Media release

Turning up the heat on our precious water resources

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Water scientists are using heat to measure the extent to which some of Australia's inland rivers and streams could dry up due to over-extraction of groundwater.

During the Millennium Drought a number of rivers and streams in the Murray-Darling Basin dried up partly as a result of over-extraction from the aquifers that normally keep them flowing.

In a bid to understand the problem better and to help federal and state water managers secure our water supplies, researchers at the National Centre for Groundwater Research and Training (NCGRT) are measuring water temperature both above and below the surface.

"By measuring the rate at which warmer water from the surface trickles into the cooler water below ground we can gain an idea of how quickly or slowly an aquifer is being recharged," says Dr Martin Andersen of NCGRT and the University of NSW.

"We've installed data loggers at various points in the Murray-Darling Basin both above and below ground, which are recording temperature changes throughout the day, allowing us much greater insight into the movement of water between streams and underground aquifers."

Although other methods, such as natural radioactive tracers are more appropriate when looking at deeper groundwater systems, where temperature changes are undetectable, in these shallow systems natural changes in heat make an excellent tracer for water movement as it is freely available and easy to measure.

"By leaving these loggers in place for long periods of time, we can collect data over many years. This not only helps us build up a consistent picture of water flow in a given area but also means that we can monitor how groundwater levels recharge during floods," says Dr Andersen.

"All this data provides us with much needed information about the connection and flow between different water sources. We can then use it to test, and improve, our models which show how one water source is linked to another and predict whether they will increase or decline."

By taking advantage of these naturally occurring temperature changes to trace the flow of water, Dr Andersen and his team are providing a much clearer picture of underground water systems that are often impossible to observe first-hand.

"It is estimated that around 95 per cent of Australia's total freshwater supplies are underground. Unlike a surface dam, there are no easy ways to observe the movement and renewability of this water."

In the laboratory, the researchers are using 'sand tanks' to test the rate at which water can move between an aquifer and a surface water body. As part of this work they are also using emerging technologies such as fiber optic lasers to measure the temperature both above and below ground with much greater clarity.

"The relationship between groundwater and surface-water is often complex and may vary between different sections of the same river," says Dr Andersen. "For example, water typically penetrates gravels and sands much more readily than it does finer silts and clays.

"Our 'sand tank' allows us to examine the movement of water through different materials. For example, we can simulate day and night changes in water temperature and observe how long it takes the heated water to penetrate these different materials, such as fine versus coarse sand grains."

The National Centre for Groundwater Research and Training is an Australian Government initiative, supported by the Australian Research Council and the National Water Commission.

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“The results increase our confidence in the use of temperature measurements for tracing how groundwater and surface-water are connected at a particular location, and tell us how fast this water is flowing,” he says.

NCGRT managing director, Prof. Craig Simmons says that the overall picture of groundwater usage in Australia has only become clear in recent years since the introduction of the National Water Initiative.

If not properly managed, increasing groundwater extraction poses a long-term risk as we generally do not know what effect its removal will have on watercourses at the surface, such as streams and rivers.

“In order to manage this risk we need to understand how withdrawing water from one area, will affect a water source in another. Using heat to trace water movement is one important method that we have at our disposal to better understand and manage catchment areas such as the Murray-Darling Basin that provide critical sources of water to communities, businesses and ecosystems throughout Australia.”

FURTHER INFORMATION:

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