“Revised estimates of ocean-atmosphere CO2 flux are consistent with ocean carbon inventory” by **Professor. Watson (andrew.watson@exeter.ac.uk)** published in *Nature Communications*.

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Revised estimates of ocean-atmosphere CO_2 flux are consistent with ocean carbon inventory

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The ocean is a sink for ~25% of the atmospheric CO_2 emitted by human activities, an amount in excess of 2 petagrams of carbon per year (PgC yr^{-1}). Time-resolved estimates of global ocean-atmosphere CO_2 flux provide an important constraint on the global carbon budget. However, previous estimates of this flux, derived from surface ocean CO_2 concentrations, have not corrected the data for temperature gradients between the surface and sampling at a few meters depth, or for the effect of the cool ocean surface skin. Here we calculate a time history of ocean-atmosphere CO_2 fluxes from 1992 to 2018, corrected for these effects. These increase the calculated net flux into the oceans by 0.8–0.9 PgC yr^{-1}, at times doubling uncorrected values. We estimate uncertainties using multiple interpolation methods, finding convergent results for fluxes globally after 2000, or over the Northern Hemisphere throughout the period. Our corrections reconcile surface uptake with independent estimates of the increase in ocean CO_2 inventory, and suggest most ocean models underestimate uptake.

Ocean carbon uptake widely underestimated

The world's oceans soak up more carbon than most scientific models suggest, according to new research.

Previous estimates of the movement of carbon (known as "flux") between the atmosphere and oceans have not accounted for temperature differences at the water's surface and a few metres below.

The new study, led by the University of Exeter, includes this – and finds significantly higher net flux of carbon into the oceans.

It calculates CO2 fluxes from 1992 to 2018, finding up to twice as much net flux in certain times and locations, compared to uncorrected models.

"Half of the carbon dioxide we emit doesn't stay in the atmosphere but is taken up by the oceans and land vegetation 'sinks'," said Professor Andrew Watson, of Exeter's Global Systems Institute.

"Researchers have assembled a large database of near-surface carbon dioxide measurements – the "Surface Ocean Carbon Atlas" (www.socat.info) – that can be used to calculate the flux of CO2 from the atmosphere into the ocean.

"Previous studies that have done this have, however, ignored small temperature differences between the surface of the ocean and the depth of a few metres where the measurements are made. Those differences are important because carbon dioxide solubility depends very strongly on temperature.

"We used satellite data to correct for these temperature differences, and when we do that it makes a big difference – we get a substantially larger flux going into the ocean."
Professor Watson added: "Our revised estimate agrees much better than previously with an independent method of calculating how much carbon dioxide is being taken up by the ocean.

"That method makes use of a global ocean survey by research ships over decades, to calculate how the inventory of carbon in the ocean has increased.

"These two 'big data' estimates of the ocean sink for CO2 now agree pretty well, which gives us added confidence in them."

Funders of the study included the Royal Society, the Natural Environment Research Council and the European Space Agency.

The paper, published in *Nature Communications*, is entitled: "Revised estimates of ocean-atmosphere CO2 flux are consistent with ocean carbon inventory."
The paper is available at: http://dx.doi.org/10.1038/s41467-020-18203-3

For further information:
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