The Southern Ocean is still swallowing large amounts of humans' carbon dioxide emissions

Aircraft data counter ocean float studies suggesting the ocean stores less CO2 than thought

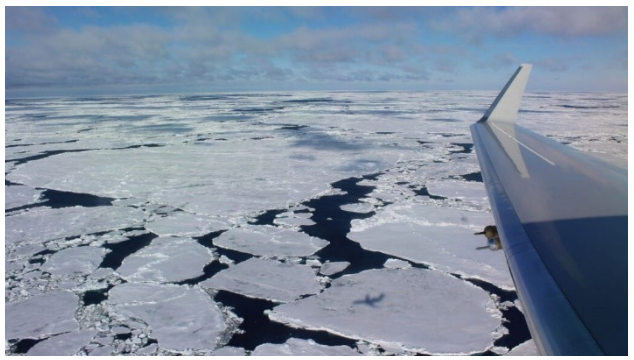

Figura 1*- Equipped with sensors to measure carbon dioxide in the atmosphere, this airplane winged across sea ice in the Southern Ocean (shown) during a 2016 field campaign to measure how much gas the waters were emitting.*

The Southern Ocean is still busily absorbing large amounts of the carbon dioxide emitted by humans' fossil fuel burning, a study based on airborne observations of the gas suggests. The new results counter a 2018 report that had found that the ocean surrounding Antarctica might not be taking up as much of the emissions as previously thought, and in some regions may actually be adding CO_2 back to the atmosphere.

It's not exactly a relief to say that the oceans, which are already becoming more acidic and storing record-breaking amounts of heat due to global warming, might be able to bear a little more of the climate change burden. But "in many ways, [the conclusion] was reassuring," says Matthew Long, an oceanographer at the National Center for Atmospheric Research in Boulder, Colo.

That's because the Southern Ocean alone has been thought to be responsible for nearly half of the global ocean uptake of humans' CO_2 emissions each year. That means it plays an outsize role in modulating some of the immediate impacts of those emissions. However, the float-based estimates had suggested that, over the course of a year, the Southern Ocean was actually a net source of carbon dioxide rather than a sink, ultimately emitting about 0.3 billion metric tons of the gas back to the atmosphere each year.

In contrast, the new findings, published in the Dec. 3 *Science*, suggest that from 2009 through 2018, the Southern Ocean was still a net sink, taking up a total of about 0.55 billion metric tons of carbon dioxide each year.

The 2018 study had used newly deployed deep-diving ocean floats, now numbering almost 200, that are part of a project called Southern Ocean Carbon and Climate Observations and Modeling, or SOCCOM. Calculations based on data collected from 2014 through 2017 by 35 of the floats suggested that parts of the ocean were actually releasing a great deal of carbon dioxide back into the atmosphere during winter. That sparked concerns that the Southern Ocean's role in buffering the impacts of climate change on Earth might not be so robust as once thought.

Long says he and other researchers were somewhat skeptical about that takeaway, however. The floats measure temperature, salinity and pH in the water down to about 2,000 meters, and scientists use those data to calculate the carbon dioxide concentration in the water. But those calculations rest on several assumptions about the ocean water properties, as actual data are still very scarce. That may be skewing the data a bit, leading to calculations of higher carbon dioxide emitted from the water than is actually occurring, Long suggests.

Another way to measure how much carbon dioxide is moving between air and sea is by taking airborne measurements. In the new study, the team amassed previously collected carbon dioxide data over large swaths of the Southern Ocean during three separate series of aircraft flights — one series lasting from 2009 to 2011, one in the winter of 2016 and a third in several periods from 2016 to 2018. Then, the researchers used those data to create simulations of how much carbon dioxide could possibly be moving between ocean and atmosphere each year.

The float-based and aircraft-based studies estimate different overall amounts of carbon dioxide moving out of the ocean, but both identified a seasonal pattern of less carbon dioxide absorbed by the ocean during winter. That indicates that both types of data are picking up a real trend, says Ken Johnson, an ocean chemist at the Monterey Bay Aquarium Research Institute in Moss Landing, Calif., who was not involved in the research. "We all go up and down together."

It's not yet clear whether the SOCCOM data were off. But to better understand what sorts of biases might affect the pH calculations, researchers must compare direct measurements of carbon dioxide in the water taken from ships with pH-based estimates at the same location. Such studies are under way right now off the coast of California, Johnson says.

The big takeaway, Johnson says, is that both datasets — as well as direct shipboard measurements in the Southern Ocean, which are few and far between — are going to be essential for understanding what role these waters play in the planet's carbon cycle. While the airborne studies can help constrain the big picture of carbon dioxide emissions data from the Southern Ocean, the floats are much more widely distributed, and so are able to identify local and regional variability in carbon dioxide, which the atmospheric data can't do.

