



Hydropedology News

The Newsletter of the Hydropedology Working Group of
Soil Science Society of America, Crop Science Society of America,
and Agronomy Society of America



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Dear Colleagues,

Greetings! Thanks for reading this inaugural issue of the *Hydropedology News*, the newsletter of the Hydropedology Working Group of the Tri-Societies (Soil Science Society of America, Crop Science Society of America, and Agronomy Society of America). This newsletter is intended to provide a communication among members of the working group and those who share similar interests. The newsletter may also be utilized as an informal forum for discussions related to hydropedology (e.g., how to enhance the interface between soil science and hydrology and how to bridge disciplines, scales, data, and education in integrated studies of soil-water interactions).

In recognizing the synergies that could be generated by bridging traditional pedology with soil physics, hydrology, and other related bio- and geo-sciences, the Tri-Societies' executive committee approved the establishment of Hydropedology Working Group (ACS 837) in 2002. It is hoped that hydropedology would contribute to our enhanced understanding of a variety of environmental, ecological, agricultural, geological, and natural resource issues of societal importance. These include water quality, soil quality, air quality, landscape processes, watershed management, nutrient cycling, precision agriculture, contaminant fate, waste disposal, climate change, and ecosystem functions.

This first issue of the *Hydropedology News* gives you some snap shots of the recent activities in the area. It intends to provide a few commonplace remarks by way of introduction so that others may come up with valuable opinions. Suggestions, news items, stories, and comments are welcome!

Sincerely,
Henry Lin, *Editor*

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**Submission deadline for the next issue:
December 2003**

For more information ...

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Brian Needelman	Univ. of Maryland, College Park, MD	Pedology, GIS
Donald Nielsen	Univ. of California, Davis, CA	Soil Physics, Hydrology
Jeff Niemann	Colorado State Univ., Fort Collins, CO	Hydrology, Geomorphology
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Larry Wilding	Texas A&M Univ., College Station, TX	Pedology, Micromorphology
Michael Young	Desert Research Institute, Las Vegas, NV	Vadose Zone Hydrology

Profiles of the Steering Committee Members

Editor's Note: To get acquainted better with our colleagues' work, we would like to profile a few colleagues in each issue of the newsletter. In this issue, we kick off with brief profiles of a few steering committee members. Hope other colleagues would follow suit in sharing their work, interests, and views related to hydropedology. Thanks to those who took the lead.

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Dr. Corwin has been a USDA-ARS research soil scientist at the George E. Brown, Jr. Salinity Laboratory for 21 years. He received his Ph.D. in soil science from the University of California-Riverside. His current research interests include (1) the use of electrical resistivity and electromagnetic induction techniques to characterize spatial variability for applications in precision agriculture and soil quality assessment, and (2) landscape-scale transport modeling of non-point source pollutants in the vadose zone.

Profiles of the Steering Committee Members (Cont.)

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Dr. Landa has been with the U.S. Geological Survey (USGS) since 1978. He received his Ph.D. in soil science from the University of Minnesota. His research at the USGS has focused on radionuclide mobility in soil, surface water- and groundwater- environments, and has included studies of uranium mill tailings, radium processing residues, oil field brines, and indoor radon. Ed is also interested in the historical development of soil science, teaching basic principles of soil science as part of undergraduate geology curricula, and in furthering soil science links to the earth science community.

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Dr. Needelman, an Assistant Professor of Soil Landscape Analysis and Information Systems, teaches and performs research in the fields of pedology, hydrology, water quality, and geospatial analysis. His research interests include (1) Combining pedology and hydrology to address environmental questions and to understand soil development and variability, (2) The hydrology of contaminant transport at field, watershed, and regional scales, particularly within agricultural landscapes, (3) Environmental and agricultural applications of soil survey databases, and (4) Soil mapping – innovative techniques and concepts.

Profiles of the Steering Committee Members (Cont.)

Jeffrey D. Niemann

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Dr. Niemann is an Assistant Professor in the Department of Civil Engineering at Colorado State University. He received his Ph.D. in Civil and Environmental Engineering from Massachusetts Institute of Technology in 2001. Dr. Niemann's research focuses on the interaction of water and topography and bridges the fields of surface hydrology and river basin geomorphology. Current research projects includes (1) Scaling properties and interpolation of soil moisture, (2) Sensitivity of regional hydrologic fluxes and soil moisture to climate changes, and (3) River basin hydrology and landscape evolution.

