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# A New Technique to Detect Super-thin Clouds

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Super-thin clouds with optical depth smaller than ~0.3 exist globally and have significant effect on satellite remote sensing of surface temperature and atmospheric compositions, but are extremely difficult to be detected by satellite instruments. In this presentation, we report a novel method for detecting cloud particles in the atmosphere with measuring the polarized sunlight from the Earth-atmosphere system (Sun et al., 2014; Sun et al., 2015). We examined solar radiation backscattered from clouds with both satellite data and a radiative-transfer model. A distinct feature was found in the angle of linear polarization of solar radiation that is scattered from clouds at near-backscattering angles. The dominant electric field from the clear-sky Earth-atmosphere system is nearly parallel to the Earth surface at these scattering angles. However, when clouds are present, this electric field can rotate significantly away from the parallel direction. Our modeling results suggest that this polarization feature can be used to detect super-thin cirrus clouds having an optical depth of only ~0.06 and super-thin liquid water clouds having an optical depth of only ~0.01. Such clouds are too thin to be sensed using any current passive satellite instruments. This method could improve the detection of super-thin clouds and tremendously impact the remote sensing of clouds, aerosols, sea surface temperature, and atmospheric composition gases, and climate modeling. It also has potential to become an innovative satellite mission to advance Earth observation from space and improve scientific understanding of all clouds and cloud-aerosol interactions.

Reference

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