume 5, January. pp 13-23.

12. **Harmsen, E. W.**, N. L. Miller, N. J. Schlegel and J. E. Gonzalez, 2009. Seasonal Climate Change Impacts on Evapotranspiration, Precipitation Deficit and Crop Yield in Puerto Rico, *J. Agricultural Water Management* 96(7):1085–1095.
13. Ramírez-Beltran, N.D, R. J. Kuligowski, E. W. Harmsen, , J. M. Castro, S. Cruz-Pol, M. Cardona-Soto, 2008. Rainfall Estimation from Convective Storms Using the Hydro-Estimator and NEXRAD. *WSEAS TRANSACTION on SYSTEMS*. No. 10, Vol. 7, pp 1016-1027.
14. **Harmsen, E. W.**, S. E. Gomez Mesa, E. Cabassa, N. D. Ramirez Beltran, S. C. Pol, R. J. Kuligowski ,R. Vasquez, 2008. Satellite Sub-Pixel Rainfall Variability. *WSEAS TRANSACTIONS on SIGNAL PROCESSING*. Issue 8, Volume 7, Pages 504-513.
15. Ramirez, V. H., T.G. Porch and **E.W. Harmsen**, 2008. A non-destructive method for leaf area estimation in common bean (*Phaseolus vulgaris* L.). *University of Puerto Rico Journal of Agriculture*, 92(3-4):171-182.
16. Paulino-Paulino, P. J., **E. W. Harmsen**, D. Sotomayor and L. E. Rivera. 2008. Nitrate leaching under different levels of irrigation for three turfgrasses in southern Puerto Rico. *University of Puerto Rico Journal of Agriculture*, 92(3-4):135-152.
17. Ramírez Beltran, N. D., J. M. Castro, **E. W. Harmsen** and R. Vásquez Espinoza, 2008. Stochastic transfer function model and neural networks to estimate soil moisture. *J. of the American Water Resources Association*, Vol. 44, No. 4:847-865.
18. González, J. E., J. C. Luvall, D. Rickman, D. E. Comarazamy, A. J. Picón, **E. W. Harmsen**, H. Parsiani, N. Ramírez, R. Vázquez, R. Williams, R. B. Waide, and C. A. Tepley, 2005: Urban heat islands developing in coastal tropical cities. *EOS Transactions, AGU*, 86, 42, pp. 397 & 403.
19. **Harmsen, E. W.** and A. González, 2005. Technical Note: A Computer Program for Estimating Crop Evapotranspiration in Puerto Rico, by *J. Agric. Univ. P.R.* 89(1-2):107-113.
20. **Harmsen, E. W.**, A. González and A. Winter. J. 2004. Re-Evaluation of Pan Evaporation Coefficients at Seven Locations in Puerto Rico, By *E.W. Agric. Univ. P.R.* vol. 88, no. 3-4, pp 109-122.
21. **Harmsen, E. W.** 2003. Fifty years of crop evapotranspiration studies in Puerto Rico. *Journal of Soil and Water Conservation*. July/August, Vol. 58, No. 4, pg. 214-223.
22. **Harmsen, E. W.**, M. R. Goyal, and S. Torres Justiniano, 2002. Estimating Evapotranspiration in Puerto Rico. *J. Agric. Univ. P.R.* 86(1-2):35-54.
23. Munster, C.L., Skaggs, R.W., Parsons, J.E., Evans, R.O., Gilliam, J.W., **E. W. Harmsen**. 1995. "Aldicarb Transport in a Drained Coastal Plain Soil." *ASCE Journal of Irrigation*. November/December. Vol. 121/Issue No. 6. pp 378-384.
24. **Harmsen, E. W.**, J. C. Converse, M. P. Anderson, and J. A. Hoopes, 1991, "Model for Evaluating the Three-Dimensional Groundwater Dividing Pathline Between a Contaminant Source and a Partially Penetrating Water-Supply Well," *Journal of Contaminant Hydrology*, 8(1); 71-90.
25. **Harmsen E. W.**, J. C. Converse, and M. P. Anderson, 1991, "Application of the Monte-Carlo Simulation Procedure to Estimate Water-Supply Well/Septic Tank-Drainfield Separation Distances in the Central Wisconsin Sand Plain," *Journal of Contaminant Hydrology*, 8(1); 91-109.
26. **Harmsen, E. W.**, 1989, "Siting and Depth Recommendations for Water Supply Wells in Relation to On-Site Domestic Waste Disposal Systems," Ph.D. Dissertation, University of Wisconsin, Madison.
27. **Harmsen, E. W.**, 1983, "A Portable Chamber to Measure Plant Water Use: Design Considerations and Analysis," M.S. Thesis, Michigan State University, East Lansing, MI.