Yakov Pachepsky

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Dr. Pachepsky is a soil scientist with a 31-year research career. He joined the USDA-ARS Environmental Microbial Safety Laboratory as a soil scientist in 2001 to research transport and fate of manure-borne pathogens. Prior to that, he was a research physical scientist at the USDA-ARS Hydrology Laboratory, a senior research scholar at the Duke University Phytotron, a research scientist in the former USSR Academy Institute of Soil Science and Photosynthesis, and a professor of soil science in Lomonosov Moscow State University. He earned his Ph. D. in physics and mathematics in 1973 from Moscow State University, Russia. Dr. Pachepsky's current research interests include the environmental hydrology of soils and the agricultural contaminant hydrology, pedotransfer functions for determining soil hydraulic properties, and scale effects on soil transport parameters and processes.

Hydropedology: Bridging Disciplines, Scales, and Data

-- A symposium at the 2003 ASA-CSSA-SSSA annual meeting, Nov. 3-5, 2003, Denver, CO.
And related activities

This symposium, sponsored by Division S-5 and ACS 837 Hydropedology Working Group, with co-sponsorship from S-1, S-3, S-7, S-9, S-10, S-11, A-5, and A-8, intends to promote hydropedology as an intertwined branch of soil science and hydrology that embraces interdisciplinary and multiscale studies of interactive pedologic and hydrologic processes and properties in the earth's surface and subsurface environments (the critical zone). There is a growing recognition that synergy can be generated by bridging traditional pedology with soil physics, hydrology, and other disciplines to enhance holistic studies of soil and water interactions. This symposium will review knowledge gaps that could be addressed with hydropedological approaches, and will discuss future opportunities.

Example topics include: 1) spatial-temporal patterns of soil and water properties and processes from pedon to landscape and from annual to geological time scales, 2) integrated studies of the vadose zone/groundwater systems in understanding the role of hydrology in pedogenesis, soil morphology, soil survey, pedodiversity, and biogeochemical processes, 3) state-of-the-art techniques in monitoring, mapping, and modeling of the landscape-soil-water systems, 4) quantitative scaling relationships among soil structure, preferential flow, and water quality parameters, 5) fundamental mechanisms and practical enhancements of pedotransfer functions and how they can improve the value of soil survey databases, and 6) enhanced education of the next generations of soil scientists and hydrologists.

We encourage the discussion of innovative ideas, enhanced conceptual frameworks and cross-disciplinary applications, as well as case studies that demonstrate hydropedology as a viable area of study. The symposium will include invited and volunteered oral and poster presentations. Selected papers from the symposium would be solicited for a possible special publication.

The schedule and the papers to be presented at this symposium are provided in the following page for your information. The presenter's name is indicated in parentheses for each paper. Please note that on Nov. 5, Wed., from 3:55-4:25 pm, a panel discussion is scheduled. The panelists will include Johan Bouma, Christopher Duffy, Rien van Genuchten, and Larry Wilding.

A reception in honor of Dr. Larry P. Wilding's career will be held in conjunction with this symposium. This reception is scheduled for Monday, Nov. 3, from 5:30 to 7:30 pm.

In addition, a general meeting of the Hydropedology Working Group is scheduled for Wednesday, Nov. 5, from 5:30-6:30 pm at the Denver Convention Center. Anyone interested is welcome to attend.

For more information on the symposium and other related activities, please contact Henry Lin at henrylin@psu.edu, 814-865-6726.



Symposium---Hydrogeology: Bridging Disciplines, Scales, and Data

Monday, Nov. 3, 2003, 7:50 am - 12:10 pm, Oral

- Advancing the Frontiers of Soil Science in Geosciences. (Larry Wilding)
- Hydrogeology as a Powerful Tool for Environmental Policy. (Johan Bouma)
- Unexpected Field Observations and DOE's Vadose Zone Roadmap. (Daniel Stephens)
- Soil reflections of water flow in landscapes and wetlands. (Jim Richardson)
- The History and Future of Hydrogeology in the National Cooperative Soil Survey. (Robert Ahrens)
- Application of Hydrologic Models to Soils Investigations. (Mike Vepraskas)
- Dynamic Representation of Soil Hydrology and Genesis Through Space and Time. (Jay Bell)
- Fragipan Controls on Runoff Generation: Hydrogeological Implications at Landscape and Watershed Scales. (Bil Gburek)
- Defining Hydrologic Response Groups For Watershed Modeling: A Hydrogeological Approach. (Ray Bryant)
- On-Site Wastewater Management Systems: An Interface between Pedology and Soil Physics. (Larry West)

