

THE CURRENT

NEWS FROM WATERBORNE ENVIRONMENTAL, INC.

SPRING 2010

HIGH(ER)-PERFORMANCE COMPUTING COMES TO WATERBORNE

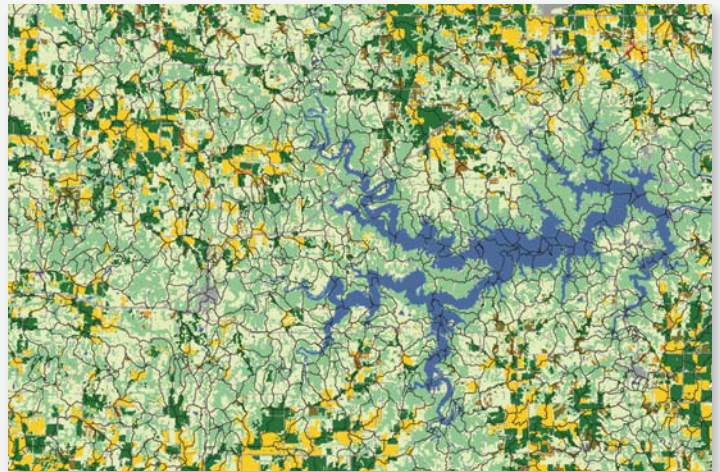
by Paul S. Miller, Ph.D. and Joshua Allen, M.A.

And you thought you were impressed before with our ability to perform continental level GIS and modeling...

The availability of large datasets and databases such as the Department of Agriculture's Soil Survey Geographic (SSURGO) database, remotely sensed crop classification data, and the National Oceanic and Atmospheric Administration's Next Generation Radar (NEXRAD) means mathematical models of environmental systems can reach a greater level of precision and detail than has ever been possible.

As problem-solvers, Waterborne has to find innovative ways to take advantage of these new data sources and methodologies to improve the simulation and analysis capabilities for our clients. In order to complete probabilistic U.S. national-scale analyses, Waterborne has turned to High-Performance Computing (HPC) and enterprise-level database systems to understand problems and complete highly detailed simulations of agricultural/environmental fate and transport.

Currently, Waterborne strives to utilize in-house computational resources by developing applications that efficiently harness parallel computational routines and enterprise-level results processing to complete probabilistic analyses across the United States. As lit-



Field-scale land use is processed as part of smaller watershed units for later summarization and results analyses.

tle as five years ago, these types of simulations required multiple workstations running for multiple days to complete the first stage of processing. Only then could post-processing routines that would mine and summarize data from these results begin. Today, Waterborne runs simulations more elaborate than in the past, for

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WATERBORNE ACCEPTED INTO VIRGINIA'S ACCESSING INTERNATIONAL MARKETS PROGRAM



Waterborne Environmental, Inc. was accepted into the January 2010 class of the Virginia Economic Development Partnership's Accessing International Markets (AIM) export development program. Based on a competitive application process, a maximum of 20 companies are accepted into the AIM program each year. The year-long AIM program introduces companies across Virginia to new global business opportunities.

AIM participants pursue leads in one target market overseas that they agree to

visit during their year in AIM. They must also participate in seminars covering the basic steps of exporting. Participants also have access to eight private-sector export specialists who provide essential expertise for expansion into international markets. The eight AIM service providers include an attorney, a banker, a translator, a freight forwarder, a U.S. export compliance specialist, a corporate growth consultant and companies offering online marketing and tax services. The January class will target countries in Europe, Asia, the Middle East

and the Americas. Waterborne has selected Australia as their target country since several employees are either on the organizing committee or invited speakers at the IUPAC conference in July.

"The AIM Program jump-starts the development of international business by connecting companies with the practical tools needed for successful export sales," said Elizabeth Morgan-Brown, AIM Program Manager.

The Virginia Economic Development Partnership, a marketing organization, was

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WATERBORNE IMPROVES THE ACCURACY AND EFFICIENCY OF SATELLITE-DERIVED LAND COVER CLASSIFICATIONS BY EMPLOYING THE COMMON LAND UNIT

Ground truthing is traditionally an expensive aspect of projects using image-derived data. Now, as remote-sensed imagery data become cheaper and more abundant, we are seeing advances in high-resolution, ancillary data, such as the Common Land Unit¹ (CLU). Waterborne is taking advantage of this available data to decrease the cost and time of processing, while improving the end product.

