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Assimilating cloud-affected visible & infrared satellite observations in idealized simulations

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Although cloud-affected satellite observations provide a promising source of information for convective-scale NWP, they are still rarely used in operational assimilation systems. This reveals that we do not fully understand the challenges involved in their assimilation as e.g. observation operator non-linearity, the non-linear evolution of clouds and unresolved scales of the model forecast. To mitigate these issues, we test various approaches for the assimilation of cloud-affected satellite observations in idealized simulations, i.e. within an observing system simulations experiments (OSSE) framework. We apply superobbing and thinning to visible and infrared observations, assimilate cloud-cover instead of radiance observations and study their effect on nonlinearity, aiming to linearize the relationship between observation and state variables and thus improve the assimilation procedure. We assimilate deep-convective systems in a 2-km Weather Research and Forecasting (WRF) model using the Data Assimilation Research Testbed's (DART) Ensemble Adjustment Kalman Filter with its novel interface to the radiative transfer model RTTOV. The latter includes MFASIS, a recently developed computationally efficient observation operator for satellite reflectances in the visible range.