Monday, Nov. 3, 2003, 4:00 pm - 6:00 pm, Poster

- Mapping water table depths and groundwater flow patterns in sandy soils with GPR. (Jim Doolittle)
- Predicting Long-term Water Table Fluctuations and Durations Using Climate Records. (Morgan)
- Subaqueous Soils of Rehoboth Bay, DE: Soil mapping in a coastal lagoon. (Cary Coppock)
- Soil Saturation and Soil Reduction. (Don Franzmeier)
- Subaqueous Soil Survey of Taunton Bay, Maine: Methods and Preliminary Results. (Flanagan)
- Micromorphological Characterization and Monitoring of Internal Drainage in Soils under Vineyard and Olive Orchard in Central Italy. (Costantini)
- Lithological Influences on Hydrology and Uranium Distribution in Weathered Nolichucky Shale on the NABIR-FRC Site. (Debra Phillips)
- Modeling Soil-Water-Landscape Systems with Satellite Imagery and GLOBE Student Data. (Jessica Robin)
- Nutrient Transport in Soils of Coastal Plain Agricultural Drainage Ditches. (Robert Vaughan)
- Upscaling of Wetland Indicators from Site-specific to Regional Scale. (McKee)

Tuesday, Nov. 4, 2003, 7:55 am - 11:40 am, Oral

- Advances in Hydrogeology: Synergistic and Integrated Examples. (Henry Lin)
- Dynamical Models and Hillslope Hydrogeology. (Chris Duffy)
- On Pedotransfer Functions, Soil Structure, and Dual-Porosity/Dual-Permeability Modeling. (Rien Van Genuchten)
- Using Fractal Models in Scaling and Pedotransfer Functions of Soil Hydraulic Properties. (Yakov Pachepsky)
- Soil Hydraulic Properties: Pore-Scale to Landscape-Scale (Binayak Mohanty)
- Soil-landscape Modeling for Evaluating Crop Yield and Landscape Water Correlations. (Paul Gessler)
- Pedology and hydrology in hydric soils studies: What have we learned? What do we need to know? (Marty Rabenhorst)
- Hydrogeology of Sedimentary Rock Saprolite in Eastern Tennessee: An Overview. (Ed Perfect)
- Infiltration Through Desert Pavements, Mojave Desert, CA, USA. (Michael Young)
- Research Linkage between Forest Hydrology and Forest Soils: Past and Present. (Jun Xu)

Wednesday, Nov. 5, 2003, 1:25 pm - 4:25 pm, Oral

- Using Subsurface Stratigraphy to Determine Subsurface Water Flow Pathways. (Tim Gish)
- Characterizing Spatial Variability at Landscape Scales with ECa-Directed Soil Sampling. (Dennis Corwin)
- Using Scientific Visualization to Represent Soil Hydrologic Conditions. (Holly Swanson)
- Soil morphology and hydrology on selected playas, Southern High Plains, West Texas. (Horton)
- Hydrogeological approach to soil moisture study in contrasting landscapes. (Chip Kogelmann)
- Hydrogeological approaches for constructing Soil-water-landscape Mechanistic Models for Australian Acid Sulfate Soils. (Rob Fitzpatrick)
- The soil landscape paradigm: Educating the ancillary disciplines. (David Hammer)
- From Agricultural Geology to Hydrogeology: Forging Links to the Geoscience Community in the 21st Century. (Ed Landa)
- Panel Discussion (Panelists: Johan Bouma, Christopher Duffy, Rien Van Genuchten, and Larry Wilding)**