"The Southern Ocean is the flywheel of the climate system," the part of an engine's machinery that keeps things chugging smoothly along, Johnson says. "If we don't get our understanding of the Southern Ocean right, we don't have much hope for understanding the rest of the world."

1- O texto discute duas pesquisas que mediram a emissão de dióxido de carbono no Oceano Ártico com métodos diferentes. Qual a limitação apresentada por Johnson para o método com dados atmosféricos?

a) Não conseguem identificar a variabilidade regional ou local.

b) Requer um equipamento de maior custo.

c) São estabelecidas diversas premissas sobre as propriedades da água do oceano para o cálculo da concentração de dióxido de carbono.

d) Não há dados reais para fundamentar o cálculo dos índices adotados.

2- Das alternativas abaixo, assinale aquela em que apresenta a melhor justificativa para o uso da sentença “the Southern Ocean was actually a net source of carbon dioxide rather than a sink”.

a) Exemplificar a absorção de dióxido de carbono pelo Oceano Ártico.

b) Comparar a absorção e a emissão de dióxido de carbono de dois objetos distintos.

c) Comparar a quantidade de dióxido de carbono emitida pelo Oceano Ártico com outros oceanos.

d) Ilustrar como o Oceano Ártico também tem emitido dióxido de carbono para a atmosfera em vez de apenas absorvê-lo.

3- O texto comenta que os resultados do novo estudo vão de encontro aos resultados de um relatório de 2018, pois:

a) Os resultados mostram que os oceanos ao redor da Antártica não estão absorvendo tantas emissões quanto previamente acreditava-se e, em algumas regiões, pode estar até adicionando CO^2 à atmosfera.

b) Os resultados mostram que o Oceano Antártico ainda está absorvendo grandes quantidades de dióxido de carbono emitido pela queima de combustíveis fósseis.

c) Há indícios de falhas na coleta de dados do estudo passado.

d) Os resultados do novo estudo complementam os achados do anterior.

4- A palavra “amassed”, no trecho “the team amassed previously collected carbon dioxide data”, apresenta um sentido semelhante a qual das alternativas abaixo?

a) Acumulou.

b) Criou.

c) Analisou.

d) Coletar.

5- O texto comenta que não é claro se os dados do primeiro estudo estavam errados, mas apresenta uma proposta de análise que pode averiguar a veracidade dos dados e está sendo realizada por pesquisadores. Qual é essa proposta?

a) Analisar os índices de pH das águas do Oceano Ártico em lugares e profundidades diferentes.

b) Combinar a análise do pH das águas do Oceano Ártico com as medições aéreas do novo experimento.

c) Comparar diretamente a quantidade de dióxido de carbono na água retirada por navios com estimativas de pH do mesmo local.

d) Controlar a temperatura das amostras de água antes, durante e após a análise dos índices de pH.

6- Nos parágrafos iniciais do texto, o autor apresenta algumas informações atuais sobre os oceanos, exceto:

a) Estão absorvendo maiores quantidades de dióxido de carbono.

b) Estão se tornando mais ácidos.

c) Estão armazenando quantidades recordes de calor.

d) São responsáveis por captar metade da emissão de CO^2 por humanos todos os anos.

7- Sobre a metodologia adotada para a análise dos níveis de dióxido de carbono no novo estudo, assinale a única alternativa que contém uma informação falsa ou não apresentada no texto.

a) Pesquisadores utilizaram medidas aéreas para analisar a quantidade de dióxido de carbono em movimento entre o ar e o mar.

b) Pesquisadores acumularam dados do Oceano Ártico em três séries de voos.

c) As séries de voos foram entre 2009 e 2011, todos os invernos entre 2011 e 2016 e vários voos entre 2016 e 2018.

d) Pesquisadores criaram simulações de quanto dióxido de carbono estaria se movendo entre o oceano e a atmosfera a cada ano.

8- O texto comenta que as duas pesquisas discutidas, embora tenham adotado coletas de dados diferentes, encontraram um achado semelhante. Qual é esse achado em comum e o que ele indica?

Foi constatado um padrão sazonal de menos absorção de dióxido de carbono durante o inverno, o que indica que uma tendência real está sendo observada por dois tipos de dados diferentes.

Being bilingual is great. But it may not boost some brain functions

Knowing a second language didn't come with better attention control, a study of U.S. kids finds

Advantages of speaking a second language are obvious: easier logistics when traveling, wider access to great literature and, of course, more people to talk with. Some studies have also pointed to the idea that polyglots have stronger executive functioning skills, brain abilities such as switching between tasks and ignoring distractions.

