High cloud size dependency in the applicability of the fixed anvil temperature hypothesis using global non-hydrostatic simulations

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The applicability of the fixed anvil temperature (FAT) hypothesis is examined using data of a global non-hydrostatic model, focusing particularly on high cloud size dependency. Decomposition of outgoing-longwave radiation (OLR) into three components, including cloud-top temperature (T_{CT}), upward cloud emissivity (ε), and clear-sky OLR (F^{CLR}), reveals that the relative contributions of these three components to changes of OLR are highly dependent on cloud size. That is, the FAT hypothesis is applicable only to smaller clouds, because the contribution of T_{CT} by those clouds is small, and $\varepsilon$is more important. In contrast, for larger clouds, the contribution of $\varepsilon$is comparable to that of T_{CT}, and thus, both components are equally important. F^{CLR} slightly reduces OLR, but shows dependence on cloud size.

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