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Closing the Earth's energy imbalance

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For multiple decades, scientists have been measuring the energy contained in the Earth's climate system. More recently, measurements have been made of the net inflow of energy at the top of the atmosphere using satellites. A comparison of satellite, ocean heat content and sea-level rise estimates of the warming climate differ, in some cases, considerably. On the other hand, all measurement methods show a strong warming trend superimposed on shorter term variability. Some of the public discussion has focused on a so-called "hiatus" of global warming which refers to a reported slowing down of the Earth's temperature increase. Throughout this hiatus, there has been a continued significant heating of the ocean. During the past decade, the increase in ocean heat content has occurred at an unprecedented rate. It has also recently been found that a significant portion (~30%) of the energy imbalance is stored deep in the oceans (below 700 m). Deep-heat storage appears to have increased in recent years and may be explained by changes to atmospheric circulation. Here, a discussion of recent ocean heat content measurements will be given with a focus on the Earth's energy imbalance. The impact of small volcanic eruptions, multi-decadal changes to Pacific Ocean patterns, changes to deep-ocean heat storage, and aerosols will be discussed. These factors each play a part in the difficulty of closing the energy balance but it appears that a scientific consensus is emerging.

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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