

## The word from on high: we're drying up fast

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SATELLITES have been used to map all of Australia's fresh water for the first time, and the picture is bleak. In just three years, the continent has suffered a net loss of 46 cubic kilometres of fresh water - enough to fill Sydney Harbour more than 90 times.

Initial results of an extraordinary international satellite project provide yet another indication that Australia is drying out.

Based on current consumption patterns of about 1.5 billion litres a day, the water lost could have quenched Sydney's thirst for more than 80 years.

The discovery has been made using two US and German satellites designed to map all the world's water stocks - a task never before possible.

Launched by a Russian rocket in 2002, GRACE, the Gravity Recovery and Climate Experiment, involves two identical craft circling 220 kilometres apart, 485 kilometres up. By repeatedly plotting variations in the tug of earth's gravity, GRACE can estimate changes in the mass of the water below. "Even water in aquifers," said Jay Famiglietti, a hydrologist at the University of California, Irvine. It also measures water in river basins and reservoirs.

While key findings will not be published until next year, Professor Famiglietti calculated for the *Herald* the overall decline observed in Australia's fresh water. Between February 2003 and January this year, Australia lost the 46 cubic kilometres. "Some regions are gaining, while others are losing," said the professor.

However, it would take another five years of mapping before his team could say if Australia's drying was a short-term variation created by drought, or a long-term trend triggered by climate change. "Once we have longer observations we will be able to weigh in on that debate," he said. "We know Australia is in drought. The data is agreeing with that."

While GRACE can map changes in the total mass of fresh water below, it cannot tell what is driving the variations.

Associate Professor Jeffrey Walker, from the University of Melbourne, and former PhD student Kevin Ellett, from the US Geological Survey, have been working in the Murrumbidgee catchment, comparing their ground measurements with GRACE's data on the entire Murray-Darling basin. It could lead to computer models for world water managers to interpret the information from space.

Putting GRACE's observations into context, it was Mr Ellett who pointed out that the water lost in three years "equates to 92 Sydney Harbours". The Murray-Darling region lost "roughly 6000 gigalitres over the three years, or 12 Sydney Harbours".

GRACE has completed the first assessment of global freshwater stocks. "Some continents have increasing water storage - for example, North America," Professor Famiglietti said. But significant drying

had been seen in African river basins, including the Congo, Zambezi and the Nile. "The global result will be interesting," he said. "I think it will have implications for the climate change debate."

GRACE maps the world's water every month, working on the principle that "water is heavy". When one satellite passes over water, the increased gravitational pull makes the probe above speed up, altering the distance between it and its orbiting twin.

"The distance between the GRACE satellites is a couple of hundred kilometres ... we can track the difference to within the thickness of a red blood cell," said the professor. "It blows me away".

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