

► 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 But in unpublished research, the SOCCOM scientists have found that their model better reproduces the data collected by floats when it incorporates more-realistic simulations of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

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"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. ■