

and production facilities for safety, as well as tracking adverse reactions, he adds.

But Marchi says studies that monitor adverse reactions don't track participants for long enough, and "cannot exclude the possibility that vaccines are toxic".

D'Anna emphasized that the donation to Corvelva is not the full amount that will be spent on the research.

Corvelva has collected more than €50,000 so far, says Marchi. The organization will use the money to check whether vaccine components are indeed those indicated on the label, and to look for contaminants. Marchi says that the group hopes to influence the debate on whether to continue with the 2017 mandatory-vaccination policy.

Giovanni Maga, a molecular biologist at the National Research Council's Institute of Molecular Genetics in Pavia, worries that the ONB's decision to fund this research could increase public distrust of vaccines.

D'Anna rejected this idea. On the contrary, he said, more people will choose to vaccinate their kids if "we could guarantee them the absolute safety of vaccines".

D'Anna said that neither he nor the ONB can be defined as 'no-vax', a term used in Italy to refer to people who are against vaccinations, and says that he has never questioned the efficacy of vaccines. "The ONB and the biologists know well the merits of vaccines, and want to know all the rest about their safety," he said.

The debate about the donation follows criticism of a conference to celebrate the ONB's 50th anniversary in March. Some academics and scientific societies urged the ONB to revise the agenda because they were concerned that anti-vaccine ideas could be promoted, although the ONB rejects this criticism.

The donation and the choice of speakers at the March meeting are included in a petition calling for the Ministry of Health, which oversees the governance of the ONB, to remove D'Anna as ONB president. The petition, created by three graduate biology students, says that these and other actions by the ONB endanger public health and discredit the scientific community.

In a telephone interview with *Nature*, D'Anna said he won't step down. And in the e-mail interview, he dismissed the seriousness of a petition launched by students. He said that those who want to verify whether "hundreds of biological and chemical impurities" can harm children do not endanger public health.

A spokesperson for the Italian Ministry of Health says that it has received "a report on the matter" of the ONB donation to Corvelva, and that the ministry asked the ONB "to provide information on the subject". The ministry doesn't fund the ONB, but it is tasked with ensuring that the governing board abides by its duties. ■



Icy southern waters help to blunt climate change by pulling carbon dioxide from the atmosphere.

CLIMATE CHANGE

Southern Ocean spotted burping CO₂

Ocean-float data reveal that waters off Antarctica don't absorb as much carbon as scientists thought.

BY JEFF TOLLEFSON

The Southern Ocean is one of humanity's allies, slowing global warming by absorbing heat and carbon dioxide from the atmosphere. But now researchers report that the choppy waters around Antarctica are also quietly belching out massive quantities of CO₂ during the dark and windy winter, reducing the ocean's climate benefit.

The scientists behind the work, presented last week at a meeting of the American Geophysical Union in Washington DC, say that the winter emissions reduce the Southern Ocean's net uptake of CO₂ by 34%, or more than 1.4 billion tonnes per year. That amount is roughly equal to Japan's annual carbon emissions.

"The Southern Ocean is still going to be important in the global carbon cycle," says Seth Bushinsky, an oceanographer at Princeton University in New Jersey who is leading the study. "We're just trying to understand exactly how and why."

The ocean's winter CO₂ emissions, which were tracked by a fleet of robotic floats, occur when deep waters rise to the surface and release centuries-old carbon. This is part of a larger process of ocean circulation that

moves heat and nutrients around the globe, but researchers have struggled to pin down precisely how the overall system works, in part because of a dearth of data.

For years, scientists have based their estimates of carbon uptake in the Southern Ocean on measurements made by ships sailing to and around Antarctica, but the data are sparse — particularly for the winter months.

The latest work factors in 3.5 years of data from 65 floats deployed as part of the US\$21-million Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) project. The floats bob up and down in the upper 2,000 metres of the ocean, measuring temperature, salinity, oxygen, carbon and nutrients — information that can be used to infer how much carbon is moving into and out of the ocean.

The first estimate based on the SOCCOM floats alone, published in August, reduced the Southern Ocean's carbon uptake by more than 90%, compared with previous calculations based on ships' measurements (A. R. Gray *et al. Geophys. Res. Lett.* **45**, 9049–9057; 2018). But the discrepancy raised eyebrows, and prompted concerns about potential bias in the float estimates.

To produce its latest estimate, which ▶

GRAEME SNOW/ALAMY

► includes float and ship data, the SOCCOM team worked with researchers who have helped to produce ship-based estimates for the Global Carbon Project, an international consortium that tracks the carbon cycle. Bushinsky says the team is reviewing incoming float data to discover what is causing the discrepancy with the ship-based measurements. The scientists are also trying to determine whether the ocean's winter CO₂ burps are a regular occurrence or a short-term trend caused by natural variations in ocean circulation.

