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Determination of cloud thermodynamic phase with ground based, polarimetrically sensitive, passive sky radiometers

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When observed from the ground, optically thick clouds minimally polarize light, while the linear polarization direction (angle) of optically thin clouds contains information about thermodynamic phase. For instruments such as the Cimel radiometers that comprise the AEROSOL ROBOTIC NETWORK (AERONET), these properties can be exploited to aid cloud optical property retrieval, in addition to merely adding to the list of deliverable data products. Using vector radiative transfer simulations, we explore the conditions most favorable to cloud thermodynamic phase determination, then test with actual AERONET data. Results indicate that this technique may be appropriate for some, but not all, conditions, and motivate a deeper investigation about the polarization direction measurement capability of Cimel instruments, which to date have been primarily used to determine degree of polarization.