

Trade winds influence oxygen levels in tropical oceans

While long-term observations indicate that oxygen-depleted zones in the tropical oceans have expanded in recent decades, the reason has remained unclear. In a [recent study](#) published in the international journal, *Geophysical Research Letters*, scientists report that the cause is a natural fluctuation of the trade winds, with recent, weaker trade winds reducing the supply of oxygen to the tropics.



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For several decades, scientists have carefully observed that the oxygen-minimum zones (OMZ) in the tropical oceans are expanding. These zones are a paradise for specially adapted microorganisms, but for most larger marine organisms they are uninhabitable.

Marine scientists from the GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany, have now found a possible reason by using model simulations. Their study shows that the trade winds north and south of the Equator play a crucial role in the supply of oxygen to tropical sea water.

‘Fluctuations in the trade winds could also be responsible for the observed enlargement of the oxygen minimum zones in recent years,’ says Dr Olaf Duteil, lead author of the study.

OMZs exist in different intensities at the eastern edges of all tropical oceans. Because nutrient-rich water from the depths reaches the surface in these areas, plankton thrives particularly well. Therefore large amounts of plankton organisms die there, too, then sink to the ocean floor. On the way down, bacteria start to decompose the biomass, consuming the oxygen.

The largest of these OMZs stretches from the coasts of Chile and Peru far into the Pacific Ocean, where currents at a

few hundred metres depth transport oxygen-rich water from the subtropics towards the tropics, where the oxygen minimum zones lie.

‘One can think of the tropical Pacific Ocean as a bathtub. When I open the tap, I fill the bathtub with water or, in this case, oxygen. When the [plughole] is open too, we lose oxygen at the same time,’ says Dr Duteil.

‘We then have an unstable equilibrium between input and output. If I turn off the tap a little, the tub empties slowly.’

The researchers were able to determine that the strength of the currents and thus the oxygen flow to the tropics is directly related to the strength of the trade winds.

‘It is well known that they vary on a decadal time scale,’ says one of the co-authors, Prof. Dr. Claus Böning. ‘But these variations have never been investigated in relation to the oxygen budget of tropical oceans.’

Since the trade winds have been in a weak phase since the mid-1970s, this could be the explanation for the observed enlargement of the oxygen minimum zones. ‘The oxygen bathtub of the tropical oceans is emptying,’ says Dr Duteil. Once the trade winds come back into a stronger phase, the process will be reversed.

This does not mean that external processes such as global warming have no influence on the oxygen concentrations in the tropical oceans.

‘There is evidence that global change affects the major wind systems of the Earth. That would have a direct impact on the oxygen transport in the subtropical and tropical ocean,’ explains Prof. Andreas Oschlies, another co-author.

‘But according to this study the trade winds must be considered as a factor for long-term development of tropical oxygen minimum zones.’

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