***Supplementary Material***

**Understanding the Differences between TOA and Surface Energy Budget Attributions of Surface Warming**

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**Supplementary Table S1:** A list of CMIP5 model simulations that are not analyzed in this study for the reason specified on the right column.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Model acronym** | **Institution** | **Reason why not used** |
| **1** | ACCESS1-0 | CSIRO and Bureau of Meteorology | not enough information to interpolate cloud data |
| **2** | ACCESS1-3 |
| **3** | CNRM-CM5 | Centre National de Recherches M´et´eorologiques | no multi-level cloud data |
| **4** | HadGEM2-CC | Met Office Hadley Centre | not enough information to interpolate cloud data |
| **5** | HadGEM2-ES |
| **6** | inmcm4 | Institute for Numerical Mathematics | missing cloud data |
| 7 | FGOALS-s2 | Institute of Atmospheric Physics, Chinese Academy of Sciences | cloud data is extreme outlier |

Diagram

Description automatically generated with medium confidence

**Figure S1**. The zonal-mean net radiative flux changes (W\*m-2) between the CMIP5 RCP8.5 and historical simulations given by the CMIP5 model outputs, the offline Fu-Liou radiative transfer model (RTM) calculations, the total sum of the linearized radiative fluxes given by the Fu-Liou RTM at the (a-c) TOA, (d-f) atmosphere, and (g-i) surface, respectively. Individual CMIP5 models (black lines); CMIP5 ensemble mean (red lines).