INDEX

Combining perovskite with silicon, solar cells convert more energy from sun

DishaDangare,AniketBandgar, ShitalBhore

Many countries around the world are committed to reducing emissions or reaching net-zero emissions to meet the United Nations' climate goals of maintaining temperature increases below 1.5 degrees Celsius by 2050. Renewable energy technologies, particularly solar energy panels, will play a significant role in achieving these goals. To fully harness the potential of sunlight -- the world's most abundant energy resource scientists have been trying for decades to maximize the amount of energy that can be extracted from the sun. In Applied Physics Letters, by AIP Publishing, researchers from Oxford PV describe how pairing metal halide perovskites with conventional silicon leads to a more powerful solar cell that overcomes the 26% practical efficiency limit of using silicon cells alone. "We identified perovskites as the perfect partner for a tandem system with silicon," said author Laura Miranda Pérez. From a materials perspective, perovskites fulfill all the optoelectronic requirements for a photovoltaic cell, and they can be manufactured using existing processes. These features make perovskite a perfect plug-and-play addition to silicon technology as it can be deposited as a layer onto a conventional silicon solar cell. "We're proving the potential of perovskite-on-silicon tandem technology through the continuous achievement of world-record efficiencies, with our current record at 29.52%," said Miranda Pérez. The elemental composition of the perovskite material is readily available within existing supply chains, providing a clear pathway to scale up the technology quickly to meet the ambitious solar energy targets needed to tackle climate change. Also, the higher power output of perovskite-on-silicon tandem cells could offset the carbon footprint embodied in the production of high-purity silicon required for photovoltaic cells.

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Journal Reference:

Christina Kamaraki, Matthew T. Klug, Thomas Green, Laura Miranda Perez, Christopher Case. Perovskite/silicon tandem photovoltaics: Technological disruption without business disruption. Applied Physics Letters, 2021; 119 (7): 070501 DOI: 10.1063/5.0054086

'Nanopore-tal' enables cells to talk to computers

Monika Dongale, AkshayPatil, RuturajChougule

Genetically encoded reporter proteins have been a mainstay of biotechnology research, allowing scientists to track gene expression, understand intracellular processes and debug engineered genetic circuits. But conventional reporting schemes that rely on fluorescence and other optical approaches come with practical limitations that could cast a shadow over the field's future progress. Now, researchers at the University of Washington and Microsoft have created a "nanopore-tal" into what is happening inside these complex biological systems, allowing scientists to see reporter proteins in a whole new light. The team introduced a new class of reporter proteins that can be directly read by a commercially available nanopore sensing device. The new system? Dubbed "Nanopore-addressable protein Tags Engineered as Reporters" or "NanoporeTERs" ?Can detect multiple protein expression levels from bacterial and human cell cultures far beyond the capacity of existing techniques. The study was published Aug. 12 in *Nature Biotechnology*.

"NanoporeTERs offer a new and richer lexicon for engineered cells to express themselves and shed new light on the factors they are designed to track. They can tell us a lot more about what is happening in their environment all at once," said co-lead author Nicolas Cardozo, a doctoral student with the UW Molecular Engineering and Sciences Institute. "We're essentially making it possible for these cells to 'talk' to computers about what's happening in their surroundings at a new level of detail scale and efficiency that will enable deeper analysis than what we could do before." For conventional labeling methods, researchers can track only a few optical reporter proteins, such as green fluorescent protein, simultaneously because of their overlapping spectral properties. For example, it's difficult to distinguish between more than three different colors of fluorescent proteins at once. In contrast, NanoporeTERs were designed to carry distinct protein "barcodes" composed of strings of amino acids that, when used in combination, allow at least ten times more multiplexing possibilities. These synthetic proteins are secreted outside of a cell into the surrounding environment, where researchers can collect and analyze them using a commercially available nanopore array. Here, the team used the Oxford Nanopore Technologies MinION device. The researchers engineered the NanoporeTER proteins with charged "tails" so that they can be pulled into the nanopore sensors by an electric field. Then the team uses machine learning to classify the electrical signals for each NanoporeTER barcode in order to determine each protein's output levels “This is a fundamentally new interface between cells and computers," said senior author Jeff Nivala, a UW research assistant professor in the Paul G. Allen School of Computer Science & Engineering. "One analogy I like to make is that fluorescent protein reporters are like lighthouses, and NanoporeTERs are like messages in a bottle.”Lighthouses are really useful for communicating a physical location, as you can literally see where the signal is coming from, but it's hard to pack more information into that kind of signal. A message in a bottle, on the other hand, can pack a lot of information into a very small vessel, and you can send many of them off to another location to be read. You might lose sight of the precise physical location where the messages were sent, but for many applications that's not going to be an issue."