But a large study of bilingual children in the U.S. finds scant evidence of those extra bilingual brain benefits. Bilingual children performed no better in tests measuring such thinking skills than children who knew just one language, researchers report May 20 in *Nature Human Behaviour*.

Figura 2*- SWITCHING: In a large study of 4,524 U.S. kids, bilingualism didn't come with obvious benefits to certain thinking skills.*

To look for a relationship between bilingualism and executive function, researchers relied on a survey of U.S. adolescents called the ABCD study. From data collected at 21 research sites across the country, researchers identified 4,524 kids ages 9 and 10. Of these children, 1,740 spoke English and a second language (mostly Spanish, though 40 second languages were represented).

On three tests that measured executive function, such as the ability to ignore distractions or quickly switch between tasks with different rules, the bilingual children performed similarly to children who spoke only English, the researchers found. "We really looked," says study coauthor Anthony Dick, a developmental cognitive neuroscientist at Florida International University in Miami, says. "We didn't find anything."

That result runs counter to earlier studies — small and large — that turned up advantages in similar tests of executive function for bilingual children. Because of its size and the fact that it represented lots of communities across the United States, the ABCD dataset presented "an excellent opportunity to look at this question," Dick says.

Compared with children who spoke only English, bilingual kids scored slightly lower on a measure of English vocabulary. But the dip was small — "a drop in the bucket," says Dick, whose son has attended a bilingual Spanish-English school for years.

Still, the complexity of bilingualism makes it hard to draw conclusions from the new results, says social scientist Gigi Luk of McGill University in Montreal. Nuances about whether a child speaks another language at home, when and how the second language was picked up and even whether one language is more respected than another can get lost in these sorts of large studies, she says. "We just don't have enough information about the bilingual experience that these children have every day."

The study was aimed at the narrow question of whether bilingualism improves the brain's executive functioning — not the other advantages that come from knowing a second language. "I don't want this to be a paper about how parents should not have their children learn a second language," Dick says. To the contrary, "there are inherent benefits outside of executive function to learning a second language — huge benefits."

9- Os resultados do estudo descrito no texto relatam que, ao comparar crianças bilíngues com monolíngues, as crianças bilíngues:

a) Apresentaram vastos benefícios em relação às monolíngues.

b) Se saíram melhor em apenas duas das três tarefas realizadas.

c) Não apresentaram um grande aumento no vocabulário se comparadas às monolíngues de espanhol.

d) Apresentaram um desempenho um pouco menor em uma tarefa de vocabulário.

10- A habilidade de alternar entre tarefas com regras diferentes é um exemplo utilizado no texto de:

a) Uma das habilidades aprimoradas em crianças bilíngues.

b) Uma das habilidades prejudicadas em crianças bilíngues.

c) Uma das tarefas realizadas na pesquisa.

d) Uma das tarefas que a pesquisa futura pretende analisar.

11- O texto apresenta algumas vantagens de ser bilíngue, exceto:

a) Maior acesso à literatura.

b) Habilidade de ignorar distrações.

c) Mais pessoas para conversar.

d) Habilidades motoras funcionais mais fortes.

12- Uma das limitações levantadas no texto para a pesquisa descrita é:

a) O foco nas funções executivas do cérebro.

b) O foco nos benefícios oriundos da aquisição de uma segunda língua.

c) A dificuldade em analisar todos os dados coletados.

d) As tarefas selecionadas para análise.

13- Com base nas informações apresentadas no texto sobre a metodologia e coleta de dados do estudo, assinale a única alternativa que contém uma informação falsa ou não apresentada no texto.

a) Os dados utilizados são oriundos de uma pesquisa prévia.

b) Os dados foram coletados em 21 lugares do país.

c) Os dados de 4524 crianças foram selecionados para análise, contemplando o espanhol e outras 40 segundas línguas).

d) 1740 crianças falavam inglês e uma segunda língua, sendo espanhol a mais comum.

14- A sentença “, although those results have been contested by other research”, pode ser inserida em apenas uma posição no trecho destacado abaixo. Assinale a alternativa que corresponde à essa posição.

[1] That result runs counter to earlier studies [2] — small and large — [3] that turned up advantages in similar tests of executive function for bilingual children [4].

a) 1

b) 2

c) 3

d) 4

15- A palavra “scant”, no trecho “But a large study of bilingual children in the U.S. finds scant evidence of those extra bilingual brain benefits”. Pode ser substituída, sem grandes mudanças de significado ou quebra de regras gramaticais, por:

a) Large.

b) Vast.

c) Minimal.

d) Sufficient.

16- Dick comenta que os dados do estudo ABCD são uma excelente oportunidade para estudar os benefícios do bilinguismo. Por quê?

Devido a quantidade de dados e ao fato deles representarem muitas comunidades nos Estados Unidos.