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Improvements to the quality and quantity of ocean heat content measurements

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Accurate measurement of the increase of thermal energy in the Earth system is perhaps the most critical metric for assessing present and future climate change. Multiple redundant measurement methods from, sea-level rise, and ocean temperature increase show conclusively that the Earth's thermal system is gaining energy (there is an energy imbalance). Accurate quantification of the imbalance, however, is elusive. Estimates from the different measurement methods and for different research teams provide a wide spread of the imbalance. Perhaps the most conclusive method to quantify the imbalance is through ocean energy increases over the past few decades. However, with measurement instruments, technologies, geographical coverage, and infilling methods that change over time, it is difficult to assemble a single authoritative evolution of ocean heat content. Since approximately 90% of the extra heat added to the Earth system ends up stored in the oceans, any uncertainty in ocean measurements translates directly to uncertainties in the overall Earth energy imbalance. Recently, however, significant improvements have been made to both current and archival temperature measurements. In particular, one of the most important ocean measuring devices, the Expendable Bathythermograph, has been extensively studied. It has been found that biases in the rate at which this device falls through the ocean water gives rise to biases. Furthermore, biases may vary by water temperature, drop height, latitude, or by the device manufacturing method. Here known biases and assess their impact on our understanding of future climate change is addressed and quantified.

Biography

John P Abraham is a Professor of thermal sciences at the University of St. Thomas, in Minnesota. He works in many areas of heat transfer and fluid flow. His main research activities are in biological heat transfer, laminar/turbulent fluid flow, and climate change. Among his nearly 200 journal papers, conference presentations, books, and patents are articles on oceanography, Earth energy balance, paleoclimate studies, and climate sensitivity.

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