

JULY 2008

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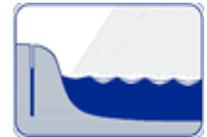
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NEWSLETTER OF THE HYDROLOGICAL SOCIETY OF SOUTH AUSTRALIA

OBSERVATIONS ON HYDROLOGY AND GLOBAL CLIMATE CHANGE

James H Jensen

There are articles almost daily about the increased variability and extremes in rainfall attributed to global climate change. As an extreme example, what the US Corps of Engineers have classified as 500-year-floods are again impacting communities all along the Mississippi River in a tragic repeat of the 1993 floods of the same region. Although statistically possible, 500 year floods separated by 15 years are more likely due to global climate change, i.e., the statistical data population should no longer be considered "stationary".

Here in Australia, recent news about the drought in the Murray-Darling Basin state that it is getting worse with June inflows the lowest on record and autumn inflows marginally above the record lows of 2007. The dire assessment of the rivers' health came only a few days after government scientists warned that Australia could expect the frequency of heat waves to increase tenfold, from once every 22 years to every one or two years (The Independent, 11 July 2008). Meteorologists have established that for every one degree Celsius rise in temperature, inflows into the river system decrease by 15 per cent.

Speaking at Greenhouse 2007, CSIRO's Dr Wenju Cai said the latest modeling by the Intergovernmental Panel on Climate Change (IPCC) showed a 5 to 15 per cent rainfall decrease by 2070. "There is no longer any doubt that climate change caused by increases in greenhouse gases is influencing seasonal shifts in rainfall patterns," Dr Cai said. "Our results provide strong evidence that rising temperatures, hence increasing evaporation due to the enhanced greenhouse effect, impact on Australia's water resources, in addition to any reduction in rainfall."

The majority of the IPCC models show increased precipitation intensity but more dry days over most of Australia. A general drying over SW Australia is projected, with rainfall decreases of about 10-30% for winter-spring seasons by 2100. This is very worrisome as a "rule of thumb" is that a 10% reduction in rainfall gives rise to a 30% reduction in runoff volume.

However, there remains significant uncertainty about the exact nature and timing of global climate change-related impacts on water re-

sources:

- Uncertainties remain in climate change cause and effect chain
- Improved sensitivity analysis and models are required as better information and improved parameter values become available
- There are feedback systems that are not fully understood which can act to either enhance or reduce the warming.
- Difficulties remain in simulating and attributing observed changes at smaller scales.

Continuing research efforts are needed to improve climate modeling, in extreme events analysis, in palaeo-climatology, to improve the confidence limits of the predictions.

As a result of global climate change, hydrologists will need to revise models of groundwater infiltration and stream flow maximums and minimums, including flood stage and frequency, to more accurately predict and prepare for the impacts of changed climate conditions.

Decreases in average annual precipitation, number of rain days and an increase in evapotranspiration (due to temperature increases) will reduce groundwater recharge.

Probable maximum precipitation (PMP) is one of the required inputs for estimating the probable maximum design flood. In estimating the PMP, no allowance is currently made for long-term climatic trends. The variability in regional rainfall patterns, timing and intensity from climate change will impact flood probability, but the actual impact is difficult to predict, as flood flows are determined not only by rainfall intensity, but by catchment initial conditions, which climate change will likely impact:

- Native vegetation species' geographical ranges
- Agricultural crops
- Level of vegetation cover
- Dry ground runoff regions (conducive to flash flooding)

Changes in rainfall distribution will alter patterns of flow affecting water resource and supply planning. More intense storm events, and an increase in the period between storm events may change or in-

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OBSERVATIONS ON HYDROLOGY AND GLOBAL CLIMATE CHANGE

James H Jensen

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crease pollutant loadings, resulting in water quality issues. An increased number/frequency of bushfires due to increased temperatures would impact system yield and increase contaminants in runoff.

Studies and input to hydrologic modeling should also consider assessment of changing priorities of water and environmental management

objectives over time – for example from economic efficiency to sustainable ecological health and diversity:

- Water set aside for environmental purposes
- Creation of wetlands and detention basins to reduce floods and increase infiltration to aquifers

In summary, the potential impact on water resources from global climate change include increased variability

and extremes in rainfall and the resulting impacts on groundwater infiltration and stream flow. As a result of the global climate changes, hydrologists will need to revise study and modeling assumptions including temperature, rainfall patterns and intensity, groundwater infiltration and stream flows to more accurately predict the impacts of changed climate conditions on water resources and the environment.

