Earth has enough groundwater to raise sea levels by 52 meters

16/11/2015

The size of this smaller renewable reservoir – never known until now – may help governments manage water resources in the face of growing demand.

Society is increasingly relying on groundwater from wells and springs for drinking and, especially, for agriculture. Despite this, hydrologists do not really know how much groundwater there is or how quickly it is being renewed through rainfall and snowmelt.

To address this, Tom Gleeson, a hydrogeologist at the University of Victoria in Canada and his colleagues made use of a by-product of thermonuclear weapons testing: radioactive tritium from above-ground explosions.

Any groundwater containing elevated levels of tritium must, they assumed, be “modern” groundwater that entered the ground since nuclear testing began about 50 years ago.

Gleeson’s team compiled nearly 3800 groundwater samples for which tritium levels had been measured and used them to map the abundance of modern groundwater at different depths below the surface.

Then they used models to predict the total groundwater present, in pores and cracks in rocks and in aquifers, within each watershed.

Vast reservoir

The uppermost 2 kilometres of Earth's crust contain nearly 23 million cubic kilometres of groundwater, they concluded. This tallies with rough calculations made about 40 years ago.

But less than 6 per cent of that total – and probably only 1.5 per cent – represents modern groundwater, they found.

This modern fraction recharges through rainfall and run-off on a timescale of decades, and thus represents the potentially renewable portion of groundwater.

The rest is too deep or too isolated from the surface to have had any significant input in half a century, and is best regarded as a non-renewable resource, says Gleeson.

No one had ever estimated before what proportion of the world's groundwater is renewable. "It is a small pool, smaller than I thought, which means that it's a more finite resource," says Gleeson.

That makes it important to know more precisely where this modern groundwater is, how quickly it turns over, and when and where it is being depleted most rapidly.

Even though only a small portion of groundwater is actively renewing, that still represents a vast reservoir, several times the size of all lakes and rivers combined, notes Richard Taylor, a hydrogeologist at University College London, UK.

However, he cautions that this modern groundwater should be regarded as only potentially renewable. "The fact that something was replenished in the last 50 years doesn't mean it's going to be replenished in the next 50 years," he says.