SCIENCE & TECHNOLOGY

SHORT SCIENCE

Scientists pin down historic rise in sea level

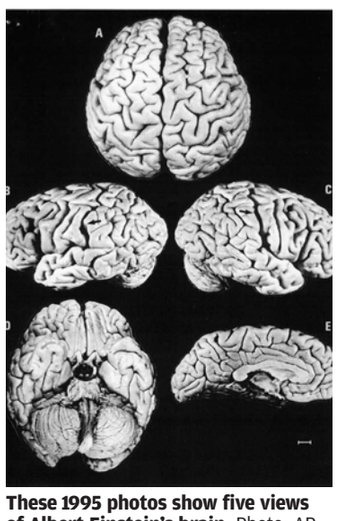
The collapse of an ice sheet in Antarctica up to 14,650 years ago might have caused sea levels to rise between 14 and 18 metres, according to a study in *Nature*, whose data could help make climate change predictions more accurate. The melting of polar ice could contribute to the long-term rise in sea levels, threatening the lives of millions, the team of French and Japanese scientists say. Reuters

'Billions' of habitable planets in Milky Way

Astronomers hunting for rocky planets with the right temperature to support life estimate there may be tens of billions of them in our galaxy. A European team said 40 per cent of red dwarf stars – the most common type in the Milky Way – had a so-called "super-earth" planet orbiting in a habitable zone. Reuters

Slices of Einstein's brain show 'the mind as matter'

We've pickled it, desiccated it, drilled it, mummified it, chopped it and sliced it over centuries, yet as the most complex entity in the known universe, the human brain remains a mysterious fascination. With samples of Albert Einstein's preserved brain on slides, and specimens from others such as the English mathematician Charles Babbage and mass murderer William Burke, a London exhibition opening this week is seeking to tap into that intrigue. Reuters



These 1995 photos show five views of Albert Einstein's brain. Photo: AP

Unmanned cargo vessel docks with space station

An unmanned European supply vessel with more than six tonnes of freight docked with the International Space Station on Wednesday, reinforcing Europe's role in the ISS, European Space Agency officials said. The docking of Europe's third automated transfer vehicle was flawless and eased into place without any intervention. It would remain until August. Reuters

ENVIRONMENT

A taxi in Yuen Long is fitted with solar panels, integral to a new air-conditioning system made in Hong Kong. The panels convert solar power into electrical energy. Photo: May Tse

SUNNY FUTURE FOR HK'S CAR-COOLING INVENTION

Government and firms are seeing green promise in solar-powered air conditioner, with initial test runs showing it can drive down fuel usage by 30pc

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A car air-conditioning system that runs on fuel-saving solar power is slowly gaining traction among firms and the government, with its Hong Kong makers saying the technology is unparalleled in the world.

Around 20 vehicles, including taxis and minibuses, have been testing the system jointly developed by private research firm Green Power and Polytechnic University – and one customer has already seen favourable results.

A 10-month test done by Swire Coca-Cola, which fitted some of its trucks with solar panels and the special air-conditioning system, concluded that it could cut carbon dioxide emissions by 12 tonnes each year.

"We have already been granted the approval [to test it on] a number of different vehicle types already and should be expecting more vehicle types to be [approved] this summer," said Jacky Lau, the vice-president of Green Power, which is based in the Science Park in the New Territories.

The Hong Kong government is even selecting a few official cars from its fleet for a trial run of the new system. If approved, the government will join around 10 companies – including Hongkong Electric, the Airport Authority, Polytechnic University and several tour bus and taxi operators – that have already been using the technology.

The new system requires vehicles to be retrofitted with solar panels on the roof. These convert the sun's energy into electrical power, which is stored in a tailor-made battery that can be used for back-up power or to power air conditioning with the help of the car's compressor system.

The entire assembly is separated from the petrol engine, such that when the vehicle is running or when the engine is switched off, the air conditioner can run independently without burning any fuel.

In contrast, conventional air conditioners for cars are powered by the internal combustion engine, which are not as fuel-efficient.

