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A new diagram of the global energy balance

Martin Wild
ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland, martin.wild@env.ethz.ch

This study provides a new assessment of the global mean energy flows from a surface perspective as well as an associated diagram of the global mean energy balance. The radiative energy exchanges between Sun, Earth and space are now accurately quantified from new satellite missions. Much less has been known about the magnitude of the energy flows within the climate system and at the Earth surface, which cannot be directly measured by satellites. In addition to satellite observations, the growing number of surface observations is used to constrain the global energy balance not only from space, but also from the surface. These observations are combined with the latest modeling efforts performed for the 5th IPCC assessment report to infer best estimates for the global mean surface radiative components. Our analyses favor global mean downward surface solar and thermal radiation values near 185 and 342 Wm-2, respectively, which are most compatible with surface observations. Combined with an estimated global mean surface absorbed solar radiation and thermal emission of 161 Wm-2 and 398 Wm-2, respectively, this leaves 105 Wm-2 of global mean surface net radiation available for distribution amongst the non-radiative surface energy balance components. Considering an imbalance of 0.6 Wm-2, the global mean sensible and latent heat fluxes are estimated at 20 and 84 Wm-2, respectively, to close the surface energy balance. The global mean surface radiative fluxes derived here in combination with a latent heat flux of 84 Wm-2 may be able to reconcile currently disputed inconsistencies between energy and water cycle estimates. The findings of this study are compiled into a new global energy balance diagram.

Related references:

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