

New ways to water



Turning on the tap in the sky

The balance between the world's water supplies and demand grows more critical by the year. Worsening water shortages will place severe limits on the life-sustaining capacity of many areas of the world. Addressing this issue calls for more than current water supply augmentation and usage efficiency technologies can deliver. The investigation and development of new approaches to add to the world's water supply of fresh water in a cost-effective, sustainable manner is of paramount importance.

At any time, the atmosphere contains about 10 times more fresh water than the combined fresh water rivers on the surface of the earth. And a small fraction of that atmospheric water which condenses as clouds falls as rain, the great majority over the world's oceans. There is a vast quantity of potentially useful rainfall in the sky. Rain-enhancing techniques present an obvious solution to water shortages around the world.

Four years of trials by Australian Rain Technologies (ART) have demonstrated that its Atlant™ ionisation rainfall enhancement technology presents as such a new approach. Even with enhancement at half the levels estimated in field trials to date, it has the potential to extract significant quantities of freshwater from the clouds – at a fraction of the value of such additional water and the cost of current alternative methods of augmenting usable water supplies.

*“There is definitely a signal...
This technology has considerable
importance for agriculture...”*

RAY CHAMBERS

Professor of Statistical Methodology,
University of Wollongong



Trials

Consistently significant results

Australian Rain Technologies conducted a series of field trials of its Atlant™ technology over the past four years in Queensland and South Australia. Australian universities have independently evaluated the trials. The most recent trials in South Australia from 2008-2010 were guided by a Scientific Reference Panel (SRP) made up of experts in the fields of atmospheric physics, statistics and water management.

The Queensland trials were conducted using the traditional cloud seeding design. These trials showed elevated levels of rainfall in the target versus control areas. On the basis of the findings, it was decided to proceed to a more sophisticated evaluation.

At this juncture, an independent scientific review panel, populated by individuals with both relevant technical and statistical expertise was established to undertake the most rigorous scientific investigation available in this field to date.

The South Australian trials made use of leading-edge statistical methods along with refined randomised experimental designs to eliminate any experimental bias. The methodology and the trials were independently reviewed. Articles were subsequently published in peer-reviewed scientific journals and presented at international scientific conferences.

Each of the three South Australian trials showed increased rainfall in excess of nine per cent with a standard error of plus or minus five per cent. Replication of consistent results for each of the trials delivered the confidence in the technology's efficacy ART was seeking, as summarised by supervising statistician Professor Ray Chambers who said: "There is definitely a signal... This technology has considerable importance for agriculture..."



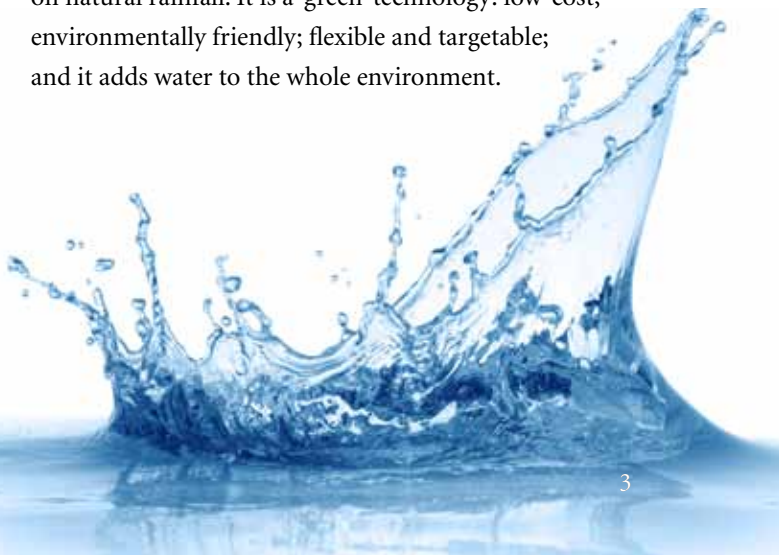
"Atlant™ was something we felt a responsibility to investigate, considering the water issues facing the earth and the need for motivated individuals to fund more 'innovative' approaches. Our efforts have been rewarded."

