A GCM-Oriented Synergistic Passive Microwave Diurnal Ice/Snow Cloud Retrieval Product using CloudSat/CALIPSO as the Baseline

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Abstract:

Thick anvils and floating snow clouds are strongly tied with precipitation formation processes, yet they are poorly constrained in models especially for the diurnal cycle due to lack of global consistent observations. CloudSat-CALIPSO missions together provide the most comprehensive and accurate vertical profiling of thick anvils and floating snow from space, but they miss the temporal resolution to resolve the diurnal evolution of ice cloud and precipitation. The combination of multiple spaceborne passive microwave (PMW) sensor observations is the solution.

Leveraging on multi-year collocated CloudSat-PMW observations and the machine learning/artificial intelligence (ML/AI) technique, a synergistic PMW diurnal thick ice/snow cloud diurnal product is produced. This product includes ice water path (IWP), cloud top height (CTH) and cloud bottom height (CBH) at hourly temporal scale that can be directly used to compare with global climate model (GCM) outputs. The innovative combination use of ML/AI and radiative transfer based physical algorithm overcomes many issues that synergistic PMW product usually faces (e.g., surface signal contamination, inter-satellite inconsistency, view-angle dependency, beam-filling effect, etc.). In this presentation, I'll introduce the new algorithm and its easy extendibility to future PMW observations. Ground validation will be shown to prove the data product quality. I'll also show the comparison against GCM outputs to demonstrate its potential use on helping improve several GCM's ice microphysical processes which will ultimately help improve surface precipitation diurnal cycle.