SSEC/CIMSS
Seminar

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Exploring the Characteristics of a Thin Ice Cloud Property Retrieval Using a Markov Chain Monte Carlo Algorithm

It is commonly assumed that ice cloud property retrievals are well constrained so that a look up table or an optimal estimation approach can be used to provide a unique solution. However, because of nonlinearities in radiative transfer models, error characteristics of retrieved ice cloud properties are generally not well known. The Markov chain Monte Carlo (MCMC) approach, which represents information from prior knowledge, observations, and the forward model probabilistically, allows for an accurate assessment of the solution space and the nature of uncertainties in a retrieval. In this paper, an MCMC algorithm is used to examine the sensitivity of infrared split window retrieved ice water path and ice particle effective radius to changes in cloud top height, cloud geometric thickness, and the assumed ice crystal shape. In addition, we assess the effect of particle settling, changes to observation error magnitude, and the implementation of a log-normal error distribution on the retrieval results.

It is found that, though the effects of uncertainty in cloud top height are not insignificant, uncertainty in the ice crystal shape contributes most to the uncertainty in the retrieval, and gives rise to the potential for multiple solutions. Reduction of observation error, and the assumption of particle settling, serve to change the preferred combination of crystal shapes in the volume, but do not eliminate the potential for a multimodal result. Application of the MCMC algorithm to a scene reveals that both the nature and magnitude of retrieval errors exhibit a strong dependence on cloud optical depth.

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1:30 p.m.
Room AOSS 351