Professor Eric Cheng Ka-wai, who led the research at Polytechnic University's electrical engineering department, said minibuses could save about 30 per cent of fuel using the solar-powered system while taxis or private cars could save about 20 per cent. Development began in 2009.

A full charge takes about 10 hours, and six to seven hours of charging could provide enough energy for about three hours of air conditioning, Lau says. "If the battery runs out, the air-conditioning system will automatically switch to derive energy from the engine," he said.

It also has a device called "maximum power point tracking", which converts all forms of light – including ultraviolet rays, which are emitted by the sun and black-light fluorescent bulbs – into electrical energy. This means charging can be done even on cloudy or rainy days.

"Since the vehicle itself has very poor heat insulation, the air-conditioner system for the vehicle requires a large cooling capacity and we have developed the system with outstanding conversion efficiency together with optimal energy control," Lau said. "We have not yet found another company that can achieve similar technology."

However, the system is not yet compatible with large buses.

Lau said Green Power was currently installing the system on more vehicles and had even received orders from Macau. "So there will be more running on the road in the next two months," he said.

"We also expect to see an exponential growth in [orders] in the coming few months, as the summer season is closing up, [based on the] enquiries we are getting now," he said.

About 10 more orders have been placed by some local transport operators who wish to test the system on their vehicles, with help from the government's Pilot Green Transport Fund, the executive says. The fund provides subsidies for trials of green and innovative technologies.

A spokeswoman for the Environmental Protection Department said they were studying the feasibility and effectiveness of the system in reducing emissions and conserving energy. She said they were looking into its compatibility with various vehicle types, its fuel-saving projections, installation and maintenance costs, and the makers' method in collecting data from pilot tests.

> **We have developed the system with outstanding conversion efficiency [and] energy control**
> JACKY LAU, GREEN POWER VICE-PRESIDENT

While results are pending, the spokeswoman urged public transport operators and private-car owners to test the solar-powered air conditioner. She noted they could apply for funding from the green transport fund, which could cover up to 75 per cent of testing costs.

Retrofitting and testing the system costs between HK$40,000 and HK$120,000, depending on the model, and for privately owned cars it would require the approval of the Transport Department. But this steep price tag will be offset by saved fuel, Cheng, the professor, says.

Lau, from Green Power, says the innovation comes ahead of a similar system being developed in Europe, the Thermal Systems Integration for Fuel Economy project, set to be rolled out in 2015 and which aims to reduce fuel use by 15 per cent.

But a challenge for the Hong Kong researchers is fitting the system to different vehicle designs, which will take time to test. While details of the research are under wraps, Lau says his firm is looking at extending the solar-powered system for use "not only in vehicles but also other mobile machinery, stations or devices".

Scores of cancer studies fail to hold up

Reuters in New York

A former researcher at Amgen has found that many basic studies on cancer – a high proportion of them from university labs – are unreliable, with grim consequences for producing new medicines in the future.

During a decade as head of global cancer research at Amgen, Dr Glenn Begley identified 53 "landmark" publications – papers in top journals, from reputable labs – for his team to reproduce. Begley sought to double-check the findings before trying to build on them for drug development.

Result: 47 of the 53 could not be replicated. He has now described his findings in the journal *Nature*.

"It was shocking," said Begley, now senior vice-president of privately held biotechnology company TetraLogic, which develops cancer drugs. "These are the studies the pharmaceutical industry relies on to identify new targets for drug development. As we tried to reproduce these papers we became convinced you can't take anything at face value."

The failure to win "the war on cancer" has been blamed on many factors, from the use of mouse models that are irrelevant to human cancers to risk-averse funding agencies. But recently a new culprit has emerged: too many basic scientific discoveries, done in animals or cells growing in lab dishes and meant to show the way to a new drug, are wrong.

Begley's experience echoes a report from scientists at the German pharmaceutical company Bayer last year. Neither group of researchers alleges fraud, nor would they identify the research they tried to replicate. But they and others fear the phenomenon stems from a skewed system of incentives that has academics cutting corners to further their careers.

Dr George Robertson of Dalhousie University in Nova Scotia previously worked at Merck on neurodegenerative diseases such as Parkinson's. He also found many academic studies that did not hold up.