Dr. Don Nielsen led a workshop on spatial-temporal statistics at Penn State

A 3-day workshop on *Spatial-Temporal Statistics in Experimental Design and Data Analysis* was given by Dr. Don Nielsen (Professor of Soil and Water Science, Emeritus, Univ. of California-Davis, and Chair of the U.S. National Committee on Soil Science). The workshop was held from June 25-27, 2003 at the Penn State University Park campus. This workshop was well attended by a total of 30 soil scientists, hydrologists, environmentalists, agronomists, ecologists, and biologists. It was intended to be an open house to attract researchers and students to conduct more meaningful field experiments to have broader application across the landscape. Presentations were given in a non-mathematical format with lots of "show and tell" of many field data sets so that those not very analytically skilled (or rusty in their math and statistics) could readily understand and appreciate the opportunity. An informal discussion session in the last day of the workshop gave the participants an opportunity to present their own relevant research design or data for exchange of ideas. If you are interested in knowing more about the relevant topics covered in this workshop, please read Dr. Nielsen's latest book, "*Spatial and Temporal Statistics-Sampling Field Soils and Their Vegetation.*"

While at Penn State, Dr. Nielsen also gave a general seminar, entitled "Taking advantage of soil variability, instead of ignoring it," which attracted a large audience.

Henry Lin, PSU



Some workshop participants enjoyed a photo opportunity with Dr. Don Nielsen.



A view of the NCSS conference in Plymouth, MA.

National Cooperative Soil Survey Conference held in Plymouth, MA, June 16-20, 2003

The bi-annual national conference of the National Cooperative Soil Survey (NCSS) was held in Plymouth, MA in June 16-20, 2003. This year's theme was "Soil Information for a Changing World." An array of presentations on the latest activities related to soil survey were given by soil scientists from the NRCS, cooperative federal agencies, university researchers, and others. There were also active committee discussions during the conference, including 3 standing committees (Research Agenda, NCSS Standards, New Technology) and 6 in-conference committees (Selling Soil Science to Society—Promoting Partnerships, Ecological Interpretations & Principles, New Inventory Techniques and Delivery Systems in Production Soil Survey, Recruitment and Retention of Soil Scientists in Soil Survey, Water Movement and Water Table Monitoring in Soil Survey, and Hydric Soil). Of particular interest to hydropedology folks is perhaps the Committee 5 on Water Movement and Water Table Monitoring in Soil Survey. The proceedings of this conference will be made available at a later time. For more information, visit the web site: <http://www.ma.nrcs.usda.gov/technical/mo12nesswpc.html>.

Henry Lin, PSU

News Flash ...

- Water flow shapes the Everglades landscape: The flow of water – including hydropatterns, water level fluctuations, sediment transport, erosional formation, and extreme hydrological events – is the central process responsible for the existence of the Everglades ecosystem, according to a forthcoming National Research Council report, <http://www.nap.edu/catalog/10758.html>
- Nearly 700 databases online: Climate scientists probing the soil's role in carbon cycling and hydrologists studying water flow could find plenty of useful information in an archive of ecological and geochemical datasets at the Oak Ridge National Laboratory, <http://www-eosdis.ornl.gov>.
- New DEMs may stimulate significant advancements in remote sensing of soil moisture: Recent advancements in making digital elevation models may act as the Rosetta Stone that allows for the InSAR measurement of soil moisture using existing satellites. Read the article in EOS, June 24, 2003.
- 18th World Congress of Soil Science: will be held in July 9-15, 2006 in Philadelphia (<http://iuss.colostate.edu/18wcss/>). A symposium on hydropedology is being planned for that meeting.
- A useful reference CD: USDA-NRCS has recently produced a CD-ROM that contains an array of current standards used by the National Cooperative Soil Survey. For the latest versions of these documents, please visit the National Soil Survey Center website: <http://soils.usda.gov>.

Publication

Book in Process ...

Development of pedotransfer functions in soil hydrology. Ya. A. Pachepsky and W. J. Rawls - eds. Elsevier, 2004.

Agricultural and environmental modeling and assessment have many uses for soil parameters governing retention and transport of water and chemicals in soils. These properties are notorious for the difficulties and high labor costs involved in measuring them. Often, there is a need to resort to estimating modeling-related soil parameters from other readily available data. Recently, statistical regression equations expressing relationships between soil properties were proposed to be called pedotransfer functions.

