An investigation of the connections between convection, clouds and climate sensitivity in a Global Climate Model

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The connections between a process-level modeling of convection and GCM simulated clouds and climate sensitivity are investigated through a set of physics and sea surface temperature perturbation experiments. A bulk diagnostic approach is constructed and a set of key diagnostic variables is derived and demonstrated to be useful in understanding the simulated relationships. The bulk diagnostic quantity of the tropical convective precipitation efficiency is proposed as a key measure of the aggregated properties of parameterized convection. It is shown to be critical in understanding many aspects of the modeled cloud sensitivity to parameters as well as model uncertainties in cloud feedback to warming in relation to convective parameterization.