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Optimal Extraction of Groundwater in Gaza Coastal Aquifer

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ABSTRACT

Two multi-objective management models are applied on a local area selected from the regional Gaza coastal aquifer. The objectives and constraints of these management scenarios include maximizing the total volume of water pumped, minimizing the salt concentration of the pumped water, and controlling the drawdown limits. The physical model is based on the CODESA-3D density-dependent advective-dispersive solute transport model. Genetic algorithm is used as the optimization tool. The models are tested on a part of the aquifer ( ) with 9 existing pumping wells located at various depths. The results of the optimization show that the optimization/simulation approach can give better decision if there is enough information to feed to the model. It confirms that the use of the concept of safe yield alone is not enough for sustainable develop-ment of the coastal aquifer. It shows that the optimum pumping rate is in the range of 26% – 34% of the total natural replenishment. The application shows that the proposed technique is a powerful tool for solving this type of management problems.

KEYWORDS

Seawater Intrusion, Genetic Algorithm, Pumping Optimization, Density-dependent Miscible Transport

Cite this paper

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References

[1] K. Qahman and A. Larabi. "Evaluation and numerical modeling of seawater intrusion in the Gaza aquifer (Pal-estine), " Hydrogeology Journal (in press), 2005a.

[2] A. Das, and B. Datta, "Development of multi-objective management models for coastal aquifers, " J. Water Re-sour. Plann. Manage., Vol. 125, pp. 76 – 87, 1999a.

[3] A. Das and B. Datta, "Development models for sustain-able use of coastal aquifers, " J. Irrig. Drain. Eng., Vol. 125, pp. 112 – 121, 1999b.

[4] E. Gordon, U. Shamir, and J. Bensabat, "Optimal extrac-tion of water from regional aquifer under salinization, " J. Water Resour. Plann. Manage. Vol. 127, pp. 71 – 77, 2001.

[5] K. Qahman, A. Larabi, D. Ouazar, A. Naji, and A. H.-D. Cheng, "Optimal and sustainable extraction of groundwa-ter in coastal aquifers, " Stochastic Environmental Re-search and Risk Assessment Journal, Vol. 19, No. 2, pp. 99 – 110, 2005b.

[6] D. E. Goldberg, "Genetic algorithms in search, optimiza-tion and machine learning, " Addison-Wesley-Longman, Reading, Mass, 1989.

[7] C. Huang and A. S. Mayer, "Pump-and-treat optimiza-tion using well locations and pumping rates as decision variables, " Water Resour Res, Vol. 33, pp. 1001 – 1012, 1997.

[8] D. C. McKinney and M. Lin, "Genetic algorithms solu-tion of groundwater management models, " J. Water Re-sour. Res., Vol. 30, pp. 1897 – 1906, 1994.

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[9] J. Holland, “Adaptation in natural and artificial systems,” University of Michigan Press, Ann Arbor, 1975.

[10] D. Halhal, G. A. Walters, D. Ouazar and D. A. Savic, “Water network rehabilitation with structured messy ge-netic algorithm,” J. Water Resours. Plann. Manage, Vol. 123, pp. 137–146, 1997.

[11] H. K. El, D. Ouazar, G. A. Walters and A.H.-D. Cheng, “Groundwater optimization and parameter estimation by genetic algorithm and dual reciprocity boundary element method,” Eng. Anal. Boundary Elem., Vol. 124, pp. 129–139, 1998.

[12] A. H. Aly and P. C. Peralta, “Comparison of a genetic algorithm and mathematical programming to the design of groundwater cleanup systems,” Water Resour. Res., Vol. 35, pp. 2415–2425, 1999a.

[13] A. H. Aly and P. C. Peralta, “Optimal design of aquifer cleanup systems under uncertainty using a neural network and a genetic algorithm,” Water Resour. Res., Vol. 35, pp. 2523–2532, 1999b.

[14] D. Ouazar and A.H-D. Cheng, “Application of genetic algorithms in water resources,” In: Katsifarakis KL (ed) Groundwater Pollution Control, WIT Press, Boston, pp. 293–316, 1999.

[15] M. Sophocleous, “Managing water resources systems: Why safe yield is not sustainable,” Ground Water, New York, NY, Vol. 35, No. 4, 1997.

[16] M. Sophocleous, “From safe yield to sustainable devel-opment of water resources: The Kansas experience,” Journal of Hydrology, Vol. 235, pp. 27–43, 2000.

[17] J. D. Bredehoeft, “The water budget myth revisited: Why hydrogeologist ’s model,” Ground Water, Vol. 40, No. 4, pp. 340–345, 2002.

[18] C. V. Theis,. “The source of water derived from wells: Essential factors controlling the response of an aquifer to development,” Civil Eng., Vol. 10: pp. 277–280, 1940.

[19] J. D. Bredehoeft, S. S. Papadopulos and H. H. Jr. Cooper, “The water budget myth,” In: Scientific Basis of Water Resource Management, National Academy Press, Studies in Geophysics, pp. 51–57, 1982.