Development of pedotransfer functions in soil hydrology is a burgeoning field responding to the increasing need in soil hydraulic parameters for environmental modeling and prediction. This book will be a unique compendium of ideas, techniques and methodologies related to pedotransfer functions. Experts from 12 countries present the international experience of addressing the problem and insightful case studies for different geographical regions. The book will include novel approaches based to estimate soil water retention and hydraulic conductivity, solute transport parameters, parameters of surface runoff and sediment transport, and mechanical properties of soils. Problems of accuracy, reliability, and utility will be scrutinized. Data availability and scale issues will be discussed. Available user interfaces will be reviewed, and extensive bibliography on pedotransfer functions will be included.

Yakov Pachepsky, USDA-ARS

Hydropedology and the Earth's Critical Zone

Henry Lin, Penn State University

The National Research Council (NRC, 2001) recently identified integrated studies of the earth's critical zone (from the land surface to the ground water) as a compelling research area for the 21st century. This critical zone encompasses the pedosphere (Fig. 1)—the thin skin of soils on the earth's surface that represents a geomembrane across which water and solutes, as well as energy, gases, solids, and organisms are actively exchanged with atmosphere, biosphere, hydrosphere, and lithosphere to create a life-sustaining environment.

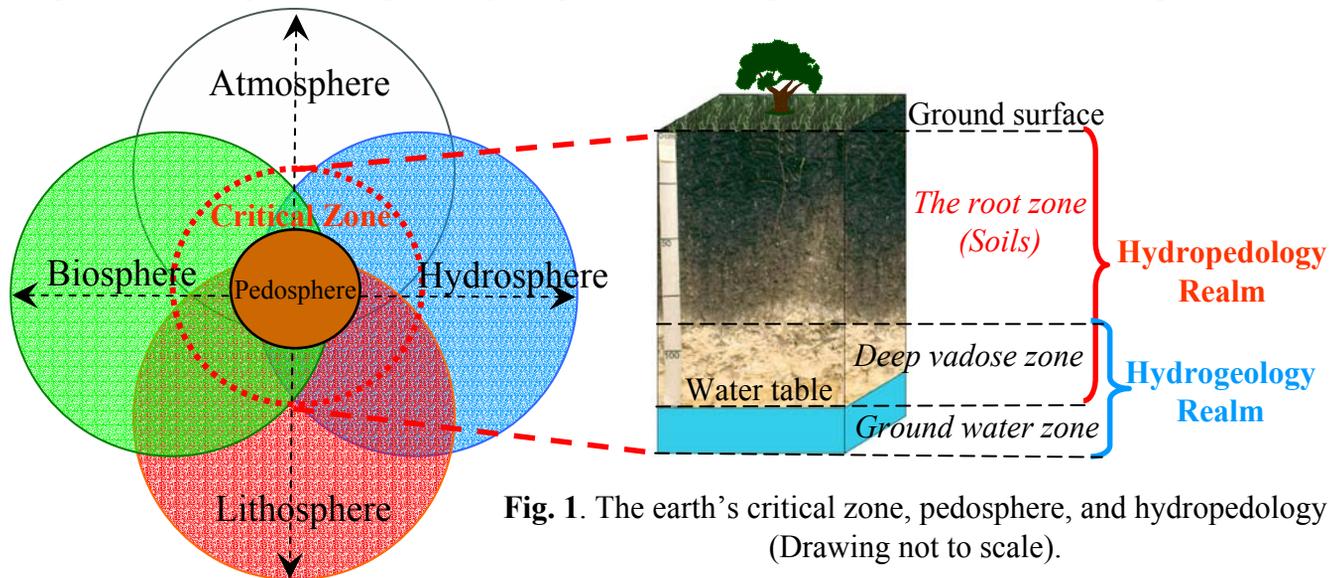


Fig. 1. The earth's critical zone, pedosphere, and hydropedology (Drawing not to scale).

Water controls a variety of soil physical, chemical, and biological processes that lead to the formation of diverse soils which support an array of land uses and biological communities. On the other hand, soils play a key role in the global hydrologic and biogeochemical cycles, contribute to the maintenance of water quality and ecosystem functions, and act as a living filter and remediation medium for waste materials. The interactions of soil and water are so intimate and complex that they cannot be studied in a piecemeal manner, but rather as a system across spatial and temporal scales. In this spirit, hydropedology—an intertwined branch of soil science and hydrology—provides a renewed perspective for synergistic integration of knowledge from relevant disciplines and at multiple scales (Lin, 2003). Hydropedology shifts the focus of geology-rooted classical pedology—a branch of soil science that integrates and quantifies the morphology, formation, distribution, and classification of soils as natural landscape entities—to a hydrology-driven approach reflecting the crucial role of water in many environmental, ecological, geological, agricultural, and natural resources issues. Synergies are expected by integrating pedologists' expert knowledge of soil-landscape relationships with soil physicists' and hydrologists' mathematical rigor of flow theory. Since interactions between the solid earth and its fluids control almost every life-sustaining activity (NRC, 2001), hydropedology holds significant potentials to improve our understanding of the earth's critical zone and to enhance the public awareness of soil and water resource issues.

