

Cloud thermodynamic phase measurements from low-cost pixelated polarization cameras

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Cloud thermodynamic phase (CTP) is a key parameter in understanding the radiative effects of clouds, must be known for remote sensing retrievals of other clouds properties, and impacts commercial airline safety. Traditional methods for sensing CTP include dual-polarization lidars and short-wave and long-wave infrared radiance ratios, and our group was the first to demonstrate that an all-sky imaging polarimeter could perform CTP retrievals using the algebraic sign of the Stokes parameter S₁ (liquid clouds had positive values of S₁ and ice clouds had negative values). In this presentation, we summarize recent work exploring the use of low-cost, division-of-focal-plane polarization imagers to measure CTP. A reliable, small, and low-cost polarization imaging system could enable widespread ground-based CTP retrievals. Preliminary results using sunlight illumination with scattering angles less than 70° have yielded over 90% accuracy using a panchromatic band (approx. 400 - 1000 nm). We also show early measurements recorded in narrower spectral bands and under moonlight illumination.

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