

Cloud thermodynamic phase inferred from simultaneous shortwave infrared and multi-angle polarization measurement

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Abstract:

Cloud thermodynamic phase (ice, liquid, supercooled water) discrimination have critical impacts on the Earth's energy budget and hydrological cycle. Also, cloud phase classification is an important first step for cloud optical and microphysical parameter retrievals. There are several approaches successfully applied to the passive sensor (like MODIS, POLDER and SGLI), including thermal infrared measurements, shortwave infrared and visible measurements and polarization measurement. The absorption of ice and water cloud in shortwave infrared (SWIR) channel is of obvious difference, and the water vapor absorption channel in SWIR is sensitive of cloud height, while polarization characterization has strong dependence on cloud particle shapes. In this study, we combine the three different observations for inferring cloud phase into a single algorithm, using PMAI (Polarization Multi-Angle Imager) data onboard FengYun rainfall satellite, which have three multi-angle SWIR polarization channel. Different polarization behavior from three SWIR channel will be present for ice, liquid, supercooled water and mixed cloud. To evaluate and optimize the performance of the algorithm, extensive granule-level comparisons have been conducted against active sensors (like EarthCARE and ACDL). This result data is expected to be useful for cloud assimilation and modeling efforts while providing more insight into the global cloud properties derived from satellite data.