As a proof of concept, the team developed a library of more than 20 distinct NanoporeTERs tags. But the potential is significantly greater, according to co-lead author Karen Zhang, now a doctoral student in the UC Berkeley-UCSF bioengineering graduate program. "We are currently working to scale up the number of NanoporeTERs to hundreds, thousands, maybe even millions more," said Zhang, who graduated this year from the UW with bachelor's degrees in both biochemistry and microbiology.

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Materials provided by University of Washington. Note: Content may be edited for style and length.

Journal Reference:

Nicolas Cardozo, Karen Zhang, Kathryn Doroschak, Aerilynn Nguyen, Zoheb Siddiqui, Nicholas Bogard, Karin Strauss, Luis Ceze, Jeff Nivala. Multiplexed direct detection of barcoded protein reporters on a nanopore array. Nature Biotechnology, 2021; DOI: 10.1038/s41587-021-01002-6

Renewable energies: No wind turbine disturbing the scenery

RaginiGhorpade, SangramPatil, SanketBapat

Wind energy is of outstanding importance to the energy transition in Germany. According to the Federal Statistical Office, its share in total gross electricity production of about 24% is far higher than those of all other renewable energy sources. "To reach our climate goals, it is important to further expand these capacities and to replace as much coal-based power as possible," says Professor Wolf Fichtner from KIT's Institute for Industrial Production (IIP). "However, there is considerable resistance, especially in beautiful landscapes." A team of researchers from KIT, the University of Aberdeen, and the Technical University of Denmark has now calculated what this means for the costs of the energy transition and for the CO_2 balance of municipalities in Germany.

Quantifying Wind Power Rejection

The calculations are based on evaluations of the beauty of German landscapes according to standardized criteria by thousands of respondents. "It was confirmed for Great Britain that rejection of wind energy expansion is much higher in municipalities located in beautiful sceneries than in less beautiful regions," says Max Kleinebrahm, IIP. "When transferring this finding to Germany and replacing the qualitative factor of rejection by a development scenario without wind power, the additional costs expected when using no wind turbines can be projected precisely." As a reference, the researchers used another techno-economically optimized scenario for the transformation of the energy system with the use of local wind power.

The comparison was made for 11,131 municipalities in Germany and projected until 2050. It was found that stopping the expansion of wind energy use in the most beautiful landscapes might increase power generation costs in some municipalities by up to 7 cents per kilowatt hour and CO_2 emissions might rise by up to 200 g per kilowatt hour. "Instead of wind energy, it would then be necessary to expand use of other types of renewable energy sources, such as solar energy or bioenergy," says Jann Michael Weinand (IIP), one of the main authors of the study. "Solar energy, however, is associated with higher system integration costs causing most of the surcharge." Only in very few cases can wind energy for local electricity production be replaced completely. In many cases, power imports would be needed, which would result in comparably high CO_2 emissions.

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Materials provided by KarlsruherInstitutfürTechnologie (KIT). Note: Content may be edited for style and length.

