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OPTIMAL SEARCH STRATEGY FOR THE DEFINITION OF A DENSE NON-AQUEOUS PHASE LIQUID (DNAPL) SOURCE

GEORGE F. PINDER

Professor of Civil and Environmental Engineering
Professor of Mathematics and Statistics
Director, Research Center for Groundwater Remediation Design
Professor of Computer Science
University of Vermont

Abstract. The overall goal of the research presented here is to develop, test and evaluate a computer assisted analysis algorithm that defines how to achieve an acceptable level of DNAPL source-location accuracy using the least possible number of water quality samples. The search strategy includes a stochastic groundwater flow and transport model that is used to calculate the concentration random field and its associated uncertainty. The model assumes a finite number of potential source locations. Each potential source location is associated with a weight determined using a discrete Choquet Integral that reflects our confidence that it is the true source location. After a water quality sample is selected, an optimization algorithm is employed that finds the optimal set of magnitudes that corresponds to the set of potential source locations. The simulated concentration field is updated using the real data and a Kalman filter. The updated plume is compared to the individual plumes (that are calculated using the groundwater flow and transport simulator considering only one source at a time) employing a fuzzy logic related strategy. The comparison provides new weights for each potential source location. These weights define how the concentration realizations calculated by the stochastic groundwater flow and transport model will be combined. The higher the weight for a specific source location, the more concentration realizations generated by this source will be included in the calculation of the mean concentration field. The steps described above are repeated until the weights stabilize and the optimal source location is determined. The algorithm has been successfully tested using various synthetic example problems and at the Anniston Army Depot (ANAD) in Alabama. The contaminant of interest at the site is trichloroethene (TCE).

EDUCATION
- Ph.D. University of Illinois, June 1968
- B.Sc. (Honors) University of Western Ontario, June 1965

PROFESSIONAL RECORD
- March 2001-present Professor of Computer Science
- July 1993-present Director, Research Center for Groundwater Remediation Design
- July 1992-June 1996 Dean, Division of Engineering, Mathematics and Business Administration
- July 1989-June 1996 Dean, College of Engineering and Mathematics, University of Vermont, Burlington, Vermont 05405
- July 1989-present Professor of Civil and Environmental Engineering
- July 1990-present Professor of Mathematics and Statistics
- July 1980-June 1989 Chairman, Department of Civil Engineering, Princeton University, Princeton, New Jersey 08544
- Sept. 1977-July 1980 Professor of Civil Engineering, Princeton University, Director, Water Resources Program
- Sept. 1972-Sept.1977 Associate Professor of Civil Engineering, Princeton University, Director, Water Resources Program
- Dec. 1968-Sept. 1972 Research Hydrologist, U.S. Geological Survey, Water Resources Division, Atlantic Coast Region, Arlington, Virginia
- June 1968-Dec. 1968 Nova Scotia Department of Mines, Nova Scotia, Canada

LEADERSHIP POSITIONS
- President, Hydrology Section of American Geophysical Union.
- President, International Society for Computational Methods in Engineering.
- Chairman, Groundwater Management Committee, American Society of Civil Engineers
- Chairman, Groundwater Council, Environmental and Water Resources Institute, American Society of Civil Engineers.

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