EMERITUS PROFESSOR JOHN W HOLMES

2.2.1921 TO 13.5.2008

Graham Allison

John Holmes joined CSIRO Australia in 1950. After some initial research on soil mechanics he focused on the development of the neutron moisture meter, which was to become a key tool in studies of both agricultural water use and catchment hydrology. In a long term study he then applied this technique, together with lysimetry and energy budgets, to assess the water balance of a very significant area of southern Australia. At this time he also became interested in the impact of plantation forestry and pasture on groundwater recharge relative to native vegetation.

In the late 1960s he saw the potential of environmental tritium to assist in the understanding of groundwater flow and recharge. The laboratory he initiated flourished and became well known for studies using tritium and other environmental tracers.

Holmes became foundation Professor of Earth Sciences at the newly established Flinders University in 1969 and until 1971 held the position jointly with his senior research position in CSIRO. In 1971 he left CSIRO to become full time at Flinders University and pour all of his considerable energies and talent into establishing what was to become a dynamic hydrology discipline at the University. At the same time he

maintained strong research link with the groups he established at CSIRO. As recognition of his contribution to science, the JW Holmes Building stands in his honour at the Waite campus.

A steady stream of postgraduate students were attracted by Professor Holmes to study at Flinders University. Studies were initiated in a wide range of fields including:

- Micro meteorology to help assess the hydrologic impacts of forests and pasture
- The water balance of lakes
- Tritium dispersal in ocean waters
- The hydrogeology of several important aquifer systems in Australia

The further development of a number of techniques in isotope hydrology.

In 1979, with former colleague T J Marshall, he wrote what was to become a seminal text entitled *Soil Physics*. In the words of a reviewer of the third edition of the book (published in 1996) "Among its attractions are the clarity of the writing and the many examples of soils physics in action ... there is no better text on soil physics in any language". This text is still widely used interna-

tionally as a reference and university text book.

A year before his retirement in 1985 he received the Distinguished Service Award of the University in recognition of his outstanding service. On his retirement he was appointed Emeritus Professor by the University. During his career he authored over 90 research papers and the text book "Soil Physics".

Holmes was a member of the Editorial Advisory Board of the *Journal of Hydrology* for 12 years between 1975 and 1987. He was recipient of numerous awards including the Prescott Medal for outstanding contributions to soil science in Australia in 2002 and the Verco medal in 1979 by the Royal Society of South Australia where he had served as President. He was a life member of the Hydrological Society of South Australia. The South Australian Government appointed him a member of the Water Resources Appeals Tribunal from the period 1982-1995.

As one who owes much to John Holmes as a mentor and collaborator I will remember him fondly for his leadership, clarity of thought, encouragement and wry sense of humour. He was a truly great leader and scientist.

INTERNATIONAL EXPERT WITH A FOCUS ON THE GLOBAL CHALLENGE OF GROUNDWATER

Helen Beringen

For international groundwater expert Kip Solomon, it all began with a child's fascination with the well which watered his farm in Utah, USA.

His inquisitive nature has matured into a scientific focus aimed at improving our understanding of groundwater resources on a global scale, and with it, our ability to feed a growing world population.

Groundwater is used to grow at least 20 per cent per cent of the world's food, and this amount is growing. Yet little is known about the resource globally, including how much we have, and whether its use is sustainable.

With a burgeoning world population and increased food production needs, groundwater research is a critical need, he says.

"The single biggest challenge in groundwater resources is to understand what the recharge rate is," says Solomon, now a Professor in Geology and Geophysics at the University of Utah, USA and currently a Distinguished Visiting Fellow with CSIRO.

"We do not know globally how vulnerable groundwater systems are to climate change. Groundwater resources are also coming under increasing stress because of exploitation."

Professor Solomon says global food production is being driven to semi-arid and arid areas of the world.

"If we are going to do this we need to have water, and groundwater is often the only source of water in these areas.

"In fast-growing parts of the world such as China, India and Pakistan, there are high extractions yet little is known about the sustainability of groundwater resources.

"Even in the US where work has been done there is still a lot to know."

This quest for knowledge led Professor Solomon to becoming involved in the development of some of the first tools using gas measurements to better understand groundwater age and flow rates.

Noble gases such as helium, argon and neon naturally occur in groundwater, and can indicate the age of the water and allow rates of groundwater flows to be better understood.

Professor Solomon's PhD in earth sciences from the University of Waterloo, Canada, revolved around the dating of young groundwaters using tritium and helium 3.

It led to the use of other dissolved gas tracers to age and measure groundwater flows.

He was the 2005 Darcy lecturer, an international recognition of his expertise in groundwater research and is former chair of the Hydrogeology Division of the Geological Society of America (GSA).