Conference Proceedings (career total =39)

1. Arocho Meaux, S., A. Mercado-Vargas, G. A. Pablos-Vega, **E. W. Harmsen**, S. Cruz-Pol and J. Colom Ustáriz, 2010. Calibration and validation of CASA radar rainfall estimation. *Proceedings*

- of the AWRA Summer Specialty Conference, Tropical Hydrology and Sustainable Water Resources in a Changing Climate. San Juan, Puerto Rico. August 30-September 1.
2. Rojas González, A., **E. W. Harmsen**, S. Cruz Pol, and Y. De Jesús Arce, 2010 Evaluation of upscaling parameters and their influence on hydrologic predictability in upland tropical areas. Proceedings of the AWRA Summer Specialty Conference, Tropical Hydrology and Sustainable Water Resources in a Changing Climate. San Juan, Puerto Rico. August 30-September 1.
 3. Cardona Soto, M., N. D. Ramirez-Beltran and **E. W. Harmsen** 2010. Rainfall estimation over Puerto Rico using a classification system and artificial neural networks. Proceedings of the AWRA Summer Specialty Conference, Tropical Hydrology and Sustainable Water Resources in a Changing Climate. San Juan, Puerto Rico. August 30-September 1.
 4. **Harmsen, E. W.**, J. Mecikalski, M. J. Cardona-Soto, A. Rojas Gonzalez and R. Vasquez, 2009. Satellite Solar Insolation-Based Daily Evapotranspiration Estimation in Puerto Rico. Proceeding of the 8th WSEAS Int. Conf. on INSTRUMENTATION, MEASUREMENT, CIRCUITS and SYSTEMS (IMCAS'09), China Jiliang University & Zhejiang University of Technology, in Hangzhou, China, May 20-22.
 5. Rojas, A. and **E. W. Harmsen**, 2009. Evaluation of MPE Radar Estimation Using a High Density Rain Gauge Network within a Hydro-Estimator Pixel and Small SubWatershed. Proceeding of the 8th WSEAS Int. Conf. on INSTRUMENTATION, MEASUREMENT, CIRCUITS and SYSTEMS (IMCAS'09), China Jiliang University & Zhejiang University of Technology, in Hangzhou, China, May 20-22.
 6. Ramírez-Beltran, N.D, Kuligowski, R.J., **Harmsen, E.**, Castro, J.M., Cruz-Pol, S., Cardona-Soto, M. (2008). Validation and Strategies to Improve the Hydro-Estimator and NEXRAD over Puerto Rico. Proceedings of the 12th WSEAS International Conference on Systems. Heraklion, Crete, Greece, July 22-24, pp 799-806.
 7. **Harmsen, E.W.**, V. H. Ramirez Builes, M. D. Dukes, X. Jia, L. R. Pérez Alegía, R. Vasquez, 2008. An Inexpensive Method for Validating Remotely Sensed Evapotranspiration. Proceedings of the 4th WSEAS International Conference on REMOTE SENSING (REMOTE'08), Venice, Italy. Nov. 20-23. pp 118-123.
 8. **Harmsen, E. W.**, S. E. Gomez Mesa, N. D. Ramírez-Beltran, R. J. Kuligowski, and R. Vasquez, 2008. Remote sensing QPE uncertainties associated with sub-pixel rainfall variation. Proceedings of the 12th WSEAS International Conference on SYSTEMS, Heraklion, Crete Island, Greece, July 22-24.
 9. Ramirez Builes, V. H., **E. W. Harmsen**, and T.G. Porch, 2008. Estimation of actual evapotranspiration using measured and calculated values of bulk surface resistance. Proceedings of the ASCE World Environmental and Water Resources Congress 2008. May 13-16, 2008, Honolulu, Hawaii.
 10. Ramirez B., V.H., Porch T.G., and **Harmsen E.W.** 2008. Evaporation and water use efficiency for common bean genotypes under non-stress and drought stress conditions. Annual Report of the Bean Improvement Cooperative 51:82-83.
 11. **Harmsen, E. W.**, N. L. Miller, N. J. Schlegel and J. E. Gonzalez, 2007. Potential climate change impacts on evapotranspiration and rainfall deficit in Puerto Rico. World Environmental and Resources Water Congress 2007, Tampa Florida, May 15-19.
 12. **Harmsen, E. W.**, I. Garcia and A. Rojas, 2007. Rainfall variation in a 4 km x 4 km area in western Puerto Rico. World Environmental and Water Resources Congress 2007, Tampa Florida, May 15-19.
 13. **Harmsen, E. W.** 2007. The potential impact of climate change on Agriculture in Puerto Rico. Proceedings of the PR Section of the American Society of Agricultural and Biological Engineers Conference: The Innovations in Science & Technology in 2107, May 24, 2007 at Bacardi Corporation, San Juan - Puerto Rico, Paper number: ASABE-PR-2007-02.
 14. Ramirez, V. H., T. G. Porch and **E. W. Harmsen**, 2006. Effects of drought on stomatal resistance, surface resistance and leaf temperature in four common bean genotypes (*Phaseolus vulgaris* L.). Proceedings of the 42nd Annual Meeting of the Caribbean Food Crops Society, Vol. XLII-Number 2. July 9-14, 2006, San Juan, Puerto Rico.

