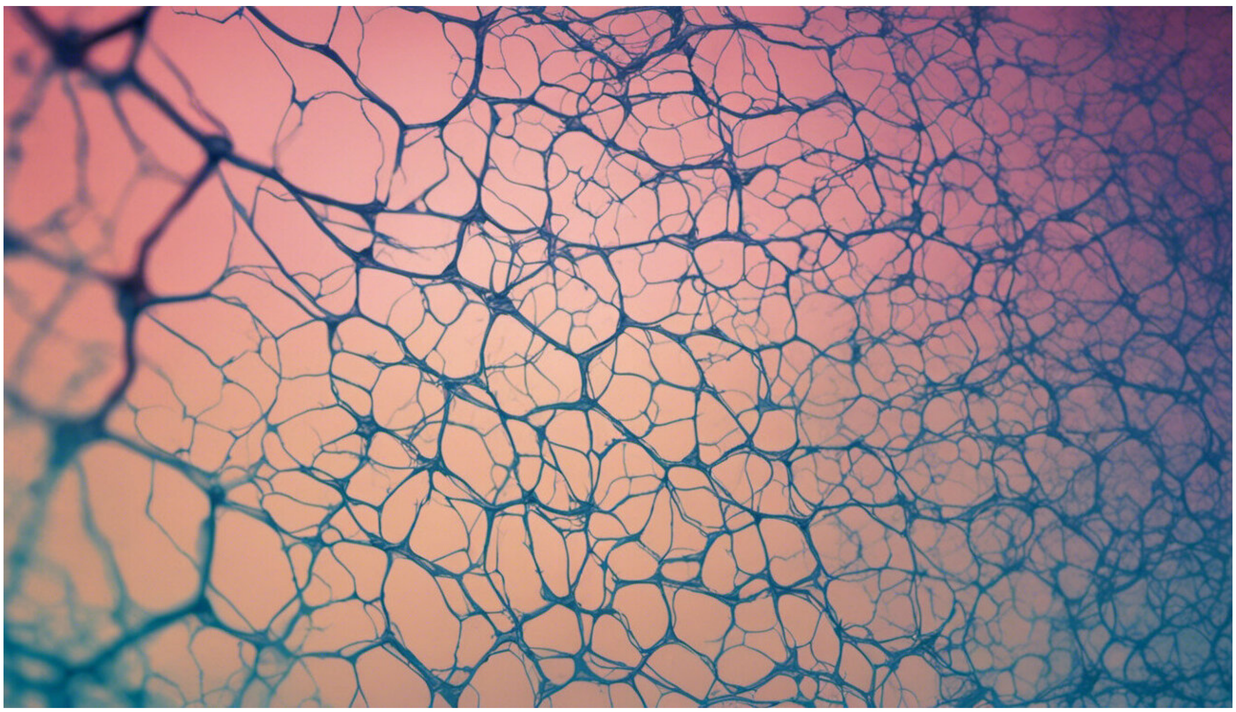
Air-sea gas exchange impact measurements could improve climate predictions

March 21 2018



Credit: AI-generated image (disclaimer)

Trace gases, ranging from carbon dioxide to water vapour, refer to any of the less common gases found in the Earth's atmosphere. Yet, many of these gases are responsible for the greenhouse effect. It's crucial to understand how their chemistry is affected by air-sea fluxes which involve the exchanges of heat, mass and momentum between the atmosphere and the ocean.

For three decades, scientists have looked into the formation of clouds and their double-edged impact on rising temperatures. Clouds cool the planet as they reflect solar energy back into space, but they also intensify warming by trapping the heat and radiating it back to earth. The scientific community has focused on such 'feedback processes' which either enhance (positive feedback) or weaken (negative feedback) the effect of climate change drivers, analysing a complex system of multiple variables. However, it hasn't yet managed to fully quantify the impact.

To address this issue and produce more reliable projections of climate change, a team of scientists, supported by the EU-funded STRATOCLIM project, observed the western tropical Indian Ocean (WTIO) during the summer monsoon period.

In an article published in the *Geophysical Research Letters* journal, the scientists said the WTIO during the summer monsoon period is one of the world's largest dimethylsulfide (DMS) source regions to the atmosphere. DMS, which originates from phytoplankton – tiny single-celled floating plants that live near the surface of the oceans – is the largest source of sulfur in the atmosphere. For clouds to form, water has to transition from gas phase to liquid. To do that, it adheres to a small particle in the air, known as a cloud condensation nucleus. Sulfur aerosols, which are formed from DMS, do the trick by allowing water vapour to condense around them.

Summarising their findings, the researchers said the air-sea flux trace gases and their transformation to aerosols and cloud condensation nuclei may be fundamental to cloud formation in the marine environment. "Clouds and aerosol have an important influence on the radiative balance of the earth," they added.

They used directly measured DMS as a variable in their quantitative model and correlated this, as well as isoprene fluxes and sea spray fluxes, with satellite-derived aerosol numbers over the WTIO during the summer monsoon. Aerosols are small particles or liquid droplets in the atmosphere that can absorb or reflect sunlight depending on their composition. Isoprene is one of the major hydrocarbons emitted to the atmosphere through both vegetation and the oceans.

The team concluded: "Although we acknowledge that correlation results do not always imply causation, the ensemble findings support the idea that marine-derived biogenic trace gases, as well as sea spray, influence the aerosol properties on a regional scale."

The ongoing STRATOCLIM (Stratospheric and upper tropospheric processes for better climate predictions) project aims to improve the understanding of the microphysical, chemical and dynamical processes that determine the composition of the upper troposphere and stratosphere, and how these processes will be affected by climate change . The scientists hope to use the improved climate models to make more robust and accurate predictions of surface climate and stratospheric ozone, both with a view to the protection of life on Earth.

More information: Project website: www.stratoclim.org/

Provided by CORDIS