Digital atlas shows oceans' iron levels

Three-dimensional map reveals global sources and sinks for trace metals.

Jessica Morrison

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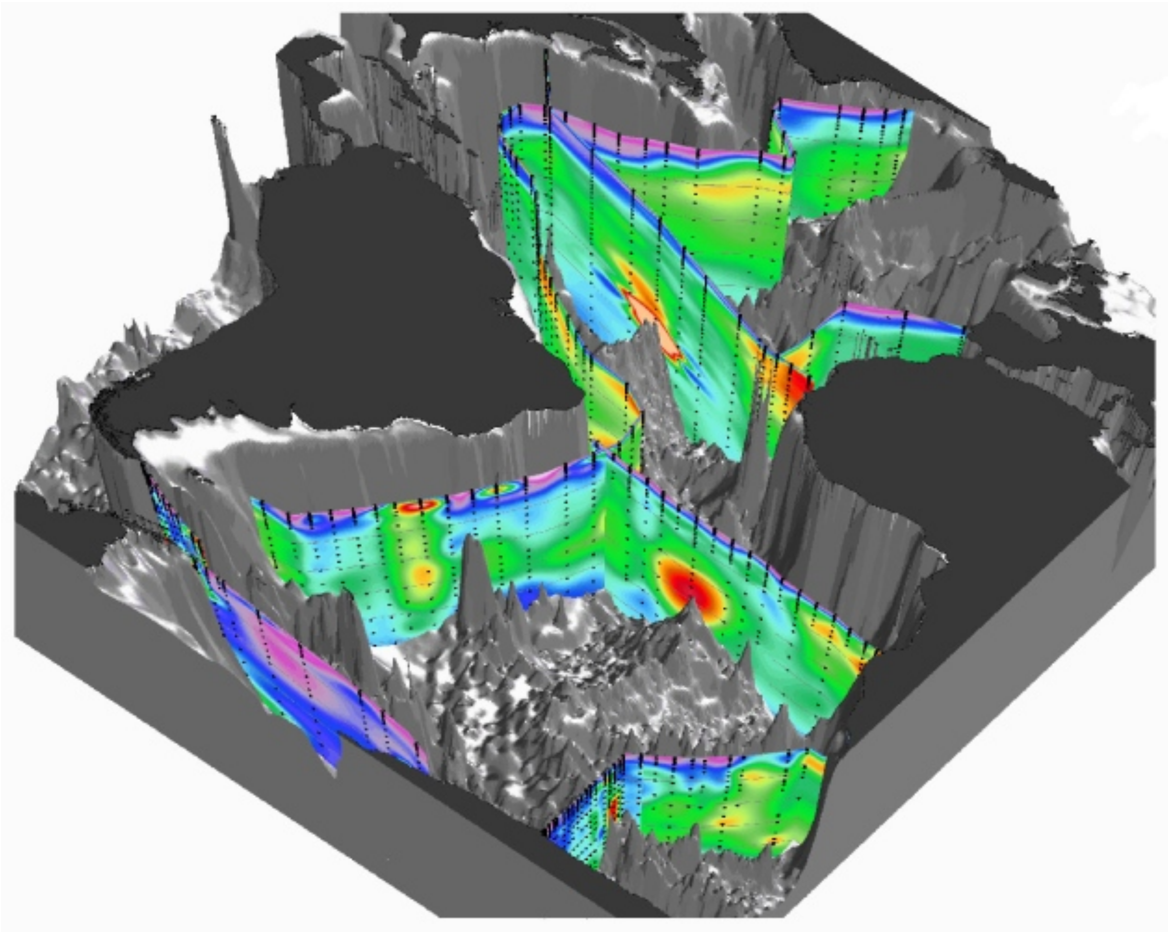

Reiner Schlitzer, eGEOTRACES

A three-dimensional atlas shows the concentrations of iron dissolved in the world's oceans.

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As a key nutrient for phytoplankton, iron has an important role in the oceanic carbon cycle. When phytoplankton bloom, they absorb carbon dioxide from ocean water, and they take it with them to the deep ocean when they die. The amount of iron available to them controls how fast they grow, and so how fast they take up carbon. But researchers have struggled to understand the relative importance of different iron sources, such as atmospheric dust, continental erosion and upwelling of lava at sea-floor mid-ocean ridges.

A three-dimensional map released this week finally shows iron concentrations in the water in detail. For example, plumes of iron extending for up to thousands of kilometres are visible at the mid-Atlantic ridge. There is no indication that one source dominates the others, but the map shows clearly that each is important. Modellers should be able to stop debating sources and start focusing on the ways in which iron moves through the system, says Robert Anderson, a chemical oceanographer at Columbia University's Lamont–Doherty Earth Observatory in Palisades, New York. “Some of these processes we’ve had hints of before, but we’ve never seen them so clearly,” he says.

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The map, released on 25 February at the 2014 Ocean Sciences Meeting in Honolulu, Hawaii, is the first major data product from GEOTRACES, an international programme launched four years ago to chart trace metals throughout the world's oceans.

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Make tracks

The electronic atlas was constructed with data from 15 cruises that focused on the Arctic, Atlantic and Indian oceans, with the highest data density coming from the Atlantic Ocean. A push into the Pacific Ocean will be reflected in subsequent data releases from the programme by the end of the decade. "It's never been done on this scale with this many samples and this many scientists who've agreed to collaborate," says William Landing, a marine chemist at the Florida State University in Tallahassee.

GEOTRACES follows in the footsteps of the Geochemical Ocean Sections Study (GEOSECS), a 1970s programme that recorded concentrations of abundant ocean elements such as carbon, nitrogen and phosphorus. Back then, trace metals were difficult to sample accurately because of contamination from the metal research vessels. But advances in sampling techniques have allowed researchers with GEOTRACES to collect data on iron, cobalt, manganese and zinc without contamination.

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The first GEOTRACES cruises have established a much-needed benchmark, says Reiner Schlitzer, co-chair of the programme's scientific steering committee and creator of the electronic atlas. He expects that in as few as five years, researchers will begin to retrace their tracks, gathering data for new snapshots that will show changes in trace-metal distributions. These temporal data sets will allow oceanographers to see how humans and climate change are affecting supplies of nutrients such as iron, and levels of contaminants such as lead and mercury.

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