Assessment of Seawater Intrusion Potential from Sea Level Rise in Coastal Aquifers of California

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This study simulated the effect of sea-level rise on the Seaside Area sub-basin near the city of Monterey, California. The simulation was carried out with a state-of-art, finite-element, variable-density, numerical model that accounts for the effects of salinity on groundwater density and viscosity.

The California Department of Water Resources (2006) predicted a rise in mean sea level along California's coastline ranging from 10 to 90 cm over the 21st century due to rising global mean surface temperature. The rise in sea level threatens coastal aquifers by exacerbating the risk of saline intrusion. This study simulated the effect of sea-level rise on two coastal aquifers of California: the Seaside Area sub-basin near the city of Monterey, and the Oxnard Plain sub-basin near the city of Ventura. The simulations were carried out with a state-of-art, finite-element, variable-density, numerical model that accounts for the effects of salinity on groundwater density and viscosity. Seawater intrusion was simulated for various scenarios of sea-level rise, varying from 0 m to 1 m. Each scenario contemplated the same level of predicted groundwater extraction through the 21st century in the study aquifers. The numerical simulations of seawater intrusion indicate that one meter of sea-level rise would contribute an additional 10 to 15 meters of inland spread of the 1,000 mg/L saline front and 20 to 30 meters of the 10,000 mg/L saline front. The effect of sea-level rise on seawater intrusion, therefore, appears minor when compared with historical measurements of seawater intrusion caused primarily by groundwater pumping since the early 1900s.

Publications

Loaiciga, H.A., Pingel, T., Garcia, E. Assessment of Seawater Intrusion Potential From Secular Sea-Level Rise in a Coastal Aquifer of California. Water Resources Research, in press.

Professional Presentations

Loaiciga, H.A., Pingel, T., Garcia, E. "Assessment of seawater intrusion potential from sea level rise and pumping in coastal aquifers of California", presented at the "Groundwater salinity: a groundwater dilemma" Conference of the UC Center for Water Resources and Ground Resources Association of California, Sacramento, California, March 24-25, 2009.

Loaiciga, H.A., Pingel, T., Garcia, E. 21st century sea level rise, economic growth, and seawater intrusion", Fall Meeting American Geophysical Union, San Francisco, California, Dec. 15, 2008.

Loaiciga, H.A., Pingel, T., Garcia, E. "21st century sea-level rise and seawater intrusion in coastal aquifers of California". Symposium on Climate Change Implications for California Groundwater Management, California Groundwater Resources Association of California, Sacramento, California, August 13, 2008.

Collaborative Efforts

A research proposal was submitted to NASA NSPIRES in collaboration with the University of Idaho, the University of Alaska, the University of New Hampshire, and UCSB. The research proposal will target the Tarim River basin in China, and its water resources, socio-economics, and climate change processes in that river basin.

A workshop on the Tarim River basin of China was funded by the National Science Foundation, November 22-27, 2009, to bring together US, Chinese, and Central Asian researchers to discuss and share scientific knowledge on the world's largest closed river basin, the Tarim river basin.

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