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WEEKLY February 18 - 24, 2023

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Geoengineering

Blocking sunlight with moon dust may ease global warming

Carissa Wong

LAUNCHING a dust cloud from the moon to reduce the amount of sunlight reaching Earth could help cool the planet – although such a strategy would require a lot of research and the risks to agriculture, ecosystems and water quality are unclear.

Previous research looked into the idea of placing more than 100 million tonnes of dust between Earth and the sun to partially block light from reaching our planet as a way to combat climate change. The particles would absorb light energy or scatter light away from Earth.

To achieve this, the dust would need to sit 1.5 million kilometres from Earth at the first Lagrange point, or L1, where the gravitational pull of the sun and our planet cancel out.

But energy from sunlight and charged particles ejected from the sun, known as the solar wind, would gradually nudge the dust further away from L1, which would need correcting.

Now, after running thousands of computer simulations, Benjamin Bromley at the University of Utah and his colleagues have found that continuously launching a stream of lunar dust from the moon's north pole towards L1 at 2.8 kilometres per second may be a better approach.

Their work suggests that each dust particle would spend about five days blocking Earth-bound sunlight, before drifting off.

Considering factors like the gravitational pull of the sun and the planets and the effect of the solar wind, the simulations found that maintaining a dust shield with a mass of 1 million tonnes near L1 for a year could dim sunlight across Earth by 1.8 per cent, equivalent to completely blocking six days of sunlight (*PLoS Climate*, doi.org/grq9zn).

If the approach were sustained until other measures were introduced to remove carbon dioxide from Earth's atmosphere, this could offset the increase in the gas's concentration that has occurred since the industrial revolution, says Ben Kravitz at Indiana University, Bloomington.

1 million

tonnes of moon dust would constantly be blocking sunlight under a mooted plan

"If this method works, it would certainly be effective at reducing global temperature, but it's hard to say whether it would be worth it relative to the effort and resources used," says Kravitz.

The simulations didn't model the use of any machinery to launch the lunar dust, but one option would be a railgun, which propels things via electromagnetic energy, says Bromley. "This would be perfect because it could be fuelled by a few square kilometres of solar panels placed near the launch site," he says.

However, shading Earth will have unequal effects in different regions, says Kravitz. "Temperature, precipitation, winds and many other things will change [as a result of this strategy]," he says. "Those changes will, of course, translate into effects on agriculture, ecosystems and water quality."

Large-scale engineering studies would be needed to assess this, says Curtis Struck at Iowa State University, and other possible effects would also need to be examined. "Would there be enhanced micrometeorite falls to Earth and damage to Earth-orbiting satellites?" says Struck.

Regardless, such an approach shouldn't replace our efforts to decrease carbon emissions, says Bromley. "We have to keep reducing the greenhouse gases within our own atmosphere, no matter what. Our dust shield solution would simply buy us more time." ▮

PAOLA IAMUNNO/ISTOCKPHOTO/GETTY IMAGES

Dust from the moon could work as a solar shield for Earth

Health

Brain pathway could be key to treating opioid addiction

Grace Wade

A NEWLY discovered brain pathway in mice may contribute to opioid tolerance, suggesting a possible target to prevent addiction and overdose.

Opioids can be effective painkillers, but also highly addictive, as frequent use means larger doses are needed to achieve the same effect. This raises overdose risk.

Research in animals – and some case reports in humans – suggest that opioid tolerance develops more quickly when the drugs are taken in the same environment, a process called associative learning.

To identify the mechanism behind this phenomenon, Wei Xiong at the University of Science and Technology of China and his colleagues studied 24 mice given daily morphine injections for five days. Mice given morphine in a setting used only for that purpose developed greater tolerance than those that got injections in their home cages.

After euthanising the mice, the team bathed slices of the animals' brains in a solution that marks areas that were recently active, and viewed them under a microscope. Compared with controls, mice in the greater-tolerance group showed signs of increased activity in three regions: the ventral hippocampus, dorsomedial prefrontal cortex and basolateral amygdala. These areas are known to be involved in memory, self-awareness and pain regulation, respectively.

The researchers then homed in on the neurons connecting these regions in mice with built-up tolerance, using a technique known as chemogenetics to activate or deactivate the cells. After four days of morphine injections, mice with active connections had nearly four times the drug tolerance of mice without them. This suggests the pathway governs the development of opioid tolerance in response to contextual cues, says Xiong. ▮