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An Observationally-based Quantification of Cloud-Climate Feedbacks

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The radiative response of clouds to an external perturbation in temperature, or cloud feedback, is an important parameter of our climate that is not well understood. Modeling studies disagree on the magnitude, and even the sign, of the cloud feedback, pointing to a need to better understand the effect that clouds have on the transfer of radiant energy. Our study seeks to constrain this feedback by analyzing over 20 years of satellite data. A clustering algorithm is applied to time series of monthly mean cloud properties to discover regions with similar time histories of cloud properties. This is an effective tool for obtaining realistic variability in cloud properties, and distinguishing real variability from satellite artifacts. This natural variability in cloud properties is then used as a perturbation on a climatology of cloud properties to ascertain the difference in flux of radiation in the atmosphere that results from the inclusion of this natural variability of cloud properties. The resultant time series in top of atmosphere radiation can be compared to surface temperature measurements to understand their relationship, possibly providing constraints on cloud feedbacks in our climate system.