Satellite-derived spatial data are useful in a variety of modeling and GIS applications when the location and extent of a target land cover or land use is required. Now, data from medium-resolution satellite sensors, such as Landsat ETM and Resource-Sat-1 AWIFS, and high-resolution sensors, such as IKONOS, are available in free or more affordable formats ready for immediate use with GIS and image processing software. These data arrive geographically, radiometrically, and spectrally corrected, allowing Waterborne to classify features right away, where historically significant time was budgeted for these preprocessing tasks. In addition to the cost savings of the raw data, recent advances in high-resolution, ancillary spatial data, such as the CLU and annually collected aerial photography, dramatically

improve the speed and accuracy of the classification process.

Waterborne has successfully incorporated the CLU into the ground truth collection routine resulting in orders of magnitude greater training data, and thus more accurate classification algorithms. Ground truth observations historically collected as point features are now assigned to CLU polygons, expanding the observation across the entire feature. Additionally, Waterborne uses current aerial photography to visually assign ground truth observations to polygon features representing urban, forest, grassland, and hydrology. Many ground truth collection tasks can now be performed in the office rather than by on-site visits, resulting in dramatic cost savings.

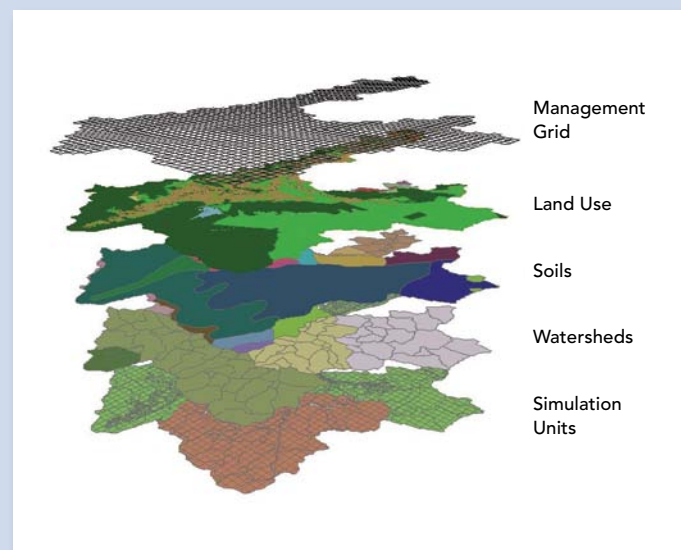
Waterborne's vision is affordable and accurate custom image classification utilizing the wealth of relevant information available for today's geospatial projects. As remotely sensed data become widely accessible, Waterborne is efficiently and accurately synthesizing it into useful information. 🌊

¹<http://www.fsa.usda.gov/FSA/apfoapp?area=home&subject=prod&topic=clu>

HIGH(ER)-PERFORMANCE COMPUTING COMES TO WATERBORNE *continued from page 1*

every crop and soil combination in the U.S., on powerful multi-core machines. These simulations take hours instead of days. Currently, Waterborne can run 30-year daily simulations for every soil in the United States for multiple cropping systems based on meteorological data from the SAMSON (Solar and Meteorological Surface Observational Network). These runs generate massive base datasets greater than one terabyte per crop configuration using greater than 40 gigabytes of optimized storage space in the enterprise database system. Waterborne has summarized these results for over 2.6 million catchments in the United States based on the NHD-Plus network. These results represent every 1:100,000 scale flow-line in the continental United States. In addition, our enterprise-level database system allows for complete tracking of results from the base results and information to knowledge extraction for scientists and engineers.

Waterborne has been designing ever more efficient applications to complete these types of analyses, and the modelers at Waterborne never want to be subject to a hardware-defined limitation to their creativity. Currently, we are planning for sub-daily simulations, numerical approaches to critical pathways, such as infiltration, and ever greater combinations of meteorology-land use- soil scenarios. As such, we are constantly learning and trying to attain more for our clients by investing our professional time (and sometimes our personal time!) in learning new languages, hardware, and development strategies. We want to spend almost all of our time on analysis rather than spending it on the “nuts and



Multi-layer spatial temporal exposure characterization for watersheds.

bolts” of the implementation required to get to the knowledge that our clients need. As such, Waterborne is actively investing, through its research and development program, in evaluating HPC resources, both utilizing internal resources and looking at external resources — such as HPC utility computing and cloud services to aid in limitless creativity for hydrology and water quality simulation at the national and global scale. 🌊