Journal Reference:

Jann M. Weinand, Russell McKenna, Max Kleinebrahm, Fabian Scheller, Wolf Fichtner. The impact of public acceptance on cost efficiency and environmental sustainability in decentralized energy systems. Patterns, 2021; 2 (7): 100301 DOI: 10.1016/j.patter.2021.100301

Scientists capture a 'quantum tug' between neighboring water molecules

KajalPalakhe, SurajHaswal, Shoeb Jamadar

Water is the most abundant yet least understood liquid in nature. It exhibits many strange behaviors that scientists still struggle to explain. While most liquids get denser as they get colder, water is most dense at 39 degrees Fahrenheit, just above its freezing point. This is why ice floats to the top of a drinking glass and lakes freeze from the surface down, allowing marine life to survive cold winters. Water also has an unusually high surface tension, allowing insects to walk on its surface, and a large capacity to store heat, keeping ocean temperatures stable. Now, a team that includes researchers from the Department of Energy's SLAC National Accelerator Laboratory, Stanford University and Stockholm University in Sweden have made the first direct observation of how hydrogen atoms in water molecules tug and push neighboring water molecules when they are excited with laser light. Their results, published in Nature today, reveal effects that could underpin key aspects of the microscopic origin of water's strange properties and could lead to a better understanding of how water helps proteins function in living organisms. "Although this so-called nuclear quantum effect has been hypothesized to be at the heart of many of water's strange properties, this experiment marks the first time it was ever observed directly," said study collaborator Anders Nilsson, a professor of chemical physics at Stockholm University. "The question is if this quantum effect could be the missing link in theoretical models describing the anomalous properties of water." Each water molecule contains one oxygen atom and two hydrogen atoms, and a web of hydrogen bonds between positively charged hydrogen atoms in one molecule and negatively charged oxygen atoms in neighboring molecules holds them all together.

A window on water

The researchers hope to use this method to gain more insight into the quantum nature of hydrogen bonds and the role they play in water's strange properties, as well as the key role these properties play in many chemical and biological processes.

"This has really opened a new window to study water," said Xijie Wang, a SLAC distinguished staff scientist and study collaborator. "Now that we can finally see the hydrogen bonds moving, we'd like to connect those movements with the broader picture, which could shed light on how water led to the origin and survival of life on Earth and inform the development of renewable energy methods."

Story Source:

Materials provided by DOE/SLAC National Accelerator Laboratory. Original written by Ali Sundermier. Note: Content may be edited for style and length.

Journal Reference:

Yang, J., Dettori, R., Nunes, J.P.F. et al. Direct observation of ultrafast hydrogen bond strengthening in liquid water. Nature, 2021 DOI: 10.1038/s41586-021-03793-9

Using artificial intelligence for early detection and treatment of illnesses

RupeshIngale, Snehal Mali, Abhishek Maske

Artificial intelligence (AI) will fundamentally change medicine and healthcare: Diagnostic patient data, e.g. from ECG, EEG or X-ray images, can be analyzed with the help of machine learning, so that diseases can be detected at a very early stage based on subtle changes. However, implanting AI within the human body is still a major technical challenge. TU Dresden scientists at the Chair of Optoelectronics have now succeeded for the first time in developing a bio-compatible implantable AI platform that classifies in real time healthy and pathological patterns in biological signals such as heartbeats. It detects pathological changes even without medical supervision. The research results have now been published in the journal Science Advances.

In this work, the research team led by Prof. Karl Leo, Dr. Hans Kleemann and Matteo Cucchi demonstrates an approach for real-time classification of healthy and diseased bio-signals based on a biocompatible AI chip. They used polymer-based fiber networks that structurally resemble the human brain and enable the neuromorphic AI principle of reservoir computing. The random arrangement of polymer fibers forms a so-called "recurrent network," which allows it to process data, analogous to the human brain. The nonlinearity of these networks enables to amplify even the smallest signal changes, which -- in the case of the heartbeat, for example -- are often difficult for doctors to evaluate. However, the nonlinear transformation using the polymer network makes this possible without any problems.