MATT HANDBURY
CEO, Australian Rain Technologies

How it works

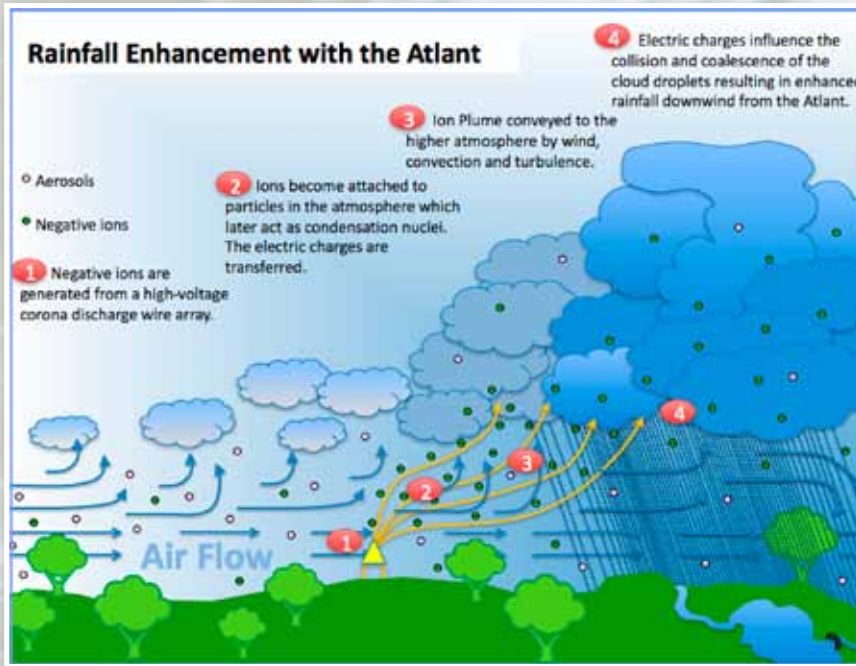
Rainfall enhancement through ionisation

Atlant™ is a ground-based ionisation system, designed to charge naturally occurring particles, which are then carried into the cloud layer through local winds, to enhance the formation and growth of raindrops and ultimately increase the amount of rainfall reaching the ground downwind on the technology. Atlant™ is reliant on natural rainfall. It is a 'green' technology: low-cost; environmentally friendly; flexible and targetable; and it adds water to the whole environment.



The Atlant™ technology

This technology uses an innovative process to influence the ionisation of the lower atmosphere and consequently stimulates the formation and growth of raindrops.



Each Atlant™ ion-emitting device consists of a high voltage generator connected to a large network of thin wires of a metal composition supported on a framework with different pyramids on top. The device's approximate dimensions are 12 m x 4 m x 5 m and it weighs approximately 500 kg.

The Atlant™ technology has many advantages over competing options to secure water supplies for future economic and population growth. Continued proof under differing conditions offers a future technology which will deliver a more environmentally friendly and lower-cost option to current alternatives such as new or enlarged dams, increased desalination, recycling, storm water harvesting and inter-basin transfers. Consequently it could play a pivotal role in addressing Australia's and the world's long-term water requirements, cyclical shortages, urban demand changes and reliance on desalination and groundwater.



Benefits

A 'green' and economical technology

Atlant™ uses a tiny fraction of the energy when compared with what is required to run other water supply technologies. It also generates negligible greenhouse gas emissions, while delivering significant amounts of water. Atlant™ is free of the high physical impact and long delays in implementation associated with alternative high capital cost projects, such as desalination, recycling plants and dams. The inclusion of water enhanced by Atlant™ into an integrated water supply scheme would have an overall effect of lowering both operating costs and the average carbon footprint of securing an additional kilolitre of water.

A portable, flexible, targetable and scalable solution

Unlike other schemes with major fixed infrastructure, Atlant™ can be easily relocated, and consequently target the areas in most need of rain. Additional rainfall provided by Atlant™ has the advantage of delivering water to the whole environment across its target areas, not just to reservoirs. Currently, the agricultural

industry in particular has limited available options to adapt to reductions in rainfall due to climate change. The Atlant™ technology offers agricultural regions an environmentally safe means to return rainfall to previous levels.

Rainfall for the whole environment

Precipitation is increased over wide areas: agricultural and pasture land, national parks, state forests, wetlands and catchments. This additional water assists in securing sustainable economic and population growth in the regions and counters carbon dioxide emissions as well as minimising and restoring land degradation and biodiversity.

Rain shadow analysis

There are clear physical reasons why rainfall enhancement technologies are unlikely to generate observable downwind rain shadow effects. However, ART decided to investigate the issue using data from the 2008 Mount Lofty Ranges trial. From these analyses, no evidence of rain shadow effect was present.



Economic return

The South Australian trials established more than efficacy. The trial clearly showed the net economic benefits the technology can deliver. Data from the 2009 trial was used to calculate the volume and value of the estimated increase in rainfall over the five-month trial. The estimated increase in runoff into urban storages was 1,600 ML valued at over \$1.5 million. The estimated increase in water flowing into the Lower Lakes and the Coorong wetlands was 26,000 ML, with a value of more than \$2.6 million, based on what governments are currently paying to buyback irrigation water to meet environmental demands.

Future Australian scenarios

If similar results were achieved in the northern wheat belt of Western Australia, the benefits would be in the order of \$20-45 million per annum due to increased crop production. Benefits in the catchments for the two major storages in the Southern Murray Darling Basin, Hume and Dartmouth Dams, would be in the order of \$17-34 million per annum in terms of increased

irrigated agricultural production. All of these scenarios – experienced and projected – represent a multiple return on costs.

