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Earth's global energy imbalance and the apparent hiatus in global mean temperatures

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“Global warming” from increased greenhouse gases really refers to a global energy imbalance at the top-of-atmosphere (TOA). Global fluctuations in TOA energy of up to 0.2 W m^{-2} occur from natural variations in clouds, aerosols, and changes in the Sun. At times of major volcanic eruptions the effects can be much larger. An energy imbalance is manifested not just as surface atmospheric or ground warming, but also as melting sea and land ice, and heating of the oceans. An inventory of energy shows that over 90% of the imbalance is manifested as ocean heat content (OHC), and this with melting land ice, causes sea level to rise. For the past decade, over 30% of the heat has apparently penetrated below 700m depth that is traceable to changes in surface winds mainly over the Pacific in association with a switch to a negative phase of the Pacific Decadal Oscillation (PDO) in 1999. Surface warming was much more in evidence during the 1976-1998 positive phase of the PDO, suggesting that natural decadal variability modulates the rate of change of global surface temperatures while sea level rise is more relentless.