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Characterizing the Trade Space Between Capability and Complexity in Next Generation Cloud and Precipitation Observing Systems: Shallow Cumulus Convection

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The 2017 U. S. National Academy of Sciences Decadal Survey for Earth Sciences identifies cloud and precipitation processes as a key target for observational constraint in the next decade. Observationally constraining the processes that cause cloud water to become precipitation is important because these processes control critical cloud lifetime and cloud coverage quantities and they are susceptible to modulation by variations in aerosol. Furthermore, such processes present unique challenges to measurement strategies and demand a level of complexity that may exceed what is reasonably possible for the measurement systems of the next decade. We are, therefore, exploring the trade space between complexity and capability in characterizing the precipitation processes in liquid-phase cumulus convection using techniques such as Markov Chain Monte Carlo (MCMC) that allow us to specify the characteristics of a notional measurement system and then explore the ability of that measurement system to characterize the processes that govern precipitation production. Because MCMC allows us to efficiently and fully characterize the posterior retrieval solution space, we can accurately quantify the information content that an observing system contributes under realistic conditions. This approach is being applied to observations collected during the recent campaigns and results from those campaigns will be discussed.