

## 5.041 CMIP5 estimate of Earth's energy budget.

Early Career Scientist

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Abstract:

The inability to make direct measurements and the complexity of the processes involved make it difficult to quantify all the components of the Earth's energy budget. Climate models have the potential to greatly inform our understanding of the relevant processes controlling the energy budget. There have been a series of climate model intercomparison projects (CMIP), the latest version of these projects, CMIP5, has contributions from dozens of global climate models. We use these models to understand how much energy has come into the Earth system since preindustrial times and the fate of that energy, whether it has warmed the oceans or been radiated back to space. Climate models have errors, biases and drifts that must be accurately accounted for to estimate anthropogenic climate change. Much of the drift can be accounted for by using anomalies from preindustrial control simulations. Despite these adjustments, there is substantial variation between the various CMIP5 models of fundamental quantities such as ocean heat content and top of the atmosphere radiative imbalance. However, much of this variation is around a mean that is consistent with observations. One quantity of interest is the ratio of energy radiated back to space to that absorbed by the ocean. Since 1957, the CMIP5 models estimate that roughly 63% of the integrated forcing is radiated back to space with 37% being stored in the ocean. The models further estimate that 15% of the change in the ocean heat content is stored in the deep ocean below 2000 m. With proper adjustments and corrections, the CMIP5 suite of climate models can robustly predict the historical trends and magnitudes of climate change. The success of these models to predict historical changes lends credence to their predictions of an ever changing future Earth.