15. **Harmsen, E. W.**, V. H. Ramirez Builes, J. E. Gonzalez, M. D. Dukes, and X. Jia. 2006. Estimation of Short-Term Actual Crop Evapotranspiration. Proceedings of the 42nd Annual Meeting of the Caribbean Food Crops Society, Vol. XLII-Number 2. July 9-14, 2006, San Juan, Puerto Rico.
16. **Harmsen, E. W.** and M. G. Prieto, 2006. Climate change impacts on the hydrology of a tropical drainage basin: GIS analysis and numerical model development. Proceedings of the Caribbean Climate Symposium, University of Puerto Rico – Mayagüez Campus, April 24 – 25.
17. **Harmsen, E. W.**, R. Díaz, J. Chaparro, 2004. A ground-based procedure for estimating latent heat energy fluxes. Proceedings of the NOAA Educational Partnership Program, Education & Science Forum, New York City, NY, October 21-23, 2004
18. Ramirez-Beltran, N. D., R. Vasquez, H. Cruzado and **E. W. Harmsen**. 2004. A transfer function model to estimate soil moisture. Proceedings of the NOAA Educational Partnership Program, Education & Science Forum, New York City, NY, October 21-23, 2004
19. **Harmsen, E. W.**, H. Parsiani and M. Torres, 2003. Evaluation of Several Dielectric Mixing Models for Estimating Soil Moisture Content in Sand, Loam and Clay Soils. Paper No. 032278. 2003 Annual International Meeting of the American Society of Agricultural Engineers, Las Vegas, Nevada , USA, July 26-30, 2003.
20. **Harmsen, E. W.**, J. Colón Trinidad, C. L Arcelay and D. Cádiz Rodríguez. 2003. Evaluation of Percolation and Nitrogen Leaching From a Sweet Pepper Crop Grown on an Oxisol Soil in Northwest Puerto Rico. Proceedings of the 39th Annual Meeting of the Caribbean Food Crops Society, 2003. Grenada. Vol. 39.
21. Arcelay, C. L., M. A. Muñoz and **E. W. Harmsen**. 2003. Effect of Liming and Fertigation Frequencies on Nitrogen Retention on Coto Clay. Proceedings of the 39th Annual Meeting of the Caribbean Food Crops Society, 2003. Grenada. Vol. 39.
22. Parsiani, H., **E. W. Harmsen**, D. Rodriguez and R. Diaz. 2003, Validation of an inverse procedure for estimating soil moisture content using GPR. Proceedings of the NOAA-CREST Remote Sensing Conference, Tallahassee, Florida, March 30-April 1.
23. **Harmsen, E. W.** and H. Parsiani. 2003. Inverse procedure for estimating vertically distributed soil hydraulic parameters using GPR. NOAA-CREST/NASA-EPSCoR Joint Symposium for Climate Studies University of Puerto Rico - Mayagüez Campus. January 10-11, 2003.
24. **Harmsen, E. W.**, A. González Pérez and A. Winter. 2003. Estimating long-term average monthly evapotranspiration from pan evaporation data at seven locations in Puerto Rico. NOAA-CREST/NASA-EPSCoR Joint Symposium for Climate Studies University of Puerto Rico - Mayagüez Campus. January 10-11, 2003.
25. **Harmsen, E. W.** 2002. A Simple Procedure for Estimating Evapotranspiration in Tropical Island Environments. Proceedings of the Caribbean Food Crops Society, Thirty Eighth Annual Meeting, 2002. Martinique. Vol. 38.
26. **Harmsen, E. W.**, J. Colón Trinidad, C. Arcelay and E. Sarmiento Esparra, 2002. Evaluation of the Pan Evaporation Method for Scheduling Irrigation on an Oxisol in Puerto Rico. Proceedings of the Caribbean Food Crops Society, Thirty Eighth Annual Meeting, 2002. Martinique. Vol. 38.
27. **Harmsen, E. W.** and S. Torres Justiniano, 2001. Estimating Island-Wide Reference Evapotranspiration for Puerto Rico Using the Penman-Monteith Method. ASAE Paper No. 01-2174. 2001 ASAE Annual International Meeting, Sacramento Convention Center, Sacramento, CA, July 30-August 1.
28. **Harmsen, E. W.** and S. Torres Justiniano, 2001. Evaluation of prediction methods for estimating climate data to be used with the Penman-Monteith method in Puerto Rico. ASAE Paper No. 01-2048. 2001 ASAE Annual International Meeting, Sacramento Convention Center, Sacramento, CA, July 30-August 1.
29. **Harmsen, E. W.**, J. Caldero and M. R. Goyal, 2001. Consumptive Water Use Estimates for Pumpkin and Onion at Two Locations in Puerto Rico. Proceedings of the Sixth Caribbean Islands Water Resources Congress. Editor: Walter F. Silva Araya. University of Puerto Rico, Mayagüez, PR 00680.
30. Chuang, R., **E. W. Harmsen**, J. Schubert, C. Powels, and G. Garcia, 1998, Transient Calibration