But the SOCCOM floats have already given scientists a better look at the Southern Ocean, says Corinne Le Quéré, director of the Tyndall Centre for Climate Change Research

in Norwich, UK.

And although the Southern Ocean is doing less to moderate global warming than scientists thought, evidence is mounting that its influence on climate will grow during this century, says Joellen Russell, an ocean modeller at the University of Arizona in Tucson who heads SOCCOM's modelling team.

One recent study found that Antarctic meltwater flowing into the ocean creates a layer of cold, fresh water that pushes warmer, saltier water up under the continent's ice shelves, accelerating ice loss (B. Bronselaer *et al.* *Nature* **564**, 53–58; 2018). Researchers used a climate model to look ahead to 2100, and project that this flow of meltwater will cool the region

and slow the increase in average global temperatures, even as it accelerates Antarctica's contribution to sea-level rise.

Now the SOCCOM team is taking a closer look at the powerful winds that circle Antarctica, which have strengthened and moved polewards over the past several decades. Few climate models simulate this process. But in unpublished research, the SOCCOM scientists have found that their model better reproduces the data collected by floats when it incorporates more-realistic simulations of Antarctic wind patterns and meltwater flows. "We now have a cookie-cutter approach for telling whether our models are getting the Southern Ocean right," Russell says. ■

CHINA

Social punishments for scientific misconduct

Offending researchers could face restrictions on jobs, loans and business opportunities.

BY DAVID CYRANOSKI

Chinese researchers who commit scientific misconduct could soon be prevented from getting a bank loan, running a company or applying for a public-service job. The government has announced an extensive punishment system that could have significant consequences for offenders — far beyond their academic careers.

Under the policy, dozens of government agencies will have the power to hand out penalties to those caught committing major scientific misconduct, a role that was previously the preserve of the science ministry or universities. In addition to existing misconduct penalties, such as the loss of grants and awards, errant researchers could face punishments that have nothing to do with research, including restrictions on jobs outside academia.

"Almost all aspects of daily life for the guilty scientists could be affected," says Chen Bikun, who studies scientific evaluation systems at Nanjing University of Science and Technology.

The policy, announced last month, is an extension of the country's controversial 'social credit system', in which failure to comply with the rules of one government agency can mean facing restrictions or penalties from other agencies.

The punishment overhaul is the government's latest attempt to crack down on misconduct. But the nature and extent of the policy has surprised many researchers. "I have never seen such a comprehensive list of penalties for

research misconduct elsewhere in the world," says Chien Chou, a scientific-integrity education researcher at Chiao Tung University in Hsinchu, Taiwan.

Although some penalties for misconduct existed before the new policy — research programmes could be suspended and offenders could be barred from promotions — drawing them together under one framework makes them much more powerful, says Yang Wei, a former head of the National Science Foundation of China who is now an engineer at Zhejiang University in Hangzhou. Whether

"Almost all aspects of daily life for the guilty scientists could be affected."

"Without doubt, it will be effective," he says.

The social credit system, which was introduced in 2014, has already had a large effect on life in the country. Failure to pay debts or fines can be recorded on the system's website and lead to restrictions when applying for a credit card, insurance or even train tickets.

As of April, the number of times people had been denied airline tickets as a result of the system had reached 11 million, and train tickets had been denied on 4.2 million occasions. More than 2 million people have paid debts or fines after facing these restrictions.

Chinese leaders have been increasingly focused on scientific misconduct, following

ongoing reports of researchers in the country using fraudulent data, falsifying CVs and faking peer reviews. In May, the government announced sweeping reforms to improve research integrity, including the creation of a national database of misconduct cases. Inclusion on the list could disqualify researchers from future funding or research positions, and might affect their ability to get jobs outside academia.

The punishment system seems to align with that goal. "It shows that China takes research integrity very seriously," says Max Lu, a chemical engineer and president of the University of Surrey in Guildford, UK, who has previously advised the Chinese government on science policy.

Lu thinks the system's success will depend on the resources that are devoted to enforcing it. The government is likely to focus on punishments for the most egregious cases first, such as repeat offenders, or those whose fraud has major consequences, says Li Tang, who studies science policy at Fudan University in Shanghai.

But the government needs to define what actions constitute major research misconduct, and how penalties will apply, says Chou.

Addressing misconduct in China will require more than punishments, says Tang. Mandatory courses on research integrity are becoming more common, but more could be done, she says. "Educating lab PIs and younger generations is extremely important," she says. ■