New way to protect precious water

April 10 2013

Australian scientists have devised a way to model polluted groundwater with computer simulation – and better protect the Earth's main fresh water supply.

Researchers at the National Centre for Groundwater Research and Training (NCGRT) have developed a new model to predict where – and how fast – polluted groundwater can move from a contaminated site, allowing water managers to better locate and clean up the water.

This could help defeat an emerging threat beneath all the world's big cities and stave off a looming global water crisis, says Professor Craig Simmons of NCGRT and Flinders University.

"Groundwater contamination currently affects 140 million people in 70 countries," says Prof. Simmons. "The water is increasingly polluted by pesticides, leaks from landfills and fuel dumps, residential and factory waste and other industrial contaminants which render it unusable and undrinkable."

In the case of Australia, he adds, the main threat to our groundwater supplies is salinity, though urban supplies are often contaminated with hydrocarbons from old fuel storages.

"Groundwater makes up 98 per cent of the Earth's fresh water. It provides drinking water to more than 1.5 billion people living in cities, and low-cost water to farmers and rural areas. In some countries, up to 90 per cent of urban groundwater is polluted, so we need to tackle the issues of contamination worldwide urgently."

When pollutants leak into groundwater, they form a plume that usually follows the normal groundwater flow, Dr Yueqing Xie of NCGRT and Flinders University explains. The plume can then spread out underground and contaminate other aquifers used by households, or leach into and contaminate rivers and lakes.

"The problem is that contaminants from landfill sites or saline disposal basins are often denser than groundwater," he says. "The plumes formed beneath these sites will follow the groundwater flow, but they will also be drawn downward by gravity to mix with often fresher groundwater below.

"Their patterns of formation and migration are very complex, and until recently we thought their onset and growth were not amenable to prediction.

"These plumes merge or split many times randomly into what are called 'fingers' until they reach the bottom," Dr Xie says. "It also depends on what contaminants are in the plume, how dense the plume is, and the type of sediment or rock they have to pass through. For instance, a dense plume sinks more easily into gravel or sand, than clay."

"Once these dense plumes enter and mix with the groundwater it has been near impossible to tell where they might end up," Prof. Simmons adds. "We had started to lose faith in our ability to make good predictions using our very best computer models."

NCGRT researchers have now developed a model that allows researchers and water managers to more reliably predict where and how fast the contaminated dense plumes will travel.

"Instead of trying to predict every fine detail of the plume as we have in the past, we now look at its overall size, how much contamination or salt it has in it, and how fast it's sinking into the freshwater," says Prof. Simmons.

"Using this new approach, we can predict how fast the plume is moving and how far away it may end up from the contaminated site. While we can't always pin down the exact destination of each and every finger, we now have a much better idea of where the overall plume is heading – and where we can intercept it, to clean it up."

Having the more reliable predictive model assists in more cost effective monitoring and remediation, he adds.

"This new model and way of looking at the problem is a big step towards better protecting one of humanity's most precious resources: our main freshwater supply."

More information: www.groundwater.com.au/

Provided by National Centre for Groundwater Research & Training

Citation: New way to protect precious water (2013, April 10) retrieved 20 September 2024 from https://phys.org/news/2013-04-precious.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.