UPCOMING TECHNICAL PRESENTATIONS

- **Comparison of European field dissipation studies to NAFTA and international use environments: Study design and dissipation rate data.** Kalumbu Malekani, Nathan J. Snyder, Aldos C. Barefoot, and Megan White. ACS 239th National Meeting, March 21–25, 2010, San Francisco, CA, USA.
- **Screening approaches for predicting pesticide concentrations in groundwater.** Dazhi Mao, W. Martin Williams, and J. Mark Cheplick. ACS 239th National Meeting, March 21–25, 2010, San Francisco, CA, USA.
- **Advances in modeling urban/residential pesticide runoff.** W. Martin Williams, Amy M. Ritter, and J. Mark Cheplick. ACS 239th National Meeting, March 21–25, 2010, San Francisco, CA, USA.
- **Comparison of European field soil dissipation studies to NAFTA and international use environments: Soil and climatic conditions.** Nathan J. Snyder, Aldos C. Barefoot, Kalumbu Malekani, and Joshua J. Amos. ACS 239th National Meeting, March 21–25, 2010, San Francisco, CA, USA.
- **Modeling the effectiveness of mitigation measures on the diazinon labels.** Nathan J. Snyder, W. Martin Williams, Debra L. Denton, and Jerry Troyan. ACS 239th National Meeting, March 21–25, 2010, San Francisco, CA, USA.
- **National stewardship program to mitigate carbamate pesticide risk in drinking water.** W. Martin Williams, Bernard A. Engel, Richard Fawcett, Gerco Hoogeweg, and J. Mark Cheplick. ACS 239th National Meeting, March 21–25, 2010, San Francisco, CA, USA.
- **Atrazine ecological exposure monitoring program: study design and conduct.** Chris Harbourt. 7th National Monitoring Conference—Monitoring From the Summit to the Sea, April 25–29, 2010, Denver, CO, USA.
- **National SSURGO based modeling at the field scale: comparative exposure potential via PRZM modeling and determining depth to a restrictive or claypan layer.** Paul Miller. 7th National Monitoring Conference—Monitoring From the Summit to the Sea, April 25–29, 2010, Denver, CO, USA.
- **Development of spatially explicit model inputs for an eco-epidemiological analysis of chemical risks to streams for fish and aquatic invertebrates.** Christopher Holmes, S.D. Dyer, C. White-Hull, K. Kapo, L. Posthuma, D. De Zwart, and C. Mulder. SETAC Europe 20th Annual Meeting, May 23–27, 2010, Seville, Spain.
- **Implementation of catchment-based temporal and spatial hydrologic network analysis of spray drift using GIS and the RIVWQ riverine model.** Christopher Holmes, Gerco Hoogeweg, and Amy Ritter. SETAC Europe 20th Annual Meeting, May 23–27, 2010, Seville, Spain.
- **Higher tier modeling of groundwater concentrations from pesticides used on rice.** Amy Ritter, W. Martin Williams, and J. Mark Cheplick. SETAC Europe 20th Annual Meeting, May 23–27, 2010, Seville, Spain.

RECENT PRESENTATIONS

- **Comparison of aquatic exposure assessment models for pesticide use on rice.** Amy M. Ritter*, W. Martin Williams, J. Tang, T.S. Ramana- rayanan, D. Desmarteau, and S. Anderson. SCI International Conference: Pesticide Behavior in Soils, Water, and Air, September 14–16, 2009, York, U.K.
- **GeoPEARL Workshop, November 4–5, 2009, The Netherlands.** Gerco Hoogeweg presented “Use of MetaPEARL to determine relative vulnerability of groundwater in the E.U.”
- **Use of SSURGO, NHDPlus, and other spatial data to assess potential watershed vulnerability to herbicide runoff and to extend monitoring study findings.** Paul Hendley*, Christopher M. Harbourt, Paul S. Miller, and Jessica J. Prenger. SETAC North America 30th Annual Meeting, November 19–23, 2009, New Orleans, LA, USA.
- **Relationships of chemical risks to fish communities in Ohio: An early eco-epidemiological analysis.** Christopher Holmes*, S.D. Dyer, C. White-Hull, D. de Zwart, L. Posthuma, C. Mulder, K.E. Kapo, and G.A. Burton. SETAC North America 30th Annual Meeting, November 19–23, 2009, New Orleans, LA, USA.