Professor Solomon's work has now led him to Australia where he has constructed a unique scientific in-

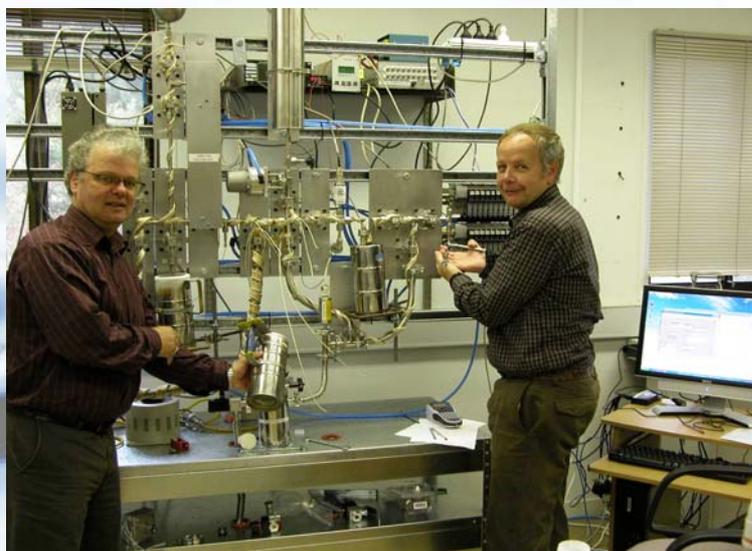
strument which will provide valuable insights into the age of Australia's precious groundwater resource and its connectivity to surface streams, rivers and lakes.

He spent six weeks at CSIRO Land and Water's Waite laboratories in Adelaide from May to early July 2008, building the measurement facility, a quadrupole mass spectrometer with high vacuum cryogenic separation system.

The \$130,000 measurement facility, one of only about six similar machines in the world, has a variety of applications, including dating water, improving estimates of groundwater/surface water connectivity and dating alluvial aquifers.

Professor Solomon plans to return to Australia in October to join CSIRO researchers in taking field measurements.

Meanwhile, his quest for knowledge to improve our global understanding of this precious resource continues, as an international consultant to a co-operative research project sponsored by the International Atomic Energy Agency working with many developing countries around the world.



Professor Solomon and CSIRO's Dr Andy Herczeg at work on the new facility.

UPCOMING EVENTS



11th International Riversymposium

Brisbane, Australia
1 – 4 September 2008

The global future of rivers is threatened by too little or too much water. The 11th International Riversymposium will explore the challenges associated with the increased incidence of flooding and drought expected with climate change. What changes can we anticipate? How can we adapt?

KEY AREAS TO BE COVERED WITHIN OUR SPECIAL THEMATIC FOCUS ARE:

- Climate change and rivers - building climate resilience into rivers
- Drought management and planning - water management with drying dams
- Floodplain rivers - flood mitigation and maintaining ecological values
- Preparing our urban waterways
- Maintaining food production

REGULAR SYMPOSIUM FEATURES:

- Environmental flows
- The trials of transboundary rivers

NEW SYMPOSIUM FEATURES:

- Water sensitive urban design
- Responsible mining - sustaining rivers and communities
- Manufactured water
- Study tours around Brisbane

<http://www.riversymposium.com/>

Urban Water Reform in Australia Governance and Structural Changes Tom Mollenkopf, CEO, Australian Water Association

Tuesday 5th August 2008

5:30pm – 7:30pm

The Ord Room, Water Corporation, Leederville

Following the successful Governance Forum held in Brisbane in June, Australian Water Association CEO Tom Mollenkopf will give a summary of recent reforms in the Eastern States including the major changes which are being implemented in South East Queensland. Additionally, there will be a brief overview of some of the implications for the water sector arising out of the recently released Draft Report by Prof Ross Garnaut. The Garnaut Report on Climate Change in Australia proposes an Emissions Trading Scheme that will impact on water utilities in several ways.

[http://www.awa.asn.au/AM/Template.cfm?](http://www.awa.asn.au/AM/Template.cfm?Section=Urban_Water_Reform_in_Australia_Governance_and_Structural_Changes)

[Sec- tion= b Aug_08 b Urban Water Reform in Australia Governance and S tructural Changes](http://www.awa.asn.au/AM/Template.cfm?Section=Urban_Water_Reform_in_Australia_Governance_and_Structural_Changes)

Conference LGSA Water Management Conference 2008 13-15 August 2008, Ballina NSW

The Local Government and Shires Associations of NSW (LGSA)' Water Management Conference is an annual event providing a forum for discussion on water supply, sewerage and broader water management issues affecting Local Government. The main focus of this year's conference will be urban water reform and the inquiry into local water utilities in regional NSW. It will feature a keynote address by and panel session with the NSW Minister for Water, the Hon Nathan Rees MP. The conference attracts councillors and general managers, water managers and operational staff, government agencies and industry stakeholders from NSW and interstate.

