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Assessment of the Earth Energy Budget within the CMIP5 Ensemble: Preliminary Results

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The energy imbalance at top-of-atmosphere over the last century has caused an accumulation of energy within the ocean, the continental subsurface, the atmosphere and the cryosphere. Although 93% of the energy gained by the climate system has been stored in the ocean, other components of the Earth's energy budget cannot be neglected because of associated climate feedback processes dependent on heat, such as soil carbon and permafrost stability. Despite that, there is no comprehensive assessment of the energy partition within global climate simulations.

Here, we explore the ability of thirty General Circulation Models (GCMs) from the fifth phase of the Coupled Model Intercomparison Project (CMIP5) to simulate the distribution of heat within the Earth's energy reservoirs along their Historical simulations. The CMIP5 GCM simulations show net gains of heat in all subsystems during the second half of the 20th century in agreement with observations, although with large variability among model results. The multimodel mean of the simulated energy proportion in the global atmosphere agree with observations, while the multimodel means and observations disagree on the energy proportion within the global ocean, the continental subsurface and the global cryosphere. Such disagreements are probably caused by the limited representation of terrestrial ice masses in CMIP5 simulations, as well as by the shallow subsurface of the employed land surface model components in the CMIP5 GCMs.