of a Groundwater Flow Model for the O-Field Area, Aberdeen Proving Ground, Maryland. In MODFLOW '98 Proceedings (E. Poeter, C. Zheng, and M. Hill, eds.), Colorado School of Mines, Golden, CO, Vol. 1, pp.19-26.

31. **Harmsen, E.W.** and D.P. Cercone, 1996. "The Proportional Cleanup Time Method for Reducing the Cost of Groundwater Solute Transport Sensitivity and Uncertainty Analyses." Proceedings of the Second National Technical Conference, ICF Kaiser Engineers, Las Vegas, Nevada, June 6-8, 1996.
32. **Harmsen, E. W.** and K. Super, 1995. "Estimating the Concentration of Chlorinated Aliphatic Hydrocarbons in the Subsurface." Proceedings of the First National Technical Conference, ICF Kaiser Environment and Energy Group, Denver, Colorado, January 26-28, 1995.
33. Zhang, J. and **E.W. Harmsen**, 1994. "Simulating the Simultaneous Movement of Water, Jet Fuel, and BTEX Components in Soil." Proceedings of the Federal Environmental Restoration III and Waste Minimization II Conference, New Orleans, April 27-29. Hazardous Materials Control Institute.
34. Zhang, J., **E.W. Harmsen**, and S.H. Djafari, 1993. "GEOFLOW3D A three-dimensional Flow and Transport Finite Element Model." Proceedings of the 1993 International Technology Exchange Symposium, Scottsdale, Arizona.
35. **Harmsen, E.W.** and R. Wice. "Development of a Simplified Method for Estimating the Time Required to Remediate a Contaminated Aquifer." Proceedings of the Federal Environmental Restoration III and Waste Minimization II Conference, New Orleans, April 27-29, 1994. Hazardous Materials Control Resource Institute.
36. **Harmsen, E. W.**, J. W. Gilliam, R. W. Skaggs, and C. L. Munster, 1991, "Variably Saturated 2-Dimensional Nitrogen Transport," 1991 International Meeting of the American Society of Agricultural Engineers (ASAE), Chicago, IL. ASAE Paper No. 912630.
37. **Harmsen, E. W.**, J. C. Converse, E. J. Tyler, and J. O. Peterson, 1991, "Considerations for Protecting Private Water Supply Wells in Rural Unsewered Subdivisions," Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems, Chicago, IL pp. 206-213.
38. **Harmsen, E. W.**, T. L. Loudon, G. A. Peterson, and G. E. Merva, 1982, "A Portable Chamber Technique for Evapotranspiration Measurement," American Society of Agricultural Engineers, Paper No. 82-2598.
39. **Harmsen, E. W.**, V. F. Bralts, T. L. Loudon, and F. J. Henningsen, 1982, "Computerized Irrigation Scheduling," American Society of Agricultural Engineers Paper No. TSR82-201.

Other publications

1. Munster, C., G.M. Chescheir, R.W. Skaggs, J.E. Parsons, T.J. Sheets, J.W. Gilliam, R.O. Evans, **E. Harmsen**, and R.B. Leidy. 1994. Effects of drainage and water table control on ground water and surface water quality, PART 1 - Methodology and Preliminary Results. Report No. 283. Water Resources Research Institute of North Carolina. Raleigh. 168 pp.
2. Brook, R. C. and **E. W. Harmsen**, 1982, "Aeration Fan Sizing and Selection for Grain Bins and Aeration Fan and Duct Selection for Flat Grain Storage," TELCAL Today's Electronic Calculator User's Manual, TELCAL 2.1 File 18.15, Michigan State University Cooperative Extension Service.