<http://www.lgsa-plus.net.au/www/html/2086-water-management-conference-2008.asp>

9th National Conference on Hydraulics in Water Engineering

23 - 26 September 2008 at Darwin Convention Centre



The focus of the conference will be on the latest techniques and challenges in hydraulics reflecting the changes in public attitudes and variability in climate that drive innovation in hydraulics.

Within this overall theme the conference sub-themes are: Climate Change, Methods in Hydraulics, Applied Hydraulics, Geophysical Hydraulics and Coastal Hydraulics.

<http://www.hydraulics2008.com/>



<http://www.hydsoc.org>

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There is currently a vacancy for a committee member.

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MEDIA WATCH

Independent South Australian Senator Nick Xenophon is considering introducing a private member's bill to Federal Parliament to put water from Menindee Lakes into the River Murray.

<http://www.abc.net.au/news/stories/2008/07/05/2295311.htm>

The Government will spend about \$426 million over four years on upgrades and expansion to wastewater treatment plants and water recycling infrastructure to meet increasing demand of the State's growing population. About \$80 million will be spent in 2008-09.

<http://www.ministers.sa.gov.au/news.php?id=3228>

Water availability in the Murray-Darling could drop by almost half by 2030, according to a new report released by the Prime Minister.

<http://www.abc.net.au/news/stories/2008/07/14/2303267.htm>

Construction is complete on the new \$21.5 million, 3.5 kilometre Torrens Pipeline which replaces the old, open channel Hope Valley Aqueduct

<http://www.ministers.sa.gov.au/news.php?id=3411>

Individuals found guilty of stealing water from the Murray River could be fined as much as \$1 million under harsh new penalties being introduced by the New South Wales Government.

<http://www.abc.net.au/news/stories/2008/07/14/2302635.htm>

You can LISTEN to the presentation by Gary Jones, Executive Director, eWater CRC, Public Seminar for the South Australian Murray Darling Basin Natural Resources Management Board - www.samdbnrm.sa.gov.au.

<http://blog.lifuse.com.au/2007/07/22/8/>

The new Murray-Darling management structure is set to fail, writes JACK WATERFORD

http://www.apo.org.au/webboard/comment_results.html?filename_num=220373

South Australia can thrive if it rises to the challenge of climate change, writes JOHN SPOEHR

http://www.apo.org.au/webboard/comment_results.html?filename_num=218536

This paper by Bill Randolph and Patrick Troy discusses the attitudes of households to their water consumption in a search for ways in which domestic demand for water may be reduced.

<http://www.fbe.unsw.edu.au/cityfutures/publications/journal/attitudestoconservationandwaterconsumption.pdf>

The Australian Competition and Consumer Commission (ACCC) has released its position paper seeking submissions on the development of water market rules. Consistent with Part 4 of the Water Act 2007, the Minister for Climate Change and Water, Senator Penny Wong, has written to the ACCC requesting advice on the water market rules.

<http://www.accc.gov.au/content/index.phtml/itemId/834697>

Hundreds of Australian long-necked turtles are the latest victims of the demise of the lower reaches of the Murray-Darling Basin.

<http://www.abc.net.au/news/stories/2008/07/14/2303044.htm>

The paper undertakes a comparative overview of the law as it pertains to Indigenous rights in freshwater in four countries: the United States, Canada, New Zealand, and Australia.

<http://www.anu.edu.au/caepr/Publications/WP/CAEPRWP42.pdf>

This page lists a selection of publications produced as a result of research conducted through the Water for a Healthy Country Flagship. Some reports are available in downloadable PDF format

<http://www.clw.csiro.au/publications/waterforahealthycountry/index.html>

The Environment Protection Authority has failed to determine the source of groundwater contamination in Adelaide's western suburbs, despite an extensive investigation.

<http://202.6.74.101/news/stories/2008/07/01/2291345.htm>

Penrice Soda has begun cleaning up limestone silt from the Port River in Adelaide, six years after it stopped pumping it into the shipping channel.

<http://202.6.74.101/news/stories/2008/06/25/2285791.htm>

A Sustainable Cap: What might it look like?

<http://news.envirocentre.com.au/lawn/article.php?issue=167&key=281&id=8847>