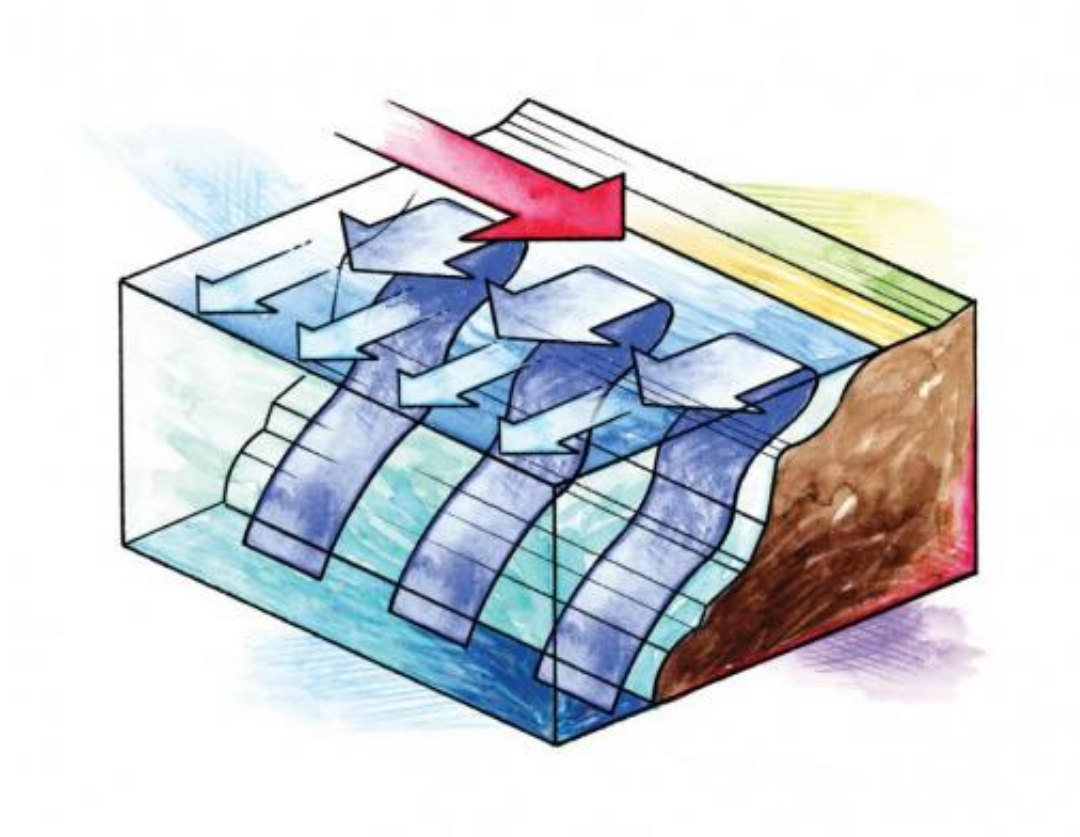
# Coastal winds intensifying with climate change, study says

July 4 2014



Cartoon of the wind intensification/upwelling process. Increasing winds and upwelling may increase nutrients in the lighted upper ocean, enhancing primary productivity, but excessive upwelling may increase turbulence, acidification and de-oxygenation of the photic zone. The ecological impacts of upwelling intensification are difficult to predict. Credit: Steve Ravenscraft for The Pew Charitable Trusts

Summer winds are intensifying along the west coasts of North and South America and southern Africa and climate change is a likely cause, a new study says.

The winds, which blow parallel to the shore and draw cold, nutrient-rich water from the deep ocean to the surface in a process known as coastal upwelling, have increased over the last 60 years in three out of five regions of the world, according to an analysis published Thursday in the journal *Science*.

Stronger winds have the potential to benefit coastal areas by bringing a surge of nutrients and boosting populations of plankton, fish and other species. But they could also harm marine life by causing turbulence in surface waters, disrupting feeding, worsening ocean acidification and lowering oxygen levels, the study says.

The shift could already be having serious effects on some of the world's most productive marine fisheries and ecosystems off California, Peru and South Africa.

At this point "we don't know what the implications are," said William Sydeman, president of the Farallon Institute for Advanced Ecosystem Research in Petaluma, Calif., who led the study by seven scientists in the U.S. and Australia. "On the one hand it could be good. On the other hand, it could be really bad."

The windier conditions are occurring in important currents along the eastern edges of the Pacific and Atlantic oceans. In those areas, the influx of nutrients from coastal upwelling fuels higher production of phytoplankton, tiny plant-like organisms that are eaten by fish, which in turn feed populations of seabirds, whales and other marine life.

Scientists said their results lend support to a hypothesis made more than

two decades ago by oceanographer Andrew Bakun. He suggested that rising temperatures from the human-caused buildup of greenhouse gases, by causing steeper atmospheric pressure gradients between oceans and continents, would produce stronger winds during summer and drive more coastal upwelling.

To test that claim, researchers reviewed and analyzed 22 published studies that tracked winds in the world's five major coastal upwelling regions using data from the 1940s to the mid-2000s.

Scientists found a trend of windier conditions in the California Current along the west coast of North America, the Humboldt Current off Peru and Chile and the Benguela Current off the west coast of southern Africa. In the Canary and Iberian currents off northern Africa and Spain, however, they found no clear signs of increasing winds.

Researchers can't say for sure that human-caused climate change is to blame, but they said finding a pattern that was consistent across several parts of the planet gives a strong indication it is a factor. The study also found that the increase in winds was more pronounced at higher latitudes, which is in line with other observed effects of climate change.

The study's conclusions are controversial among ocean scientists. They say the records used in the analysis do not go back far enough in time to rule out naturally occurring climate cycles such as the Pacific Decadal Oscillation, which shifts between warm and cool phases about every 20 to 30 years and also influences atmospheric conditions.

"It doesn't prove that global warming is driving this," said Art Miller, a climate scientist at Scripps Institution of Oceanography who was not involved in the study.

Similar limitations in the data have made it difficult for other

researchers to link increases in coastal upwelling to climate change.

A study published last year by Canadian researchers, for instance, found huge year-to-year changes in coastal winds and the timing and intensity of upwelling from Vancouver Island to Northern California and urged caution in analyzing trends over short time periods.

"We found it extremely difficult to capture a climate change signal," said Brian Bylhouwer, an environmental scientist with Stantec Consulting in Dartmouth, Canada, who led that study.

Sydeman acknowledged that scientists need more time and data to firmly establish that shifting winds are the result of climate change and not natural cycles.

He said future research will examine the mechanism behind the increase in coastal winds and study how a boost in upwelling might be affecting fish and seabirds off California and South Africa.

**More information:** Climate change and wind intensification in coastal upwelling ecosystems, *Science* 4 July 2014: Vol. 345 no. 6192 pp. 77-80. DOI: 10.1126/science.1251635