As suggested by Dumanski (1993), five working models or perceptions of soil may be used to assess the relevancy of hydropedology and its relation to the earth's critical zone: soil as (1) a natural body (geosciences), (2) a medium for plant growth (agricultural sciences), (3) a structural material (engineering sciences), (4) a water transmitting mantle (hydrological sciences), and (5) a component in ecosystem (ecological sciences). Encompassing all is the overarching environmental science that is cross-cutting and multidisciplinary in nature. In each of the above models, soil-water interactions are critical (Fig. 2).

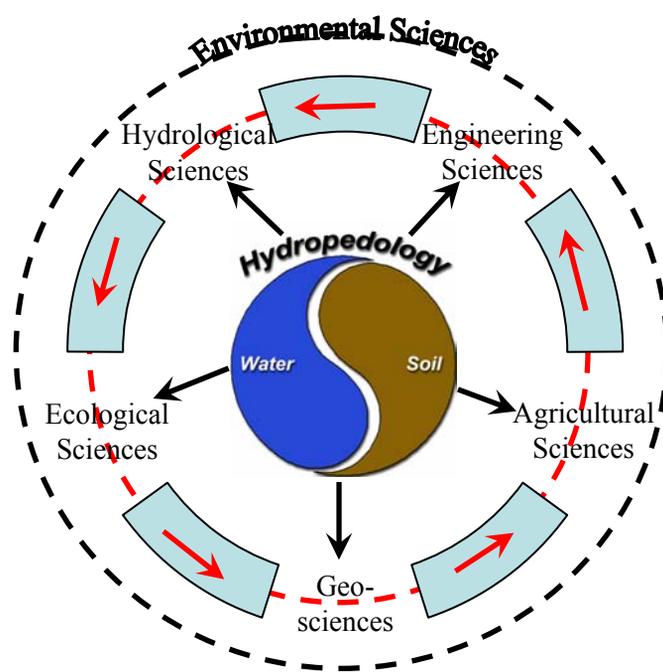


Fig. 2. The relevancy of hydrogeology to the five working models of soil.

Hydrogeology, in combination with hydrogeology, suggests an integrated approach to study the interactions of solid earth and its fluids in the critical zone (Fig. 1). Soil investigations should no longer be limited to the top two meters of the earth's surface but extend well into the deeper vadose zone. It requires a concerted effort to study the soil and underlying material to whatever depth is needed to meet our scientific needs. Geologists are extending their investigations to the surface and including the biosphere and surficial processes, so it is paramount that soil scientists redirect their efforts to interface with other geoscientists in making soil science an integral part of the earth and environmental sciences.

References Cited:

- Dumanski, J. 1993. Strategies and opportunities for soil survey information and research. p. 36-41. In J.A. Zinck (ed.) *Soil Survey: Perspectives and Strategies for the 21st Century*. ITC Publ. 21, International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands.
- Lin, H. 2003. Hydrogeology: Bridging disciplines, scales, and data. *Vadose Zone J.* 2:1-11.
- National Research Council. 2001. *Basic Research Opportunities in Earth Science*. National Academy Press, Washington, D.C.

Do You Know?

- What is the magic of soil + water? ... When Mrs. soil and Mr. water come together, you can image the miracle it produces! (e.g., life and civilization in this blue planet we call home).
- Water year 2003? ... This year is the International Year of Fresh Water declared by the United Nations. See <http://www.wateryear2003.org>
- When is World Water Day? ... March 22, 2003. See <http://www.worldwaterday.org/>
- When is World Soils Day? ... Last year in the 17th WCSS held in Bangkok, International Union of Soil Sciences has proposed December 5 as World Soils Day.
- When is GIS Day? ... November 19, 2003. See <http://www.gisday.com/index.html>.