In trials, the AI was able to differentiate between healthy heartbeats from three common arrhythmias with an 88% accuracy rate. In the process, the polymer network consumed less energy than a pacemaker. The potential applications for implantable AI systems are manifold: For example, they could be used to monitor cardiac arrhythmias or complications after surgery and report them to both doctors and patients via smartphone, allowing for swift medical assistance."The vision of combining modern electronics with biology has come a long way in recent years with the development of so-called organic mixed conductors," explains Matteo Cucchi, PhD student and first author of the paper. "So far, however, successes have been limited to simple electronic components such as individual synapses or sensors. Solving complex tasks has not been possible so far. In our research, we have now taken a crucial step toward realizing this vision. By harnessing the power of neuromorphic computing, such as reservoir computing used here, we have succeeded in not only solving complex classification tasks in real time but we will also potentially be able to do this within the human body. This approach will make it possible to develop further intelligent systems in the future that can help save human lives."

Story Source:

Materials provided by TechnischeUniversität Dresden. Note: Content may be edited for style and length.

Journal Reference:

Matteo Cucchi, Christopher Gruener, Lautaro Petrauskas, Peter Steiner, Hsin Tseng, Axel Fischer, Bogdan Penkovsky, Christian Matthus, Peter Birkholz, Hans Kleemann, Karl

Leo. Reservoir computing with biocompatible organic electrochemical networks for brain-inspired biosignal classification. Science Advances, 2021; 7 (34): eabh0693 DOI: 10.1126/sciadv.abh0693

Solar cells: Boosting photovoltaic effect in ferroelectric-paraelectric superlattices

NaemDaffedar, AsiyaPendhari, HarshadDeshmukh

The photovoltaic effect of ferroelectric crystals can be increased by a factor of 1,000 if three different materials are arranged periodically in a lattice. This has been revealed in a study by researchers at Martin Luther University Halle-Wittenberg (MLU). They achieved this by creating crystalline layers of barium titanate, strontium titanate and calcium titanate which they alternately placed on top of one another. Their findings, which could significantly increase the efficiency of solar cells, were published in the journal Science Advances.

Most solar cells are currently silicon based; however, their efficiency is limited. This has prompted researchers to examine new materials, such as ferroelectrics like barium titanate, a mixed oxide made of barium and titanium. "Ferroelectric means that the material has spatially separated positive and negative charges," explains physicist Dr Akash Bhatnagar from MLU's Centre for Innovation Competence SiLi-nano. "The charge separation leads to an asymmetric structure that enables electricity to be generated from light." Unlike silicon, ferroelectric crystals do not require a so-called pn junction to create the photovoltaic effect, in other words, no positively and negatively doped layers. This makes it much easier to produce the solar panels.

However, pure barium titanate does not absorb much sunlight and consequently generates a comparatively low photocurrent. The latest research has shown that combining extremely thin layers of different materials significantly increases the solar energy yield. "The important thing here is that a ferroelectric material is alternated with a paraelectric material. Although the latter does not have separated charges, it can become ferroelectric under certain conditions, for example at low temperatures or when its chemical structure is slightly modified," explains Bhatnagar.Bhatnagar's research group discovered that the photovoltaic effect is greatly enhanced if the ferroelectric layer alternates not only with one, but with two different paraelectric layers. Yeseul Yun, a PhD student at MLU and first author of the study, explains: "We embedded the barium titanate between strontium titanate and calcium titanate. This was achieved by vaporising the crystals with a high-power laser and redepositing them on carrier substrates. This produced a material made of 500 layers that is about 200 nanometres thick."

When conducting the photoelectric measurements, the new material was irradiated with laser light. The result surprised even the research group: compared to pure barium titanate of a similar thickness, the current flow was up to 1,000 times stronger -- and this despite the fact that the proportion of barium titanate as the main photoelectric component was reduced by almost two thirds. "The interaction between the lattice layers appears to lead to a much higher permittivity -- in other words, the electrons are able to flow much more easily due to the excitation by the light photons," explains Akash Bhatnagar. The measurements also showed that this effect is very robust: it remained nearly constant over a six-month period.Further research must now be done to find out exactly what causes the outstanding photoelectric effect. Bhatnagar is confident that the potential demonstrated by the new concept can be used for practical applications in solar panels. "The layer structure shows a higher yield in all temperature ranges than pure ferroelectrics. The crystals are also significantly more durable and do not require special packaging."