"It drives people in industry crazy. Why are we seeing a collapse of the pharma and biotech industries? One possibility is that academia is not providing accurate findings," he said.

Over the last two decades, the most promising route to new cancer drugs has been one pioneered by the discoverers of Gleevec, the Novartis drug that targets a form of leukaemia, and Herceptin, Genentech's breast-cancer drug. In each case, scientists discovered a genetic change that turned a normal cell into a malignant one. Those findings allowed them to develop a molecule that blocks the cancer-producing process.

Scientists at Bayer did not have much more success. In a 2011 paper titled, "Believe it or not", they analysed in-house projects that built on "exciting published data" from basic science studies. "Often, key data could not be reproduced," wrote Dr Khusru Asadullah, vice-president and head of target discovery at Bayer HealthCare in Berlin, and colleagues.

Of 47 cancer projects at Bayer during 2011, less than one-quarter could reproduce previously reported findings. Bayer dropped the projects.

SCIENCE FOCUS
WYSS YIM

Hot? Blame the urban heat island

Global warming is one of the chief suspects behind the rise in Hong Kong's temperatures. But the city's climate records show more culprits than CO_2

According to the US National Oceanic and Atmospheric Administration's global temperature database, the first record of Hong Kong temperatures date back to 1853.

For 28 years, between 1853 and 1880, discontinuous records of monthly mean temperatures are available for a station within the Victoria Harbour basin. The Royal Engineers and the Harbour Office were probably responsible for these records.

The Royal Observatory Hong Kong (renamed Hong Kong Observatory or HKO for short after the handover) was established in 1883. Since 1884, continuous temperature records have been kept at HKO's headquarters, within a stone's throw from Nathan Road, except between 1940 and 1946. New stations have been added since the late 1960s, including the oceanic Waglan Island station, 5 kilometres east of Hong Kong Island, in 1968.

The mean annual temperature for the HKO's headquarters station from 1884 to 2011 is 22.62 degrees Celsius. The 11 coldest years and the top 11 hottest years are shown in the bottom graph (far right).

All the 11 coldest years occurred before 1935, when the city's total population was below one million. The first four years of records, from 1884 to 1887, make up the coldest, the second coldest, the fourth coldest and the fifth coldest years. This is partly accounted for by cooling caused by the ash and gases released by the 1883 eruption of the Krakatoa volcano in Indonesia.

Similarly, the eruption of the Pinatubo volcano in 1991 was reported in 2002 to have lowered surface air temperatures over northern hemisphere continents by up to 2 degrees in the summer of 1992 and made the winters of 1991-1992 and 1992-1993 warmer than normal by up to 3 degrees.

With the exception of 1966, all the 11 hottest years have occurred during the past 20 years. 1998, the year immediately following the handover, is the hottest on record.

A study of local urban temperature trends was made by the Royal Observatory Hong Kong in 1988. The rising temperature trend of the Observatory's headquarters station from 1884 to 1984 is in disagreement with those of the Macau station and the Waglan Island station. The rise in annual mean temperature at HKO's headquarters station by 0.8 degrees, from 22.1 to 22.9 degrees, in more than a century is explained by the urban heat-island effect.

However, a decrease in the maximum temperature since the late 1960s was observed to be concurrent with decreasing solar radiation and increasing urban haze. Consequently, human activities were affecting temperatures more profoundly in urban Hong Kong than activities on a global scale were.

In the present analysis, a comparison is made of the mean annual temperatures of HKO's headquarters station and the Waglan Island station from 1968 to 2011. Although the Waglan Island station record is discontinuous, because of maintenance difficulties caused by the remote location, observations drawn include:

- HKO's headquarter station, at 23.14 degrees, is 0.64 degrees higher than the Waglan Island station at 22.5 degrees;
- The year-to-year variation including maximum and minimum mean temperatures at the two stations do not agree with each other;
- The 44-year mean annual temperature range of HKO's headquarters station (1.5 degrees) is 0.4 degrees lower than the Waglan island station (1.9 degrees).
- The 10 years showing the greatest temperature difference between HKO's headquarters station and the Waglan Island station, as shown in the second graph (far right), have largely been caused by infrastructural development during the pre- and post-handover periods.