A big opportunity

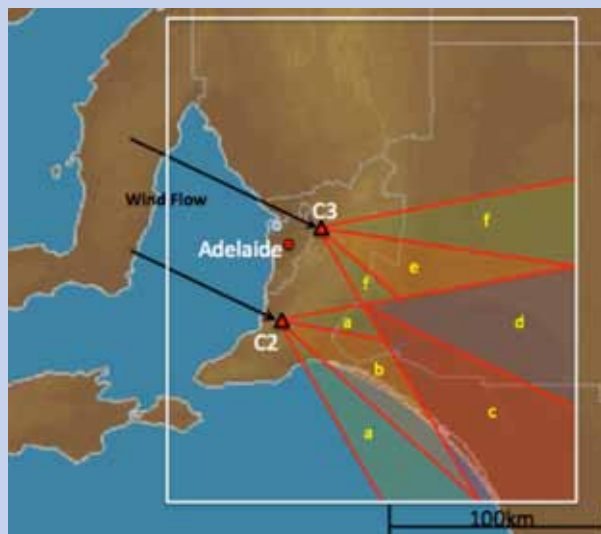
Our results and economic analysis show that the risks of deploying the technology to no effect are far outweighed by the risk of foregoing the benefits of enhancement at levels well below those delivered in trials to date.

The independent scientists overseeing ART's trials recommended further investigation of the technology in other parts of Australia, on the basis of the results to date and the enormous net economic returns of any such enhancement achieved.

The way forward is to fund the local investigation and deployment of this welcome break-through in water supply augmentation, whether for urban water supplies, crops, the environment, or food supply and drinking water in drought-stricken Africa.

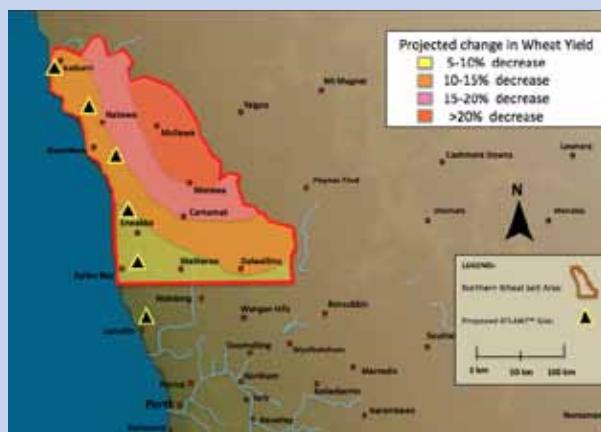
Environmental impact

Trials in Queensland and South Australia have shown that the Atlant™ system is a low-risk system. It is environmentally friendly. Ionisation is a basic natural process that presents no harm for humans, animals or ecosystems and it does not interfere with radio or other frequencies. In addition there are no chemicals or any fallout that would be opposed to the interests of fauna and flora. A study by the University of Queensland and further independent analysis by Dr. Franco D'Alessandro found the Atlant™ would have no harmful effects on: (1) people, (2) local flora and fauna, (3) communication systems and air traffic.



The correlation of individual rain gauges were studied across downwind sub-regions of the target area and accounted for in the statistical models, facilitating the use of data from individual rain gauges in the analysis, as opposed to averaging the data across the target area. This dramatically increases the capacity to detect changes in rainfall attributable to the Atlant™ technology.

ART conducted a feasibility study into the operation of the Atlant™ technology to augment the water supply over the Western Australian northern wheat belt. The feasibility study measured the use of an array of six systems, average run off and rainfall figures adjusted for recent declines and previous trial results. The benefits of a trial over the region were calculated on the basis of partially restoring crop yields in the region. A conservative ratio of rainfall to yield was used where a five per cent increase in effective rainfall resulted in an approximately equivalent increase in average crop yields. The estimated benefit from such an increase in effective rainfall in the northern wheat belt was over \$20 million, many times the cost of installation and annual operation.



ART uses statistical models to allow for rainfall variation due to local meteorological conditions, local topographical variation and the correlation between gauge readings, which are nearby in space and in time. Target area is dynamically defined based on prevailing wind directions and speeds as shown for the 2009 Mount Lofty ranges trial for west, southwest and northwest winds.



Open access

ART maintains an open-access policy to its analysis of the results of completed trials and the associated economic analysis, including the data obtained from trials and independent scientific reviews.

ART's Scientific Reference Panel is an advisory group whose members have independent opinions about the design and the results of these trials. Both technical and statistical experts are available to be contacted directly.

Information requests in the first instance should be directed to the CEO Matt Handbury, on +61 419 236 166 or at handbury@australianrain.com.au

The ART website – www.australianrain.com.au – contains published articles on trials to date, the hypothesised underlying physical process, history of the technology, the Scientific Reference Panel (SRP) conclusions, and an economic analysis of the probabilistic net returns across potential trial areas given estimated levels of enhancement and confidence levels from previous trials.