

The Baltic Sea contributes carbon dioxide to the atmosphere

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This is a view of the Baltic Sea. Credit: Photography University of Gothenburg

The Baltic Sea emits more carbon dioxide than it can bind. Local variations have increased the exposure of the Bay of Bothnia. These are the results from a study of how carbon dioxide flows between the water of the Baltic Sea and the atmosphere, carried out by scientists at the University of Gothenburg, Sweden.

"The capacity of the Baltic Sea to absorb [carbon dioxide](#) without major changes to the acidity of the water has changed in recent centuries. In the Bay of Bothnia, the ability to resist change has fallen, while it has increased in the south-eastern parts of the Baltic Sea", says Karin Wesslander of the Department of [Earth Sciences](#) at the University of Gothenburg.

The concentration of carbon dioxide in the atmosphere is rising steadily as a result of human activities, but global climate models remain inaccurate. The coastal seas are rarely included in large-scale climate

models. Karin Wesslander has investigated the carbon dioxide system of the surface water of the Baltic Sea, in order to increase understanding of how the [concentration](#) of carbon dioxide affects seas.

Carbon dioxide is an important component of photosynthesis, which converts the energy from sunlight, and it is [phytoplankton](#) that carry out [photosynthesis](#) in the seas. The carbon dioxide in the sea is consumed during the [algal blooms](#) that take place during the spring and summer.

This means that the fraction of carbon dioxide in the water is lower than it is in the atmosphere, and carbon dioxide flows into the sea. The sea is thus a sink for [atmospheric carbon dioxide](#). When the [plankton](#) subsequently die, they are broken down and the carbon dioxide reappears in the water. The windy weather that occurs during the autumn and winter causes water mixing, and the carbon dioxide returns to the surface. This is the reason that the sea is most often a source of carbon dioxide during these seasons.

Large differences across the Baltic Sea

"The study is based on 15 years of measurements from the sea outside of Gotland, 1994-2009, and shows that there are large differences between seasons, between years and between regions. One of the factors that contribute to these differences is the magnitude of the algal bloom. The wind is another important factor."

The Baltic Sea is a well-defined and enclosed sea, and it receives a large contribution from the many rivers that flow into it. The composition of this river water, thus, plays a major role. Karin Wesslander's results show that the ability of the Baltic Sea to absorb carbon dioxide without a concomitant increase in acidity is significantly higher in the south-eastern parts and around the Gulf of Finland than it is in the Bay of Bothnia.

"We believe that the differences result from the fact that the rivers flowing into the Gulf of Finland and from the coastlines of the Baltic states carry more limestone, since they flow through limestone-rich rocks. The rivers that empty into the Bay of Bothnia do not have so high a level."

The thesis contains a model study that shows that eutrophication of the [surface water](#) of the Baltic Sea may have counteracted the acidification that the increase in carbon dioxide in the atmosphere otherwise would have caused. The new results are part of the work to improve better environmental and climate models for the [Baltic Sea](#).

Provided by University of Gothenburg

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