The obvious explanation for the temperature difference found between HKO's headquarters station and the Waglan Island station is the non-stop generation of heat within the Victoria Harbour basin by human activities. This heat cannot be dispersed easily, because of the topography and the effects of high-rise buildings which trap heat and create canyon effects.

2.7C
The difference in the mean annual temperature between HK's coldest year since records began (1884) and its hottest (1998)

In the assessment of the Intergovernmental Panel on Climate Change in 2007, carbon dioxide was identified as the main cause of global warming. This may be an overestimation of carbon dioxide and an underestimation of the water vapour caused by human activities.

The atmospheric concentration of carbon dioxide is currently about 0.04 per cent. At such a low concentration, carbon dioxide cannot compare to water vapour as a greenhouse gas. This is supported by studies on Antarctic ice cores which show that the rise in carbon dioxide lags behind temperature by some 800 years.

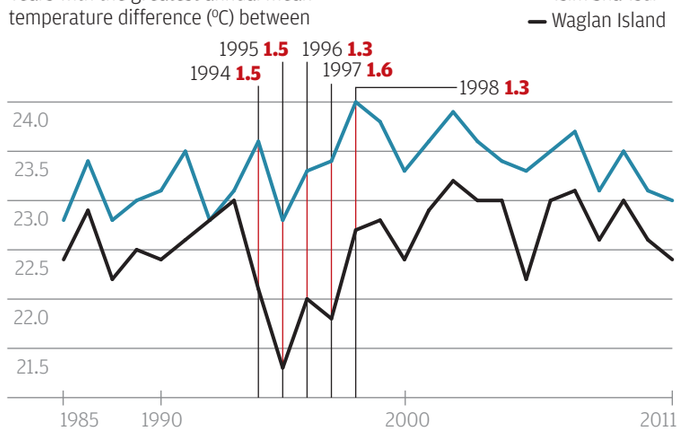
In 2009, a global trade-linked analysis of carbon footprint by Hertwich and Peters ranked Hong Kong second in the world, with 29 tonnes of carbon dioxide emission per person. In a city where virtually everything consumed is imported, carbon trading, if adopted, will surely affect the economy and jobs.

The urban heat-island effect is also responsible for transferring significant amounts of water vapour into the atmosphere by Hong Kong people. This, together with the water vapour already generated by fossil fuel consumption, may be more important in warming the planet than carbon dioxide.

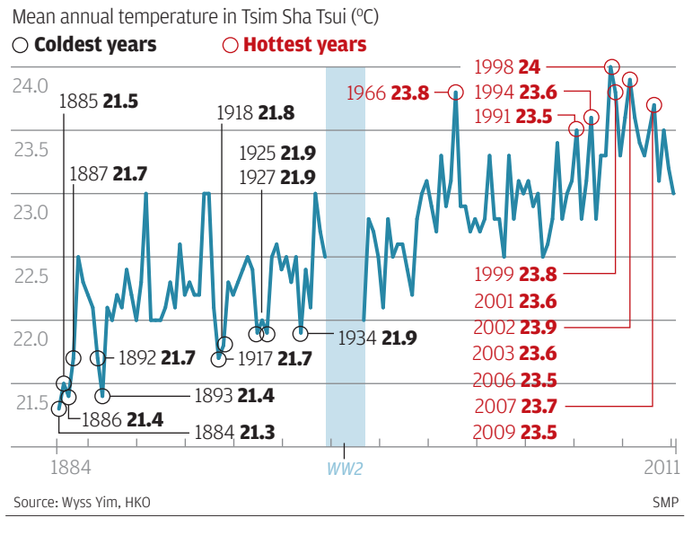
Wyss Yim is an honorary professor in the department of earth sciences at the University of Hong Kong. From 2007 to 2009 he served as the deputy chairman of the Climate Change Science Implementation Team of Unesco's International Year of Planet Earth. The views expressed here are his alone.

Temperature record

Years with the greatest annual mean temperature difference (°C) between



Mean annual temperature in Tsim Sha Tsui (°C)



Source: Wyss Yim, HKO SMP