Lake Erie's thermal structure and circulation are backward

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A series of high-resolution measurements has shown that Lake Erie, one of the North American Great Lakes, is, in some respects, backward. In the majority of thermally stratified lakes, the thermocline, a thin subsurface layer of rapid temperature change, is deeper near the coast than near the center of the lake. Lake Erie, however, has an inverted thermocline, which is deeper offshore than at the coast. Beletsky et al. first mapped this bowl-shaped thermocline during the summer of 2005 with a large network of temperature sensors.

In 2005, and again in 2007, moored instruments that collected temperature readings at 1 meter (3.3 feet) depth intervals were spread 30 to 50 kilometers (19 to 31 miles) apart around the central basin of the lake. Supporting these point measurements, the authors collected higher-resolution temperature profiles with a boat-towed sensor. The authors find that the 2 to 3 meter (6.5 to 10 feet) thick thermocline, which was most pronounced in late summer, sat up to 8 m (26 ft) deeper offshore than at the coast. In addition to the anomalous thermocline behavior, the authors find that the circulation of central Lake Erie flows in a direction opposite of most Northern Hemisphere lakes. Using circulation sensors placed on the lake floor, the authors observed a pronounced clockwise (anticyclonic) circulation.

The authors attribute the unusual circulation and thermocline patterns to anticyclonic winds that tend to blow over Lake Erie. Such anticyclonic winds would cause the warm surface waters to converge in the center of the lake, driving down the depth of the thermocline. They suggest that

the depressed thermocline squashes the cool region near the lake bed, where many species hide from the summer heat. The depressed thermocline could also be responsible for amplifying deep-water summer hypoxia, reducing the oxygen available to lake-bottom plants and animals.

More information: "Summer thermal structure and anticyclonic circulation of Lake Erie" *Geophysical Research Letters*, doi:10.1029/2012GL051002, 2012

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