Story Source:

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Journal Reference:

Yeseul Yun, Lutz Mühlenbein, David S. Knoche, AndriyLotnyk, Akash Bhatnagar. Strongly enhanced and tunable photovoltaic effect in ferroelectric-paraelectric superlattices. Science Advances, 2021; 7 (23): eabe4206 DOI: 10.1126/sciadv.abe4206

Woven nanotube fibers turn heat energy into electrical energy

KajalMulla, PradneshOtari, PrathameshPatil

Invisibly small carbon nanotubes aligned as fibers and sewn into fabrics become a thermoelectric generator that can turn heat from the sun or other sources into other forms of energy. The Rice University lab of physicist Junichiro Kono led an effort with scientists at Tokyo Metropolitan University and the Rice-based Carbon Hub to make custom nanotube fibers and test their potential for large-scale applications. Their small-scale experiments led to a fiber-enhanced, flexible cotton fabric that turned heat energy into enough electrical energy to power an LED. With further development, they say such materials could become building blocks for fiber and textile electronics and energy harvesting. The same nanotube fibers could also be used as heat sinks to actively cool sensitive electronics with high efficiency. The effect seems simple: If one side of a thermoelectric material is hotter than the other, it produces usable energy. The heat can come from the sun or other devices like the hotplates used in the fabric experiment. Conversely, adding energy can prompt the material to cool the hotter side.

Until now, no macroscopic assemblies of nanomaterials have displayed the necessary "giant power factor," about 14 milliwatts per meter kelvin squared, that the Rice researchers measured in carbon nanotube fibers. "The power factor tells you how much power density you can get out of a material upon certain temperature difference and temperature gradient," said Rice graduate student Natsumi Komatsu, lead author of the paper. She noted a material's power factor is a combined effect from its electrical conductivity and what's known as the Seebeck coefficient, a measure of its ability to translate thermal differences into electricity. "The ultrahigh electrical conductivity of this fiber was one of the key attributes," Komatsu said.

The source of this superpower also relates to tuning the nanotubes' inherent Fermi energy, a property that determines electrochemical potential. The researchers were able to control the Fermi energy by chemically doping the nanotubes made into fibers by the Rice lab of co-author and chemical and biomolecular engineer Matteo Pasquali, allowing them to tune the fibers' electronic properties.

While the fibers they tested were cut into centimeter lengths, Komatsu said there's no reason devices can't make use of the excellent nanotube fibers from the Pasquali lab that are spooled in continuous lengths. "No matter where you measure them, they have the same very high electrical conductivity," she said. "The piece I measured was small only because my setup isn't capable of measuring 50 meters of fiber."

Pasquali is director of the Carbon Hub, which promotes expanding the development of carbon materials and hydrogen in a way that also fundamentally changes how the world uses fossil hydrocarbons. "Carbon nanotube fibers have been on a steady growth path and are proving advantageous in more and more applications," he said. "Rather than wasting carbon by burning it into carbon dioxide, we can fix it as useful materials that have further environmental benefits in electricity generation and transportation." Whether the new research leads to a solar panel you can throw in the washing machine remains to be seen, but Kono agreed the technology has great and varied potential. "Nanotubes have been around for 30 years, and scientifically, a lot is known," he said. "But in order to make real-world devices, we need macroscopically ordered or crystalline assemblies. Those are the types of nanotube samples that Matteo's group and my group can make, and there are many, many possibilities for applications."

Story Source:

Materials provided by Rice University. Note: Content may be edited for style and length.