*Presenter

PRZM-ADAM MODEL LINKAGE


Waterborne has recently linked the Aquifer Dilution/Advection Model (ADAM) to the Pesticide Root Zone Model (PRZM). ADAM can be used to estimate concentrations of pesticides in a saturated, unconfined aquifer and to address predominant transport and dissipation pathways while maintaining minimal requirements for user comfort.

The model operates on the principal of mass balance that predicts chemical dilution, partitioning, persistence, and transport. Darcy’s law forms the basis for the water balance algorithm in ADAM. Chemical algorithms account for volatilization, partitioning, between soil-pore water and aquifer media, decay, and outflux. ADAM has the ability to simulate a single parent chemical and up to four degradation products.

The model has been able to reproduce the results of prospective groundwater monitoring (PGW) studies. ADAM has been used in the Pesticide Leaching U.S. (PLUS) tool (Jackson et al., 2007) and the Pesticide Risk Assessment Exposure Simulation Shell (PRAESS), a regulatory tool for pesticide risk assessment customized for The People’s Republic of China.

For more information and details, please join Waterborne on the afternoon of March 21, 2010, at the 239th ACS National Meeting in San Francisco, CA, for a presentation entitled “Screening approaches for predicting pesticide concentrations in groundwater” (Session: Increasing the Utility of Terrestrial Field Dissipation).

Reference:

Jackson, S.H., P. Hendley, and M.J. Cheplick, 2007, PLUS: A regional groundwater assessment and ranking tool, *J. Agric. Food Chem.* 55(14), 5408-5415. 

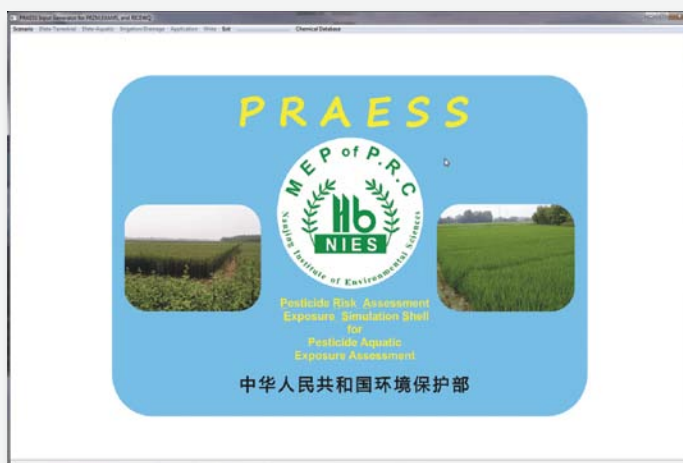
PESTICIDE RISK ASSESSMENT SIMULATION SHELL (PRAESS)

Waterborne Environmental, Inc., and the Nanjing Institute of Environmental Sciences (NIES) are pleased to announce the development of the Pesticide Risk Assessment Exposure Simulation Shell (PRAESS). PRAESS is a modeling platform designed to evaluate the potential for pesticides to occur in surface and groundwater resources in the People's Republic of China. The architecture of PRAESS allows seamless executions of several environmental fate and transport models including WIN-PRZM, RICEWQ, EXAMS, and ADAM¹ in the Windows environment. A shared model input structure provides the flexibility for the user to create, update, and maintain databases on pesticide environmental fate properties and exposure scenarios. Model scenarios developed to date include cotton and corn for surface water and groundwater assessment and rice scenarios for surface water assessment.

PRAESS has the ability to simulate multiple chemicals and metabolites within a single model execution and the flexibility to specify unique pesticide application conditions for different scenarios. Simulations are conducted using 30 years of historical meteorological data in order to evaluate pesticide transport under a variety of weather conditions. A statistical analysis is performed on model output to produce peak, 24-hour, 4-day, 21-day, 60-day, 90-day, and annual exposure durations. Tabular and graphical output can be exported to Windows metafile format.

PRAESS contains a number of features not available in similar modeling systems that are being used for pesticide exposure assessment in the European Union or the United States, including:

- The ability to conduct groundwater and surface water assessments within a single modeling system
- The ability to simulate row crop and rice crop scenarios within a single modeling system
- The inclusion of an aquifer model to estimate pesticide concentrations in leachate and in groundwater
- The flexibility for the user to add scenarios over time
- The flexibility to simulate up to five receiving water systems with each combination of crop-soil-weather condition



No where before has there been a modeling platform with the features in PRAESS.

