

4th workshop on assimilating satellite cloud and precipitation observations for NWP



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Cloud Process Nonlinearity and Model Uncertainty in Data Assimilation and Remote Sensing

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Assimilation of remote sensing observations of clouds and precipitation is challenging for many reasons, including:

- Nonlinearity in cloud and precipitation processes, and in the relationships between state variables (e.g., hydrometeor profiles) and observations (e.g., radar reflectivity).
- Large spatial and temporal variability in cloud features, leading to large forecast-observation innovations
- Parameterizations of cloud processes with poorly understood uncertainty, and whose error is state-dependent (e.g., one set of parameter values does not work equally well for all precipitating cloud systems)

The nonlinear and spatially and temporally variable nature of clouds will continue to present challenges for data assimilation for the foreseeable future. New observing systems, new data assimilation algorithms, and new methodologies for characterizing and quantifying uncertainty in forward models offer pathways forward. In this presentation, we present the results of experiments that utilize new techniques that offer the potential to advance cloud and precipitation data assimilation, including:

- Quantification of uncertainty in cloud microphysical parameterizations
- Development of new data assimilation algorithms that may be better suited to positive definite quantities and nonlinear cloud and precipitation processes
- Adaptive ensemble techniques that make use of high time frequency geostationary satellite data for constraint of isolated and organized convective systems

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