Coast to Cosmos Lecture Series

Saltwater Intrusion in Baton Rouge's Aquifers, Southeastern Louisiana

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Digital Media Center 1034
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Abstract:

Groundwater resources are vital for Louisiana's economic and demographic developments. Many freshwater aquifers underneath Baton Rouge are being contaminated by saltwater intrusion due to excessive groundwater withdrawals. This talk discusses the construction of high-resolution three-dimensional saltwater intrusion models to better understand salinization in the "1,200-foot", the "1,500-foot", the "1,700-foot", and the “2,000-foot” sands in the Baton Rouge area. The model area includes the east-west trending Baton Rouge fault and the Denham Springs-Scotlandville fault, which restrict flow to the heavily pumped area between two faults. To develop three-dimensional models, we first constructed the geological architecture of the Baton Rouge aquifer system using electrical well logs. Then, we converted the geological architecture into MODFLOW computational grid. A model of 45 layers was constructed to include the "1,200-foot", the "1,500-foot", and the "1,700-foot" sands. For the “2,000-foot” sand model, the MODFLOW grid is consisted of 29 layers. To overcome the computational difficulty, we implemented the Covariance Matrix Adaptation Evolution Strategy (CMA-ES) to a cluster of the LSU supercomputers for calibrating the flow and transport models. It was found that the complex geological architecture and sand displacements at the Baton Rouge fault mainly control the saltwater encroachment location. The simulation results showed that saltwater will eventually stop at Lula wells in the “1,500-foot” sand and stop at Entergy wells in the “2,000-foot” sand in the industrial district.

Speaker's Bio:

Frank Tsai is an associate professor of the Department of Civil & Environmental Engineering, Louisiana State University. He currently serves as the Director of Louisiana Water Resources Research Institute. He joined LSU as a faculty member since 2003. Frank Tsai received his Ph.D. degree from the Department of Civil Engineering, University of California, Los Angeles in 2002 and stayed at UCLA one year as a postdoc fellow. His current research is groundwater flow and transport modeling in aquifer systems, which includes geological architecture modeling, inverse problems, uncertainty analysis, experimental designs, and high performance computing. His research is funded by the National Science Foundation, the U.S. Geological Survey, and the Louisiana Board of Regents. He is serving as an associate editor for ASCE Journal of Hydrologic Engineering and ASCE Journal of Water Resources Planning and Management.

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