SCENARIOS CURRENTLY AVAILABLE IN PRAESS

Endpoint	Crop	Location	Receiving Water
Surface water	Cotton	Jiangsu Nantong	Pond and river
Surface water	Corn	Henan Zhumadian	Pond and river
Surface water	Rice	Zhejiang Hangzhou	Pond and river
Surface water	Rice	Jiangsu Changzhou	Pond and river
Groundwater	Cotton	Jiangsu Nantong	Aquifer
Groundwater	Corn	Henan Zhumadian	Aquifer

The Nanjing Institute of Environmental Sciences (NIES) is affiliated with the Ministry of Environmental Protection of the People's Republic of China. The Institute is a key technical provider for policies, legislation, action plans, and technical guidelines on biodiversity conservation in China, with research areas in rural environmental protection, nature conservation, and biodiversity protection. 🌿

¹WINPRZM®, RICEWQ®, and ADAM® were developed by Waterborne Environmental, Inc.

WATERBORNE ACCEPTED INTO VIRGINIA'S AIM PROGRAM *continued from page 1*

created by the Virginia General Assembly in 1995 to encourage, stimulate, and support the development and expansion of the economy of the Commonwealth. The Partnership is a state authority, which is governed by a 22-member Board of Directors appointed by the Governor and the Virginia General Assembly. To accomplish its objectives of promoting economic expansion within the Commonwealth, the Partnership focuses its efforts on business recruitment, expansion and international trade. VEDP has offices in Virginia, Belgium, Hong Kong, Mexico and Japan.

To learn more about the AIM program, visit www.exportvirginia.org.

Waterborne to Attend IUPAC in Australia

Waterborne will be at 12th IUPAC International Congress of Pesticide Chemistry being held in Melbourne Australia, July 4–8, 2010. The theme “Chemistry for a Sustainable World” will feature scientific programs with a holistic focus on sustainable use of pesticides in agriculture for scientists and industry members. Amy Ritter is co-organizer with Dimitrios Karpouzas of the symposium entitled “Advances in Simulation of Pesticide Fate and Transport, including the application Spray Drift Modeling, GIS, and Remote Sensing” in the Environmental and Safety Assessment Program. Paul Miller is one of the invited speakers in this sure to be enthralling symposium. 🌿

NEW HIRES



Paul Davidson, a part-time employee with Waterborne since April 2008, joined us full time in February 2010 as a Staff Agricultural Engineer. He has just finished requirements for a Ph.D. in Agricultural Engineering as a USDA National Needs Fellow at the University of Illinois, Champaign-Urbana, where he also received his Bachelor's and Master's degree. His interests are primarily in the area of soil and water resources engineering. His graduate studies focused on characterizing the fate and transport of waterborne pathogens, and then designing systems such as vegetative filter strips to reduce the impact of these pathogens on receiving water systems. He has experience teaching, mentoring and supervising students in field studies, and implementing research projects home and abroad. In addition to his engineering skills, Paul has real world agricultural experience from assisting in running his family's farm.



Joshua Allen joined our Illinois office full time in January 2010 as a Staff Writer after a year working part time. He has a Bachelor's degree in English and Math from Lyon College and a Master's degree in English from Loras College. Josh taught college writing, worked as an editor for the University of Chicago Press on the Astrophysical Journal, performed project editing for Wright Group/McGraw-Hill, and researched for grants, nonprofit tax information, and telecommunication software for Garton Consulting Services. Josh also has experience with database design, web editing, and designing graphics. Josh's position will include report preparation, client interaction, and marketing and proposal writing.



Kai Van Horn joined our Illinois office part time in December 2009 as a Staff Agricultural Engineer. He received his Bachelor's degree in Multidisciplinary Engineering from Purdue University. Kai spent a year and a half working with the Peace Corps in Zambia designing, organizing, and executing programs related to sustainable agriculture and forestry practices. He has studied a variety of topics, including wind energy and turbines, environmental sustainability, renewable energy resources, and bacterial infection and antibiotic mitigation. He is experienced in several software tools such as Energy-10, Catia, ArcGIS, and others, in addition to having supervised students and farmers in different projects. He is currently working on his Master's degree at the University of Illinois at Champaign.