Journal Reference:

Natsumi Komatsu, Yota Ichinose, Oliver S. Dewey, Lauren W. Taylor, Mitchell A. Trafford, YoheiYomogida, Geoff Wehmeyer, Matteo Pasquali, Kazuhiro Yanagi, Junichiro Kono. Macroscopic weavable fibers of carbon nanotubes with giant thermoelectric power factor. Nature Communications, 2021; 12 (1) DOI: 10.1038/s41467-021-25208-z

Researchers refine estimate of amount of carbon in Earth's outer core

NamrataChougule, KamilMutwalli, AmeyPanade

New research from Florida State University and Rice University is providing a better estimate of the amount of carbon in the Earth's outer core, and the work suggests the core could be the planet's largest reservoir of that element. The research, published in the journal Communications Earth & Environment, estimates that 0.3 to 2.0 percent of the Earth's outer core is carbon. Though the percentage of carbon there is low, it's still an enormous amount because the outer core is so large. The researchers estimated that the outer core contains between 5.5 and 36.8 × 10^24 grams of carbon an immense number.

"Understanding the composition of the Earth's core is one of the key problems in the solid-earth sciences," said co-author MainakMookherjee, an associate professor of geology in the Department of Earth, Ocean and Atmospheric Science. "We know the planet's core is largely iron, but the density of iron is greater than that of the core. There must be lighter elements in the core that reduce its density. Carbon is one consideration, and we are providing better constraints as to how much might be there." Previous research has estimated the total amount of carbon on the planet. This work refines the estimates for the carbon content of Earth to a range between about 990 parts per million and more than 6,400 parts per million. That would mean the core of the Earth which includes both the outer core and the inner core -- could contain 93 to 95 percent of the planet's carbon.

Because humans can't access the Earth's core, they have to use indirect methods to analyze it. The research team compared the known speed of compressional sound waves traveling through the Earth to computer models that simulated different compositions of iron, carbon and other light elements at the pressure and temperature conditions of the Earth's outer core. "When the velocity of the sound waves in our simulations matched the observed velocity of sound waves traveling through the Earth, we knew the simulations were matching the actual chemical composition of the outer core," said lead author and postdoctoral researcher SurajBajgain. Scientists have attempted to give a range of the amount of carbon in the outer core before. This research narrows that possible range by including other light elements namely oxygen, sulfur, silicon, hydrogen and nitrogen in the models estimating the outer core's composition.

The National Science Foundation and NASA supported this research, and the Extreme Science and Engineering Discovery computing (XSEDE) and the Research Computing Center (RCC) at FSU provided computing resources for this work.

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Journal Reference:

Suraj K. Bajgain, MainakMookherjee, RajdeepDasgupta. Earth’s core could be the largest terrestrial carbon reservoir. Communications Earth & Environment, 2021; 2 (1) DOI: 10.1038/s43247-021-00222-7

New algorithm flies drones faster than human racing pilots can

Dayalraj Pore, AnisMulla, Juned Pathan, RutujaPatil

To be useful, drones need to be quick. Because of their limited battery life they must complete whatever task they have searching for survivors on a disaster site, inspecting a building, delivering cargo in the shortest possible time. And they may have to do it by going through a series of waypoints like windows, rooms, or specific locations to inspect, adopting the best trajectory and the right acceleration or deceleration at each segment.

Algorithm outperforms professional pilots

The best human drone pilots are very good at doing this and have so far always outperformed autonomous systems in drone racing. Now, a research group at the University of Zurich (UZH) has created an algorithm that can find the quickest trajectory to guide a quadrotor -- a drone with four propellers -- through a series of waypoints on a circuit. "Our drone beat the fastest lap of two world-class human pilots on an experimental race track," says DavideScaramuzza, who heads the Robotics and Perception Group at UZH and the Rescue Robotics Grand Challenge of the NCCR Robotics, which funded the research.

