Past decade saw unprecedented warming in the deep ocean

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From 1975 on, the global surface ocean has shown a pronounced-though wavering-warming trend. Starting in 2004, however, that warming seemed to stall. Researchers measuring the Earth's total energy budget-the balance of sunlight streaming in compared to the amount of light and heat leaving from the top of the atmosphere-saw that the planet was still holding on to more heat than it was letting out. But with that energy not going into warming the surface ocean-a traditionally important energy sink-scientists weren't sure where it went. It became known, in some circles, as a case of "missing heat."

Through a reanalysis of global ocean heat content measurements, Balmaseda et al. find the missing heat. The authors show that though the upper ocean waters, from the surface to 700 meters (2,300 feet) depth, showed no warming from 2004 to 2008, the waters from 700 to 2000 meters (2,300 to 6,500 feet) were warming at an unprecedented rate. They find that during the past decade, of the excess energy trapped by the anthropogenic greenhouse effect that has gone into warming the ocean, 30 percent of it has contributed to warming the deep ocean.

The authors also find that throughout the observational record the warming of the surface ocean has stalled before, because of large volcanic eruptions or swings of the El Niño-Southern Oscillation. They also note that changes in surface wind patterns are an important factor in driving ocean heat content from the surface layers to the deep ocean.

More information: Distinctive climate signals in reanalysis of global

ocean heat content, *Geophysical Research Letters*, doi:10.1002/grl.50382, 2013 http://onlinelibrary.wiley.com/doi/10.1002/grl.50382/abstract

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