Amanda Alberg joined our Illinois office part time in February 2010 as a Staff Agricultural Engineer. She received her Bachelor's degree in Biosystems and Agricultural Engineering from the University of Minnesota and her Master's degree in Agricultural and Biological Engineering from Purdue University. While at Purdue, she worked as a research assistant. She has taken coursework in machinery design, safety engineering, and human factors in engineering, and has experience with SolidWorks and AutoCAD. 🌿

WATERBORNE BABIES

Dazhi and Xinyu Mao are enjoying their new arrival. Eric Hansen was born on December 12, 2009 at 7:55 am weighing 7 lbs and 10 oz and was 21 inches long.

Jessie Prenger and Kaustubh Bhalerao have a new baby boy. Samarth Philip arrived on October 19, 2009, weighing in at 6 lbs 3 oz and 19 ½ inches long. Sachin is very excited to be a big brother. 🌿

PROMOTIONS *Waterborne is pleased to announce the following employee promotions:*

Brian Jacobson has been promoted to Principal Agronomist. Brian joined Waterborne in 1996 and has been responsible for bringing in and completing many millions of dollars worth of field work since then. He is a great asset for Waterborne and our clients and one of the best GLP field scientists in the country. He is a consummate professional who is prepared to do whatever it takes to get the job done and done well. Brian will be growing the Fayette, MO, office over the next year as we build additional capacity to assist him with the increasing workload related to terrestrial and aquatic field dissipation and runoff studies.

Mark Cheplick, in addition to his role as Principal Engineer, has been named WEI's Chief Information Officer. He has been with Waterborne since April 1993 as an expert modeler and software developer. His new title is reflective of everything he has done for our IT infrastructure over the years, from initially running wire

for our computer network to currently working closely with our IT contractor to ensure that WEI capabilities are the very best.

Nathan Snyder has been promoted from Senior Engineer to Manager. He joined the engineering group of Waterborne in August 1995 in our Leesburg office and now works from an office in Philadelphia, PA. After starting as our resident expert in field instrumentation, most of his attention has shifted to modeling and project management in support of our clients' U.S. and E.U. regulatory demands. Over the past five plus years, he has been focused on building a strong alliance with an important client. This alliance continues to enable Waterborne to build our staffing with a focus on providing regulatory modeling, kinetic analysis, and pre- and post-registration product support.

Please join us in congratulating each of them! 🌿

GOING DUTCH

When people hear about the Dutch, typically they think about the land of cheese, tulips, wooden shoes (I still have mine), and Amsterdam's assorted tourist attractions. The Dutch are also renowned for their water engineers (we know how to build dikes and keep the water out) and, in our industry, for the many advancements in modeling the environmental fate of plant protection products (PPP) in the E.U.

Since the late 1990s the Dutch have been very active in the development and promotion of their environmental fate models such as PESTLA and later PEARL. Waterborne is increasingly using the various flavors of the PEARL model to support its clients within the framework of Directive 91/414/EEC. As such, we use FOCUS PEARL, metaPEARL, GeoPEARL, and EuroPEARL.

In November 2009, I participated in a two-day GeoPEARL workshop in Bilthoven, The Netherlands. During this workshop, many European users and one from the U.S. shared their experiences using the PEARL model suite. In addition to the PEARL development team, staff from the European Food and Safety Agency and the Joint Research Center attended and presented on upcoming E.U. regulation and the development of new soils data-

bases. The core of the user presentations focused on implementations of GeoPEARL in Germany, Austria, and Belgium (Flemish and Walloon regions). During this workshop, I had the opportunity to share some of our experiences in using the metaPEARL model. Waterborne's presentation focused on the use of the metaPEARL model as an index model to determine the relative sensitivity for PPPs based on the crop location in the EU27. We concluded that metaPEARL is a suitable model for relative rankings of vulnerable areas.

Attending this workshop was also an excellent opportunity to share information and ideas, and a chance to learn about future developments from the PEARL team. One interesting development is the inclusion of runoff in the next version of the GeoPEARL Model. This key process, which is an integral part in FIFRA's models, will now be implemented in PEARL. Therefore, in the near future, we finally can compare the predicted concentrations using PEARL, PELMO, or PRZM under similar conditions.

If you would like to know more about the PEARL modeling suite, please do not hesitate to contact me.

Gerco Hoogeweg, Ph.D.