"The novelty of the algorithm is that it is the first to generate time-optimal trajectories that fully consider the drones' limitations," says Scaramuzza. Previous works relied on simplifications of either the quadrotor system or the description of the flight path, and thus they were sub-optimal. "The key idea is, rather than assigning sections of the flight path to specific waypoints, that our algorithm just tells the drone to pass through all waypoints, but not how or when to do that," adds Philipp Foehn, PhD student and first author of the paper.

External cameras provide position information in real-time

The researchers had the algorithm and two human pilots fly the same quadrotor through a race circuit. They employed external cameras to precisely capture the motion of the drones and -- in the case of the autonomous drone -- to give real-time information to the algorithm on where the drone was at any moment. To ensure a fair comparison, the human pilots were given the opportunity to train on the circuit before the race. But the algorithm won: all its laps were faster than the human ones, and the performance was more consistent.

This is not surprising, because once the algorithm has found the best trajectory it can reproduce it faithfully many times, unlike human pilots. Before commercial applications, the algorithm will need to become less computationally demanding, as it now takes up to an hour for the computer to calculate the time-optimal trajectory for the drone. Also, at the moment, the drone relies on external cameras to compute where it was at any moment. In future work, the scientists want to use onboard cameras. But the demonstration that an autonomous drone can in principle fly faster than human pilots is promising.

Story Source:

Materials provided by University of Zurich. Note: Content may be edited for style and length.

Journal Reference:

Philipp Foehn, Angel Romero, DavideScaramuzza. Time-optimal planning for quadrotor waypoint flight. Science Robotics, 2021; 6 (56): eabh1221 DOI: 10.1126/scirobotics.abh1221

Increased snowfall will offset sea level rise from melting Antarctic ice sheet, new study finds

Ashwini Patil, Juned Pathan, Ashitosh More

A new study predicts that any sea level rise in the world's most southern continent will be countered by an increase in snowfall, associated with a warmer Polar atmosphere. Using modern methods to calculate projected changes to sea levels, researchers discovered that the two ice sheets of Greenland and Antarctica respond differently, reflecting their very distinct local climates. The paper, published today in Geophysical Research Letters, is based on the new generation of climate models which are used in the newly published Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, reviewing scientific, technical, and socio-economic information regarding climate change. The project brought together over 60 researchers from 44 institutions to produce, for the first time, process-based community projections of the sea level rise from the ice sheets. This particular paper focusses on one aspect of the overall project which is how the new generation of climate model projections used in the current IPCC assessments differ from the early generation in their impact on the ice sheets.

Professor Tony Payne, Head of Bristol's School of Geographical Sciences said the team were trying to establish whether the projected sea level rise from the new generation of climate models was different from the previous generation. "The new models generally predict more warming than the previous generation but we wanted to understand what this means for the ice sheets." he said. "The increased warming of the new models results in more melt from the Greenland ice sheet and higher sea level rise by a factor of around 1.5 at 2100."There is little change, however, in projected sea level rise from the Antarctic ice sheet. This is because increased mass loss triggered by warmer oceans is countered by mass gain by increased snowfall which is associated with the warmer Polar atmosphere."

The recent findings suggest that society should plan for higher sea levels, and match with virtually all previous estimates of sea level rise, in that scientists expect sea levels to continue to rise well beyond 2100, most likely at an accelerating rate.

Prof Payne added: "Predicting the mass budget of the ice sheets from estimates of global warming is difficult and a great many of the processes involved require further attention.

"Discovering that warmer climates do not affect Antarctic mass budget, in particular, warrants further examination because this is based on large changes in snowfall and marine melt balancing." "One of the main things to take away from this, interestingly, is that the response of two ice sheets and what impact global heating has on them is different and depends heavily on their local conditions," said Prof Payne.

Story Source:

Materials provided by University of Bristol. Note: Content may be edited for style and length.

Journal Reference:

Antony J. Payne, Sophie Nowicki, Ayako Abe-Ouchi, et al. Future sea level change under CMIP5 and CMIP6 scenarios from the Greenland and Antarctic ice sheets. Geophysical Research Letters, 2021; DOI: 10.1029/2020GL091741